A numerical method for American options using semi-infinite linear programming

Sören Christensen
Christian-Albrechts-Universität, Mathematisches Seminar, Kiel, Germany

Abstract: A new approach for the numerical pricing of American options is introduced. The main idea is to choose a finite number of suitable excessive functions (randomly) and to find the smallest majorant of the gain function in the span of these functions. The resulting problem is a linear semi-infinite programming problem, that can be solved using standard algorithms. This leads to good upper bounds for the original problem. For our algorithms no discretization of space and time and no simulation is necessary. Furthermore it is applicable even for high-dimensional problems. The algorithm provides an approximation of the value not only for one starting point, but for the complete value function on the continuation set, so that the optimal exercise region and e.g. the Greeks can be found immediately. One furthermore easily obtains good lower bounds. We apply the algorithm to (one- and) multidimensional diffusions and to Lévy processes, and show it to be fast and accurate.

Keywords: optimal stopping, numerical method, excessive functions, semi-infinite linear programming

[1] Sören Christensen, *A method for pricing American options using semi-infinite linear programming*, preprint available at http://arxiv.org/abs/1103.4483.

Optimal stopping of autoregressive processes

Sören Christensen
Christian-Albrechts-Universität, Mathematisches Seminar, Kiel, Germany

Abstract: We consider a general optimal stopping problem with discounting for autoregressive processes. Our strategy for a solution consists of two steps: First we give elementary conditions to ensure that an optimal stopping time is of threshold-type. Then the resulting one-dimensional problem of finding the optimal threshold is to be solved explicitly. This second step is carried out for innovations of phase-type distribution using martingale techniques. The principle of continuous fit leads to explicit solutions. The talk is based on [1] and [2].

Keywords: optimal stopping, numerical method, excessive functions, semi-infinite linear programming

[1] S. Christensen, A. Irle, A. Novikov, *An Elementary Approach to Optimal Stopping Problems for AR(1) Sequences*, Sequential Analysis, Volume 30, Issue 1, 2011, 79 - 93

[2] S. Christensen, *Phasetype distributions, autoregressive processes and overshoot*, preprint available at http://arxiv.org/abs/1008.0756.