ON A ZEROS-SUM OPTIMAL STOPPING GAME

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ABSTRACT. On a filtered probability space $(\Omega, \mathcal{F}, P, \mathcal{F} = (\mathcal{F}_t)_{t=0,...,T})$, we consider stopper-stopper games $V := \inf_{\rho \in T_{\downarrow}} \sup_{\tau \in T} E[U(\rho(\tau), \tau)]$ and $\underline{V} := \sup_{\tau \in T} \inf_{\rho \in T} E[U(\rho(\tau), \tau)]$ in discrete time, where $U(s, t)$ is $\mathcal{F}_{s \lor t}$-measurable instead of $\mathcal{F}_{s \land t}$-measurable as is often assumed in the literature, $\mathcal{T}$ is the set of stopping times, and $T_{\uparrow}$ and $T_{\downarrow}$ are sets of mappings from $\mathcal{T}$ to $\mathcal{T}$ satisfying certain non-anticipativity conditions. We convert the problems into a corresponding Dynkin game, and show that $V = \underline{V} = \overline{V}$, where $V$ is the value of the Dynkin game. We also get the optimal $\rho \in T_{\downarrow}$ and $\tau \in T_{\uparrow}$ for $V$ and $\underline{V}$ respectively. I will also discuss the extensions to continuous time.

This is a first step in solving the robust semi-static hedging problems using American options.

Joint work with my Ph.D. student Zhou Zhou.

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