

IWH-DPE/CGDE

**Professor Christiane Baumeister, PhD**

(University of Notre Dame, CEPR)

[cbaumeis@nd.edu](mailto:cbaumeis@nd.edu)

**September 3-7, 2018**

## **Advanced Econometrics Bayesian Time Series Analysis**

### **Course Description**

Structural vector autoregressions are the workhorse models in empirical macroeconomics. The Bayesian approach to estimation and inference of (S)VAR models has gained popularity as models have become more complex. The goal of this course is to equip students with the tools they need for state-of-the-art empirical research and to develop practical skills to apply Bayesian methods to specific problems. The first part of the course covers the basics of Bayesian econometrics including standard choices of prior distributions and numerical simulation methods. The second part of the course challenges the current practice of identification of VAR models by introducing a more general Bayesian framework that encompasses standard identification approaches as special cases. Drawing structural inference from VAR models requires making use of prior information. This course provides formal tools of Bayesian analysis that allow to incorporate prior beliefs about both the structural coefficients and the impacts of shocks in a flexible way and to characterize the contribution of prior information. The third part of the course extends the standard VAR model by allowing macroeconomic dynamics to evolve over time. Time-varying coefficients capture smooth changes in the underlying structure of the economy, while stochastic volatility allows for time variation in the variances of the error processes that affect the VAR. This course focuses on the specification and estimation of TVP-VARs in a Bayesian framework. The methods introduced in the lectures will be illustrated with various applications in Matlab.

### **Course Outline**

**Monday, September 3, 2018**

10:30–17:00

**Tuesday, September 4, 2018**

09:45–17:00

**Wednesday, September 5, 2018**

09:45–17:00

**Thursday, September 6, 2018**

09:45–17:00

**Friday, September 7, 2018**

09:00–15:30

### **Grading**

Each student is asked to write a proposal for a research paper using one of the methods discussed in the course. The deadline for submission is **October 30, 2018**.

### **Venue**

Halle Institute for Economic Research (IWH) – Member of the Leibniz Association, Kleine Maerkerstrasse 8, 06108 Halle (Saale), Germany, conference room (ground floor)

### **Registration**

Please contact Annett Hartung, Phone: +49 345 7753 751, E-mail: [annett.hartung@iwh-halle.de](mailto:annett.hartung@iwh-halle.de), until August 1, 2018.

The course is designed for at most 25 participants.

## Detailed Program

### Monday, September 3, 2018: Bayesian Analysis of VAR Models

- 10:30–12:00 Introduction to Bayesian Estimation  
13:30–15:00 Bayesian Inference in Vector Autoregressions  
15:30–17:00 Matlab Application: Implementation of Priors and Gibbs sampling

### Tuesday, September 4, 2018: A Bayesian Approach to Structural VAR Models

- 09:45–10:15 Office Hours  
10:30–12:00 The Identification Problem Revisited  
13:30–15:00 Identification Using Inequality Constraints  
15:30–17:00 Matlab Application: Labor Market Dynamics

### Wednesday, September 5, 2018: The Role of Prior Information

- 09:45–10:15 Office Hours  
10:30–12:00 A Bayesian Interpretation of Traditional Identification Assumptions  
13:30–15:00 Matlab Application: Oil Supply and Demand Shocks  
15:30–17:00 Matlab Application: Labor Market Dynamics (Continued)

### Thursday, September 6, 2018: Inference in Set-Identified SVAR Models

- 09:45–10:15 Office Hours  
10:30–12:00 Credibility Sets for Impulse Response Functions, Variance and Historical Decompositions  
13:30–15:00 Prior Information about Structural Coefficients and Impacts of Shocks  
15:30–17:00 Matlab Application: The Effects of Monetary Policy

### Friday, September 7, 2018: Modeling Time Variation in VAR Models

- 09:00–10:30 Time-Varying Parameter Models and the Kalman filter  
11:00–12:30 Stochastic Volatility Models  
14:00–15:30 Matlab Application: Forecasting Macroeconomic Variables

## Reading List

### Reference textbooks:

- Greenberg, E., *Introduction to Bayesian Econometrics*, Cambridge University Press, second edition, 2012.  
Kim, C.J., and C.R. Nelson, *State-Space Models with Regime Switching*, MIT Press, 1999.

### 1. Bayesian Analysis of VAR Models

- Casella, G., and E.I. George (1992), "Explaining the Gibbs Sampler," *American Statistician*, 26, 167-174.  
Doan, T., R. Litterman, and C. Sims (1984), "Forecasting and Conditional Projection Using Realistic Prior Distributions," *Econometric Reviews*, 3(1), 1-100.  
Kadiyala, K.R., and S. Karlsson (1997), "Numerical Methods for Estimation and Inference in Bayesian VAR-models," *Journal of Applied Econometrics*, 12, 99-132.  
Kim and Nelson, Chapter 7

### 2. A Bayesian Approach to Structural VARs

- Baumeister, C., and J.D. Hamilton (2015), "Sign Restrictions, Structural Vector Autoregressions, and Useful Prior Information," *Econometrica*, 83(5), 1963-1999.  
Baumeister, C., and J.D. Hamilton (2017), "Structural Interpretation of Vector Autoregressions with Incomplete Identification: Revisiting the Role of Oil Supply and Demand Shocks," working paper, UCSD.  
Baumeister, C., and J.D. Hamilton (2018), "Inference in Structural Vector Autoregressions When the Identifying Assumptions are Not Fully Believed: Re-evaluating the Role of Monetary Policy in Economic Fluctuations," working paper, UCSD.  
Chib, S., and E. Greenberg (1995), "Understanding the Metropolis-Hastings Algorithm," *American Statistician*, 49(4), 327-335.  
Rubio-Ramirez, J.F., D.F. Waggoner, and T. Zha (2010), "Structural Vector Autoregressions: Theory of Identification and Algorithms for Inference," *Review of Economic Studies*, 77(2), 665-696.  
Sims, C. A., and T. Zha (1998), "Bayesian Methods for Dynamic Multivariate Models," *International Economic Review*, 39(4), 949-968.

### **3. Time-Varying Parameter Models with Stochastic Volatility**

- Baumeister, C., and L. Benati (2013), "Unconventional Monetary Policy and the Great Recession: Estimating the Macroeconomic Effects of a Spread Compression at the Zero Lower Bound," *International Journal of Central Banking*, 9(2), 165-212.
- Canova, F., and F.J. Perez Forero (2015), "Estimating Overidentified, Nonrecursive, Time-Varying Coefficients Structural Vector Autoregressions," *Quantitative Economics*, 6, 359-384.
- Carter, C.K., and R. Kohn (1994), "On Gibbs Sampling for State Space Models," *Biometrika*, 81, 541-553.
- Cogley, T., Morozov, S. and T.J. Sargent (2005), "Bayesian Fan Charts for U.K. Inflation: Forecasting and Sources of Uncertainty in an Evolving Monetary System," *Journal of Economic Dynamics and Control*, 29(11), 1893-1925.
- Jacquier, E., N.G. Polson, and P. Rossi (1994), "Bayesian Analysis of Stochastic Volatility Models," *Journal of Business and Economic Statistics*, 12, 371-418.
- Lubik, T.A., and C. Matthes (2015), "Time-Varying Parameter Vector Autoregressions: Specification, Estimation, and an Application," *Federal Reserve Bank of Richmond Economic Quarterly*, 101(4), 323-352.