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Dynamic sender–receiver games ☆

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Abstract

We consider a dynamic version of sender–receiver games, where the sequence of states follows an irreducible Markov chain observed by the sender. Under mild assumptions, we provide a simple characterization of the limit set of equilibrium payoffs, as players become very patient. Under these assumptions, the limit set depends on the Markov chain only through its invariant measure. The (limit) equilibrium payoffs are the feasible payoffs that satisfy an individual rationality condition for the receiver, and an incentive compatibility condition for the sender.

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1. Introduction

Since [8], sender–receiver games, or cheap-talk games, have become a natural framework for studying issues of information transmission between a privately informed 'expert' and an uninformed decision maker, where the two parties have non-aligned interests.

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When the decision maker acts only *once*, the extent to which information can be shared at equilibrium has been studied extensively, when 'talk' takes place prior to the decision stage. While [8], see also [14], have focused on the case where communication is limited to a single costless and non-verifiable message from the sender to the receiver, more recent papers have shown that this restriction is not innocuous, and have characterized the equilibrium outcomes for general cheap-talk games, see [18,2]. This line of work has been motivated by numerous concrete situations. We refer to [19,11,23] for a discussion of these applications.

The present work is motivated by the following observation. Whether the sender is a financial advisor who provides advice to a client, an expert who is consulted on a project, or a referee on a project/person, the situation often calls for a dynamic approach. Indeed, the financial advisor provides advice on a series of investments, and the expert and the referee may be consulted on successive, related projects.

Such a situation is analyzed in [13]. They assume that the sender repeatedly sends messages, the receiver repeatedly makes decisions, while the state of the world remains *fixed* throughout. Within the framework of [8] (continuum of states/messages), they show that, for some specifications on the initial distribution on states, (necessarily complex) equilibria exist, that achieve full revelation of the state of the world in finite time.

We here deal with situations in which the state of the world may change through time. Specifically, we assume that the successive states form an irreducible Markov chain over some finite set. In every stage, the sender issues a message/recommendation, and the receiver makes a decision. States are only known to the sender, and payoffs only depend on the current state and on the receiver's decision, but not on the message sent by the sender.

Since states are autocorrelated, any information disclosed in stage n provides valuable information in later stages as well, as in [13]. Yet, since the Markov chain is irreducible, this information becomes eventually valueless.

Intuitively, the inter-temporal situation puts some restrictions on the players' behavior. As an illustration, the opinion of an expert who systematically provides laudatory reports will eventually come to be discounted, if not ignored, since the decision maker is aware of the fact that the time-average report of the quality of people/projects should reflect the invariant measure of the states of the world. On the other hand, an expert who genuinely provides accurate information to promote efficiency, but sees that the decision maker only acts in his interests, may become wary and may stop to provide valuable information to the decision maker. As is well known from repeated games, the sender may indeed provide powerful incentives by conditioning his future communication policy on the behavior of the decision maker. Similar insights already appear in the literature on dynamic contracting, see [5,6,4].

Our paper relates to the recent and growing literature on incomplete information games, in which the uncertainty evolves according to a stochastic process. Examples of such papers include, e.g., [1,9,20–22,24,15] and, especially, [10]. We provide a characterization of the limit set of sequential equilibrium payoffs, when players are very patient. Our main findings are the following. We first show (Theorem 1) that a feasible payoff vector is a (limit) equilibrium payoff as soon as the following two conditions are met. On the one hand, the payoff of the receiver should be at least his babbling equilibrium payoff. This condition is an individual rationality condition. Indeed, the latter payoff is equal to the receiver's minmax payoff in the dynamic game since the receiver has the option to ignore the announcements of the sender. On the other hand, the sender's payoff should satisfy an incentive compatibility condition, which reflects the fact that the sender has the option of substituting artificially generated states to the