UNIVERSITÀ DEGLI STUDI DI MILANO

UNIVERSITÀ DI PAVIA

Ph.D. in ECONOMICS – Universities of Milan and Pavia

Econometrics

Academic year 2026-27 –First Term

Fabrizio Iacone, University of Milan,
Office: Room 4, Via Conservatorio 7, Milano (Iacone) and Department of Economics
E-mail: fabrizio.iacone@unimi.it

Office hours: by appointment

Course description: In the first part of this module, we introduce the basic statistical theory that can be used to establish the asymptotic properties of the most popular econometrics estimates. In the second part we apply these concepts to study advanced topics in econometrics: Quantile Regression, Non-parametric kernel methods, Bootstrapping, the Invariance Principle. Additional topics include Factor Models and Shrinkage methods for prediction.

Learning objectives Relevant economics and social sciences questions are often analysed also using data analysis. In this module we establish what properties are statistically desirable for an estimate, and how to verify if these are met in situations of interest.

Learning Outcomes
By the end of the module, the students should be familiar with the meaning of various types of convergence, and they should be able to establish if an estimate is consistent, and establish its limit distribution, in a range of simple situations.

Course prerequisites Differential calculus, matrix algebra

Course organization: 20 hours of lectures

Course Assessment:

Knowledge of the contents of the module will be assessed by means of one summative assessment at the end of the module. The exam will be a sit-down, closed-book assignment. For the first sitting only, candidates will have the option to present a project, instead.

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Syllabus

- Types of Convergence
- Consistency
- Stochastic orders of magnitude
- Convergence in distribution
- Conditions for consistency and asymptotic normality for implicitly defined extremum estimates
- The Functional Central Limit Theorem, with application to the estimation of the mean for unit root processes.
- Quantle Regression
- Non parametric kernel methods
- Introduction to Bootstrapping
- The Invariance Principle
- Factor Models
- Shrinkage methods for prediction

References

White, H., 2000. Asymptotic theory for econometrician (rev. ed.), New York, Academic Press.
Further readings for the second part will be given during the module.

Additional references for the topics will be indicated during the module.