Bayesian estimation of DSGE models

Time and venue

The class takes place at the DIW Berlin on Wednesday from 8.30 to 12 am. Due to the evaluation of the institute on May 8th and 9th and the preceding preparations, we have to move two meetings from Wednesday to Friday.

The specific dates and venues are:

1. Session: Friday, April 12th, 8.30-12, Ferdinand-Friedensburg (instead of April 10th);
2. Session: Wednesday, April 17th, 8.30-12, Room 3.3.002c;
3. Session: Wednesday, April 24th, 8.30-12, Room 3.3.002c;
4. Session: Friday, May 10th, 8.30-12, Room 3.3.002c (instead of May 8th);
5. Session: Wednesday, May 15th, 8.30-12, Room 3.3.002c.

If necessary, we will have another session on Friday, May 17th (2-5 pm) as a substitute for May 22nd.

Please bring a Laptop with a Matlab installation or team up with someone who brings a Laptop with a Matlab installation.

Course summary

This class covers the essentials to estimate DSGE models with Bayesian methods. We start by deriving the state-space form of a DSGE model. In a next step, we introduce the Kalman Filter, a very useful tool to extract unobserved components from time series or to evaluate the likelihood of a DSGE model. The exercise classes will apply the simple New Keynesian model to extract monetary policy shocks.

Equipped with the basics, we start exploring the Bayesian way to estimate models. More precisely, we will introduce the Prior and the Posterior distribution of parameters. Students will learn how to evaluate the Posterior distribution numerically using different sampling algorithms. In the exercise class, we discuss how a Bayesian model can be employed to forecast economic variables.

The final part will see the introduction of the Dynare software package that is usually used to solve and estimate DSGE models. After the introduction of the basic setup of a Dynare file, we will put Dynare to work. Finally, we aim to consider complex models such as the Smets and Wouters model (2007, AER).

The course will use the textbook by Ed Herbst and Frank Schorfheide ``Bayesian estimation of DSGE models'' (2016, Princeton University Press).

Prerequisites

Participants are expected to have a working knowledge in Matlab and Dynare. Lutz Weinke gave in excellent introduction into Dynare. In case, you are missing prerequisites in Matlab, but would like to attend the class nevertheless, please let me know by email until April 1st. I will then offer an introduction into Matlab on Friday, April 5th (10-12).

Part 1: DSGE model basics

Introduction of the workhorse DSGE model

The state-space form a DSGE model

The Kalman Filter

Likelihood of DSGE models

Exercises:

- Extraction of unobserved components (monetary policy shock)

- Evaluation of the Likelihood of a DSGE model

Part 2: Bayesian estimation

Introduction of Bayesian estimation

The analytics of the Posterior distribution

Numerical evaluation the Posterior distribution

Important topics in Bayesian estimation:

- Marginal data density

- Convergence and accuracy of the numerical methods

Exercises:

- Sampling algorithm
    1. Direct sampling
    2. Importance sampling
    3. Random-walk Metropolis-Hastings algorithm

- Forecasting

Part 3: Dynare

Implementation of a DSGE model in Dynare

Estimation of a DSGE model in Dynare

Interpreting Dynare output

Exercises:

- Dynare in practice

- Estimation of more complex models

Grading

Bayesian estimation of DSGE models is very difficult to test in an exam. Instead of an exam, I will ask you to employ the methods you have learned in class and to write a very brief paper (5-10 pages). The paper could be the estimation of an existing model with a new dataset. It will count for 50%. Furthermore, class participation (20%) and the presentation of solutions to the exercises during classes (30%) will count for your grade.