Essays on the economics of social networks

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Summary

Chapter One

The chapter studies a local interaction model in which agents are situated on a circle and play bilateral prisoners' dilemmas with their immediate neighbours. They have three possible strategies: cooperate in all interactions (a fully altruistic strategy), defect in all interactions (a fully egoistic strategy), or cooperate with one immediate neighbour with probability 1/2 (a strategy dubbed partial cooperation), which allows a middle option between the two extremes. Agents apply a naive imitation decision rule – after the first period they use the strategy which has the highest average payoff from the ones they have observed in their local neighbourhood, which consists of their two immediate neighbours. The absorbing states of the process are outlined theoretically and analysed further with extensive computer simulations. There does not exist an absorbing state in which the partially cooperative strategy coexists with any of the other strategies. The partially cooperative strategy limits the diffusion of altruistic behaviour in the population and gives the model a "rock-paper-scissors" feel, so that every strategy's propagation in the population is inhibited by one other strategy and supported by the third one, especially when interacting in big homogeneous groups. Even though clustering of altruists is generally beneficial for sustaining altruism, relatively big groups of altruists at the onset of the process actually *enable* the spread of the partially cooperative strategy, while relatively scattered altruists in the initial state benefit the propagation of *egoists*.

Chapter Two

This chapter studies a model of network formation in which agents create links following a simple heuristic - they invest their limited resources proportionally more in neighbours who have fewer links. More precisely, in an equal-degree network every node spreads its resources equally amongst its neighbours. However, if a node has two neighbours, one with degree two and the other one with degree one, the neighbour with degree one will get an investment twice as big as the other neighbour. This decision rule captures the notion that when considering *social* (rather than informational) value more connected agents are on average less beneficial as neighbours and node degree is a useful proxy when payoffs are difficult to compute (or just uncertain). The decision rule illustrates an externalities effect whereby an agent's actions also influence his neighbours' neighbours. Besides complete networks and fragmented networks

with complete components, the pairwise stable networks produced by this model include many non-standard ones with characteristics observed in real life like clustering and irregular components. Multiple stable states can develop from the same initial structure - the stable networks could have cliques linked by intermediary agents while sometimes they have a core-periphery structure. The observed pairwise stable networks have close to optimal welfare. This limited loss of welfare is due to the fact that when a link is established, this is beneficial to the linking agents, but makes them less attractive as neighbours for others, thereby partially internalising the externalities the new connection has generated.

Chapter Three

This chapter studies a multiple-receiver Bayesian persuasion model, where a sender communicates with receivers who have homogeneous preferences and vote sincerely. The sender wants to implement a proposal and commits to a communication strategy which sends correlated messages to the receivers. Receivers are connected in a commonly known network and perfectly observe not only their own messages but also their direct neighbours' messages. After updating their beliefs accordingly, they vote on the proposal. Under a standard multiple-receiver Bayesian persuasion model, the sender can improve upon public communication (i.e. treating all receivers *uniformly*) by using private messages. The chapter examines how networks of shared information affect persuasion in contrast to the empty network setting. This presents multiple difficulties because most of the assumptions that hold under standard multiple-receiver Bayesian persuasion models are no longer without loss of generality. For instance, straightforward or anonymous strategies are not generally optimal, and neither are strategies which are truth-telling in the sender's preferred state. Nevertheless, the chapter determines many interesting cases in which it is optimal for the sender to employ a private communication strategy and outlines sufficient conditions and the corresponding optimal strategies to achieve the optimal persuasion probability. In particular, this is done for the star, circle and wheel networks and for networks with sufficiently many singleton nodes. Surprisingly, in many cases the sender's gain from persuasion does not decrease due to the additional information provided by the receivers' neighbourhoods and is the same as in the empty network case. Moreover, the value of the optimal communication strategy does not go down monotonically when the network becomes *denser*.