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Summary

This dissertation contains four independent studies on applications of social and economic networks. Social connections between agents are represented as links between nodes in a network structure, which is taken as given in each study. We investigate various effects caused by the interaction of decision makers, including non-monotonic dynamics of adopting behavior of innovation, coordination under restricted communication, wisdom of crowds with structural variability, and cost sharing of cleaning a polluted river among regions in the basin of the river network.

In the first study we propose a generalized model of network games to incorporate inclinations as an endogenous driving force of innovation. Individuals can choose between two actions: either to adopt a new behavior or stay with the default one. Adoption of new behavior is determined by individual expected return which depends on the number of neighbors one has, the proportion of the neighbors that already adopted the new behavior and individual inclination towards adoption. The aggregate adoption rate and inclination are interdependent and are influenced by the underlying social network. With our model we are able to explain a variety of behavior of adoption. Of particular interest is the existence of non-monotonic behavior of the aggregate adoption rate which is not possible under the model without inclination. Inclination dynamics can explain “sudden” outbreaks of collective action. This suggests to reinvent the common static concept of a tipping point by defining it endogenously by means of inclination dynamics.

Our second study investigates a multi-period binary choice game with an underlying social network, where each agent can only observe actions and payoff functions of her neighbors'. Each agent is supposed to choose one action from the status quo and the irreversible alternative. The alternative is beneficial for an agent only if there are enough coordinators in the network, where the thresholds varies with different agents. We study the roll of playing the alternative action at an early stage as a signaling device in achieving a broader collective action. This signaling effect may encourage the emergence of coordination. It is shown that network structure and individual preferences can either help or hamper coordination.

The third study focuses on the phenomenon “wisdom of crowds”, proposed by Golub and

Jackson (2010), which is a characterization of growing networks where individual beliefs of people therein converge to the truth in the double limit of time and network size. It extends the classic model of DeGroot (1974) about reaching a consensus with a fixed size network. In this study we examine the validity of wisdom of crowds when the network structure is variable over time. We observe that when the network is randomly selected from a finite set of alternatives in each time period, the society can still reach a consensus with a tighter condition, though wisdom of crowds is indeterminable. We demonstrate this finding through both mathematical analysis and numerical simulations.

In our four study, cost sharing problems of cleaning a polluted river among the regions in the basin of the river network is considered. Solutions by applying cooperative game theory are proposed in Ni and Wang (2007) and Dong, Ni, and Wang (2012), namely the Local Responsibility Sharing (LRS) method, the Upstream Equal Sharing (UES) method and the Downstream Equal Sharing (DES) method. In our study, we show that the UES and DES methods can also be obtained as the conjunctive permission value of an associated game with a permission structure, where the permission structure corresponds to the river structure and the game is determined by the cleaning costs. Then, we show that several axiomatizations of the conjunctive permission value also give axiomatizations of the UES and DES methods, of which one is comparable with the one from Dong, Ni, and Wang (2012). Besides, by applying another solution, the disjunctive permission value, to polluted river games with a permission structure we obtain a new cost allocation method for polluted river problems. We axiomatize this solution and compare it with the UES method.