

SCIENTIFIC REPORT OF THE XII “COALITION THEORY NETWORK” MEETING

BY **SERGIO CURRARINI**

The XII CTN conference was held in Louvain-la-Neuve last January, hosted by the Center for Operational Research and Econometrics (C.O.R.E.). The focus of this year’s meeting was the analysis of coalition and network formation by heterogeneous agents. The programme included a preliminary session (held on the 17th), co-organised with the Department of Engineering of the Université Catholique de Louvain.

The meeting confirmed the trend of growing attendance experienced in the past few years, especially of young researchers and PhD students from member institutions. Another clear trend that was confirmed in Louvain was the growing attention of the scientific community to the problem of social and economic networks, on which most contributed papers have focused. Here follows a brief and non technical summary of the main contributions to the conference. I have grouped contributions according to broad fields of research, in alphabetical order.

COALITION THEORY

Although the interest in coalition theory, and in cooperative game theory in general, has slightly weakened in the last few years (also due to the emerging field of network formation), we had a few extremely interesting contributions. **Vincent Iehlè**, from CODE, has presented a sharp result, establishing conditions for the existence of a core partition in hedonic games. This paper fills a gap in cooperative game theory, extending to hedonic games a recent result on necessary and sufficient conditions for core stability in games without transferable utility. Although the conditions found by the author, based on a variation of the notion of balancedness, seem hard to check in practice, the result is clearly a noteworthy contribution to the field of cooperative games.

Another missing bit in the theory is addressed in the paper by **Jacques Durieu**, from CREUSET, in which the problem of farsightedness is studied in the contest (context?) of TU cooperative games. Farsightedness is important in that it considers the expectations that players might have on the ultimate consequences of their actions and, in particular, of their objections to proposed cooperative allocation. The paper shows that every game with transferable utility has a nonempty “largest consistent (?) set”, which is, loosely speaking, a natural extension of the core concept that allows for farsighted players.

Another noteworthy contribution was presented by **Baskar Dutta**, from the University of Warwick. In his paper, Dutta extends some previous work and concepts on the problem of information sharing within coalitions to the concept of correlated equilibrium. The problem of information sharing arises when coalitions form at the interim stage (that is, when private information is held by players), and take cooperative actions. The previous literature has mainly focused on the formulation of constraints that could characterise the amount of information that would be shared in this event. In a previous paper, Dutta himself proposed that the type of information sharing should be credible, that is (i.e.) self-enforcing, within the forming coalition. In this paper, Dutta applies the same logic in the context of correlated equilibrium, that is in situations where players can agree ex-ante on some randomised recommendation about how to play the game. In these contexts, private information is identified with the recommendation received by each player, and the previous analysis can be directly imported in the correlated equilibrium setting. Dutta proposes two concepts of equilibrium,: a strong correlated equilibrium, immune to coordinated deviations by coalitions of

players, and the coalition proof correlated equilibrium, immune to coalitional deviations which are themselves stable. It is shown that although strong correlated equilibria may fail to exist, coalition-proof equilibria always exist in all games which are dominance solvable and in all games with positive externalities and in which action spaces are made of two choices.

A more applied paper was finally presented by **Ben Zissimos**, from Vanderbilt University, who addressed the important issue of regional trade agreements. The main question raised in the paper is why such agreements are mostly regional, in the sense that follows the geographical location of countries, rather than following other distributions based on commodities characteristics or political similarities. Zissimos employs a well known model of simultaneous coalition formation to represent the game played by policy makers in choosing trading partners. The nice result shown in the paper is that the presence of costs related to geographical distance help policy makers to coordinate on one specific equilibrium out of the many existing ones, and that this equilibrium is regional.

NETWORK THEORY

Following a well established trend in the last few years, this year's meeting has featured a substantial number of contributions in the area of network theory. This is certainly a new and promising area of research, that lends itself to a number of natural economic applications. As in the previous editions, two pioneers of this research field were present.

Sanjeev Goyal, from the University of Cambridge, presented a paper addressing the issue of strategic diffusion in networks. This very interesting contribution formalises in general terms the intuitive and somewhat commonly accepted view that the shape of local interactions described by a social network is relevant for the optimal choice of decision makers, such as firms or governments. Word of mouth communication is indeed often cited as an important element in marketing, while no comprehensive study of its mechanics has been attempted yet. In this paper, two aspects of information sharing are shown to interact in the determination of optimal policies. The "level" of information sharing, that is the architecture of the social network, and the "content" of information sharing, that is the type of information that is passed over along the network. This may relate to elements of demand or on information about adoption externalities. The paper reaches three important conclusions: first, incorporating local information changes profits of decision makers in a relevant way; second, the effect of different network architectures on profits depends on the content of information; third, the value of additional information about the network depends on the dispersion of the latter.

Matt Jackson, of Stanford University, presented a paper addressing the issue of the role of social networks in the formation of agents' beliefs. This is a very interesting problem, which is right on the frontier of current research in the field. In particular, Jackson's paper studies the way in which society as a whole may achieve a *convergence* of beliefs through mutual influence exerted by its members, and how this possibility may depend on the initial network architecture. Another closely related paper was presented by **Willemien Kets** of Tilburg University, studying the role of the social network in the formation of beliefs and in the strategic interplay when agents have only local (and therefore limited) information on the shape of the network. Here, players play a game with their neighbours, and use their local information to update their (common) prior belief on the whole network structure. In this local interaction setting, the paper asks how sensitive equilibrium behaviour of players is to the system of beliefs.

