Course unit: Mathematics and statistics for finance

- Title in French: Mathématiques et statistiques pour la finance
- Course code: tba
- ECTS credits: 2
- Teaching hours: 50h
- Language of instruction: English
- Coordinator: Christophe Pouet
- Instructors: Sébastien Darses, Christophe Pouet

Brief description

This course is a ground course for anyone interested in quantitative finance. It is split into two parts. The first part is devoted to stochastic calculus and Black-Scholes model. It introduces the mainstream mathematical and probabilistic tools for derivatives pricing. The second part called Introduction to econometrics is devoted to the analysis of time series and related tools.

Learning outcomes

- Master the notion of stochastic process (in particular Brownian motion)
- Use it to value (simple) financial assets
- Know the main models of time series
- Use it to model financial series

Course content

Stochastic calculus and introduction to mathematical finance

1. Brownian motion: Definition and properties
2. Stochastic integrals: Itô integral, Itô formula, Girsanov theorem
3. Stochastic differential equations: existence and uniqueness of a solution
4. Link with parabolic PDE: Feynman-Kac formula
5. Black-Scholes model: pricing of european options

Introduction to econometrics: time series analysis

1. Theory for SARIMA models
2. Identification statistical tools: autocorrelation function, partial autocorrelation function, spectral density
3. Parameter estimation and their asymptotic distribution
4. Model hypothesis checking: homoskedasticity vs heteroskedasticity, residual randomness and gaussianity
5. Forecasting using SARIMA models

Bibliography

- Lamberton, D. and B. Lapeyre, "Introduction to Stochastic Calculus Applied to Finance", 2nd ed., Chapman and Hall/CRC, 2007

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