

Syllabus

Contents of the Course

The course will be divided into two main blocks. First we introduce non-parametric estimation methods which are at the core of modern statistics. The aim of this course is to provide a short but self-contained introduction to the theory of nonparametric estimation, where we emphasis is on the construction of optimal estimators. This is a concise course where we introduce the fundamental concepts of the theory while maintaining the exposition suitable for a first approach in the field. Second, we introduce topics of Time Series econometrics that are relevant and novel which can be used to motivate other innovative research questions.

- **Non-Parametric Estimation**

1. Estimation of the CDF and Statistical Functional
 - (a) The empirical Distribution Function
 - (b) Statistical Functionals
2. Nonparametric Curve Estimation
 - (a) The Bias-Varince Tradeoff
 - (b) Histograms
 - (c) Kernel Density Estimation
 - (d) Nonparametric Regression
3. Smoothing Using Orthogonal Functions
 - (a) Orthogonal Functions and L_2 Spaces
 - (b) Density Estimation
 - (c) Regression
 - (d) Wavelets
4. The Bootstrap
 - (a) Simulation
 - (b) Bootstrap Variance Estimation
 - (c) Bootstrap Confidence Intervals

- **List of References for Time Series Research**

1. Unit Roots and Beyond
 - (a) D. Kwiatkowski, P.C.B. Phillips, P.Schmidt, Y.Shin. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root, *Journal of Econometrics*, 54, Issues 1–3, 159-178.
 - (b) M. Caner, L. Kilian, (2001) Size distortions of tests of the null hypothesis of stationarity: evidence and implications for the PPP debate, *Journal of International Money and Finance*, 20, 639-657.

- (c) V. Berenguer-Rico, J.Gonzalo, (2014) Summability of stochastic processes—A generalization of integration for non-linear processes, *Journal of Econometrics*, 178, 331-341.
2. Threshold Models
 - (a) H. Tong, (2015), Threshold models in time series analysis—Some reflections, *Journal of Econometrics*, 189, 2, 485-491.
 - (b) Hansen, B.E. (2000), Sample Splitting and Threshold Estimation. *Econometrica*, 68: 575-603.
 - (c) B.E. Hansen (2017) Regression Kink With an Unknown Threshold, *Journal of Business & Economic Statistics*, 35:2, 228-240.
 3. Self-Normalization Methods
 - (a) Kiefer, N. M., Vogelsang, T. J., & Bunzel, H. (2000). Simple Robust Testing of Regression Hypotheses. *Econometrica*, 68(3), 695–714.
 - (b) Ignacio N Lobato (2001) Testing That a Dependent Process Is Uncorrelated, *Journal of the American Statistical Association*, 96:455, 1066-1076.
 - (c) Kiefer, N., & Vogelsang, T. (2002). Heteroskedasticity-Autocorrelation Robust Testing Using Bandwidth Equal to Sample Size. *Econometric Theory*, 18(6), 1350-1366.
 4. Testing for Normality
 - (a) Bai, J., & Ng, S. (2005). Tests for Skewness, Kurtosis, and Normality for Time Series Data. *Journal of Business & Economic Statistics*, 23(1), 49–60.

Course Dynamic and Evaluation

Course dynamic: The first 8-9 weeks we will teach non-parametric estimation. From week 9-10 to week 18, each student has to present at least one paper in the reference list.

Evaluation: The grade of the course will be distributed as follow, 30% of the grade will correspond to daily grading in which attendance (10%), active participation (10%), and the slides the student has to write for the oral exam (presentation) (10%) will be evaluated. 70% of the grade is assigned to the oral exam.

References

- R. Christensen (2001). Advanced Linear Modeling. *Springer*. Second edition.
- Efron, B., & Tibshirani, R.J. (1994). An Introduction to the Bootstrap (1st ed.). *Chapman and Hall/CRC*