Kiel Institute **Christian Wolf**
Summer 2026 **MIT**

Empirical Methods for Business-Cycle Analysis

May 18 - 21, 2026

Course outline

1. Part 1: impulse response estimation for macroeconomic shocks and policies
    - Identification
        - SVMA model objects of interest & identification challenge
        - Approach I: invertibility + something else (exclusion restrictions, sign/magnitude restrictions, . . .)
        - Approach II: instruments/proxies
    - Estimation
        - LP/VAR population equivalence
        - Finite-sample recommendations: bias-variance trade-off
2. Part 2: policy shocks & policy rules – shock vs. instrument space
    - "Instrument sufficiency" as the bridge between policy shocks and systematic policy
    - Empirical methods: Sims-Zha, McKay-Wolf, and policy causal effect extrapolation (through structural models or semi-structural assumptions)
    - Inversion: using rule changes to learn about policy transmission
3. Part 3: micro to macro
    - What does cross-sectional variation identify?
        - Cross-household/firm analysis & sequence-space Jacobians
        - Cross-regional analysis & local general equilibrium effects
    - The "missing intercept"/aggregation problem
        - "Micro"-based aggregation
        - Leveraging shock equivalence

Reading list

Essential readings are listed first and marked with a star (*). Other readings are included for your reference. Original contributions are not always cited when good handbook/textbook references are available.

Preparatory readings

I will assume knowledge of some basic time series concepts (lag operators, linear filters, VARMA models, Wold decomposition), at the level of an advanced undergraduate or first-year graduate class. Good reference books include:

Hamilton, J. D. (1994). *Time Series Analysis*. Princeton University Press. (Comprehensive reference for time series econometrics methods developed before the mid-1990s.)

Cochrane, J. H. (2005). *Time series for macroeconomics and finance*. Manuscript, University of Chicago. (Accessible introduction to linear time series methods.)

I will also assume familiarity with basic solution methods for linearized structural macroeconomic models (both state-space and sequence-space). References are:

Fernández-Villaverde, J., Rubio-Ramírez, J. F., and Schorfheide, F. (2016). "Solution and estimation methods for DSGE models." In *Handbook of Macroeconomics, Volume 2*, edited by Taylor, J. B., and Uhlig, H., Elsevier, 527–724.

Auclert, A., Bardóczy, B., Rognlie, M., and Straub, L. (2021). "Using the sequence-space Jacobian to solve and estimate heterogeneous-agent models." *Econometrica*, 89(5), 2375–2408.

Finally, as general background reading, I recommend the following two survey articles:

Ramey, V. A. (2016). "Macroeconomic Shocks and Their Propagation." In *Handbook of Macroeconomics, Volume 2*, edited by Taylor, J. B., and Uhlig, H., Elsevier, 71–162.

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

Part 1

Identification

1. *Identification problem, invertibility*

   * Fernández-Villaverde, J., Rubio-Ramírez, J. F., Sargent, T. J., and Watson, M. W. (2007). "ABCs (and Ds) of Understanding VARs." *American Economic Review* 97(3), 1021–1026.

   Lippi, M., and Reichlin, L. (1994). "VAR Analysis, Nonfundamental Representations, Blaschke Matrices." *Journal of Econometrics* 63(1), 307–325.

   Leeper, E. M., Walker, T. B., and Yang, S. C. S. (2013). "Fiscal Foresight and Information Flows." *Econometrica*, 81(3), 1115–1145.

   Forni, M., Gambetti, L., and Sala, L. (2019). "Structural VARs and Noninvertible Macroeconomic Models." *Journal of Applied Econometrics* 34(2), 221–246.

2. *Exclusion restrictions*

   * Christiano, L. J., Eichenbaum, M., and Evans, C. L. (1999). "Monetary Policy Shocks: What Have We Learned and to What End?" *Handbook of Macroeconomics*, 1, 65–148.

   * Blanchard, O., and Quah, D. (1989). "The Dynamic Effects of Aggregate Demand and Supply Disturbances." *American Economic Review*, 79(4), 655–673.

   Blanchard, O., and Perotti, R. (2002). "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output." *The Quarterly Journal of Economics*, 117(4), 1329–1368.

   Ramey, V. A. (2011). "Identifying Government Spending Shocks: It's All in the Timing." *The Quarterly Journal of Economics*, 126(1), 1–50.

3. *Sign/magnitude restrictions*

   * Uhlig, H. (2005). "What are the Effects of Monetary Policy on Output? Results from an Agnostic Identification Procedure." *Journal of Monetary Economics* 52(2), 381–419.

* Baumeister, C., and Hamilton, J. D. (2015). "Sign Restrictions, Structural Vector Autoregressions, and Useful Prior Information." *Econometrica* 83(5), 1963–1999.

Giacomini, R., and Kitagawa, T. (2021). "Robust Bayesian Inference for Set-Identified Models." *Econometrica*, 89(4), 1519–1556.

Wolf, C. K. (2022). "What Can We Learn from Sign-Restricted VARs?" *AEA Papers and Proceedings* 112, 471–75.

4. *Instruments/proxies*

* Stock, J. H., and Watson, M. W. (2018). "Identification and Estimation of Dynamic Causal Effects in Macroeconomics Using External Instruments." *Economic Journal* 128(610), 917–948.

