Macroeconometrics

Module 3, 2013-2014

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Course description

This course provides a survey of recent developments in time series econometrics, with a strong emphasis on macroeconomic applications, rather than on econometric theory. We will begin with a quick overview of the simple univariate models and filters. Then, we will cover multivariate models: VAR and SVAR models, different methods of their identification, multivariate unit roots, cointegration and vector error-correction models. After that, we will study the models in data-rich environment: factors models and FAVARs. And, finally, we will discuss different methods of estimation and inference of the dynamic stochastic general equilibrium models (DSGE), in particular, simulated method of moments, maximum likelihood, Bayesian methods and hybrid models (DSGE-VAR).

Course requirements, grading, and attendance policies

There will be a few (maximum 4) home assignments (50% of the grade). The students may work in groups. The exam (50% of the grade) will contain questions on a published applied macroeconomic article handed out in advance. All these components (including all home assignments), as well as at least 70% attendance, are mandatory for getting a passing grade.

Course contents

1. **Univariate time series models:** business cycles and time series econometrics, the Wold representation theorem, stationary ARMA models, spectrum, data transformations and univariate filters

2. **Reduced-form Vector Autoregressions:** definition, estimation, inference and forecasting, Granger causality, impulse response functions, variance decomposition

3. **Structural Vector Autoregressions:** definition, impulse response functions, variance decomposition, historical decomposition, identification: short-run restrictions, long-run restrictions, sign restrictions, applications

4. **Unit roots, spurious regressions and cointegration:** definition, testing the unit roots, spurious regression, cointegration, testing and estimation of co-integrating relations, VECM representation of cointegrated VAR, applications

5. **Introduction to Bayesian methods and Bayesian VARs:** Bayesian estimation and inference, priors, Markov Chain Monte Carlo (MCMC) algorithms: Metropolis-Hastings, Gibbs sampler, Bayesian VARs

6. **Factor models and FAVAR:** static and dynamic factor models, principal components analysis, determining a number of static and dynamic factors, structural FAVAR and its identification, applications

7. **DSGE models and their estimation:** definition, approximating and solving DSGE, calibration, GMM and simulated GMM estimation, ML estimation, Bayesian estimation of DSGE models

8. **Hybrid models:** using priors from DSGE model for VAR, DSGE-VAR and its application for policy analysis and forecasting

Sample tasks for course evaluation

Problem 1. Univariate filters

For this exercise you may write your own code in MATLAB, GAUSS, R, etc. or use any user-written code found in internet (with proper citations). You should understand every single line of the code used.

1. Download quarterly data on real GDP in Russia from Rosstat database

2. Use the following three filters to extract business cycle component from original and log-transformed series

   - run OLS regression to detrend these series
   - Hodrick-Prescott filter
   - Baxter-King band-pass filter

3. Estimate spectrum for all series before and after applying each of the three procedures and draw them. Discuss the differences.

Problem 2. Identification of SVAR using combination of short-run and long-run restrictions

(problem from Canova textbook)

Consider a structural model of the form:

$$
\begin{aligned}
y_t &= \alpha_0 + \epsilon_t^S - \alpha_1(i_t - E_t\Delta p_{t+1}) + \epsilon_t^{IS} && (1)\\
M_t - p_t &= \alpha_2 y_t - \alpha_3 i_t + \epsilon_t^{MD} && (2)\\
\Delta M_t &= \epsilon_t^{MS} && (3)\\
\Delta p_t &= \Delta p_{t-1} + \alpha_4(y_t - \epsilon_t^S) && (4)
\end{aligned}
$$

where ϵ_t^S is a supply shock; ϵ_t^{IS} is an IS shock; ϵ_t^{MS} is a money supply shock and ϵ_t^{MD} is a money demand shock, y_t is output, p_t is price level, i_t is the nominal interest rate and M_t is money. Identify these shocks from a VAR with $(\Delta y_t, \Delta i_t, i_t - \Delta p_t, \Delta M_t - \Delta p_t)$ using Euro area data and the following restrictions: (i) only supply shocks have long run effects on output, (ii) money demand and money supply shocks have no contemporaneous effects on Δy_t, (iii) money demand shocks have no contemporaneous effect on the real interest rate. Trace out the effects of a money supply shock on interest rates and output.

Course materials

Required textbooks and materials

1. Hamilton, James D., *Time Series Analysis*, Princeton University Press, 1994

2. DeJong, David N. & Dave, Chetan, *Structural Macroeconometrics*, Princeton University Press, 2nd ed., 2011

Additional materials

1. Lutkepohl, Helmut, *New Introduction to Multiply Time Series Analysis*, Springer, 2007

2. Canova, Fabio, *Methods for Applied Macroeconomic Research*, Princeton University Press, 2007

3. Favero, Carlo A., *Applied Macroeconometrics*, Oxford University Press, 2001

I will also provide a reading list of papers applying models and methods discussed in the class, with the rate of about 2-3 per week.

Academic integrity policy

Cheating, plagiarism, and any other violations of academic ethics at NES are not tolerated.