SING13

The 13th European Meeting on Game Theory

Paris, 5-7 July, 2017

Book of abstracts

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Abstracts of 13th European (formerly Spain-Italy-Netherlands) Meeting on Game Theory (SING13)

July 5-7, 2017, Paris-Dauphine University, France

Edited by Stefano Moretti

Foreword

Dear Colleagues,

It's our great privilege and honour to welcome you all for the 13th European (formerly Spain-Italy-Netherlands) Meeting on Game Theory (SING13). The conference takes place at the University Paris-Dauphine from Wednesday July 5th to Friday July 7th 2017, and it is organized by the LAMSADE (*Laboratoire d'Analyse et Modélisation de systèmes pour l'Aide à la Décision*).

The call for papers attracted 203 submissions from all continents on Earth (except Antarctica). The scientific program includes around 190 talks and 5 plenary lectures. The conference is preceded by a pre-conference workshop and tutorial (also organised by the LAMSADE) on Tuesday July 4th on topics related to game theory.

We would like to thank the authors and the invited speakers for their contributions, and all the participants for taking part in this event. We are grateful to the members of the program committee for their contribution to the selection of this very interesting scientific program. We are also deeply indebted to our colleagues and students who helped us with the organization during the conference days: thanks a lot Anaëlle, Fabien, Francesca, Giulia, Hossein, Marianna and Thomas!

We would also like to acknowledge a financial support from the Paris-Dauphine University and from the project CoCoRICo- CoDec ANR-14-CE24-0007 and the project NETLEARN ANR-13-INFR-004 of the French National Research Agency (ANR).

Last but not least, as the chair of SING13, I wish to express my sincere gratitude to all the members of the organizing committee, for their constant support and help before and during the meeting: without them, this event would not have been possible.

Sincerely yours,
Stefano Moretti
(on behalf of the Organizing Committee)

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The SING history

The history of SING dates back to the beginning of the 1980s with the first meetings held in Italy. Then, subsequently, meetings were added in Spain, the Netherlands and Poland.

Italy

The first time the Italian researchers joined together for a meeting on Game Theory was due to the initiative of the mathematician Gianfranco Gambarelli and the economist Michele Grillo. On the 12th October 1983, a working day was held in Bergamo entitled: "A discussion between economists and mathematicians: recent contributions of Game Theory to Economics". One year later, Pierangelo Mori and Fioravante Patrone organized in Pavia (December 14 and 15) the first meeting under the name that would last for a long time: "Convegno di Teoria dei Giochi ed Applicazioni", called the "second meeting" to acknowledge the relevance of the "working day" held in Bergamo the year before. From then on meetings took place almost annually with the name "Convegno di Teoria dei Giochi ed Applicazioni": Florence (1986, organised by Andrea Battinelli), again Bergamo (1987, Gianfranco Gambarelli), Cagliari (1988, Andrea Battinelli), Modena 1989 (Gianni Ricci), Florence (1991, Piero Tani), Pisa (1992, Giacomo Costa), Genoa (1993, Fausto Mignanego and Fioravante Patrone), Siena (1995, Stefano Vannucci), Bergamo (1996, Gianfranco Gambarelli), Milan (1997, Michele Polo and Mario Gilli), Genoa (1998, Fioravante Patrone) and Bologna (1999, Elettra Agliardi). After this date, the conferences began to form part of the joint venture described later.

Spain

The first Spanish Meeting on Game Theory was organised in 1994 in Bilbao by Federico Valenciano and Jose Zarzuelo. This was followed by meetings in Santiago de Compostela (1996, organised by Ignacio Garca Jurado), Barcelona (1998, Carles Rafels) and Valencia (2000, Amparo Urbano). During the world meeting on Game Theory Society, organised in 2000 in Bilbao by Federico Valenciano, the idea arose of a joint venture that will be discussed later.

The Netherlands

There is no tradition of organising Dutch Game Theory conferences. Before the SING joint venture only periodic seminars and impromptu conferences were held. As far as seminars are concerned, monthly ones were organised by Stef Tijs in Nijmegen at the beginning of the 1980s; others followed in Tilburg under the responsibility of Peter Borm. Again in Tilburg, a monthly seminar has been held since the mid 1980s on the closely related area of social choice organised by Ton Storcken, Ad van Deemen, and Harrie de Swart. Several workshops on cooperative game theory have been organised by Gerard van der Laan and Ren van den Brink in Amsterdam and by Theo Driessen in Enschede.

