Stochastic (and deterministic) dynamic optimization in finance and insurance

To introduce the subject and the notation used, we will start showing the two main methods for continuous-time dynamic optimization in the deterministic case. We will pay special attention to the dynamic optimization principle and the Hamilton–Jacobi–Bellman equation (eventually, some hints will also be made to the Pontryagin maximum principle). Then, we will pass to the stochastic case, where the focus will be the HJB approach. Possible finance and insurance applications, which will be explained in much detail (showing all the mathematical calculations and passages in the related papers), are:

- The problem of finding the optimal premium for a (non-life) insurer taking into account market competition [1], [2].
- The problem of finding the optimal asset allocation problem for a defined benefit pension plan [3].
- The problem of finding the optimal asset allocation in a portfolio of financial assets [4].

Research papers

[1] Emms, P., Haberman, S., Pricing General Insurance Using Optimal Control Theory, *AstinBulletin*35, pp. 425-453 (2005).

[2] Emms, P., Dynamic Pricing of General Insurance in a Competitive Market, *AstinBulletin*37, pp. 1-34 (2007).

[3] Gao, J., Optimal portfolios for DC pension plans under a CEV model, Insurance: Mathematics and Economics 44, pp. 479–490 (2009).

[4] Merton, R. C. "Lifetime Portfolio Selection under Uncertainty: the Continuous-Time Case". The Review of Economics and Statistics, 51, 247–257 (1969).

Basic teaching material

[5] Fleming, W. H., Rishel, R. W., Deterministic and Stochastic Optimal Control, Springer (1975).

[6] Slides of the teacher.