Moral hazard in stochastic differential games: Beyond Markov equilibrium

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Abstract

We study a broad class of n-player continuous-time stochastic games with imperfect monitoring in which the publicly observable state vector follows a controlled Markov diffusion process. We characterize the set of perfect public equilibria and attainable payoffs. This class of equilibria goes beyond Markov perfect equilibria, and the set of attainable payoffs in classic examples can be significantly larger. We introduce two types of optimality equations to characterize equilibria: one is an elliptic partial differential equation (PDE), and another is a parabolic PDE. The correspondence of perfect public equilibrium payoffs solves the elliptic equation, but it may not be the unique solution. The parabolic equation has a unique solution, and we develop a numerical algorithm to compute it. Relative to the class of two-player continuous-time repeated games of Sannikov (2007) the optimal equilibria in the class of games that we study have new features, such as absorbing regimes that do not correspond to a static Nash or a Markov perfect equilibrium.