

FAU – School of Business, Economics and Society
Chair of Statistics and Econometrics
Bayesian Econometrics
Winter Term 2024/25 – Syllabus

Instructor:

Jonas Dovern

Office: LG 4.169

E-Mail: jonas.dovern@fau.de

Office hours: by appointment

Assistant

Maximilian Böck

Office: LG 4.173

E-Mail: maximilian.boeck@fau.de

Office hours: by appointment

Overview: This course is an introduction to Bayesian statistics. It focuses on models that are relevant in economics. The course will give students the theoretical knowledge and practical skills to apply Bayesian techniques in a wide range of empirical applications. We will start with the foundations of Bayesian statistics and then cover estimation of linear and non-linear regression models as well as probit models and Bayesian vector autoregressions. The course will also cover various numerical methods needed to estimate those models. Students will learn how to practically implement the covered methods using the software R. Students will be able to use the covered methods on their own and to understand academic papers that use Bayesian methods in empirical analyses. The course will be self-contained in the sense that no prior knowledge of both Bayesian statistics and R are required. However, students should have solid knowledge of the basics of statistics and econometrics and will profit from prior experience with R or other econometric software packages.

Main textbook: Koop, G. (2003), Bayesian Econometrics, Wiley, West Sussex.

Other literature: Announced during the course.

We teach the course over the period 15th October to 14th January. We have three regular weekly time slots: Tuesday: 15:00h – 16:30h, LG 4.109; Tuesday: 16:45h – 18:15h, LG 4.109; Thursday: 09:45h – 11:15h, LG 4.109.

Lectures: 15.10.(15:00), 17.10.(9:45), 22.10.(16:45), 24.10.(9:45), 29.10.(15:00), 31.10.(9:45), 6.11.(13:15), 7.11.(9:45), 14.11.(9:45), 19.11.(15:00), 21.11.(9:45), 28.11.(9:45), 5.12.(9:45), 12.12.(9:45)

Exercise sessions: 22.10.(15:00), 29.10.(16:45), 5.11.(9:45), 12.11.(16:45), 19.11.(16:45), 26.11.(15:00), 26.11.(16:45), 3.12.(15:00), 3.12.(16:45), 10.12.(15:00), 10.12.(16:45), 17.12.(15:00), 17.12.(16:45), 19.12.(9:45)

Final examination: 14th January, 2025 (afternoon, oral exams, 20 minutes)

Grading: Grading is based 100 % on the oral exam.

Course outline

- Topic 1: The idea of Bayesian statistics / Bayes' theorem
- Topic 2: Prior + Likelihood = Posterior
- Topic 3: Linear regressions with conjugate priors
- Topic 4: Linear regressions with many explanatory variables / MC integration
- Topic 5: Linear regressions with independent priors / Gibbs sampler
- Topic 6: Linear regressions with inequality constraints / importance sampling
- Topic 7: Non-linear regression models / Metropolis-Hastings algorithm
- Topic 8: Probit models
- Topic 9: Forecasting
- Topic 10: Model comparison / Bayesian model averaging
- Topic 11: Bayesian VAR models
- Topic 12: Bayesian estimation of DSGE models / Review of course content

Course requirements: Course participants are strongly advised to ...

- **Attend.** You can only fully benefit from this course if you attend both lectures and exercises regularly because the course content is cumulative, meaning that later topics rely heavily on stuff covered in the previous weeks.
- **Prepare.** Ideally, do the assigned readings before the lecture and come to class prepared to discuss them and to ask questions that you have about the topic.
- **Follow the website.** I will make course material available through the course website on StudOn. I will also make announcements using this platform.
- **Code.** Your learning gains will be much higher if you regularly work on the R assignments, which ask to implement the material that we cover in the lectures. Do not underestimate how much coding an approach helps understanding it!

R Software

R is a free software environment. You can download R using any of the links on the following website: <https://cran.r-project.org/mirrors.html>.

We recommend that you use RStudio to organize your codes. You can download RStudio Desktop for free [here](#) (just use the download button that is most to the left).

We will use the first exercise session to explain how to install R/RStudio and to make sure that it works on everyone's laptop. If you are not familiar with R/RStudio at all, we kindly ask you to take our [online introduction to R on StudOn](#) to learn the very basics. There are also many excellent online courses for learning R available online which you might want to study R on your own. We recommend the following:

- A free course on [Coursera](#) offered by Johns Hopkins University;
- The book "R Programming for Data Science" by one of the authors of the Coursera course;
- Many tutorials on various aspects of R offered via the [swirl project](#);
- The course "[Topics in R Statistical Language](#)" offered by PennState University.

The most important thing to enhance your programming skills and to master the implementation of econometric methods is to write a lot of code. Do not be afraid of bugs!