FAU – School of Business, Economics and Society
Chair of Statistics and Econometrics

MSE-7340: Bayesian econometrics
Summer 2020 – Syllabus

Lecture: Wednesday (22.4., 29.4., 6.5., 13.5., 20.5., 27.5., 10.6., 17.6., 24.6., 1.7., 8.7.), 8:00-9:30, room LG 3.152/3 <u>AND</u> Thursday (30.4., 7.5., 14.5.), 11:30-13:00, room LG 4.109

Exercise: Thursday (23.4., 30.4., 7.5., 14.5., 28.5., 18.6., 25.6., 2.7., 9.7., 16.7.), 8:00-9:30, room LG 0.141<u>AND</u> Wednesday (20.5., 10.6.), 15:00-16:30, room LG 3.152/3

Final examination: 14.7.2020 (starting at 13:30h), room LG 2.429

Instructor: **Assistant**
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Main textbook: Koop, G. (2003), Bayesian Econometrics, Wiley, West Sussex.
Other literature: Announced during the course.

Overview: This course is an introduction to Bayesian statistics. It focuses primarily 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 vectorautoregressions. The course will also cover various numerical methods needed so 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.

Grading: Grading is based on an oral exam (of about 20 minutes) at the end of the course.

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 highly 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.

- **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, much higher if you regularly work on the R assignments which ask to implement the material that we cover in the lectures. Do n0t underestimate how much coding an approach helps understanding it!

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

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 a free copy of RStudio Desktop 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. The first exercise sessions cover the basics of programming in R.

There are also many excellent online courses for learning R available online which you might want to consul if you do have no prior experience with R at all. 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.