Actuarial models

Part II

Adrien Lebègue

adrien.lebegue@uantwerpen.be

Academic year 2023–2024

Table of content

Outline

Report & presentation

- 3 topics
  - Static super-replication of exotic options
  - Measuring herd behavior in stock markets
  - The use/abuse of copulas in actuarial science and finance
- 3 groups of 2 students: one per topic
- Assignment
  - Writing of a report (12/05/2024) which
    - summarizes the topic (up to 2 pages), and
    - makes the link with lecture's topics (part I) and highlights possible applications (up to 3 pages).
  - On the 21st of May, each group will present its report to the whole class with a slide deck

Outline

Static super-replication of exotic options

- The purpose is to understand how comonotonicity can help us in the determination of hedging strategies for exotic options.
- In particular, static super-replicating strategies are studied.
- Use of the decomposition of the stop-loss premium for the weighted sum of comonotone assets and the fact that comonotone sum is an upper bound for the convex order sense.

References

- Xinliang Chen, Griselda Deelstra, Jan Dhaene, and Michèle Vanmaele. "Static super-replicating strategies for a class of exotic options". In: *Insurance: Mathematics and Economics* 42.3 (2008), pp. 1067–1085
- Daniël Linders, Jan Dhaene, Hippolyte Hounnon, and Michèle Vanmaele. "Index Options: A Model-Free Approach". In: *Research report AFI-1265 FEB (KULeuven)* (2012)
- Xinliang Chen, Griselda Deelstra, Jan Dhaene, Daniël Linders, and Michèle Vanmaele. "On an optimization problem related to static super-replicating strategies". In: *Journal of Computational and Applied Mathematics* 278 (2015), pp. 213–230

Measuring herd behavior in stock markets

- The purpose is to develop a measure of the degree of herd behavior (co-movement) between stock prices.
- This is done by means of the concept of comonotonicity.
- The idea is to compare observed market movements with the extreme and theoretical situation behind which the market is only driven by one risk factor.
- Use of options prices and swap rates.

References

- Jan Dhaene, Daniël Linders, Wim Schoutens, and David Vyncke. "The Herd Behavior Index: A new measure for the implied degree of co-movement in stock markets". In: *Insurance: Mathematics and Economics* 50.3 (2012), pp. 357–370
- Dilip B. Madan and Wim Schoutens. "Systemic risk tradeoffs and option prices". In: *Insurance: Mathematics and Economics* 52.2 (2013), pp. 222–230
- Daniël Linders, Jan Dhaene, and Wim Schoutens. "Option prices and model-free measurement of implied herd behavior in stock markets". In: *International Journal of Financial Engineering* 02.02 (2015), p. 1550012

The use/abuse of copulas in actuarial science and finance

- The purpose is to understand the impact of the assumption regarding the dependence structure between risk factors.
- This is done by means of the concept of copulas.
- In particular, we study the impact of misused copulas and correlation in the valuation of collateralized debt obligations (CDO's).

References

- Catherine Donnelly and Paul Embrechts. "The Devil is in the Tails: Actuarial Mathematics and the Subprime Mortgage Crisis". In: *ASTIN Bulletin* 40.01 (2010), pp. 1–33
- Paul Embrechts, Alexander J. McNeil, and Daniel Straumann. "Correlation and Dependence in Risk Management: Properties and Pitfalls". In: *Risk Management: Value at Risk and Beyond*. Ed. by M.A.H. Dempster. Cambridge: Cambridge University Press, 2002, pp. 176–223
- Edward W. Frees and Emiliano A. Valdez. "Understanding Relationships Using Copulas". In: *North American Actuarial Journal* 2.1 (1998), pp. 1–25