A Course in:

Bayesian Methods for Empirical Macroeconomics

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Overview

Overview: Bayesian methods are increasingly used in econometrics, particularly in the field of macroeconomics. This is a course in Bayesian econometrics with a focus on the 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 in detail. Computer tutorial sessions, using MATLAB, will allow the student to develop the necessary programming skills. In light of the Big Data revolution, applied economists often face the situation where the number of variables under consideration is large relative to the number of observations and conventional econometric methods do not work well. We describe various methods that can be used with Big Data in the context of the regression model and emphasize the wider applicability of these methods in other modelling contexts. Subsequently, the course shows how Bayesian methods are used with models which are currently popular in macroeconomics such as Vector Autoregressions (VARs), state space models, 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.

All course materials are available on the website:
http://personal.strath.ac.uk/gary.koop/sgpe_bayesian.html

Readings

Koop, G. (2003). Bayesian Econometrics, published by Wiley.

Koop, G. and Korobilis, D. (2009). Bayesian Multivariate Time Series Methods for Empirical Macroeconomics, monograph in the Foundations and Trends in Econometrics series available on Gary Koop's website.

Koop, G. (2016). Bayesian Methods for Fat Data, manuscript to be made available on Gary Koop's website.

I also have a book of solved exercises which , 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 from previous coursework, 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: K2003 = Koop (2003), K2016 = Koop (2016), KK = Koop and Korobilis (2009), KPT = Koop, Poirier and Tobias (2007).

Topic 1: **An Overview of Bayesian Econometrics**
Reading: K2003, Chapter 1.

Topic 2: **Bayesian Inference in the Normal Linear Regression Model**
i) The regression model under the classical assumptions
Reading: K2003, Chapters 2 and 3.
ii) The regression model with general error covariance matrix
Reading: K2003, Chapter 6

Topic 3: Bayesian Methods for Regression Models with Fat Data
i) Bayesian model averaging with Fat Data
ii) Variable selection and shrinkage using hierarchical priors
iia) Stochastic search variable selection (SSVS)
iib) Least absolute shrinkage and selection operator (LASSO)
Reading: K2016

Topic 4: 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
vi) Large VARs

Topic 5: 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 6: TVP-VARs and Factor Models
Reading: KK, sections 4 and 5
i) The homoskedastic TVP-VAR
ii) The TVP-VAR with multivariate stochastic volatility
iii) The static factor model
iv) The dynamic factor model
v) The factor augmented VAR (FAVAR)
vi) The TVP-FAVAR