

**COURSE SYLLABUS**

**19I033**

# Quantitative and Statistical Methods II Development

**6 ECTS**

**TERM 2**

**ELECTIVE**

## Professor

Prof. Albrecht Glitz

Prof. Geert Mesters

## Prerequisites to enroll

The participants of this course should be familiar with basic concepts of statistics and econometrics that are usually covered in an undergraduate degree in economics. They should also have followed the course Econometric Methods I in the first term of the year.

## Overview and objectives

This course builds on and further extends the econometric and statistical content studied in the first term, with a special focus on techniques relevant to the specific field studied and their empirical applications. The course deals with the econometric issues related to the use of micro data (individual, household or firm data) in empirical analysis. We will discuss the most important micro-econometric methods and their applicability in contexts typically encountered by empirical researchers. The course combines both theoretical and empirical

aspects. The theoretical part of the course will be complemented with practical exercises to be solved by the students using real data sets and Stata.

## **Course outline**

### Part I: Albrecht Glitz

1. Panel Data Models (10 hours)
  - a. Basic linear models
  - b. Random/fixed effects models
  - c. Dynamic models
  - d. GMM methods in panel data
  - e. Applications
2. Discrete Choice Models (4 hours)
  - a. Binary choice models
  - b. Multinomial choice models
  - c. Ordered response models
  - d. Applications
3. Tobit and Selection Models (4 hours)
  - a. Censoring and Truncation
  - b. Tobit model
  - c. Sample selection models
  - d. Applications
4. Duration Models (2 hours)
  - a. Basic theory
  - b. Parametric models with observed heterogeneity
  - c. Models with unobserved heterogeneity
  - d. Applications

### Part II: Geert Mesters

1. Causal inference, counterfactuals, and the Rubin causal model: introduction (2 hours)
2. Estimation of causal effects, Randomized Controlled Trials and more (10 hours)
  - a) Difference-in-Differences (DD)
  - b) RCTs and causal estimation
  - c) Heterogeneity in treatment effects
  - d) Power calculations, standard errors and intra-cluster correlation
  - e) Pitfalls of multiple equations testing in RCT (and elsewhere)
  - f) Imperfect compliance, IV and the Local Average Treatment Effect
  - g) Estimation of externalities
3. Weak instruments (2 hours)
4. Non-parametric estimation of densities and regressions (2 hours)
5. Regression Discontinuity Design (2 hours)
6. Selection on Observables and Matching (2 hours)

## Required activities

The course will comprise 4 hours of lectures per week. In addition, the students will have to hand in problem sets that are discussed during tutorial.

## Evaluation

Exam (70%) and problem sets (30%).

## **Materials**

### **Part I**

The course is largely based on lecture notes that will be provided during the course. Additional references for the different topics are the following:

#### **Panel Data Models**

Arellano, M. (2003), Panel Data Econometrics, Oxford University Press.

Baltagi, B. H. (2005), Econometric Analysis of Panel Data, 3rd Edition, John Wiley.  
Cameron, A. C. and P. K. Trivedi (2005), Microeconometrics: Methods and Applications, Cambridge University Press, New York, Chapters 21- 23.

Hsiao, C. (2003), Analysis of Panel Data, Cambridge University Press.

Wooldridge, J. M. (2010), Econometric Analysis of Cross Section and Panel Data, 2<sup>nd</sup> Edition, MIT Press, Cambridge MA.

#### **Discrete Choice Models & Tobit and Selection Models**

Cameron, A. C. and P. K. Trivedi (2005), Microeconometrics: Methods and Applications, Cambridge University Press, New York, Chapters 14- 16.

Greene, W. (2005), Econometric Analysis, 5th edition, Prentice-Hall International, Chapter 23.

Maddala, G. S. (1989), Limited Dependent and Qualitative Variables in Econometrics, Cambridge University Press, New York.

Wooldridge, J. M. (2010), Econometric Analysis of Cross Section and Panel Data, 2<sup>nd</sup> Edition, MIT Press, Cambridge MA, Chapters 15-17 & 19.

#### **Duration Models**

Greene, W. (2005), Econometric Analysis, 5th edition, Prentice-Hall International, Chapter 22.5 (Brief discussion within a standard econometrics textbook)

Heckman, J. and B. Singer (1984), "A Method for Minimizing the Impact of Distributional Assumptions in Econometrics Models for Duration Data," *Econometrica*, 52 (2), 271-318.

