

Summer School of the Austrian National Bank and Joint Vienna Institute on:
“A Bayesian Approach to Identification of Structural VAR Models”

August 26-30, 2024

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This course will focus on estimation and inference in structural vector autoregressive (SVAR) models which are the workhorse models in empirical macroeconomics. The goal of this course is to equip participants with state-of-the art Bayesian methods for empirical research and policy analysis. 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. The methods introduced in the lectures will be illustrated with applications to monetary policy, labor market dynamics, and oil price fluctuations and hands-on programming in Matlab.

COURSE CONTENT AND KEY REFERENCES

Module 1: *Identification of Structural VAR Models*

We revisit the identification problem in structural VAR models and introduce a general Bayesian framework that nests traditional identification schemes. In particular, we challenge the current practice of identification in VAR models using inequality constraints. We illustrate the problems that arise from the traditional algorithm based on sign restrictions with an application to modeling the labor market. We introduce a more flexible approach for estimation and inference that is not subject to these concerns.

- 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 (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 (2023), “Advances in Using Vector Autoregressions to Estimate Structural Magnitudes,” *Econometric Theory*, forthcoming.

- 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.
- 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.

Module 2: The Role of Prior Information

We illustrate this new method for identification by revisiting the role of oil supply and demand shocks in generating historical fluctuations in the price of oil and highlight several shortcomings of traditional approaches to identification of oil supply and demand shocks with a particular focus on the estimation of behavioral elasticities.

- 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 (2022), “Structural Vector Autoregressions with Imperfect Identifying Information,” *AEA Papers and Proceedings*, 112, 466-470.
- Caldara, D., M. Cavallo, and M. Iacoviello (2016), “Oil Price Elasticities and Oil Price Fluctuations,” *Journal of Monetary Economics*, 103, 1-20.
- Kilian, L. (2009). “Not all Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market,” *American Economic Review*, 99, 1053-1069.
- Kilian, L., and D.P. Murphy (2012), “Why Agnostic Sign Restrictions Are Not Enough: Understanding the Dynamics of Oil Market VAR Models,” *Journal of the European Economic Association*, 10(5), 1166-1188.

Module 3: Inference in Set-Identified Models

We show how to supplement prior information about structural parameters with prior knowledge about the impacts of structural shocks. We apply this idea to the study of the dynamic effects of monetary policy, its role in business cycle fluctuations, and the estimation of structural policy response coefficients in an interest-rate rule. We also show how to construct credibility sets for impulse response functions, variance decompositions, and historical decompositions.

- 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.

- 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.
- Read, Matthew (2023), “Set-identified Structural Vector Autoregressions and the Effects of a 100 Basis Point Monetary Policy Shock,” Reserve Bank of Australia working paper.
- Watson, M.W. (2019), “Comment on ‘On the Empirical (Ir)Relevance of the Zero Lower Bound’ by Debortoli, Gali, and Gambetti,” *NBER Macroeconomics Annual*.

COURSE TIMETABLE

Monday, August 26

09:00 – 10:30: A Review of Bayesian Vector Autoregressions: Estimation and Inference
 11:00 – 12:30: Structural VAR Models: The Identification Problem Revisited
 14:00 – 15:30: Matlab Application: The Effects of Monetary Policy
 15:45 – 17:00: Identification Using Inequality Constraints: Theory

Tuesday, August 27

09:00 – 10:30: Identification Using Inequality Constraints: Practice
 11:00 – 12:30: Matlab Application: Labor Market Dynamics
 14:00 – 15:30: A Bayesian Algorithm for Structural VARs
 15:45 – 17:00: Matlab Application: Labor Market Dynamics (continued)

Wednesday, August 28

09:00 – 10:30: A Bayesian Interpretation of Traditional Identification Assumptions
 11:00 – 12:30: Estimation of Behavioral Elasticities
 14:00 – 15:30: Matlab Application: Oil Supply and Demand Shocks
 15:45 – 17:00: Practice session

Thursday, August 29

09:00 – 10:30: Prior Information about Structural Coefficients and Impacts of Shocks
 11:00 – 12:30: Credibility Sets for Impulse Responses, Variance and Historical Decompositions
 14:00 – 15:30: Estimation of a Small-Scale New Keynesian Monetary Model
 15:45 – 17:00: Estimation of a Structural Model of the Global Oil Market with Inventories

Friday, August 30

09:00 – 10:30: Prior Information about the Long Run

11:00 – 12:30: Matlab Application: Labor Market Dynamics (continued)

14:00 – 15:30: Priors for Larger Systems and Recent Developments

15:45 – 17:00: Matlab Application: The Effects of Monetary Policy (continued)