Advanced Topics in Statistical Learning (60h – 9CFU)

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Course learning objectives and skill acquisition

The aim of the course is to provide students with a coverage of a set of methods used in the analysis of economic data to answer a variety of specific, quantitative questions and with the computational tools to be used in the empirical applications. The program includes further topics on the classical regression model, time series analysis and some recent proposal to deal with applications having many observations and/or many predictors relative to the number of observations.

The course applies the widely used freeware programming environment for statistical analysis, known as R (through the RStudio interface).

A refresher on multiple linear regression. Further topics in regression analysis: Instrumental variables, Differences-in-Differences, Regression Discontinuity estimators, Heckman's sample selection model, Mediation analysis, Quantile regression. Introduction to time series and forecasting. Models for univariate time series: ARMA, ARIMA, ARCH, GARC. Time series regression with additional predictors. The autoregressive distributed lag model. Estimation of dynamic causal effects. The VAR model. Breaks. Cointegration and error correction. Prediction with many regressors and big data: Ridge regression, the Lasso, regression trees and random forests.

Assessment

The final exam is composed of a written two hours closed-book and closed-note test, takes place in the Lab and consists in both analytical and computer-exercise questions and an oral exam. The oral exam is not compulsory and consists mainly in a discussion on the written test. Each candidate may prepare a short essay on the analysis of a set of data, using the tools discussed during the classes, whose content will be argue during the oral exam.

Teaching material

Textbooks

Stock J.H. and Watson M.W., Introduction to Econometrics, Global edition, 4th Edition, 2020, Pearson.

Angrist, J.D. ; Pischke, J.-S., Mostly harmless econometrics : an empiricist's companion, 2009, Princeton University Press.