Title: Introduction to the Dynamic Games Special Issue

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Introduction to the Dynamic Games Special Issue

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This special issue of the *Review of Economic Dynamics* is devoted to the subject of dynamic games. There are two classes of problems that have excited the interest of game theory researchers over the last several years. The first is the topic of repeated games and the folk theorem; the second is the way in which learning in games may lead to the selection of particular equilibria. This special issue contains some of the most recent research on both of these topics.

The most significant result on repeated games is the folk-theorem, which says roughly that if players are sufficiently patient then any socially feasible individually rational payoff vector can be supported as a subgame perfect equilibrium. Recent years have seen a strong effort to extend the theorem to environments with imperfect information. Harrison Cheng's "Folk Theorem with One-Sided Information" is one such effort. By focusing on the special case of one-sided information, Cheng is able to simplify and extend the folk-theorem of Fudenberg, Levine and Maskin [1994]. The simplification comes about by introducing an easy to verify criterion called *admissability*. The extension comes about by showing that in the case of one-sided moral hazard, the Nash threats folk theorem can be improved on to give a full minimax folk theorem.

The other recent topic in the folk-theorem literature has been to try to expand the scope of the theorem beyond the setting of repeated games, to incorporate storage and other state variables. Ligon, Thomas and Worral in "Mutual Insurance, Individual savings and Limited Commitment" examine a setting with a linear storage technology dynamic that allows self-insurance as a substitute for mutual insurance. The striking fact is that the welfare effects of the storage technology are ambiguous. Higher levels of utility are possible because of self-insurance: however, this reduces the equilibrium level of mutual insurance, and hence the welfare level. In numerical examples, they find that storage and the gain from insurance are correlated: more storage gives more utility from autarky, so to sustain insurance these households must have more to gain from it.

By way of contrast David Levine's "Castle on the Hill" shows just how badly the folk theorem can fail when the repeated game assumption is dropped. Dutta [1991] showed that the folk theorem continues to hold with state variables when players cannot prevent states from being reached. Levine studies a simple game with irreversibility: in one state one player is a Lord living in a castle and the other is a serf; while in the other state the roles are reversed. However, the Lord may, by a costly defence of his castle prevent the roles from being reversed. In repeated games, the set of possible equilibria generally expands with the discount factor, and for discount factors near one there are many equilibria. In Castle on the Hill, for a broad range of discount factors, including those close to one, equilibrium is unique. Moreover, the equilibrium for large discount factors is Pareto dominated by the equilibrium for low discount factors. A unique cyclic equilibrium is also possible for intermediate ranges of discount factors.

The remaining papers in our special issue examine learning. Dimitri's "Correlation Learning and the Robustness of Cooperation" studies learning in a repeated

game framework. In particular he examines a repeated Prisoner's Dilemma game, where players learn using fictitious play. The novelty of the model is that players may think that the probabilities of the choices are correlated rather than independent. Remarkably, in this framework cooperation can survive with positive probability: If cooperative players meet sufficiently often the estimated conditional probability of being matched with a cooperative player will remain sufficiently high.

Perez's "Private Experience in Adaptive Learning Models" turns to the connection between learning theory and the experimental laboratory. The experimental motivation is the discrepancy between the Marimon-Sunder [1993] results and the learning theory of Marcet and Sargeant [1989a,b]. Perez finds that if we allow different agents to participate and acquire information at different levels the experimental anomalies disappear.

Finally, Cabrales and Ponti in "Implementation, Elimination of Weakly Dominated Strategies and Evolutionary Dynamics" study the role of learning dynamics in mechanism design. Specifically, they examine the dynamic implementation of the Siostrom mechanism. In this mechanism players simultaneous announce their preferences, and the preferences of their immediate neighbors. The truth telling equilibrium is the only one that survives the first round of elimination of weakly dominated strategies. However, as is often the case, this mechanism has many equilibria. The authors study dynamic implementation: an outcome is dynamically implemented if it is the limit point of some dynamic process. They focus on monotone dynamics and best response dynamics. Monotone dynamics is not a strong enough assumption to pin down an equilibrium: every component of the Nash equilibrium set contains a limit point of the monotonic dynamics. The best-response dynamic leads to a much sharper conclusion: any interior solution of the best reply dynamics converges to the equilibrium whose outcome is desired by the social planner.

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