Master in Financial Engineering at EPFL:
Advanced Topics in Financial Econometrics

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Third semester

Content

The course presents some advanced topics in Financial Econometrics, such as semiparametric and nonparametric option pricing; measuring liquidity in FX market using ultra high-frequency data; estimating integrated variance efficiently with ultra high-frequency noise-contaminated data; inference on stochastic volatility models; variance swaps.

Structure of the course

• Recall principles of statistical inference, Maximum Likelihood, etc. Recall basic finance concepts, derivative instruments, Black–Scholes implied volatility, etc.


• GARCH option pricing inverting characteristic function (Heston and Nandi, 2000), semiparametric GARCH option pricing (Barone-Adesi, Engle, and Mancini, 2008).


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• Nonparametric option pricing under shape restrictions (Aït-Sahalia and Duarte, 2003), model-guided nonparametric option pricing (Fan and Mancini, 2009).

• Ultra high frequency data, discreteness of price changes, irregular temporal spacing, diurnal patterns and temporal dependencies of volatilities, volumes, and durations (Engle and Russell, 2002), marked point process, hazard rate, Autoregressive Conditional Duration model (Engle and Russell, 1998), VAR models of marks in tick time.

• Construction of regularly spaced time grid, correlation, Epps effect (Epps, 1979), integrated variance, market microstructure noise.

• Two-scale realized volatility (Zhang, Mykland, and Aït-Sahalia, 2005; Aït-Sahalia and Mancini, 2008).

• Liquidity in equity market (Pastor and Stambaugh, 2003; Korajczyk and Sadka, 2008).

• Liquidity in FX market (Evans and Lyons, 2002; Lustig, Roussanov, and Verdelhan, 2008; Mancini, Ranaldo, and Wrampelmeyer, 2013).

• Variance swap rates, stochastic volatility model (Heston, 1993), stochastic volatility jump diffusion model (Pan, 2002).

• Variance risk premia (Carr and Wu, 2009), inference on stochastic volatility models (Aït-Sahalia, Karaman, and Mancini, 2015; Filipovic, Gourier, and Mancini, 2015).


• If time allows: Filtering historical simulation, robust Value at Risk prediction (Mancini and Trojani, 2011).

Assignment

There will be one assignment which will require to fit a GARCH model to S&P 500 index returns using Pseudo Maximum Likelihood; calculate European option prices via Monte Carlo simulation; recover Black-Scholes implied volatility smile; fit nonparametrically the implied volatility smile.
Grade

40% homework, 60% final written exam on the material and research papers covered in class.

Prerequisites

Prior knowledge of basic concepts in Financial Economics, option pricing, Econometrics, and Time series analysis is required. Familiarity with software, such as Matlab, for simulations and empirical analysis is required as well.

References


