Coordination with Local Information

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ABSTRACT

How can the details of who observes what affect the outcomes of economic, social, and political interactions? Our thesis is that outcomes do not depend merely on the status quo and the available (noisy) information on it; they also crucially depend on how the available pieces of information are allocated among strategic agents. We study the dependence of coordination outcomes on local information sharing.

In the economic literature, common knowledge of the fundamentals leads to the standard case of multiple equilibria due to the self-fulfilling nature of agents' beliefs. The global-games framework has been used extensively as a toolkit for arriving at a unique equilibrium selection in the context of coordination games, which can model bank runs, currency attacks, and social uprisings, among others. Yet, there is a natural mechanism through which multiplicity can reemerge, while keeping information solely exogenous: the (exogenous) information structure *per se*, namely, the details of who observes what noisy observation. The aim of this paper is to understand the role of the exogenous information structure in the determination and characterization of equilibria in the coordination game. We answer the question of how the equilibria of the coordination game depend on the details of local information sharing. Our main contribution is to provide conditions for uniqueness and multiplicity that pertain solely to the details of information sharing. The findings in the present paper give an immediate answer as to the determinacy of equilibria using only the characterization of what agent observes what pieces of information.

We build on the standard global game framework for coordination games with incomplete and asymmetric information and consider a coordination game in which each of a collection of agents decides whether to take a risky action (whose payoff depends on how many agents made the same decision, and the fundamentals) or a safe action, based on their noisy observations regarding the fundamentals. Generalizing away from the standard practice of considering only private and public signals, we allow for signals that are observed by arbitrary subsets of the agents. We refer to signals that are neither private nor public as *local* signals. We pose the following question: how do the equilibria of the coordination game depend on the *information locality*, i.e., on the details of local information sharing?

Our key finding is that the number of equilibria is highly sensitive to the details of information locality. As a result, a new dimension of indeterminacy regarding the outcomes is being introduced: not only may the same fundamentals well lead to different outcomes in different societies, due to different realizations of the noisy observations; the novel message of this work is that the same realization of the noisy observations is compatible with different equilibrium outcomes in societies with different structures of local information sharing.

In particular, we show that as long as a collection of agents share the same observations, and no other agent's observations overlap with their common observations, multiple equilibria arise. Identical observations is not, nevertheless, a necessary condition for multiplicity: we show that as long as the observations of a collection of agents form a cascade of containments, and no other agent's observations overlap with the observations of the collection, then multiplicity emerges. This is not to say however that common knowledge of information at the local level necessarily implies multiplicity: in particular, in the absence of identical observations or cascade of containments of observations, or if the condition of no overlap of information is violated, then, despite the presence of some signals that are common knowledge between agents, a unique equilibrium may be selected.

In the case where each agent observes exactly one signal, we characterize the set of equilibria as a function of the details of the information structure. We show how the distance between the largest and smallest equilibria depends on how information is locally shared among the agents. In particular, the more equalized the sizes of the sets of agents who observe the same signal, the more diverse the information of each group becomes, heightening inter-group strategic uncertainty, and leading to a more refined set of equilibria.

We use our characterization to study the set of equilibria in large coordination games. We show that as the number of agents grows, the game exhibits a unique equilibrium if and only if the largest set of agents with access to a common signal grows sublinearly in the number of agents, thus identifying a sharp threshold for uniqueness versus multiplicity.

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