# **Professor(s)**

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# **Overview and Objectives**

This is a course in introductory 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.

In macroeconomics, we often have Big Data and work with models where the number of parameters to be estimated is large relative to the number of observations in the data set. A range of Bayesian methods have been derived for dealing with Big Data including Bayesian model averaging (BMA), stochastic search variable selection (SSVS) and the least absolute shrinkage and selection operator (LASSO). The second part of the course covers these methods and shows how they are applied in the context of the regression model. Subsequently, the course turns to state space models and discusses estimation of several state space models popularly used in macroeconomics. These include time series models where parameters change over time, models with regime change and stochastic volatility models.

The models and methods covered in this course are of direct use in many macroeconomic applications. But they also represent the groundwork that underlies popular multivariate macroeconomic models such as Vector Autoregressions (VARs), time-varying parameter VARs (TVP-VARs), factor and Dynamic Stochastic General Equilibirum (DSGE) models.

# **Course Outline**

# Code for references: K = Koop (2003), KPT = Koop, Poirier and Tobias (2007), Ko = Korobilis (2013)

# Topic 1: Bayesian Basics

# i) An Overview of Bayesian Econometrics.

# ii) Bayesian inference in the Normal linear regression model. Computational topic: Monte Carlo integration.

# iii) Bayesian treatment of the regression model with general error covariance matrix Computational topic: Gibbs sampling (Reading: K pages 62-68) and the Metropolis-Hasting algorithm.

# Topic 2: Bayesian Model Averaging and Model Selection

# i) Bayesian Model Averaging (BMA) Computational topic: Markov Chain Monte Carlo Model Composition (MC3).

# ii) Prior shrinkage: empirical Bayes and training sample priors.

# iii) Stochastic Search Variable Selection.

# iv) The Bayesian Lasso.

# Topic 3: Bayesian State Space Modelling

# i) The Normal linear state space model.

# ii) Linearized DSGE models as state space models.

# iii) Dynamic mixture models for modelling breaks and regime change.

# iv) Stochastic volatility.

# v) Forecasting with TVP regression models (including dynamic model averaging).

## List of References

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

Koop, G., Poirier, D. and Tobias, J. (2007). Bayesian Econometric Methods, Cambridge University Press

Koop, G. and Korobilis, D. (2012). Forecasting inflation using dynamic model averaging, International Economic Review.

Korobilis, D. (2013). Hierarchical shrinkage priors for dynamic regressions with many predictors, International Journal of Forecasting, 29, 43-59.