16I032 Quantitative & Statistical Methods III

Term 3 – 6 ECTS

Elective Course

Prof. Gergely Gánics

Prerequisites to Enroll

Students are expected to have a solid background in statistics and econometrics at the introductory graduate level (e.g. Econometric Methods I offered in the Economics Master's program), and some coding experience (preferably in MATLAB). However, plenty of references (both theoretical and practical) will be provided throughout the course, including a MATLAB tutorial, therefore students interested in time series econometrics, macroeconometrics and forecasting will be able to follow the classes. Note that this is going to be a challenging but rewarding course, which requires students to study and practice continuously throughout the term.

Overview and Objectives

This is an introductory course in time series econometrics, with a special emphasis on macroeconomic forecasting. We will cover the necessary theoretical background, and the corresponding practical aspects, such as Monte Carlo simulations and empirical applications using real data.

Upon successfully completing the course, students are going to be familiar with the standard toolkit of macroeconometrics, and use it to analyze relevant macroeconomic problems.

Course Outline

1. Univariate stationary and non-stationary time series processes.
2. Trends and cycles.
3. Multivariate time series processes. Basics of state-space models and the Kalman filter.
4. VAR models. Factor models.
5. Cointegration.
6. Bayesian VAR models, Structural VAR models.
7. Forecasting (topics will be discussed throughout the course when relevant):
    a. loss functions, point and density forecasts,
    b. forecast combinations,
    c. forecast evaluation techniques,
    d. some practical aspects of forecasting: real-time data, etc.

Evaluation

Grades will be based on the problem sets (40%) and a final exam (60%).

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Required Activities

The course will consist of 40 hours of lectures and 10 hours of TA sessions. In addition, the students will have to hand in 4 problem sets (approximately every other week) whose solutions are discussed in the TA sessions. Problem sets will include both theoretical and empirical exercises, therefore some basic knowledge of statistical software is required (solutions to the empirical problem sets will consist of MATLAB code). Students can work on the problem sets in small groups of up to 4. Additional, non-graded problem sets will be provided whose solutions will be discussed in the remaining TA classes, to help students deepen their understanding of the material.

NOTE: due to the COVID-19 situation, the relative weight of the problem sets have been increased to 40% and that of the final exam has been decreased to 60%.

Competences

☒ Capacity of utilization of the theoretical instruments of the to analyze situations of coherent form.
☒ Ability to use the appropriate (statistical and numerical) techniques.
☐ Ability to identify and successfully search for the data necessary for the analysis, either grossly or in the form of more elaborate databases.
☒ Ability to make independent judgments and defend them dialectically.
☐ Ability to write formal reports.
☒ Acquire a solid knowledge base for the study of quantitative issues.
☒ Ability to recognize and know how to use the principles of econometrics and statistics.
☐ Ability to work with microeconomic analysis tools and their empirical and theoretical applications.

Learning Outcomes

☐ Students should get an overview of economic and financial theory.
☒ Students must be able to recognize theories and present arguments with precise examples.
☐ Students will have the ability to understand how markets work and explain their weaknesses.
☒ Students will acquire the technical tools that will allow them to perform the advanced analytics required in the second module as econometric methods.
☒ Students will know what the appropriate inference for each situation is.

Materials

The course is going to be largely self-contained, and the main reading materials are lecture notes, which are going to be made available online before classes. Additionally, references to papers will be provided.

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On certain topics, students are advised to consult the following references (chapters will be specified during the course):

- James D. Hamilton (1994), *Time Series Analysis*, Princeton University Press.
- Francis X. Diebold (2017), *Forecasting*, Department of Economics, University of Pennsylvania, http://www.ssc.upenn.edu/~fdiebold/Textbooks.html (freely downloadable).
- Fumio Hayashi (2000), *Econometrics*, Princeton University Press.
- Bruce Hansen (2019), *Econometrics*, manuscript, http://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics.pdf (freely downloadable).
- Helmut Lütkepohl (2005), *New Introduction to Multiple Time Series Analysis*, Springer.
- Joshua C. C. Chan (2017), Notes on Bayesian Macroeconometrics, manuscript, https://joshuachan.org/papers/BayesMacro.pdf (freely downloadable).