Regarding conferences, in 1996 the Third International Meeting of the Society for Social Choice and Welfare was organised in Maastricht by Hans Peters and Ton Storcken. In 1998, the 8th International Symposium on Dynamic Games and Applications was organised in Maastricht-Va by Frank Thuijsman and Koos Vrieze. The first conference on Logic, Game Theory and Social Choice (LGS1) was organised in Tilburg-Oisterwijk by Harrie de Swart in 1999. In 2002, Peter Borm c.s. organised a Game Theory conference on the occasion of Stef Tijs' 65th birthday in Tilburg.

Poland

While some of the pioneering works in Game Theory are due to Polish mathematicians such as Hugo Steinhaus and Jan Mycielski, no national meeting on this area was ever established in Poland. Since the 1970s the groups working on Game Theory and related topics in Warzaw and Wrocaw held regular seminars that used to be rather interdisciplinary. In 2004 Andrzej Wieczorek organised an international conference in Game Theory and mathematical economics in Warzaw, and in 2008 the 13th International Symposium of Dynamic Games was organised by Andrzej Nowak in Wrocaw just after SING4.

SING: the joint venture

In 2000 Federico Valenciano organized in Bilbao GAMES 2000, the first Meeting of the Game Theory Society. During this conference Fioravante Patrone, director of the Italian CITG, took the initiative of looking for a "joint venture" between Italy and Spain, suggesting the alternation of Italian and Spanish meetings. The agreement of this idea by the involved researchers lead to the meetings of Ischia (2001), Sevilla (2002), Urbino (2003) and Elche (2004).

During the Meeting of Urbino the idea of The Netherlands as a "new entr" into the Italian-Spanish alternation, proposed by Patrone, was eagerly approved. The first edition of SING (Spanish-Italian-Netherlands Game Theory Meeting) was organized by Hans Peters in Maastricht from 24 to 26 June 2005. Andrea di Liddo organized the second edition, SING2, in Foggia. Juan Tejada organized SING3 in Madrid in 2007. It was then agreed that other European countries wishing to enter the rota had to participate first as guest organisers and only after a second participation in this role could they then actually join SING. In 2008 the conference was organized outside one of the three SING countries for the first time: Jacek Mercik organized SING4 in Wroclaw. In 2009 SING5 was held in Amsterdam, organized by Ren van der Brink. In 2010 SING6 has been organized in Palermo by Dario Bauso. The following two years the conference is again outside the SING countries: in 2011 Michel Grabisch organized SING7 in Paris; in 2012 Lszl . Kczy organized SING8 in Budapest. SING9 was organized respectively in Vigo in 2013 by Gustavo Bergantios. Poland was the guest organiser for the second time in 2014 (Krakw, organized by Izabella Stach) for SING10 and Poland became an actual

member of SING. In 2014, a decision has been made not to change the acronym, in view of the fact that it has become well-known, but to transform the name of the meetings from 2015 on to "SING - European Meeting on Game Theory". In 2015, the SING11 Meeting taken place in St. Petersburg, organised by Leon Petrosyan. The 2015 edition (SING11) also involved the 9th International Conference on Game Theory and Management (GTM2015). The 2016 edition (SING12) took place in Odense, Denmark, organized by Peter Sudhölter. The 2017 edition (SING13) takes place in Paris, at the Paris-Dauphine University (organized by Stefano Moretti). Bayreuth (with Frank Steffen) is candidate for the following meeting.

Table 1: A Synthesis of the Joint Venture

year	Name	Location	Organiser
2001	Italy/Spain 1	Ischia	Jacqueline Morgan
2002	Italy/Spain 2	Sevilla	Jess Mario Bilbao, Francisco Fernndez
2003	Italy/Spain 3	Urbino	Gian Italo Bischi
2004	Italy/Spain 4	Elche	Joaqun Snchez Soriano
2005	SING 1	Maastricht	Hans Peters
2006	SING 2	Foggia	Andrea Di Liddo
2007	SING 3	Madrid	Juan Tejada
2008	SING 4	Wrocaw	Jacek Mercik
2009	SING 5	Amsterdam	Ren Van den Brink
2010	SING 6	Palermo	Dario Bauso
2011	SING 7	Paris	Michel Grabish
2012	SING 8	Budapest	László Kóczy
2013	SING 9	Vigo	Gustavo Bergantios
2014	SING 10	Kraków	Izabella Stach
2015	SING 11	St. Petersburg	Leon Petrosyan
2016	SING 12	Odense	Peter Sudhlter
2017	SING 13	Paris	Stefano Moretti

SING - Best Student Paper Prize

The SING Best Student Paper Prize is established to provide incentives for young researchers to write good papers and submit them to the SING meetings. Since 2017 (SING13), the prize is awarded every year at the SING meeting.