The transmission of information is yet again the topic of another paper, by **Andrei Karavaev**, from Pennsylvania State University, in which agents are assumed to be either informed or uninformed, and to trade information in exchange for money. One strong assumption of the model is the absence of

cycles and, at the same time, the regularity of the network, which together force the author to assume an infinite number of nodes. However, the analysis of the sequential game is a complex one, and the current version of the paper contains interesting insights. Beside some interesting technical properties of the model, the main point made in the paper is perhaps that, although the aggregate amount of traded information grows in time, some agent may end up with no information in equilibrium. This type of inefficiency is of interest, since the process studied in the paper appears as a good approximation of many information trading situations, in which the network does not need to describe spatial location, by any kind of proximity that puts agents in a condition to communicate.

Another issue which has been put forward by a recent paper by Bloch and Dutta is the possibility that agents have a limited amount of resources (say time) that they can spend to form links. Links are therefore indexed by an intensity, which indicates the amount of resources spent on each link. The main result of the paper, presented by **Frederic Deroian** from GREQAM, is that this enrichment of the model allows for uniqueness of Nash equilibrium architecture (the wheel), and for the treatment of a geometric discount rate.

Finally, a paper presented by **Ana Mauleon**, from CORE, has built a first bridge between the two leading approaches to cooperation: coalition and network formation theories. In her paper, agents are located on a network, but are also partitioned according to a coalition structure, which is independent of the network topology. Coalitions may for instance represent economic unions, while networks may indicate bilateral relations between countries. The role of coalitions is that of imposing a unanimity decision rule to its members, which also governs the decision of establishing new links in the network. The usual concepts of stability are extended to this new framework, and some well known network games are extended to encompass a coalition structure as defined above. Although no final result was presented, the paper is clearly a promising direction of research to bring the theoretical model closer to real world issues.

EXPERIMENTS

Another novelty of this year's meeting has been a series of contributions in the field of experimental game theory. Consideration of this field was overdue, given its increasing importance and role within the scientific community, and the many possible applications to coalition and network formation.

The first paper, by **Arno Riedl** of the University of Maastricht, studies the model of link formation by Bala and Goyal (2000) in the laboratory. A very interesting result tells us that heterogeneity of players (either in costs or in benefits from link formation) not only brings the model closer to real world applications, but is responsible for an experimental play closer to equilibrium prediction. In fact, his paper shows how star architecture (efficient and equilibrium outcomes) emerges in the laboratory, with players characterised by a high benefit or a low cost of linking acting as central node.

Although not an experimental paper, the contribution by **Jeanne Hagenbach** takes an experiment as a starting point and a motivation for the study of "communication dilemmas". These are situations in which it would be socially desirable to disclose agents' private information, but individual agents have no incentive to do so. In the paper, agents are embedded in a fixed network, and sequentially decide whether to disclose or to conceal their own private information. The objective of the analysis is to relate the network architecture with the amount of disclosed information (and therefore with efficiency), and to relate the various positions of players in the network with different incentives to disclose information.

Another experimental contribution, by **Stephanie Rosenkranz**, from Utrecht University, takes as benchmark the paper by Kranton et al. (2005) on public good games played on a network. Three main results of that paper are tested: first, more asymmetric networks are shown to be associated with a stronger specialisation (with some agents investing and some agents free-riding). Second, social welfare is shown to be higher in more regular structures, in which specialisation is moderate. Third, risk aversion of players is shown to play a role in his investment decisions, and to be related to its degree in the network.

Differently from the above papers, studying network structures, the fourth and last experimental contribution addresses a problem of bargaining. More specifically, the paper by **Massimo Morelli**, from Ohio State University, is a laboratory test of the main insights of a recent theoretical model studying the choice of a committee (say a parliament) between private and public good production. The paper studies the incentives of a committee leader to devote resources to produce the public good and to retain private resources for himself and for the rest of the committee. The experiment focuses on certain counterintuitive conclusions of the paper, according to which the incentives to produce public good depend in a non monotonic fashion on the value attributed by players to the public good.

SOCIAL CHOICE

In a very interesting paper, **Alexei Savvateev** addressed the issue of how to locate public facilities on a given area on which potential users reside. The paper obtains two main findings: first, although a stable plan does not exist in general (by stable we mean immune from objections of groups of users that may opt to build their own facility), still it (?) can be shown to exist once a very small fraction of costs is covered by some external agent. The second main finding is that in order to obtain stability, access fees must be fully egalitarian, in the sense that all users must bear the same total cost, including the transportation cost.

A similar problem is addressed by **Olivier Bochet**, whose paper takes an axiomatic approach to the problem of locating public facilities on the real line. The main ingredient is here that users have single-peaked preferences on locations, and a rule for deciding where to build facilities must satisfy a series of axioms, among which incentive compatibility with respect to the revelation of agents preferences. The rules that are so identified fail to be anonymous.

Finally, the paper presented by **Guillame Haeringer**, from Universitat Autònoma de Barcelona, deals with the issue of how to assign children to public schools. The paper is motivated by recent debate on the opportunity of a transition from the widely employed Boston mechanism, to other theoretically founded mechanisms. The problem of such proposed mechanisms is that, although fulfilling desirable properties in theory, they may not perform so well in the real world, where students are not allowed to elicit a whole list of desired schools, but may be constrained to list a limited ranking of preferences. The paper addresses therefore the problem of selecting the best mechanism under this constraint. The conclusion attained by the authors is that the Boston Mechanism, although less desirable in theory, may perform better under this further realistic constraint, since its properties do not depend on “quotas”. In practice, the use of other mechanisms may end up into the occurrence of unstable Nash Equilibria, in which, although preferences are fully revealed, students may end up complaining about the final outcome, possibly seeking legal action against schools.