* Plagborg-Møller, M., and Wolf, C. K. (2022). "Instrumental Variable Identification of Dynamic Variance Decompositions." *Journal of Political Economy*, 130(8), 2164–2202.

Gertler, M., and Karadi, P. (2015). "Monetary Policy Surprises, Credit Costs, and Economic Activity." *American Economic Journal: Macroeconomics* 7(1), 44–76.

Nakamura, E., and Steinsson, J. (2018). "High-Frequency Identification of Monetary Non-Neutrality: the Information Effect." *The Quarterly Journal of Economics*, 133(3), 1283–1330.

Känzig, D. R. (2021). "The Macroeconomic Effects of Oil Supply News: Evidence from OPEC Announcements." *American Economic Review*, 111(4), 1092–1125.

Estimation

* Plagborg-Møller, M., and Wolf, C. K. (2021). "Local Projections and VARs Estimate the Same Impulse Responses." *Econometrica*, 89(2), 955–980.

* Montiel Olea, J. L., Plagborg-Møller, M., Qian, E., and Wolf, C. K. (2025). "Local Projections or VARs? A Primer for Macroeconomists." *NBER Macroeconomics Annual*.

Rubio-Ramírez, J. F., Waggoner, D. F., and Zha, T. (2010). "Structural Vector Autoregressions: Theory of Identification and Algorithms for Inference." *Review of Economic Studies* 77(2), 665–696.

Montiel Olea, J. L., and Plagborg-Møller, M. (2021). "Local Projection Inference is Simpler and More Robust Than You Think." *Econometrica*, 89(4), 1789–1823.

Li, D., Plagborg-Møller, M., and Wolf, C. K. (2024). "Local Projections vs. VARs: Lessons From Thousands of DGPs." *Journal of Econometrics*, 244(2), 105722.

Montiel Olea, J. L., Plagborg-Møller, M., Qian, E., and Wolf, C. K. (2025). "Double Robustness of Local Projections and Some Unpleasant VARithmetic." *Econometrica*, forthcoming.

Part 2

Background: history of thought on policy evaluation

* Christiano, L. J., Eichenbaum, M., and Evans, C. L. (1999). "Monetary Policy Shocks: What Have We Learned and to What End?" *Handbook of Macroeconomics*, 1, 65–148.

* Bernanke, B. S., Gertler, M., and Watson, M. W. (1997). "Systematic Monetary Policy and the Effects of Oil Price Shocks." *Brookings Papers on Economic Activity*, 1997(1), 91–157.

Sims, C. A., and Zha, T. (2006). "Does Monetary Policy Generate Recessions?" *Macroeconomic Dynamics*, 10(2), 231–272.

Christiano, L. J., Eichenbaum, M., and Evans, C. L. (2005). "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy." *Journal of Political Economy*, 113(1), 1–45.

Chari, V. V., Kehoe, P. J., and McGrattan, E. R. (2009). "New Keynesian Models: Not Yet Useful for Policy Analysis." *American Economic Journal: Macroeconomics*, 1(1), 242–266.

Recent perspectives on policy shocks vs. rules

* McKay, A., and Wolf, C. K. (2023). "What Can Time-Series Regressions Tell Us About Policy Counterfactuals?" *Econometrica*, 91(5), 1695–1725.

* Manuel, E., and Wolf, C. K. (2026). "Identifying Policy Causal Effects from Rule Changes." Working Paper.

Barnichon, R., and Mesters, G. (2023). "A Sufficient Statistics Approach for Macro Policy Evaluation." *American Economic Review*, 113(11), 2809–2845.

Inoue, A., and Rossi, B. (2021). "A New Approach to Measuring Economic Policy Shocks, With an Application to Conventional and Unconventional Monetary Policy." *Quantitative Economics*, 12(4), 1085–1138.

Hack, L., Istrefi, K., and Meier, M. (2024). "Identification of Systematic Monetary Policy." Working Paper.

Caravello, T. E., McKay, A., and Wolf, C. K. (2026). "Evaluating Monetary Policy Counterfactuals: (When) Do We Need Structural Models?" Working Paper.

Part 3

What does cross-sectional variation identify?

* Nakamura, E., and Steinsson, J. (2014). "Fiscal Stimulus in a Monetary Union: Evidence from US Regions." *American Economic Review*, 104(3), 753–92.

* Auclert, A., and Rognlie, M. (2018). "Inequality and Aggregate Demand." NBER Working Paper.

Koby, Y., and Wolf, C. K. (2020). "Aggregation in Heterogeneous-Firm Models: Theory and Measurement." Working Paper.

The "missing intercept"/aggregation problem

* Chodorow-Reich, G. (2019). "Geographic Cross-Sectional Fiscal Spending Multipliers: What Have We Learned?" *American Economic Journal: Economic Policy*, 11(2), 1–34.

* Wolf, C. K. (2023). "The Missing Intercept: A Demand Equivalence Approach." *American Economic Review*, 113(8), 2232–2269.

Guren, A., McKay, A., Nakamura, E., and Steinsson, J. (2021). "What Do We Learn from Cross-Regional Empirical Estimates in Macroeconomics?" *NBER Macroeconomics Annual*, 35(1), 175–223.

Auclert, A., Rognlie, M., and Straub, L. (2024). "The Intertemporal Keynesian Cross." *Journal of Political Economy*, 132(12), 4068–4121.