

Econometrics 2 - Syllabus

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Information at a glance. This course focuses on state space methods for time series analysis, with particular emphasis on the detection of trend, seasonality and cycles. The salient features of linear and Gaussian state space models will be described, together with their connections with ARMA processes and regression models. Generalisations to non linear and non Gaussian state space models will be presented. The ultimate goal of the course is to enable students to manage this class of models through the programming language R.

Prerequisites. Students are expected to be familiar with basic statistics, probability and time series econometrics at the level of Enders (2014).

Teaching method. There will be ten meetings, lasting 2.5 hours. Relevant material will be made available before classes start. Lectures will be online. I recommend to attend classes using also a computer with installed the latest R release (<https://cran.r-project.org/>) and RStudio (<https://www.rstudio.com/products/rstudio/download/>), an integrated development environment for R. All the software is freely available.

Reading material. The textbook for this course is:

James Durbin and Siem Jan Koopman: *Time Series Analysis by State Space Methods: Second Edition*, Oxford University Press, 2012.

A useful R manual is freely available online: [An introduction to R](#).

Further references will be given during the course.

Schedule. Unless differently specified, classes are held online through Zoom meetings.

- *When:* 24/03, 15:30-18:00
What: Presentation of the course. Definitions. Introduction to structural models. The multivariate normal distribution, Kalman filtering and smoothing.
- *When:* 25/03, 15:30-18:00
What: Introduction to R. Implementation of Kalman filtering and smoothing.
- *When:* 31/03, 15:30-18:00
What: Structural time series models. State space representation of ARMA models. Linear regression with time varying parameters. Classical inference on state space models.
- *When:* 01/04, 15:30-18:00
What: Applications of state space models to economic and financial data.
- *When:* 07/04, 15:30-18:00
What: Bayesian inference on state space models. MCMC methods.
- *When:* 08/04, 15:30-18:00
What: Implementation of state space models within the Bayesian paradigm.
- *When:* 21/04, 15:30-18:00
What: Non linear and non Gaussian state space models.
- *When:* 22/04, 15:30-18:00
What: Fitting non linear and non Gaussian state space models in practice.
- *When:* 28/04, 15:30-18:00
What: Stochastic volatility and state space models.
- *When:* 29/04, 15:30-18:00
What: Estimation of stochastic volatility with R.