Degenerate obstacle problems in mathematical finance

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Abstract:

Solutions to obstacle problems for partial-integro differential operators correspond in mathematical finance to value functions for American-style options on an underlying asset modeled by a Markov process associated with the given partial-integro differential operator. Questions of existence, uniqueness, regularity, and numerical solution by finite element or finite difference methods are especially challenging when the operator is degenerate, although that is usually the case for problems arising in mathematical finance when asset prices are modeled as stochastic volatility processes. With the aid of weighted Sobolev spaces and Holder spaces, we establish the optimal regularity for solutions to obstacle problems for degenerate operators when the obstacle functions are sufficiently smooth and report on progress in establishing the regularity of the optimal exercise boundary. This is joint work with Panagiota Daskalopoulos and Camelia Pop.