Optimal Stopping with Randomly Arriving Opportunities

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Motivated by asset-liquidity spirals, we analyze general optimal stopping problems in which opportunities to exercise an option arrive randomly, and where the occurrence of the exercise opportunities and the option's underlying asset price processes may be interrelated. Such problems occur naturally in applications with market frictions and are thus relevant for financial applications.

To date, a few papers have studied optimal stopping problems where the stopping opportunities are restricted to random times, and these are typically generated by an independent Poisson process. The development of numerical methods for these problems is still ongoing and we are not aware of a numerical method that deals with more intricate arrival processes, such as processes that depend on the underlying asset prices.

In this work, we provide such numerical methods, under the assumption of Markovian dynamics. The pivotal element of our approach is the use of random rather than deterministic time scales, which brings important computational advantages.

This change of perspective allows us to introduce three algorithms that are adapted from algorithms from the Bermudan option pricing literature: we extend the Longstaff-Schwartz algorithm, the policy iteration algorithm and the Andersen-Broadie dual method to be able to use them for optimal stopping problems with randomly arriving opportunities. We determine conditions for the validity of our algorithms and their convergence.

The efficiency of our methods and the relevance of randomly arriving opportunities are illustrated in a few examples, among which a variant of a benchmark example: the Bermudan max-call contract.