Extracting 'Greeks' from Multistage Linear Stochastic Optimization: Computing parameter sensitivities in Approximate Dual Dynamic Programming.

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We propose a method to calculate the sensitivities of the optimal value of a multi-stage stochastic optimization problem with respect to changes in the model parameters using Approximate Dual Dynamic Programming [1].

As a first step, we set up a discrete-time replication problem for a standard European option [2] and study the sensitivity of the minimal initial amount of required capital with respect to the value of the underlying. Since this problem approximates the classical continuous time setting for option pricing, we use it as a testbed, comparing our results with the analytical solutions that are available for this problem.

We proceed by showing that parameter sensitivities may be calculated by the algorithm, for more complicated contracts for which there exist no closed form solutions.

References

[1] Nils Löhndorf, David Wozabal, Stefan Minner (2013) Optimizing Trading Decisions for Hydro Storage Systems Using Approximate Dual Dynamic Programming. Operations Research 61(4):810-823.

[2] A.J King (2002) Duality and martingales: A stochastic programming perspective on contingent claims. Mathematical Programming, Series B, 91:543-562.