Jenkins, S. P. (2005a), *Survival Analysis*, unpublished manuscript, Institute for Social and Economic Research, University of Essex. Downloadable from <http://www.iser.essex.ac.uk/teaching/degree/stephenj/ec968/pdfs/ec968lnotesv6.pdf>

Kiefer, N. (1985), "Econometric Analysis of Duration Data," *Journal of Econometrics* 28, 1-169. (Extensive survey for econometricians)

Kiefer, N. (1988), "Economic Duration Data and Hazard Functions," *Journal of Economic Literature* 26, 646-679. (Readable general survey)

Lancaster, T. (1990), *The Econometric Analysis of Transition Data*, Cambridge University Press. (The modern classic)

Wooldridge, J. M. (2010), *Econometric Analysis of Cross Section and Panel Data*, 2<sup>nd</sup> Edition, MIT Press, Cambridge MA, Chapter 22.

## **Part II – Causal inference**

The course is largely based on lecture notes that will be provided during the course. A textbook that contains a good deal of the material we cover in class (and more) is

J. D. Angrist and J.-S. Pischke (2009). *Mostly Harmless Econometrics, An Empiricist's Companion*, Princeton University Press.

Also good sources are:

Wooldridge, J. M. (2002), *Econometric Analysis of Cross Section and Panel Data*, MIT Press, Cambridge MA

Cameron, A. C. and P. K. Trivedi (2005), *Microeconometrics: Methods and Applications*, Cambridge University Press, New York.

None of the sources below is required reading, and the references are listed not so much for exam preparation but rather if you want to have a deeper appreciation of certain topics.

### **Estimation and Inference with Complex Survey Design and non-iid Data**

Bertrand, M., E. Duflo, and S. Mullainathan. (2004). How much should we trust differences-in differences estimates? *Quarterly Journal of Economics* 119, 249–276.

Brownstone and Valletta (2001), The Bootstrap and Multiple Imputations: Harnessing Increased Computing Power for Improved Statistical Tests. *Journal of Economic Perspectives*, 15(4), 129-141.

Cameron and Miller (2015). A Practitioner's Guide to Cluster-Robust Inference. *Journal of Human Resources*, 50(2), 317-352.

Deaton, Angus (1997). *The Analysis of Household Surveys: A Micro-econometric Approach to Development Policy*. Johns Hopkins University Press: Baltimore, Maryland. (Chs. 1 and 2)

Wooldridge, J. M. (2002), *Econometric Analysis of Cross Section and Panel Data*, MIT Press, Cambridge MA, Chapter 17.

### **Randomized Experiments**

Deaton, Angus (2010). "Instruments, randomization, and learning about development", *Journal of Economic Literature*, 48(2): 424-455.

Deaton, Angus, and Nancy Cartwright. 2016. "Understanding and Misunderstanding Randomized Controlled Trials." NBER Working Paper, no. 22595.

Duflo, E. R. Glennerster and M. Kremer, 2007, "Using Randomization in Development Economics Research: A Toolkit," CEPR Discussion Paper No. 6059.

### **Pitfalls of Weak Instruments**

Imbens, G. and J. D. Angrist (1994), "Identification and Estimation of Local Average Treatment Effects," *Econometrica* 62 (2), 467-475.

Stock, J. H., J. Wright and M. Yogo, 2002, "A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments," *Journal of Business and Economic Statistics*, 20, 518 – 529.

### **Regression Discontinuity Designs**

Imbens, G. and T. Lemieux, 2007, "Regression Discontinuity Designs: A Guide to Practice," *Journal of Econometrics*, 2007, 142(2): 615-635.

David S. Lee and T. Lemieux, 2009, "Regression Discontinuity Designs in Economics," *Journal of Economic Literature*, 48(2): 281-355.

### **Selection on Observables**

Dehejia, R. and S. Wahba, (2002), "Propensity Score Matching Methods for Non-experimental Causal Studies," *Review of Economics and Statistics* 84(1), 151-161.

### **Nonparametric Estimation of densities and regressions**

Deaton, Angus (1997). *The Analysis of Household Surveys: A Micro-econometric Approach to Development Policy*. Johns Hopkins University Press: Baltimore, Maryland. (Ch. 1)

Pagan and Ullah (1999). *Nonparametric Estimation*. Cambridge University Press.

## Competencies

- ☐ Capacity of utilization of the theoretical instruments of the to analyze situations of coherent form.
- ☐ Ability to use the appropriate (statistical and numerical) techniques.
- ☐ Ability to make independent judgments and defend them dialectically.
- ☐ Acquire a solid knowledge base for the study of quantitative issues.
- ☐ Ability to recognize and know how to use the principles of econometrics and statistics.
- ☐ Ability to work with microeconomic analysis tools and their empirical and theoretical applications.

## Learning outcomes

- ☐ Students should get an overview of economic and financial theory.
- ☐ Students must be able to recognize theories and present arguments with precise examples.
- ☐ Students will acquire the technical tools that will allow them to perform the advanced analytics required in the second module as econometric methods.
- ☐ Students will know what the appropriate inference for each situation is.