

THE NEW SCHOOL FOR SOCIAL RESEARCH  
DEPARTMENT OF ECONOMICS  
SPRING TERM 2013

## Syllabus for GECO 6281 Advanced Econometrics I

**Instructor:** Dr. Christian Proaño  
**Office Location:** 6 East 16th Street, Room 1113  
**Office Phone Nr.:** (212) 229-5717 ext. 3046  
**E-mail:** proanoac@newschool.edu

**Lecture:** Mondays 4:00 – 5.50 pm  
**Office hours:** Mondays 1:30–3:30pm

**TA:** Lauren Schmitz  
**E-mail:** schml347@newschool.edu

### Course Description

This course covers a variety of advanced techniques of econometric analysis, and it is centered around Generalized Method of Moments (GMM) and Maximum Likelihood Estimation as organizing principles. After an in-depth introduction to probability theory, the single equation OLS estimator, its asymptotic properties, and shortcomings will be treated. Using the notion of the Instrumental Variables Estimation, the Generalized Method of Moments will be introduced. Furthermore, after an introduction to Maximum Likelihood Estimation, a variety of applications such as discrete response models will be discussed. Finally, several topics in time-series and panel econometrics will also be treated. The software used in this course will be STATA.

### Grading

Grading will be based on the midterm in-class exam (30%) and the final in-class exam (40%). By working out and handing in all exercise sets one can earn the remaining 30%.

### Course Prerequisites

GECO 6181 or equivalent. This assumes that students have a working knowledge in basic probability theory, linear algebra and multivariate calculus, as well as a basic understanding of computer programming.

### Course Content

#### I. Probability Theory (DM ch.1)

- Continuous and discrete random variables, probability distributions.
- expected values: properties, law of total expectations.

## **II. The Geometry of Least Squares (DM ch.2)**

- Euclidean Geometry, column spaces and orthogonal projections,
- partitioned fit multicollinearity.

## **III. Least Squares Estimation (DM ch.3-5, 7, H ch.1-2)**

- Gauss-Markov Conditions, derivation of OLS estimator, small sample and asymptotic properties, confidence intervals, hypothesis testing
- Generalized Least Squares (GLS) estimation.

## **IV. Instrumental Variables Estimation (DM ch.8)**

- Instrumental Variables Estimation Techniques: IV and 2SLS estimators.

## **V. Generalized Method of Moments Estimation (DM ch.9, H ch.3)**

- Introduction, asymptotic properties, computational issues.
- Hypothesis testing.

## **VI. Maximum Likelihood Estimation (DM ch.10)**

- Basic theorems covariance matrix of the MLE Estimator, asymptotic properties
- Likelihood ratio-, Lagrange multipliers-, and Wald tests.

## **VII. Estimation of Discrete and Limited Variables (DM ch.11, H ch.8)**

- Binary choice models: Probit and Logit.

## **VIII. Panel Data (DM ch.7, H ch.5)**

- Introduction, pooled regression, fixed and random effects estimation.

## **IX. Stationary Time Series Analysis (DM ch.13, H ch.6)**

- Introduction, autoregressive and moving average processes
- Conditions for stationarity, statistical properties, ACF and PACF functions
- Estimation of ARMA processes

## **Course Outline (Tentative)**

In order to enhance the learning experience and hands-on qualifications of the students, this course consists in two intensive blocks of six and seven lectures, respectively, and an empirical mid-term project to be handled by the students in groups of three (the composition of the groups will be determined randomly) over three weeks in the middle of the semester. This midterm project the students is meant to serve as a bridge from the theoretical presentation of the estimation methods handled in the first lecture block to the applied econometric work before more advanced methods are introduced.

<b>Week of</b>	<b>Lecture Topic</b>
Jan. 28	CLASS I: Probability Theory (DM ch.1)
Feb. 1	TUTORIAL I
Feb. 4	CLASS II: The Geometry of Least Squares (DM ch.2)
Feb. 8	TUTORIAL II
	CLASS III: Least Squares Estimation (DM ch.3-5, 7, H ch.1-2)
Feb. 11	CLASS IV: Asymptotic Properties of OLS
Feb. 15	TUTORIAL III
Feb. 22	CLASS V: Post-Estimation (DM ch.4)
Feb. 25	CLASS VI: Generalized Least Squares
Mar. 1	TUTORIAL IV
Mar. 4	TUTORIAL V:
Mar. 8	TUTORIAL VI:
Mar. 11	TUTORIAL VII: STATA SESSION I
Mar. 18	– TAKE-HOME MIDTERM PROJECT –
Mar. 25	SPRING BREAK
Apr. 1	– TAKE-HOME MIDTERM PROJECT –
Apr. 8	CLASS VII: Instrumental Variables Estimation (DM ch.8)
Apr. 12	TUTORIAL VIII
Apr. 15	CLASS VIII: Generalized Method of Moments Estimation (DM ch.9, H ch.3)
Apr. 19	CLASS IX: Generalized Method of Moments Estimation (cont'd)
Apr. 22	TUTORIAL IX
Apr. 26	CLASS X: Maximum Likelihood Estimation (DM ch.10)
Apr. 29	TUTORIAL X
May 3	CLASS XI: Panel Data (DM ch.7, H ch.5)
May 6	TUTORIAL XI
May 10	CLASS XII: Stationary Time Series (DM ch.13, H ch.6)
May 13	TUTORIAL XII
May 17	CLASS XIII: Stationary Time Series (cont'd)
May 20	<b>Final Exam</b>

## Course Textbooks

- Cameron, Adrian Colin, & Pravin K. Trivedi (2005), *Microeconometrics: Methods and Applications*, Cambridge University Press.
- Cameron, Adrian Colin, & Pravin K. Trivedi (2009), *Microeconometrics using STATA*. Vol. 5. College Station, TX: Stata Press.
- Davidson, R. & MacKinnon, J. D. (2003), *Econometric Theory and Methods*, Oxford University Press.
- Greene, W. (2007), *Econometric Analysis*, 6th ed, Prentice Hall.
- Hansen, B. (2012), *Econometrics*. Online available at <http://www.ssc.wisc.edu/~bhansen/econometrics/>
- Hayashi, F. (2000), *Econometrics*, Princeton University Press.
- Rudd, O. (2000), *An Introduction to Classical Econometric Theory*, Oxford University Press.
- Wooldridge, J. M. (2002), *Econometric Analysis of Cross Section and Panel Data*, MIT Press.