CONTINUOUS-TIME GAMES WITH IMPERFECT INFORMATION:
FOLK THEOREMS AND EXPLICIT RESULTS

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My dissertation focuses on continuous-time models of repeated interactions with imperfect public monitoring. In such models, players do not directly observe each other’s actions and instead observe only the impacts of the chosen actions on the distribution of a random signal. Even though imperfect monitoring makes coordination more difficult, Abreu, Pearce and Stacchetti [1] and Fudenberg, Levine and Maskin [3] show that a multitude of equilibria exist if these interactions are repeated at fixed time intervals and players are sufficiently patient. The benefit of studying repeated interactions in continuous time is that continuous-time techniques make it possible to obtain explicit results that are not available in discrete time (see Sannikov [4]). For example, boundaries of equilibrium payoff sets can be characterized and computed via differential equations.

The first part of my dissertation, “The Folk Theorem with Imperfect Public Information in Continuous Time” [2], joint with Christoph Frei, forthcoming in Theoretical Economics, proves a folk theorem for these games by adapting the recursive methods of [3] to the continuous-time setting. This is not trivial. One concern with continuous-time models, for example, is that they may lead to equilibria that oscillate infinitesimally fast between action profiles. We provide a partial rebuttal to this concern: our proof relies entirely on strategies that are constant for positive (but random) time intervals, showing that the ability to switch actions infinitesimally fast is not necessary to attain efficiency. We also show that public randomization in continuous-time games makes it possible to transform equilibrium strategies continuously across games within the same model, for example, across games arising from varying the discount rate. As players become more patient, equilibrium strategies can be transformed by reducing their execution speed.

A second advantage of continuous-time models is that the information players observe can be cleanly separated into two types: Information that is continuously available, such as the production quantity or price of a good, and information that arrives abruptly, such as accidents or other unforeseen events. In continuous-time games, the first type of information can be modelled as a Brownian motion governing the evolution of the public signal, and the second type can be modelled as a Poisson process. Repeated interactions with both types of information were first studied in Sannikov and Skrzypacz [5], whose main result is an asymptotic payoff bound as the length of the time periods approach zero. In my job market paper, “Continuous-Time Games with Imperfect and Abrupt Information,” I derive an explicit characterization of all payoffs that are attainable in 2-player games with continuous and abrupt information. It is thus a generalization of the main result in [1] to a more general information structure that includes abrupt information, as well as an improvement from an asymptotic payoff bound in [5] to an explicit description of the equilibrium payoff set for all discount rates. The explicit nature of the result makes it possible to precisely quantify the impact of this abrupt information on players’ payoffs in equilibrium. Because abrupt information arrives only infrequently, this additional value is larger for more patient players.
References


