

# **Introduction to the Theory and Practice of Global VAR modelling (Bank of Lithuania)**

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## **1 Overview**

Recent intensification of globalisation has made it necessary to account for global linkages and interdependencies. Traditional techniques of panel or dynamic econometric models cannot be used to infer the functioning of the world economy due to data limitations and the curse of dimensionality. The global vector autoregression (GVAR) is designed to explicitly model the economic and financial interdependencies at national and international levels. The idea is quite simple: country (or other economic entity) specific vector error-correcting models are estimated, where the domestic variables are related to corresponding foreign variables constructed exclusively to match the international trade (or some other, theoretically motivated) pattern of the country under consideration. The individual country models are then linked in a consistent manner so that the GVAR model is solved for the world as a whole. The GVAR methodology is therefore useful for evaluating the importance of different shocks and channels of transmission mechanisms, accounting for global factors, general equilibrium effects, and using for counterfactual analysis. This approach has already found uses in macro, international economics, financial applications, forecasting, and policy analysis.

The key advantages of the GVAR modelling approach are that it:

- allows for interdependence at a variety of levels (national and international) in a transparent way that can be empirically evaluated;
- allows for long-run relationships consistent with the theory and short-run relationships that are consistent with the data;
- provides a coherent, theory-consistent solution to the curse of dimensionality in global modelling.

## **2 Background Knowledge**

I will assume that participants are comfortable with intermediate macroeconomics and econometrics. A good reference for intermediate macroeconomics is David Romer's Advanced Macroeconomics;

a useful reference for intermediate econometrics is either Stock and Watson (2011) or Wooldridge (2008).

### 3 Texts

The following texts will prove most useful:

- Garratt et al. (2006, Global and National Macroeconometric Modelling: A Long-Run Structural Approach)
- di Mauro and Pesaran (2013, The GVAR Handbook: Structure and Applications of a Macro Model of the Global Economy for Policy Analysis)

The first text is most useful for technical insights whereas the second one exemplifies wide uses of the GVAR methodology. Excellent texts about advanced macroeconomics and econometrics are, respectively,

- Obstfeld and Rogoff (1996, Foundations of International Macroeconomics)
- Pesaran (2015, Time Series and Panel Data Econometrics)

There will also be discussions on applications and uses of GVAR toolbox, accessible from this site.

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#### Note on Tutorials

Theory is covered to provide useful background for the practical sessions. It will be advisable to work with the real data to get a feeling of applicability and major challenges of the GVAR methodology.

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### 4 Course Outline

This is a tentative syllabus, provided for the guidance purposes. There might be changes/additions/restructuring.

### Topics

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1. Theory: Vector Autoregressions, Stationarity, Unit Roots
2. Theory: Vector Error Correction Models
3. Theory: Structural VARs and VARXs
4. Application: small open economy macroeconomic model
5. Theory: Basics of Global VARs. Global Dynamic Factor.
6. Application of GVAR: Building country-specific models, weak exogeneity testing and model diagnostics
7. Practicals: GVAR Toolbox 2.0
8. Application of GVAR: Solving the GVAR model, impulse response analysis, variance decomposition
9. Application of GVAR: Testing over-identifying restrictions on the cointegrating vectors, bootstrapping the GVAR model
10. Practicals: GVAR Toolbox 2.0
11. Application of GVAR: Trend/Cycle decomposition
12. Example: International linkages of the Euro Area
13. Example: Macroprudential applications of the GVAR
14. Example: Fiscal shocks on financial variables
15. Example: Labour market outcomes in the global economy
16. Example: Multicountry DSGE modelling

## 4.1 Tutorials

There will be a number of tutorials to get experience using GVAR for different research questions. The class and home works will require MS Excel and MATLAB (for simple panel and VAR, covered at the start, any econometric software will do).

## 5 Miscellaneous

We will also make use of a number of research papers. These readings will motivate much of our theoretical discussions. A set of sample readings include:

- Garratt et al. (2003),
- Pesaran et al. (2004),
- Dees et al. (2007),
- Dees et al. (2010),
- Cesa-Bianchi et al. (2011),
- Rebucci et al. (2012).

## References

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- Obstfeld, M. and K. Rogoff**, *Foundations of International Macroeconomics*, Cambridge, Massachusetts: MIT Press, 1996.
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- Wooldridge, Jeffrey M.**, *Introductory Econometrics: A Modern Approach ISE - International Student Edition*, Cengage Learning, 2008.