

# The effects of local information and trading opportunities in a network constrained economy

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Work within the field of artificial life has as history of exploring the ways in which locally constrained interactions between the elements of a system can give rise to organised behaviour at the level of the ensemble. Here we study the effect of constraining co-operative, competitive and communicative interactions within a market by embedding it within a network. We are particularly interested in how these different kinds of interaction are influenced by the structure of the market network. The paper aims to examine the effect of limited trading opportunities and information availability on the behaviour of individuals and of the market as a whole. It examines how a trader's ability to make profit is influenced by their location within a trade network and how trader strategy must be adapted to cope with this constraint. To this end we employ an agent-based model of trader interaction in which the actions of each trader are governed by individual behavioural rules. Traders are situated on the nodes of a network and interact with potential trading partners through the ties. The networks considered in this work are constructed via preferential attachment schemes resulting in networks both with and without positive assortedness. The behavioural rules of the traders are optimised for their respective locations within the networks through the use of a hill-climbing algorithm. It is demonstrated that a trader's ability to profit and to identify the equilibrium price is positively correlated with its degree of connectivity within the market. Better connected traders are able to exploit their market position at the expense of other market participants. When the effects of constraining trade and information are separated it is demonstrated that when traders differ in their number of potential trading partners, well-connected traders are found to benefit from aggressive trading behaviour. A higher number of potential trading partners allows these traders to demand better terms as there is a higher chance of another trader being willing to trade with them. Where information propagation is constrained by the topology of the trade network, connectedness affects the nature of the strategies employed. Better connected traders attempt to learn more quickly, taking in as much information as possible at the start of the market in order to exploit possible trading opportunities. Less well connected traders learn more slowly and average over time to avoid being exploited by better connected individuals. We also demonstrate that traders are unable to exploit second order information and trade effects connected to the network. We show that it is not possible for traders to modulate their price or the way in which they weight information based on the connectedness of the potential trading partner/information source to make higher profits. When this situation is permitted all traders adopt strategies such that none benefit from the additional abilities.