Econometrics of asset pricing

Alain Monfort (Université Maastricht and Crest)

Course : 18 hours

Objectives

The main objective of the course is to propose methods for valuing assets in discrete time by relying on four pillars, i) a financial pillar: the hypothesis of no arbitrage opportunity, ii) a mathematical pillar: the Laplace transform, iii) a probabilistic pillar: affine processes, iv) a statistical pillar: linear and non-linear space-state models. These valuation methods are applied in various fields: interest rate models with regime shifts and/or zero-stay possibilities, valuation of interest rate derivatives, default risk, illiquidity risk, quadratic and Wishart models, valuation of default events, valuation of options in the presence of conditional heteroscedasticity, regime shifts and/or stochastic volatility, Simultaneous modelling of exchange rates, interest rates, stock indices and international derivatives, valuation of spot prices, forward/futures of energy products, modelling of convenience yields Statistical tools to solve inference, filtering and smoothing problems are provided. Concrete examples based on real or simulated data are presented.

Outline

- **VALORIZATION, STOCHASTIC DISCOUNT FACTOR, DYNAMIC NEUTRAL RISK: Absence of arbitrage opportunity, affine exponential stochastic discount factor, typology of discrete-time valuation models.**
- **DISCRETE TIME REFINED PROCESSES : Laplace transforms, Gamma, Wishart autoregressive processes, recursive formulas for multi-horizon Laplace transforms, transform analysis, recursive vector affine processes, Esscher transforms.**
- **VALORIZATION OF OBLIGATIONS, DEFAULT RISK AND REGIMES CHANGES: Tools for models with regime changes, default risk, default intensity, contagion, ratings, estimation methods by inversion, Kalman or Kitagawa-Hamilton filter.**
  Applications: 1) Euro area yield curves, probability of default, 2) Key ECB interest rates and monetary policy transmission.
- **RATE MODELS AND ZERO-STAYS: ZERO-VARG models, lift-off probability, forecasting, stationarity, inference.**
  Application: Dynamics of the Japanese yield curve.
- **VALORIZATION OF CREDIT DERIVATIVES: Valuation of risky bonds, recovery rates and first to default baskets, credit VaR.**
  Application: Credit spread decomposition
- **QUADRATIC MODELS CREDIT RISK AND ILLIQUIDITY RISK: Quadratic models and quadratic Kalman filter, credit risk and illiquidity risk.**
  Application: Modeling of the Euribor-OIS spread.
- **VALORIZATION OF CREDIT EVENTS: Valuation of the "surprise" of the default, pre-intensity and intensity, exogeneity, contagion.**
  Applications: 1)Credit-spread puzzle, 2)Recursive contagion, 3)Valuation of CDOs.
- **VALORIZATION OF OPTIONS, CONDITIONAL HETEOSCEDASTICITY, REGIMES CHANGE AND STOCHASTIC VOLATILITY: Truncated Laplace transforms, backward modeling of option prices with hidden Markov Chains, ARG or Wishart volatilities, GARCH effects.**
  Application: Smiles and implied volatility bands.
- **VALORISATION OF INTERNATIONAL DERIVATIVES, WISHART MODELS Simultaneous modelling of exchange rates, interest rates and stock market indices of several countries, Wishart process.**
  Application: Valuation of forwards, futures and options products defined on several markets.
- **FORWARDS ,FUTURES ,DIVIDENDS ,COMMODITIES ,YIELDS CONVENIENCE: Valuation of forward and futures contracts, dividends, commodities, convenience yields, taking into account seasonality, taking into account the constraints of lack of arbitrage opportunities.**
- **MODELLING OF ELECTRICITY SPOTS AND FORWARDS PRICES: Specificities of electricity markets ("spikes", no storage, seasonality, continuous delivery), direct modelling, valuation of forwards and options.**

Application: modelling of spot and forwards prices on the French electricity market.

- **SIMULTANEOUS MODELLING OF SPOT AND FORWARD PRICES ON SEVERAL COMMODITY MARKETS: "backward" modelling, taking into account internal consistency constraints in the risk-neutral dynamics, stochastic discount factor, historical dynamics, VAR-type models with regime changes.**

APPENDIX I - QUANTITATIVE LATENT VARIABLE MODELS

Kalman filtering and smoothing, extended first and second order Kalman filters, Unscented" Kalman filter, quadratic Kalman filter.

APPENDIX II - QUALITATIVE LATENT VARIABLE MODELS

Hidden Markov chain, Kitagawa-Hamilton filtering and smoothing, EM algorithm, transition matrix parameterization.

Bibliography

- Gouriéroux C. et Monfort A. (2006) : « Affine Models for Credit Risk Analysis », Journal of Financial Econometrics, 4, 494-530.
- Monfort A. et Pegoraro F. (2007) : « Switching VARMA Term Structure Models », Journal of Financial Econometrics, 5, 103-151.
- Bertholon H., Monfort A; et Pegoraro F. (2008) : « Econometric Asset Pricing Modelling », Journal of Financial Econometrics, 4, 407-458.
- Gouriéroux C. et Monfort A. (2010) : « International Money and Stock Market Contingent Claims », Journal of International Money and Finance, 29, 1727-1751.
- Monfort A. et Renne J.P. (2010) : Default, liquidity and crises : an econometric framework, Document de travail CREST 2010-46.
- Jardet C., Monfort A. et Pegoraro F. (2011) : « No-arbitrage Near-Cointegrated VAR(p) Term Structure Models, Term Premia and GDP Growth (2011), Document de travail CREST 2011-03.