E823 Advanced Time Series Analysis (Spring 2026)

Instructor:

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Lecture Time:

Start: 11.02.; End: 26.03.
Wednesday: 10:15am-11:45am in L7, 3-5, room P043
Thursday: 10:15am-11:45am in L7, 3-5, room P043

Course Description

The course will focus on multivariate time series models. This year, I teach the course just as a 'half-course' within seven weeks. So, we can cover only less material and have to go through quite superficially through some concepts.

After reviewing a few general concepts in time series analysis, we will first deal with stable VAR models and their use for Granger causality, impulse response analysis, and forecast error variance decompositions. To this end, we will also discuss important issues on asymptotic- and bootstrap-based inference.

Then, we deal with multivariate VAR processes integrated of order 1, $I(1)$. Potentially, we start with a quick reminder on univariate unit root processes and before looking into inference for VARs with $I(1)$ variables.

The course both addresses asymptotic analyses as well as implementation issues. Accordingly, tutorial sessions are also devoted to coding and empirical problems besides addressing theoretical problems.

In the last part of the course, participants introduce or discuss in more details (further) model classes by giving a presentation and writing a paper.

Our course is complementary to the course offered by Matthias Meier. While the latter course focus on structural modeling approaches from an applied macro perspective, we take an econometric approach on multiple time series frameworks.

Pre-requisites

For participating in the course you have to pass Advanced Econometrics I-III. Accordingly, I expect participants to have a basic knowledge on univariate time series concepts, stable ARMA models, and unit root econometrics.

Grading: Assignments, Presentations, Paper

Grading for this course will be based on two assignments (30%), one presentation (30%), and a paper (40%). The assignments will mostly involve theoretical questions but also cover empirical issues and practical implementations of the methods discussed in class. The grade for each assignment will be on a 0-10 scale: 10 excellent and 0 not handed in. The solutions and empirical output/programming code must be sent by email. Answers will be partly discussed in the tutorial sessions.

Presentations

The idea is that every participant acquires profound knowledge of a further model class or specific methods in multiple time series analysis. We should discuss early on what is of most interest to you. The paper can be submitted and presentations be given in week 8 after the Eastern break. We discuss details in this regard in the first lecture week.

Course Outline

1. Introduction: some concepts in time series analysis
2. Stable VARs: model framework, estimation, and specification
3. (Structural) VAR tools: Granger-causality, impulse response analysis, forecast error variance decompositions
4. Bootstrap inference for impulse response analysis: bootstrap confidence intervals
5. Multivariate I(1) processes and inference in VARs with $I(1)$ variables

Course Reading

Here, I only list the main references. I will provide detailed comments on the reading for each part of the course in separate documents. These also include additional references for a more detailed study of certain issues.

Brüggemann, R., Jentsch, C. and, Trenkler, C. (2016), Inference in VARs with conditional heteroskedasticity of unknown form, *Journal of Econometrics*, 191, 69-85.

Hansen, B.E. (2022), *Econometrics*, Princeton: Princeton University Press, Chs. 14-16.

Hamilton, J.D. (1994), *Time Series Analysis*, Princeton: Princeton University Press, Ch. 2-3, 5, 7-8, 15-20.

Kilian, L. and Lütkepohl, H. (2017), *Structural Vector Autoregressive Analysis*, Cambridge: Cambridge University Press, Ch. 2-4, 12.

Lütkepohl, H. (2005), *New Introduction to Multiple Time Series Analysis*, Berlin: Springer Verlag, Ch. 1-4, 6-9, 11-12, 15 Appendix D. and structural vector autoregressions in macroeconomics. In *Handbook of Macroeconomics*, Volume 2, Chapter 8. Elsevier.

White, H. (2000), *Asymptotic Theory for Econometricians*, revised edn, San Diego: Academic Press

Lecture Plan

Here is a preliminary plan on how lectures, tutorials, and assignments are scheduled.

	Wednesday	Thursday
Week 1: 11.02./18.02.	Lecture (Part 1)	Lecture (Part 1)
Week 2: 18.02./19.02.	Lecture (Part 2)	Lecture (Part 2)
Week 3: 25.02./26.02.	Tutorial (PSet 1)	Tutorial (PSet 1)
Week 4: 04.03./05.03.	Lecture (Part 3)	Lecture (Part 3)
Week 5: 11.03./12.03.	Tutorial (PSet 2)	Tutorial (Part 2, Assign. 1)
Week 6: 18.03./19.03.	Lecture (Part 4)	Lecture (Part 5)
Week 7: 25.03./26.03.	Lecture (Part 5)	Tutorial (PSet 3, Assign. 2)

Assignment 1: provided at xx.xx., due at xx.xx. at 10am via email
Assignment 2: provided at xx.xx., due at xx.xx. at 10am via email