Seminar Finance: Derivatives & Risk Management

Master Seminar

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Institute of Finance and Commodity Markets

Winter Term 2023/24

Requirements

- Preparation of a seminar paper in groups of up to 2
- Scope: 15/20 pages (depending on group-size)
- Independently perform empirical / quantitative analysis
- Use of appropriate statistics software (R/Matlab/Python/etc.)
- Pure literature research is not sufficient
- Presentation of seminar paper in blocked seminar
- Assessment: 60 % written work and 40 % presentation

Procedure

- 21.07.2023, Kick-off meeting in I-342
- 26.07.2023, submission of preferences
- 27.07.2023, allocation of topics via email (I send you an email)
- 31.07.2023, binding registration
- 20.11.2023, submission deadline
- Nov/Dec (TBA): presentation
- General information, registration form, grading specification form, guideline for writing seminar papers:
  `https://www.fcm.uni-hannover.de/de/lehre/seminare/`

Valuation of American Options Using Monte Carlo Simulation

Task:

- Theoretically describe the problems arising when pricing American options.
- Implement a Monte Carlo simulation technique to price American-style options.
- Perform further analyses, e.g., parameter sensitivity, application to real data, stochastic volatility/interest rates, multiple dimensions etc.

Literature:

- Longstaff, F. A., & Schwartz, E. S. (2001). Valuing American options by simulation: A simple least-squares approach. *Review of Financial Studies*, 14(1), 113-147.
- Broadie, M., & Glasserman, P. (1997). Pricing American-style securities using simulation. *Journal of Economic Dynamics and Control*, 21(8-9), 1323-1352.
- Glasserman, P. (2013). Monte Carlo methods in financial engineering (Vol. 53). Springer Science & Business Media.

Option Pricing with Non-Constant Volatility

Task:

- Describe and implement at least one method to price options whose underlying exhibits non-constant volatility.
- Perform further analyses, e.g., compare Monte-Carlo to analytic solutions, study the influence of different GARCH-processes, etc.

Literature:

- Christoffersen, P., & Jacobs, K. (2004). Which GARCH model for option valuation?. *Management science*, 50(9), 1204-1221.
- Heston, S. L. (1993). A closed-form solution for options with stochastic volatility with applications to bond and currency options. *Review of financial studies*, 6(2), 327-343.

Model-Free Implied Volatility

Task:

- Estimate the model free implied volatility of an asset and compare it to its subsequently realized volatility.
- Perform further analyses, e.g., study conditional risk premia, compare it to Black-Scholes-Merton IV or historical forecasts (GARCH family), study the influence of discretization/truncation/interpolation, etc.

Literature:

- Britten–Jones, M., & Neuberger, A. (2000). Option prices, implied price processes, and stochastic volatility. *Journal of Finance*, 55(2), 839-866.
- Jiang, G. J., & Tian, Y. S. (2005). The model-free implied volatility and its information content. *Review of Financial Studies*, 18(4), 1305-1342.
- CBOE (2019). VIX white paper.

EU Emissions Trading Scheme

Task:

- To implement international climate protection agreements the EU introduced the EU Emissions Trading Scheme (EU-ETS). The assets on this market are Emission Allowances, as there are caps on how much emissions a company is allowed to expel.
- One allowance allows the emission of one tonne of carbon dioxide equivalent. The market has free pricing. The general idea is that companies can reduce their emissions and sell their unused allowances.
- Besides the allowances themselves there exist derivatives on them, namely Futures and Options.
- Your task is to explain the EU-ETS and analyze the market. Investigate what type of valuation/model has the best fit for options written on carbon index futures.

Literature:

- Isenegger, P., & von Wyss, R. (2009): The Valuation of Derivatives on Carbon Emission Certificates - A GARCH Approach, *Available at SSRN: https://ssrn.com/abstract=1343835*
- Uhrig-Homburg, M., & Wagner, M. (2009): Futures Price Dynamics of CO_2 Emission Allowances: An Empirical Analysis of the Trial Period, *The Journal of Derivatives*, 17 (2), 73-88

Variance Reduction Techniques for Monte Carlo Simulation

Task:

- Describe, implement, and combine variance reduction techniques like antithetic sampling, control variates, stratified sampling, importance sampling, moment matching, quasi-random sequences, etc.
- Quantify the impact on the trade-off between computational time and error rates by pricing a simple financial derivative using Monte Carlo simulation.

Literature:

- Glasserman, P. (2013). Monte Carlo methods in financial engineering (Vol. 53). Springer Science & Business Media.

Estimation of Greeks for Hedging

Task:

- Describe, implement, and compare methods to estimate the Greeks of an (exotic) option contract using Monte Carlo simulation.

Literature:

- Glasserman, P. (2013). Monte Carlo methods in financial engineering (Vol. 53). Springer Science & Business Media.