Participation rules

1. The SING Best Student Paper Prize is awarded to young researchers. The candidates must have been PhD students on or after January 1 of the year preceding the SING Meeting, or have received their PhD after that date. Appropriate documentation for eligibility has to be provided, including the name of the advisor when applicable.

2. In order to compete for the Best Student Paper Award the candidates have to submit an unpublished paper which they are authors or co-authors of before the deadline fixed by the organizing committee of the SING Meeting. The submitted paper must present original research conducted primarily by the candidate (the paper cannot be submitted by more than one of its authors in the same year). The paper has to be submitted and accepted for the SING meeting of that year.

3. The paper has to be submitted in anonymous form, without the name(s) of author(s) or any phrases allowing identification of its author(s). In addition, the candidate has to submit a resume of at most one page specifying the state-of-the-art and the new contributions of the paper, and a Word document or a pdf stating the candidate's contact information, the contact information of his/her primary research advisor and all co-authors, the paper title and appropriate keywords.

4. After the deadline, the organizing committee of the SING meeting selects the award committee appointing five Full or Associate Professors from different SING Countries (Spain, Italy, The Netherlands, Poland, France) that are not advisors of the participants or co-authors of submitted papers or members of the organizing committee.

5. The SING organizing committee sends all submitted papers and resumes to each member of the award committee.

6. The award committee selects at most one paper.

7. The author of the selected paper, if any, receives the Prize in the form of a certificate.

8. The names of other competitors for the Best Student Paper Prize will not be made public.

Scheduled sessions

All sessions will take place at the second floor of the Paris-Dauphine University.

Day 1 - July 5th, 2017:	
8:30 - 9:15	Registration (HALL2)
9:15 - 9:30	Opening session (Amphi 8)
9:30 - 10:30	Plenary session I (Amphi 8)
10:30 - 11:00	Coffee break (HALL2)
11:00 - 12:30	6 parallel sessions, 4 talks each (Amphi 5, 6, 8, Salle A, C, D)
12:30 - 14:00	Lunch (Foyer)
14:00 - 15:30	6 parallel sessions, 4 talks each (Amphi 5, 6, 8, Salle A, C, D)
15:30 - 15:50	Coffee break (HALL2)
15:50 - 17:20	6 parallel sessions, 4 talks each (Amphi 5, 6, 8, Salle A, C, D)
17:20 - 18:20	Plenary session II (Amphi 8)
18:30 - 20:45	Welcome reception and cocktail

Day 2 - July 6th, 2017:	
9:15 - 10:15	Plenary session III (Amphi 8)
10:15 - 10:35	Coffee break (HALL2)
10:35 - 11:45	6 parallel sessions, 3 talks each (Amphi 5, 6, 8, A, C, D)
11:45 - 12:45	Plenary session IV (Amphi 8)
12:45 - 14:00	Lunch (Foyer)
14:00 - 15:30	6 Parallel sessions, 4 talks each (Amphi 5, 6, 8, Salle A, C, D)
15:30 - 15:50	Coffee break
15:50 - 17:00	6 parallel sessions, 3 talks each (Apmhi 5, 6, 8, Salle A, C, D)
17:00 - 17:30	Meeting of the SING representatives
18:15 - 23:15	Visit at the Orsay museum and gala dinner

Day 3 - July 7th, 2017:		
9:30 - 10:40	5 parallel sessions, 3 talks each	(Amphi 5, 6, Salle A, C, D)
10:40 - 11:00	Coffee break (HALL2)	
11:00 - 12:30	5 parallel sessions, 4 talks each	(Amphi 5, 6, Salle A, C, D)
12:30 - 14:00	Lunch (foyer)	
14:00 - 15:00	Plenary session V (Amphi 8)	
15:00 - 15:10	SING Best Student Paper Prize (Amphi 8)	
15:10 - 15:25	Coffee break	
15:25 - 16:35	3 parallel sessions, 3 talks each	(Amphi 5, 6, Salle A)
16:35 - 16:45	Closing session (Amphi 8)	
16:45 - 17:00	SING assembly (Amphi 8)	
18:00 - 20:00	Guided tour of the Latin Quarter	

Scientific program[1]

[1] For papers with multiple authors, the speaker of the associated talk is underlined.

