The identification of structural shocks in dynamic models

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(15 Sept: Room 3068, Anthropole building; 16–18 Sept: Room 2128, Anthropole building)

1- Objective of course

The identification and estimation of dynamic responses to structural shocks are central goals of macroeconometrics. These responses represent the effects, over time, of an exogenous shock that propagates throughout the economy, as modelled by a system of simultaneous equations.

Over the past decades, various methodologies have been developed to estimate these responses. The aim of this course is to provide a comprehensive overview of these methods and equip students with practical tools to apply them in different contexts.

Laboratory sessions will demonstrate the techniques covered during the course, using R software. Students are encouraged to bring a laptop to class if they have one.

2- Venue and schedule

All courses will be given at UNIL. The schedule is as follows:

- **September 15th and 16th:** from 9 am to 12:30 pm and from 1:30 pm to 3:15 pm.
- **September 17h:** from 9 am to 12:30 pm.
- **September 18th:** from 1:30 pm to 3:30 pm.

3- Classes

a. Basics of multivariate time-series modelling (2 x 45 min, JPR)
   i. Introduction to vector autoregressive moving average (VARMA) models
   ii. Estimation of VARMA models
   iii. Concepts of Impulse Response Functions (IRFs)

b. Standard identification techniques (2 x 45 min, JPR)
   i. The identification problem (in the Gaussian case).
   ii. Zero restrictions (short-run and long-run).

c. Inference (2 x 45 min, KB)
   i. Monte Carlo
   ii. Bootstrap

d. Alternative methods I (4 x 45 min, KB)
   i. Forecast error variance maximization
   ii. Sign restrictions
   iii. Mixing sign and zero restrictions

e. Alternative methods II (4 x 45 min, JPR)
   i. Identification of shocks in the non-Gaussian case
   ii. Local Projection methods
   iii. External instruments methods

f. Panel VARs (2 x 45 min, KB)

i. Panel VAR representation and specific issues
ii. The mean-group estimator

g. Presentations given by students (2 x 60 min)
The students have two options:
1. (reading list) They present an article chosen in a list they will be provided with at the beginning of the course.
2. (micro-project) They implement one of the techniques presented throughout the course on real data and present their results.

4- What students will learn

Students will receive a comprehensive overview of methodologies designed to identify structural shocks and generate impulse response functions (IRFs) within multivariate models.

References (partial)

Arias Jonas, Juan F. Rubio-Ramìrez and Daniel Waggoner (2016), "Inference Based on SVARs Identified with Sign and Zero Restrictions: Theory and Applications." Mimeo

Barsky, R. B., and E. R. Sims (2011): "News Shocks and Business Cycles," *Journal of Monetary Economics*, vol. 58(3), 273-289.

Beaudry, Paul and Frank Portier, "Stock Prices, News, and Economic Fluctuations," *American Economic Review*, 2006, vol. 96(4), pp. 1293-1307.

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

Canova, Fabio and Ciccarelli, Matteo (2013), "Panel Vector Autoregressive Models: A Survey," CEPR Discussion Papers 9380, C.E.P.R. Discussion Papers.

Francis, Neville, Michael T. Owyang, Jennifer E. Roush and Riccardo Di Cecio, (2014), "A Flexible Finite-Horizon Alternative to Long-Run Restrictions with an Application to Technology Shocks," *The Review of Economics and Statistics*, vol. 96(4), pp. 638-647.

Gali, J. (1992). "How Well Does the IS-LM Model Fit Postwar U.S. Data?," *The Quarterly Journal of Economics*, vol. 107(2), pp. 709-738.

Gouriéroux, C., Monfort, A. and J.-P. Renne (2017). "Statistical Inference for Independent Component Analysis: Application to Structural VAR Models," *Journal of Econometrics*, vol. 196, pp. 111-126.

Gouriéroux, C., Monfort, A. and J.-P. Renne (2019). "Identification and Estimation in Non-Fundamental Structural VARMA Models," Mimeo.

Jordà, Ò, 2005, "Estimation and Inference of Impulse Responses by Local Projections," *American Economic Review*, vol. 95(1), pp. 161-182.

Lutz Kilian, 1998. "Small-Sample Confidence Intervals For Impulse Response Functions," *The Review of Economics and Statistics*, vol. 80(2), pp. 218-230.

Lütkepohl, H, (1990), "Asymptotic distributions of impulse response functions and forecast error variance decompositions of vector autoregressive models," *Review of Economics and Statistics*, vol. 72 (1990), pp. 116-125

Ramey, V. (2016). "Macroeconomic Shocks and their Propagation," *Handbook of Macroeconomics*, vol. 2A. Amsterdam: Elsevier, pp. 71-162.

Runkle, D.E. (1987), "Vector Autoregression and Reality," *Journal of Business and Economic Statistics*, vol. 5, pp. 437-442.

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

Uhlig, Harald (2003) "What moves real GNP?" Manuscript. Humbolt University, Berlin

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