

DUALITY-BASED ERROR ESTIMATES FOR SOME APPROXIMATION SCHEMES FOR OPTIMAL INVESTMENT PROBLEMS

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ABSTRACT. Duality methods represent a powerful tool for solving optimal investment/consumption problems. We focus on a model similar to Cuoco and Liu [1] who establish a duality relation in continuous time. A synthesis of the usual arguments, most of them based on the seminal work of Kramkov and Schachermayer [2], can be found in a note of Rogers [4]. Referring to their abstract framework, we investigate the duality relation between a class of semi-discrete approximations of the primal and dual problem. It will then be shown how the results can be applied in order to derive error bounds for the numerical schemes under consideration. In particular, the dual result allows us to by-pass a generally applicable, but in this case pessimistic bound proved by Krylov [3] for the control approximation.

Keywords: Error estimates, Utility maximization, semi-Lagrangian schemes.

Mathematics Subject Classifications (2010): 91G80, 49L25, 93E20

REFERENCES

- [1] D. Cuoco and H. Liu. A martingale characterization of consumption choices and hedging costs with margin requirements. *Mathematical Finance*, 10:355-385, 2000.
- [2] D. Kramkov and W. Schachermayer . The asymptotic elasticity of utility functions and optimal investment in incomplete markets. *Annals of Applied Probability*, 9:904-950, 1999.
- [3] N. V. Krylov. Approximating value functions for controlled degenerate diffusion processes by using piecewise constant policies *Electronic Journal of Probability*, , 4(2):1-19, 1999.
- [4] L. C. G. Rogers. Duality in Constrained Optimal Investment Problems: A Synthesis. In *Springer Lecture Notes in Mathematics*, number 1814, chapter Paris–Princeton Lectures on Mathematical Finance, 95–131, 2002.

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