Day 1 - July 5th

Plenary Session I - Room: Amphi 8 - July 5th, 9:30-10:30

An Axiomatization of the Proportional Rule in Financial Networks

Péter Csóka[1], Jean-Jacques Herings[2]

[1]Department of Finance, Corvinus University of Budapest and "Momentum" Game Theory Research Group, Centre for Economic and Regional Studies, Hungarian Academy of Sciences, peter.csoka@uni-corvinus.hu, [2]Department of Economics, Maastricht university, P.O. Box 616, 6200 MD, Maastricht, The Nether- lands, P.Herings@maastrichtuniversity.nl.

The most important rule to determine payments in real-life bankruptcy problems is the proportional rule. Many bankruptcy problems are characterized by network aspects and default may occur as a result of contagion. Indeed, in financial networks with defaulting agents, the values of the agents' assets are endogenous as they depend on the extent to which claims on other agents can be collected. These network aspects make an axiomatic analysis challenging. This paper is the first to provide an axiomatization of the proportional rule in financial networks. Our two central axioms are impartiality and non-manipulability by identical agents. The other axioms are claims boundedness, limited liability, priority of creditors, and continuity.

Parallel Sessions I

Session: TU-games - Room: Amphi 5 - July 5th, 11:00-12:30

Overall efficiency and extensions of the Shapley value

Sylvain Béal[1], André Casajus[2], Eric Rémila[3], Philippe Solal[4]

[1]CRESE EA3190, Univ. Bourgogne Franche-Comté, sylvain.beal@univ-fcomte.fr [2]HHL Leipzig Graduate School of Management, mail@casajus.de, [3]GATE LSE, eric.remila@univ-st-etienne.fr, [4]GATE LSE, philippe.solal@univ-st-etienne.fr

We study cooperative games with transferable utility (TU-games), for which the Shapley value Shapley (1953) is the most well-known value. The Shapley value satisfies the axiom of efficiency, which imposes that the total distributed payoffs add up to the worth of the grand coalition. This axiom can be disputed when the game is not cohesive, i.e., if the players can reorganize themselves into a partition such that the total generated worth is larger than the worth of the grand coalition. In such cases, it is difficult to take for granted the traditional assumption that the grand coalition will form. Any efficient value will distribute the worth of the grand coalition, letting aside a possible surplus. Following Perez-Castrillo and Wettstein (2001) we advocate that the total distributed payoff must be equal to the maximal total worth that the players are able to obtain by organizing themselves into partitions. We materialize this requirement by the axiom of overall efficiency. We examine how the three most classical axiomatizations of the Shapley value by Shapley (1953), Myerson (1980) and Young (1985) respond if efficiency is replaced by overall efficiency. In Shapley (1953), efficiency is combined with additivity, the null player property and equal treatment of equals. In Myerson (1980), efficiency is combined with balanced contributions. In Young (1985), efficiency is combined with equal treatment of equals and strong monotonicity. We first obtained two impossibility results. There exists no value satisfying overall efficiency and either additivity or strong monotonicity. To the contrary, there is a unique value satisfying overall efficiency and balanced contributions as a corollary of a result in Hart and Mas-Colell (1989). For any game, we show that this value is the Shapley value of its superadditive cover defined, for any coalition, as the maximal total worth achieved among its partitions. In spite of the impossibility results, we consider weak versions of the axiom of additivity that are compatible with overall efficiency and axioms highlighting the role of cohesive coalitions. We provide another characterization of the Shapley value of the superadditive cover of a game and a characterization of a second variant of the Shapley value, which coincides with the Shapley value of a game in which only the worth of the grand coalition is augmented to attain the maximal worth among the partitions of players. We conclude by proving that the characterization of the equal allocation of non-separable costs by efficiency and collective balanced contributions in Béal et al. (2016) can be adapted. If efficiency is replaced by overall efficiency, the unique characterized value coincides, for any game, with the equal allocation of non-separable costs of its superadditive cover.

