

GARCH and stochastic volatility models

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Course : 18 hours - TP : 0 hours

Goals

This course deals with volatility modelling of financial returns. The objective will be to present the classical volatility models, their empirical motivation, as well as their main properties and to give an overview of the relevant statistical inference techniques. The benchmark model will be the generalized autoregressive conditionally heteroscedastic (GARCH) process introduced by the Nobel Prize for Economics Robert Engle. The probabilistic and statistical properties of this time series model will be studied and confronted with the stylized facts of the financial series. Several extensions, such as the asymmetric power GARCH, and alternatives, such as stochastic volatility models or the exponential GARCH, will be also studied.

Outline

- Financial series and GARCH models
- Structure of the standard GARCH processes (strict and second-order stationarity, conditional heteroskedasticity, volatility clustering, skewness and leptokurticity, weak ARMA presentation of the squares)
- Leverage effect and asymmetric GARCH models, TARCH and EGARCH.
- Statistical inference of the GARCH models (test for ARCH effects, model identification, and asymptotic properties of the quasi-maximum likelihood estimator)
- Stochastic volatility models, Markov-switching models

Bibliography

- Engle, R.F. (1982) "Autoregressive conditional heteroscedasticity with estimates of the variance of U.K. inflation." *Econometrica*, 50, 987-1008
- Francq, C and Zakoian, J-M. (2010) *GARCH Models: Structure, Statistical Inference and Financial Applications*. John Wiley
- Gouriéroux, C. (1997) *ARCH models and financial applications*. Springer
- Tsay, R.S. (2002) *Analysis of Financial Time Series*. John Wiley