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Network Games with Local Correlation and Clustering

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Extended Abstract

People rarely make decisions in isolation. Often, the choices of friends, family, and acquaintances shape our beliefs and behavior. This observation forms the basis for a growing body of economics research examining the impact of social influence on individual decision making and collective outcomes. Network games, in which agents in a social network play a game where their payoffs depend on their own actions and the actions of their network neighbors, capture situations where the costs and benefits of our choices depend directly on the decisions of our social contacts [1].

This paper builds on the network games framework to incorporate an additional feature of social decision making: people's actions tend to be locally correlated, and this local correlation in turn affects how information and behaviors spread. We expect local correlation to arise in a variety of contexts. For example, two colleagues are likely to use a common software package because it facilitates collaboration, while individuals in another firm or department might use an alternative. In other cases, social influence may lead to locally negatively correlated behavior; if we can count on a particular parent to volunteer in our child's classroom then we may be more likely not to volunteer and instead free-ride off of their generosity. Moreover, local correlation changes the way that behaviors and information spread. In the case of software choice for example, if it were not for local correlation most people would be forced to adopt the software that is most popular in the population as a whole, while with local correlation, different pockets of people may make different choices.

While previous models of network games capture the local nature of influence [1], this paper extends that framework to account for local correlation. We apply the model to two classes of games, games of strategic complements and games of strategic substitutes. Games of strategic complements correspond to situations in which agents prefer to take an action when more of their neighbors also take that action - these games apply particularly to problems of technology adoption. Games of strategic substitutes, on the other hand, capture public goods games in which agents prefer to take an action more when fewer of their neighbors take that action. We find that agents' strategies tend to be locally associative in games of strategic substitutes and locally dissociative in games of strategic complements (Figure 1).

In addition to incorporating local correlation, we also extend our framework to take network clustering into account. In many empirical settings two agents that share a mutual friend are likely to be friends of each other [2]. We adjust the model to incorporate clustering and examine the dependence of predicted equilibria in games of complements and substitutes on clustering as quantified by the clustering coefficient of the network. We find that in the case of public goods provision, clustered networks result in more agents providing the public good than non-clustered networks. In games of complements, clustering can help beneficial new technologies break into markets that are dominated by less preferred standards. Intuitively, clustering protects the new technology by shielding tightly coupled communities of early adopters from the status quo technology.

References

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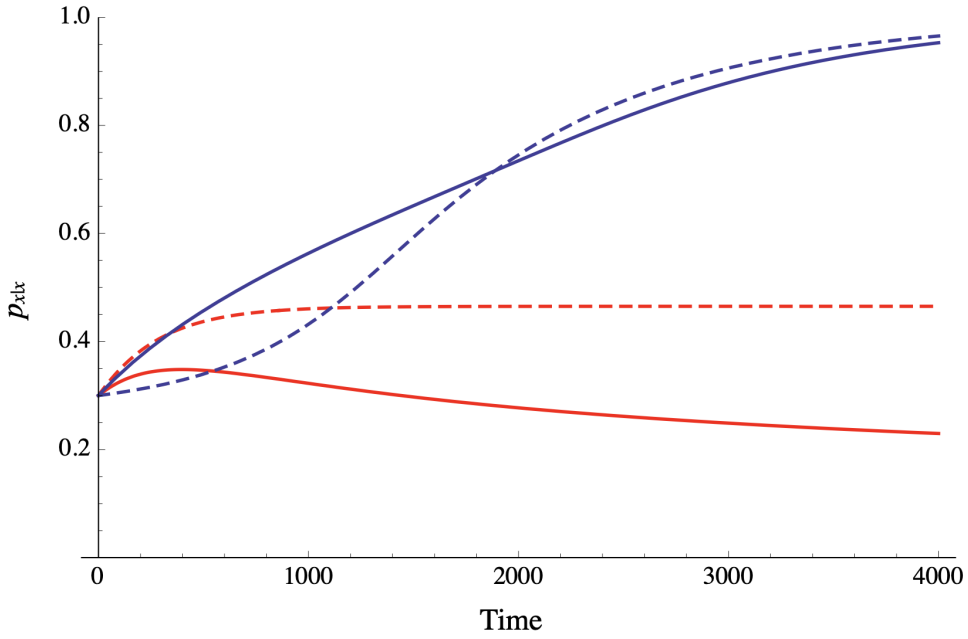

Figure 1: The conditional probability $p_{x|x}$ that a given neighbor of an agent playing strategy x is also playing x from the locally correlated model (solid lines), and the fraction of agents playing strategy x from an independent model (dashed lines). The blue lines are for a game of strategic complements and the red lines are for a game of strategic substitutes.