

A Course in:

Bayesian Methods for Empirical Macroeconomics

Gary Koop, University of Strathclyde (Gary.Koop@strath.ac.uk)

Overview

This is a course in Bayesian econometrics with a focus on models used in empirical macroeconomics. It begins with a brief introduction to Bayesian econometrics, describing the main concepts underlying Bayesian theory and seeing how Bayesian methods work in the familiar context of the regression model. Computational methods are of great importance in modern Bayesian econometrics and these are discussed in detail. Subsequently, the course shows how Bayesian methods are used with models which are currently popular in macroeconomics such as Vector Autoregressions (VARs), time-varying parameter VARs (TVP-VARs) and factor models. Empirical illustrations that show how these models can be used to address macroeconomic questions will be provided throughout the course.

Readings

Material relating to empirical macroeconomics is based on the monograph: Koop, G. and Korobilis, D. (2009). *Bayesian Multivariate Time Series Methods for Empirical Macroeconomics* (available on my website).

Bayesian theory and regression material is taken from my textbook: Koop, G. (2003). *Bayesian Econometrics*, published by Wiley.

I also have a book of solved exercises that I will draw on occasionally: Koop, G., Poirier, D. and Tobias, J. (2007). *Bayesian Econometric Methods*, Cambridge University Press, (Volume 7 in the *Econometrics Exercises* Series edited by Karim Abadir, Jan Magnus and P.C.B Phillips)

Background

The course assumes that participants have some background knowledge of econometrics (e.g. obtained from a graduate level or senior undergraduate level econometrics course), but will assume no prior knowledge of Bayesian methods. I will assume that participants have a basic knowledge of probability (i.e. definitions and rules relating to conditional, marginal and joint probabilities and definitions and properties of common distributions such as the Normal and t -distributions). In addition, the participant should have a knowledge of basic matrix algebra. The Appendices to Koop (2003) provide a summary of the probability theory and matrix algebra used in this course.

Course Content

Code for references: K = Koop (2003), KK = Koop and Korobilis (2009), KPT = Koop, Poirier and Tobias (2007).

Topic 1: Bayesian Basics

- i) An Overview of Bayesian Econometrics (Reading: K, Chapter 1).
- ii) Bayesian inference in the Normal linear regression model.
Computational topic: Monte Carlo integration
Reading: K, Chapters 2 and 3.
- iii) Bayesian treatment of regression model with general error covariance matrix (Reading: K, pages 117-121 and 130-137)
Computational topic: Gibbs sampling (Reading: K pages 62-68)

Topic 2: Bayesian VARs

Reading: KK, sections 1 and 2, plus K pages 137-143 and KPT, chapter 17.

- i) Unrestricted VARs: Shrinkage and the Minnesota Prior
- ii) Restricted VARs
- iii) An example involving the New Keynesian Phillips curve
- iv) Forecasting with Bayesian VARs
- v) Other methods which help with shrinkage in VARs

Topic 3: Bayesian State Space Modelling

Reading: KK, section 3 and K, chapter 8.

- i) The Normal linear state space model
- ii) Linearized DSGE models as state space models
- iii) Computational topic: the Metropolis-Hastings algorithm (Reading, K pages 92-99)
- iv) Stochastic volatility
- v) Forecasting with TVP regression models (including dynamic model averaging)

Topic 4: TVP-VARs (including variants with stochastic volatility)

Reading: KK, section 4

Topic 5: Factor Model Extensions of VARs and TVP-VARs

Reading: KK, section 5