



Allievi Program, Master in Economics, and Ph.D. in Economics

# ECONOMETRIC THEORY I

## Fall 2023

Instructor: Yagan Hazard

### Contact Information

Collegio Carlo Alberto

Office: TBD

E-mail: [yagan.hazard@psl.eu](mailto:yagan.hazard@psl.eu)

Office hours: Send me an email and we set up an appointment

### Course Description

This course provides formal exposure to many of the fundamental principles of micro econometric theory and causal inference used in economic research. A rigorous treatment of these tools is essential for a thorough understanding (and practice) of applied economics and econometrics. The course will also be an opportunity to review key statistical and probability theory tools — that will be formally introduced on a need-based basis — and to familiarize students with their use in econometric theory. In parallel, students will be introduced to causal inference — learning how to build (carefully) on the classic econometric toolbox to learn about causal relationships.

### Prerequisites

As mentioned in the course description, this class will provide a formal treatment of classical econometric theory principles. As such, it will often rely on the use of formal mathematical reasoning, fundamental statistical and probability theory results, linear algebra and some real analysis. For pedagogical purposes, I will do my best to make this course self-contained

— with all the necessary mathematical tools being introduced on a need-based basis. However, some knowledge of the fundamentals of probability and statistics — and possibly an introduction to linear algebra — would be a good preparation for this class. Prior exposure to the fundamentals of econometrics at an intermediate level is not absolutely required, but would likely help students get the most out of this more advanced exposition.

## Requirements and Grading

To be determined. Provided TA sessions can occur, there would be most likely bi-weekly problem sets mixing both theory and practical coding exercises. These would be handed in and graded, making 20% of the final grade. The final grade would be completed by a midterm exam (30%) and a final exam (50%).

## Textbooks

This course will draw extensively on the lecture notes of Clement de Chaisemartin, available online [here](#). Some additional slides and notes will be provided to complete these notes, making it a self-contained corpus for this class.

For some textbook references on the various topics studied in this course, students can refer to:

- Bruce Hansen, Probability and Statistics for Economists, Princeton University Press, 2022
- Bruce Hansen, Econometrics, Princeton University Press, 2022
- Guido W. Imbens and Donald B. Rubin, Causal Inference for Statistics, Social, and Biomedical Sciences, Cambridge University Press, 2015
- Aad W. van der Vaart, Asymptotic Statistics, Cambridge University Press, 1998
- Joshua Angrist and Jorn-Steffen Pischke, Mostly Harmless Econometrics, Princeton University Press, 2008

## Outline

1. **Review of probability and statistics**
2. **Causal inference intro.**, with an application to RCTs
3. **OLS** (estimand, estimator, causal interpretation under homogeneous vs. heteroge

neous treatment effects)

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4. **2SLS** (estimand, estimator, causal interpretation under homogeneous vs. heterogeneous treatment effects)
5. **Causal inference and estimation under unconfoundedness** (OLS revisited, matching, re-weighting)
6. **Intro. to Maximum Likelihood estimation and discrete-choice models** (Time permitting)