Characterization of the nucleolus for risk allocation games

Miklos Pinter

Faculty of Business and Economics, University of Pécs, pinterm@ktk.pte.hu

The class of risk allocation games (Denault, 2001) coincides with the class of totally balanced games (Csoka et al., 2009). The (pre)nucleolus (Schmeidler, 1967) is characterized on the class of all games by (Sobolev, 1975) with the axioms Covariance, Equal Treatment Property and Reduced Game Property (also called Consistency) where the reduced game is the Davis-Maschler reduced game (Davis and Maschler, 1965). It is well known that the nucleolus and prenucleolus coincide on the class of (totally) balanced games.

In this paper we make an attempt to characterized the nucleolus for risk allocation games. We show that the nucleolus does not meet the Reduced Game Property on this class of games, hence Sobolev's axiomatization does not work on this class of games. We also show that the nucleolus, however, does meet the Weak Reduced Games property axiom (Peleg and Sudhlter, 2007). We incorporate further axioms into the analysis in order to give a complete characterization of the nucleolus on the class of risk allocation games.

Weakly differentially monotonic solutions for cooperative games

André Casajus[1], Koji Yokote[2]

[1]HHL Leipzig Graduate School of Management, mail@casajus.de, [2]Waseda University, Tokyo, sidehand@toki.waseda.jp

Casajus and Huettner (2013, JME) consider a strengthening of differential marginality (Casajus 2011, THEO) called differential monotonicity and a relaxation of the standard null player property called the null player in a productive environment property. Differential monotonicity requires the differential of two players' payoffs weakly to increase whenever the differential of their marginal contributions (to coalitions containing neither of them) weakly increases. The null player in a productive environment property requires a null player to obtain a non-negative payoff whenever the worth generated by the grand coalition is non-negative. They show that, for games with more than two players, these properties together with efficiency characterize the class of egalitarian Shapley values. Casajus and Yokote (2017, JET) consider a substantial relaxation of differential marginality called weak differential marginality. Weak differential marginality requires two players payoffs to change in the same direction whenever their marginal contributions change by the same amount, i.e., one player's payoff weakly increases/decreases if and only if the other player's payoff weakly increases/decreases. They show that, for games with more than two players, this property together with efficiency and the null player property characterize the Shapley values. We consider a property called weak differential monotonicity that relaxes differential monotonicity in the same vein as weak differential marginality relaxes differential marginality. This property refers to two players in situations where one player's change of marginal contributions is weakly greater than the other player's change of marginal contributions. If, in such situations, the latter player's payoff weakly/strictly increases, then the former player's payoff also weakly/strictly increases. First, we demonstrate that one cannot replace differential monotonicity with weak differential monotonicity in the above mentioned characterization of the egalitarian Shapley values. Second, we consider a property called the average dummy player property that on the one hand relaxes the standard dummy player property and on the other hand strengthens the null player in a productive environment property. Whenever a dummy player's singleton worth is weakly greater/smaller than the per capita worth generated by the grand coalition, this player's payoff is weakly smaller/greater than her singleton worth. For games with more than three players, efficiency, weak differential monotonicity, and the average dummy player property characterize the egalitarian Shapley values. This is not true for games with two players and an open question for games with three players. Cum grano salis, this result generalizes a result on redistribution rules by Yokote and Casajus (2017, EL).

2-Step Procedural Values - Bargaining Solutions and Solidarity in Cooperative Games

Julia Belau

TU Dortmund University, julia.belau@tu-dortmund.de

Cooperative allocation can be seen as a normative approach to the solution of bargaining problems: in contrast to a strategic analysis, the outcome of bargaining results from agreements on characterizing properties - which, however, might be a whole range. An alternative approach interprets cooperative allocation rules as resulting from a sharing procedure of coalition dividends. Following this procedural approach, this paper defines and analyzes 2-step procedural values, solutions modeled for situations that take into account a coalition structure. These values can be interpreted as the outcome of renegotiation within a productive or a priori union, influenced by an ex ante prenegotiation as a reference (as, for example, government formation or the distribution of ministerial positions influenced by the ex ante distribution of seats). We find that the class of these values covers the popular component restricted Shapley value, the chi-value, and component restricted versions of both the egalitarian Shapley values and the equal division value, respectively, as well as the Owen value, the Shapley-Solidarity value, and the 2-Step Shapley value. Since our approach allows to justify the most popular cooperative approaches for coalition structures by the underlying procedures only, it simplifies the corresponding bargaining process: from a normative point of view, it is sufficient to agree on how to share coalition dividends to uniquely determine the bargaining outcome. Emphasizing solidarity as a desirable property, we further analyze the relation between procedures and solidarity resulting in the definition and characterization (both by procedures and properties) of two new variants of Solidarity values for productive unions.

