The evolution of beliefs and strategic behavior

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VALORIZATION

This final Chapter of the dissertation discusses the valorization opportunities that this PhD thesis presents. This is in accordance with article 23.5 of the *Regulation governing the attainment of doctoral degrees at Maastricht University*. I start by providing the summary of the socio-scientific implications of the thesis findings. The social and economic relevance of the study will be followed with a description of the potential target groups for whom the results may be of interest. I will then present the degree of innovativeness of the research methods used and how the results of the study will be disseminated to a wider audience.

This dissertation has focused on three aspects of social and economic interactions: coordinated change in strategic behavior, opinion formation and the nature of public beliefs, and the role of the structure of social interactions in shaping both aspects.

The analysis and results of the first part of the project can be directly applied to the scientific study of how social institutions and technologies may arise and evolve. Social institutions and technologies are dynamically similar in that they both require coordinated change in expectations and behavior of individuals. Our analysis of coordinated change in strategic behavior therefore directly extends to these specific cases of social and economic interactions. Social institutions can be formally defined as mechanisms that facilitate interactions and coordination among individuals of any given society. Examples of social institutions include social norms, forms of corporate governance, terms of economic contracts and private property rights. Social technologies in this context refer to technological products with positive returns to adoption, such as information technologies. This dissertation thus contributes to our understanding of how such institutions and technologies evolve. And in particular, it shows how innovations can bring about change in social institutions and technologies.

This thesis finds that (*a*) the payoff gains from the potentially new social institutional or technology and (*b*) the structure of day-to-day social interactions, matter in

shaping their evolution. These two factors determine whether or not the new insti-
tution and technology can gain a foothold in the society. Our study shows that for
societies in which connections between individuals are sparse, incremental changes
are feasible. By contrast, for societies in which individuals are highly connected, only
radical changes are feasible. These findings are particularly relevant in the current
Information and Social Ages in which societal interactions are shaped by digital tech-
nologies because social interactions such as online relationships, collaboration and
information sharing are becoming more and more structured.

Beyond the above mentioned socio-scientific relevance, the findings in this the-
sis are also of relevance to firms and policy makers. Social norms and interactions
influence productivity and organizational efficiency in corporations and public or-
ganizations. Norms define expected behavior and hence accepted levels of perfor-
mance by members of an organization. Our findings then imply that when thinking
about changing the working norms within an organization, not only does one have
to consider the potential reward from the desired norm but also the structure of in-
teractions among the members of the organization. Perhaps most importantly, the
results in Chapter 3 imply that if the structure of interactions is known, then the
design of rewards to be offered for adopting a new norm can be determined.

In relation to firms as target groups, our findings can directly be applied in de-
signing market expansionary strategies. The thesis theoretically shows that if the
preferences over a set of consumer or technological products exhibit network exter-
nalities, then for a given structure of social interactions among consumers, one can
determine the level of innovation on a product required for it to takeover (at least the
largest share of) the market. Examples of consumer products that exhibit network
externalities range from durable goods in which buyers care about post-purchase
services to IT products in which its benefits depend on how many others in one's
social network adopt it. In the case where two competing products with network
externalities co-exist within the market, our findings imply that having knowledge
of the network of interactions among consumers enables determination of the level
of incremental innovation on the product for it to gain a larger share of the mar-
ket. Similarly, when a new product is introduced to the market, it is not only the
relative gains that the new product offers to the consumers but also the structure of
interactions among consumers that determines its success.

Our results are also of relevance to policy makers. The success of any economic
policy depends on public opinion towards it. Consider an example of the current
debate on the exact cause of climate change. After examining nearly 12,000 peer-
reviewed scientific papers, Cook et al. [29] found that 97.1% of them endorsed the

consensus position that humans are causing global warming. By contrast, only 41% of the American public says that global warming is anthropogenic. The success of any economic policy aiming at reducing anthropogenic factors such as CO_2 emissions will then depend on how it affects the 59% of the population with an alternative opinion on causes of global warming. The second part (Chapter 5) of this thesis studies conditions under which public consensus and disagreement may arise and how fast structured societies converge to stable public opinion. We show how historical factors (prior beliefs), the manner in which individuals assimilate new information and networks governing information exchange interactively shape public opinion. Knowledge of these factors can be used by policy makers to promote desirable economic policies.

In terms of innovativeness, this thesis introduces novel analytical methods that are not limited to the field of social sciences. The methods introduced include probability techniques for studying dynamic interaction systems that involve experimentation and communication among interacting entities. It also introduces theoretical methods for analyzing processes in which interactions among entities are decentralized. Such interaction systems can be found in the field of biological sciences and computer science. Our theoretical methods can for example be employed to study flocking and herding behavior in social animals, or biological evolutionary processes. Similarly, they can also be applied to the study of consensus and coordination in sensor and electric networks. The theoretical methods introduced will therefore be of use to a wider scientific circle.

Finally, the dissemination of the outcomes of this project is already in progress. The results have been presented to international audiences in conferences and seminars. Presentations have been given at The Centre d'Economie de La Sorbonne and Paris School of Economics, University of Cergy Pontoise THEMA, Cournot seminars at Bureau d'Economie Théorique et Appliquée (BETA), University of Strasbourg, Royal Economic Society Postgraduate Presentation Meeting & Job Market, 10th Workshop on Networks in Economics and Sociology at Utrecht School of Economics, and Maastricht Lecture Series in Economics. The four main chapters of the thesis have been rewritten into journal article formats, all of which are under submission for publication in top peer-reviewed economic journals.