

Dynamic statistical models with hidden variables

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Cours : 16 heures - TP : 0 heures [*lecture in english*]

Objectives

Dynamic models involving hidden variables, or factors, constitute a rich class which is particularly important to capture the dynamic properties of economic and financial series. Important models of this class are the state-space linear models, the hidden-Markov or Markov-switching models, the stochastic volatility models. Hidden variables can receive an economic interpretation, or they can be used as statistical tools. To handle such models, the standard statistical methods (e.g. the likelihood inference) are often in failure. Alternative estimation methods, which can be based on simulations, have to be introduced. The main objective of the course is to present the main specifications, to derive their probabilistic properties and to study the appropriate inference methods for such models. Illustrations based on simulated or real economic data will also be presented.

Plan

- **Introduction** - Examples of dynamic models with hidden variables.
- **Markov regime-switching models** - Definition, examples. Stationarity. Filtration, smoothing and forecasting with the Hamilton algorithm. Asymptotic properties of the maximum likelihood estimator in the regime-switching AR case.
- **Linear state space models** - Kalman filtering and smoothing (covariance and information filter). Forecasting, estimation and tests. Application to the stochastic volatility model.
- **Generalised moments method** - Principle of the method. Use of ARMA representations. Example applications.
- **Random variable simulation techniques** - Inversion method. Acceptance-rejection method. Markov chain Monte Carlo method (MCMC). Gibbs algorithm. Hastings-Metropolis algorithm. Hybrid algorithms.
- **Simulated moments methods and extensions** - Simulated moments method. Indirect inference. Simulated pseudo-maximum likelihood method.
- **Simulated maximum likelihood methods, Bayesian approach** - Importance sampling. MCMC algorithms in the classical framework and the Bayesian framework.

Bibliography

- Gouriéroux, C. and A. Monfort (1997) Time Series and Dynamic Models, Cambridge University Press, Cambridge.
- Frühwirth-Schnatter, S. (2006) Finite Mixture and Markov Switching Models, Springer.
- Hamilton, J. D. (1994) Time Series Analysis. Princeton University Press.
- Harvey, A.C. (1989) Forecasting, structural time series models and the Kalman filter. Cambridge University Press.
- Kim, C-J. and C.R. Nelson (1999) State-space models with regime switching. The MIT Press.