

Advanced Economics Extension Course at the Central Reserve Bank of Peru:

“A Bayesian Approach to Identification of Structural VAR Models”

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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 participants with the tools they need for state-of-the-art empirical research in macroeconomics and to develop practical skills to apply Bayesian methods to specific policy questions. 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 methods introduced in the lectures will be illustrated with applications to the labor market, monetary policy, and oil price shocks in Matlab.

LECTURES: Monday 10:15 am – 12:00 pm and Tuesday-Friday, 8:45 am – 12:00 pm, for a total of 15h

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EXAM: take-home exam with coding exercises in Matlab

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.

Hamilton, J.D., *Vector Autoregressions*, Cambridge University Press, in progress.

On Identification in Macroeconomics:

Nakamura, E., and J. Steinsson (2018), “Identification in Macroeconomics,” *Journal of Economic Perspectives*, 32(3), 59-86.

Ramey, V. (2016), “Macroeconomic Shocks and Their Propagation,” *Handbook of Macroeconomics*, edited by J.B. Taylor and H. Uhlig, vol. 2, 71-162.

1. Bayesian Analysis of VAR Models

- Casella, G., and E.I. George (1992), “Explaining the Gibbs Sampler,” *American Statistician*, 26, 167-174.
- Chib, S., and E. Greenberg (1995), “Understanding the Metropolis-Hastings Algorithm,” *American Statistician*, 49, 327-335.

- Doan, T., R. Litterman, and C. Sims (1984), “Forecasting and Conditional Projection Using Realistic Prior Distributions,” *Econometric Reviews*, 3(1), 1-100.
- Hamilton, Chapter 3.
- 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 (2022), “Structural Vector Autoregressions with Imperfect Identifying Information,” *AEA Papers & Proceedings*, 112, 466-470.
- 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 (2019), “Structural Interpretation of Vector Autoregressions with Incomplete Identification: Revisiting the Role of Oil Supply and Demand Shocks,” *American Economic Review*, 109(5), 1873-1910.
- 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,” *Journal of Monetary Economics*, 100, 48-65.
- Baumeister, C., and J.D. Hamilton (2020), “Drawing Conclusions from Structural Vector Autoregressions Identified on the Basis of Sign Restrictions,” *Journal of International Money and Finance*, 109, article 102250.
- Baumeister, C., and J.D. Hamilton (2024), “Advances in Vector Autoregressions to Estimate Structural Magnitudes,” *Econometric Theory*, 40(3), 472-510.
- Belongia, M.T., and P.N. Ireland (2021), “A Classical View of the Business Cycle,” *Journal of Money, Credit, and Banking*, 53(2-3), 333-366.
- Brinca, P., J.B. Duarte, and M. Faria-e-Castro (2021), “Measuring Labor Supply and Demand Shocks during COVID-19,” *European Economic Review*, 139, article 103901.
- Read, M. (2024), “Sign Restrictions and Supply-demand Decompositions of Inflation,” Reserve Bank of Australia, Research Discussion Paper #5.
- 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.
- Uhlig, H. (2005), “What Are the Effects of Monetary Policy on Output? Results from an Agnostic Identification Procedure,” *Journal of Monetary Economics*, 52, 381-419.

3. Structural Breaks: How to Deal with the COVID-19 period (time permitting)

- Hamilton, Chapter 6.
- Lenza, M., and G.E. Primiceri (2022), “How to Estimate a Vector Autoregression after March 2020,” *Journal of Applied Econometrics*, 37(4), 688-699.
- Ng, S. (2021), “Modeling Macroeconomic Variations after Covid-19,” NBER Working Paper 29060.