3 ECTS

17M025

Advanced Time Series

Overview and Objectives

PART 1 (by Marek Jarocinski)

Bayesian Vector autoregressions (VARs) are becoming a standard tool both in the academia and in policy institutions. They are useful for forecasting and for structural analysis. This module starts with an introduction to the Bayesian approach to econometrics and then familiarizes students with the theory and practice of Bayesian VARs. Examples from central banking practice are given throughout the course.

We explain the standard priors for VARs introduced by Sims, Litterman and their coauthors. We run examples implemented in matlab and in Dynare and discuss applications of Bayesian VARs to forecasting. We discuss density forecasts and define the Marginal Likelihood - the basic ingredient in Bayesian model choice. We interpret the Marginal Likelihood and discuss its relation with out-of-sample density forecasting. We finish with applications of conditional forecasting in policy institutions and, time permitting, optional topics such as other priors for VARs, choice of variables and non-gaussian errors.

PART 2 (by Danilo Leiva)

When making predictions or structural analysis, economists often have to deal with data-rich environments which, moreover, may be subject to a nonlinear nature. The focus of this course is on the Bayesian estimation of sophisticated macroeconometric models which, by accounting for such features of the data, are useful to provide valuable information for central banks, government institutions, academic researchers or consulting firms.

Each topic covered during the course is accompanied by economic applications that illustrate its use in practice. These applications involve issues related to business cycle analysis, real-time nowcasting, monetary policy analysis, financial markets assessments, among others. The theoretical econometric issues of each topic will be discussed, although a high emphasis will be put on training the students to deal with the empirical issues. Computer programs associated to each economic application will be explained in detailed during the sessions. Basic knowledge of Bayesian econometrics and MATLAB is recommended.

Course Outline

PART 1
1. Introduction to / refreshment of Bayesian econometrics
   - Likelihood, prior, posterior, posterior simulation
   - Linear regression, prior as additional observations

Koop (2003, Ch.1), Sims (2002)

2. Bayesian VARs
   - Motivation for the standard priors for VARs
   - Minnesota prior, one-unit-root prior, no-cointegration prior
   - Forecasting examples: Medium size VAR, Large VAR, ECB short-term projections

Litterman (1986), Sims and Zha (1998), Sims (2006) Banbura et al. (2010), Giannone et al. (2010)

3. Density forecasts and Bayesian model choice
Koop (2003, Ch.1), Geweke (2005)
4. Unconditional vs conditional forecasting.
Example: 'missing disinflation' and 'missing inflation' during the Great Recession
Waggoner and Zha (1999), Bobeica and Jarocinski (2016)

PART 2

1. Bayesian State Space Models
- Carter and Kohn Algorithm
- Dynamic Factor Models: A Bayesian Perspective
- Factor-augmented VAR (FAVAR)
- VAR with Time-varying Coefficients
- *Economic Applications*: Real time nowcasting in a data-rich environment, The changing effects of monetary policy shocks on the economy.

2. Bayesian Regime-Switching Models
- Kim and Nelson Algorithm
- VAR with Markov-Switching Coefficients
- Markov-Switching Models with Multiple State Variables
- Markov-Switching and the Kalman Filter: A Bayesian Perspective
- *Economic Applications*: Measuring the synchronization of international business cycles, Nowcasting Real Activity Under Structural Breaks.

3. Stochastic Volatility
- Kim, Shephard and Chib Algorithm
- VAR with Time-varying Coefficients and Stochastic Volatility
- Factor Stochastic Volatility Model
- *Economic Applications*: Modelling the volatility of stock returns, Measuring Global Macroeconomic Volatility.

Required Activities

Evaluation

There will be one final exam.

3 ECTS

17M025

Advanced Time Series

Materials

PART 1

Bánbura, M., Giannone, D., and Reichlin, L. (2010). Large Bayesian vector auto regressions. Journal of Applied Econometrics, 25(1):71{92.

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PART 2

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12M012

Advance Time Series and Panel Data

4.5 ECTS

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Ductor L. and D. Leiva-Leon (2018). “Global Macroeconomic Volatility.” Bank of Spain Working Paper, Forthcoming.

Fruhwirth-Schnatter, S. and H. Wagner (2010). “Stochastic model specification search for Gaussian and partial non-Gaussian state space models.” Journal of Econometrics, 154, 85–100.

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Hubrich, K. and R. J. Tetlow. (2015). “Financial stress and economic dynamics: The transmission of crises.” Journal of Monetary Economics, 70 (C), 100–115.

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12M012

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4.5 ECTS

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