

Duality methods for stochastic optimal control problems in finance

Citation for published version (APA):

Kamma, T. (2023). *Duality methods for stochastic optimal control problems in finance*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20230112tk>

Document status and date:

Published: 01/01/2023

DOI:

[10.26481/dis.20230112tk](https://doi.org/10.26481/dis.20230112tk)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Duality Methods for Stochastic Optimal Control Problems in Finance

BY
THIJS KAMMA

1. While retaining the analytical nature unique to closed-form solutions, without depending upon numerically demanding routines, dual-control methods considerably facilitate the retrieval of near-optimal control variables. (Chapter 2)
2. Fenchel duality constitutes a fairly colossal umbrella, generalizing the conventional Lagrangian results, under which a great majority of finite- and infinite-dimensional convex optimisation problems can be subsumed. (Chapter 3)
3. The salient sensitivity of optimal investment strategies with respect to the estimates for the market prices of risk strongly corroborates the implementation of approaches that explicitly account for model and/or parameter uncertainty. (Chapter 4)
4. Novel dual-control methods, dual formulations or duality-based solutions can contribute in a significant manner, along a profound theoretical axis, to the analysis of quantifiable issues that bear practical as well as societal relevance. (Chapters 2-4)
5. The omnipresent use of the power utility function is illustrative for the dangerous academic proclivity to prefer mathematical elegance over economic soundness.
6. In the spirit of Zeno's dichotomy paradox, despite the acute mathematical arguments, the infinitesimal step distinguishing continuity from discontinuity still outlines a practical enigma. While continuous-time finance advances in its dependency on continuously defined Brownian motions, all computational attempts are confined to discretised equivalents of the corresponding trajectories.
7. Malliavin calculus, albeit underestimated, furnishes a powerful tool, particularly beneficial to the sphere of portfolio theory, on account of its ability to concretise the martingale representation.
8. Target-oriented investing based on individual-specific optimisation criteria, rendered by preference qualifications or hedging objectives involving concrete goals, can have a substantial positive impact on a pension fund's replacement ratio.
9. Original sin has taught us that human beings are in possession of – or possessed by – a natural inclination to measure amounts of monetary units in relative terms. Obtaining a lump-sum of 10,000 monetary units, while your neighbor receives a lump-sum of 100,000 monetary units, seems awkward and gives rise to feelings of envy. Utility functions that do not incorporate a reference level consequently ignore an ugly yet significant aspect of man's behavioral tendencies.
10. Science in its purest form is the art of getting acquainted with God's reason, love and beauty. The fact that it may yield humanly relevant progress is of secondary importance. All ways "up" still pass by the graves of our loved ones and ancestors.