Session: Bargaining - Room: Amphi 6 - July 5th, 11:00-12:30

Majoritarian Bargaining and Rentseeking

Haruo Imai[1], Hannu Salonen [2]
[1]Taisho University, imai@kier.kyoto-u.ac.jp, [2]University of Turku

We investigate the possibility of asymmetric equilibria involving pure investment strategies of a version of the Baron-Ferejohn bargaining game of where recognition probabilities are determined by the Tullock contest. Under the symmetric and linear costs, we show that there are asymmetric equilibria where at least two investment levels are involved if the number of players is more than 3, and three investment levels if the number of players is 3. To do this, we utilize an explicit derivation of equilibrium payoffs which shows that equilibria at the bargaining stage tries to equate payoffs among players by an adjustment of probabilities to participate in a proposed minimum winning coalitions, and only when recognition probabilities are so large or so small, that this adjustment fails, players payoffs differ from that of the rest of players. From this computation, one can reconfirm the non-existence of a symmetric equilibrium with a pure investment level. Based on equilibria we found for the case of constant costs, for the case with the number of players more than 4, we can extend our result rather easily, while for the case with 3 or 4 players, the problem of existence arises.

A sequential bargaining protocol for land rental arrangements

Alfredo Valencia-Toledo[1], Juan Vidal-Puga[2]
Universidade de Vigo [1]alfredo.valencia@uvigo.es, [2]vidalpuga@uvigo.es

We consider land rental between a single tenant and several lessors. The tenant should negotiate sequentially with each lessor for the available land. In each stage, we apply the Nash bargaining solution. Our results imply that, when all land is necessary, a fixed price per unit is more favourable for the tenant than a lessor-dependent price. Furthermore, a lessor is better off with a lessor-dependent price only when negotiating first. For the tenant, lessors' merging is relevant with lessor-dependent price but not with fixed price.

Divide the Dollar and Conquer More: Sequential Bargaining and Risk Aversion

Philip Grech[1], Oriol Tejada[2]
ETH Zurich, [1]pgrech@ethz.ch, [2]toriol@ethz.ch

We analyze the problem of dividing a fixed amount of a single commodity between two players on the basis of the Nash Bargaining Solution (NBS). For one-shot negotiations, a cornerstone result of Roth (1989) establishes that the more risk averse player will obtain less than half the total amount. In the present paper, we assume that the bargaining procedure occurs along several rounds. In each round, only a share of the total amount is negotiated over in accordance with the NBS, with the disagreement point being determined by the outcome of the previous rounds. In line with Roths result, the amount received by the more risk averse player is still bounded by half the total amount. As a new feature, however, this player does not lose from bargaining over more rounds if his opponent exhibits non-increasing absolute risk aversion. What is more, both players' risk profiles become essentially irrelevant if the number of rounds is sufficiently large, each player then getting approximately half of the commodity.

A non-cooperative mechanism yielding the nucleolus of airport problems

Jose Manuel Zarzuelo[1], José Miguel Echarri[2], M. Josune Albizuri[3]
[1]The University of the Basque Country, University of Southern Denmark, josemanuel.zarzuelo@ehu.eus, [2]The University of the Basque Country, josemiguel.echarri@ehu.es, [3]The University of the Basque Country, mj.albizuri@ehu.eus

A non-cooperative approach is employed to solve the problem of allocating the total cost of building and maintaining an airport runway among its users. More precisely, it is proposed a non-cooperative bargaining game with a unique subgame perfect equilibrium outcome, and it is shown that the SPE outcome payoffs coincide with those prescribed by the nucleolus of the corresponding airport cooperative game.

