Econometrics 2

Mariona Segú

Master 1 Applied Economics, Semester 2

Academic Year 2026–2027

Instructor: Mariona Segú
Lectures: 36 hours (12 sessions × 3h)
Tutorials (TD): 18 hours (12 sessions × 1h30)
Language: English
Software: R
Level: Master 1

Course Description

This course provides rigorous training in causal inference and applied econometric methods. The first part introduces the potential outcomes framework and uses it as a common language for studying causal effects, identification, and the construction of counterfactuals. It shows why naive comparisons are affected by selection bias and presents randomized experiments as the benchmark for causal identification. It then examines the main sources of endogeneity and presents several econometric strategies for causal identification with observational data, including panel data methods, instrumental variables, and difference-in-differences.

The second part covers econometric models for qualitative, censored, and selected outcomes, including logit and probit models, the Tobit model, and the Heckman sample selection model. Throughout the course, methods are illustrated with applications drawn from the applied economics literature (labor, public, urban, and development economics) and implemented in R during the tutorial sessions.

Assessment

- Midterm examination — 40%
- Participation in tutorials — 10%
- Final examination — 50%

Tutorials

The course is accompanied by 18 hours of tutorials (12 sessions of 1h30), conducted in R. Tutorial sessions closely follow the lecture content, combining applied exercises, simulations, data analysis, and replication of empirical research.

Lecture Outline

Part 1 — Causal Inference and Identification

- **Chapter 1. The Potential Outcomes Framework.** Correlation and causation; confounding, reverse causality, and chance; directed acyclic graphs; potential outcomes and counter-

factuals; the stable unit treatment value assumption (SUTVA); the fundamental problem of causal inference; individual and average treatment effects; average treatment effect (ATE), average treatment effect on the treated (ATT), and on the untreated (ATU); heterogeneous treatment effects and selection on gains.

- **Chapter 2. Selection Bias and Randomized Experiments.** The naive comparison of treated and untreated units; selection bias and heterogeneous treatment effect bias; selection bias in regression form; identification versus estimation; independence and conditional independence; randomized controlled trials; balance tests; threats to validity (compliance, attrition, spillovers); internal and external validity.

- **Chapter 3. Endogeneity.** The conditional mean independence assumption; omitted variable bias; reverse causality; simultaneity; measurement error; consequences of endogeneity for OLS; identification versus estimation.

- **Chapter 4. Panel Data Methods.** Pooled OLS; fixed-effects and random-effects estimators; within and first-difference transformations; strict exogeneity; Hausman test.

- **Chapter 5. Instrumental Variables.** Identification with instrumental variables; relevance and exogeneity conditions; two-stage least squares; weak instruments; overidentification tests; local average treatment effects (LATE).

- **Chapter 6. Difference-in-Differences.** Two-period, two-group design; potential outcomes interpretation; parallel trends assumption; regression implementation; multiple periods; event-study designs.

Part 2 — Models of Qualitative Outcomes, Censoring, and Selection

- **Chapter 7. Qualitative Dependent Variables.** Linear probability model; logit and probit models; maximum likelihood estimation; marginal effects.

- **Chapter 8. Censored and Truncated Data.** Censoring versus truncation; Tobit model; latent-variable interpretation; maximum likelihood estimation.

- **Chapter 9. Sample Selection.** Heckman selection model; exclusion restrictions; inverse Mills ratio; two-step estimator; maximum likelihood estimation.

References

- Wooldridge, J. M. (2020). *Introductory Econometrics: A Modern Approach*. Cengage Learning.
- Angrist, J. D. and Pischke, J.-S. (2009). *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.
- Cunningham, S. (2021). *Causal Inference: The Mixtape*. Yale University Press.
- Cameron, A. C. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press.