Session: Voting - Room: Amphi 8 - July 5th, 11:00-12:30

Electoral Competition under Best-Worst Voting Rules

Arkadii Slinko[1], Dodge Cahan[2]

[1]The University of Auckland, a.slinko@auckland.ac.nz, [2]University of California San Diego, dcahan@ucsd.edu

We characterise multi-candidate pure-strategy equilibria in the Hotelling-Downs spatial election model for the class of best-worst voting rules, in which each voter is endowed with both a positive and a negative vote, i.e., each voter can vote in favour of one candidate and against another one. The importance of positive and negative votes in calculating a candidate's net score may be different, so that a negative vote and a positive vote need not cancel out exactly. These rules combine the first-place seeking incentives of plurality with the incentives to avoid being ranked last of antiplurality. We show that these rules generally admit equilibria, which are nonconvergent if and only if the importance of a positive vote exceeds that of a negative vote. The set of equilibria in the latter case is very similar to that of plurality, except that the platforms are less extreme due to the moderating effect of negative votes. Moreover, any degree of dispersion between plurality, at one extreme, and full convergence, at the other, can be attained for the correct choice of the weights.

A concept of sincerity for combinatorial voting

Claudia Meroni[1], Francesco De Sinopoli[2]

[1]Department of Economics, University of Verona, claudia.meroni@univr.it, [2]Department of Economics, University of Verona

A basic problem in voting theory is that all the strategy profiles in which nobody is pivotal are Nash equilibria. We study elections where voters decide simultaneously on several binary issues. We extend the concept of conditional sincerity introduced by Alesina and Rosenthal (1996) and propose an intuitive and simple criterion to refine equilibria in which players are not pivotal. This is shown to have a foundation in a refinement of perfection that takes into account the material voting procedure. We prove that in large elections the proposed solution is characterized through a weaker definition of Condorcet winner and always survives sophisticated voting.

Truth-revealing voting rules for large populations

Matias Nunez[1], Marcus Pivato[2]

[1]CNRS - Paris Dauphine, matias.nunez@dauphine.fr, [2]THEMA, Université de Cergy-Pontoise, marcuspivato@gmail.com

Deterministic voting rules are notoriously susceptible to strategic voting. We propose a new solution to this problem for large electorates. For any deterministic voting rule, we can design a stochastic rule that asymptotically approximates it in the following sense: for a sufficiently large population of voters, the stochastic voting rule (i) incentivizes every voter to reveal her true preferences and (ii) produces the same outcome as the deterministic rule, with very high probability.

Evaluationwise strategy-proofness

Bora Erdamar[1], Remzi Sanver[2], Shin Sato[3]

[1]Universityof Rochester, bora.erdamar@eas.bau.edu.tr, [2]Universit Paris-Dauphine,PSL Research University,CNRS, UMR [7243], LAMSADE, 75016 and Murat Sertel Center for Advanced Economic Studies,IstanbulBilgi University,Turkey, remzi.sanver@lamsade.dauphine.fr, [3]Fukuoka University, shinsato@adm.fukuoka-u.ac.jp

We consider manipulation of collective decision making rules in a framework where voters not only rank candidates but also evaluate them as "acceptable" or "unacceptable". In this richer informational setting, we adopt a new notion of strategy-proofness,called evaluationwise strategy-proofness, where incentives of manipulation exist if and only if a voter can replace an outcome which he nds unacceptable with an acceptable one. Evaluationwise strategy-proofness is weaker than strategy-proofness. However, we establish the prevalence of a logical incompatibility between evaluationwise strategy-proofness, anonymity and efficiency. On the other hand, we show possibility results when either anonymity or efficiency is weakened.

Session: Mechanism design - Room: Salle A - July 5th, 11:00-12:30

Bidding Mechanisms for Group Purchasing with Price-Sensitive Buyers

Behzad Hezarkhani[1], Greys Sosic[2]

[1]Nottingham University Business School, b.hezarkhani@gmail.com, [2]University of Southern California, sosic@marshall.usc.edu

Through collaborative replenishment buyers increase their buying power and take advantage of economies of scale in joint replenishment. Examples of CR are observed in healthcare, education, consumer goods, and even automotive aftermarket. Most often, collaborative replenishment is organised by a third party, a.k.a. a Group Purchasing Organisation (GPO), that operates either by centrally deciding order quantities and cost-shares of the buyers, or by posting unit prices and acting as an intermediary. As central decisions are based on the information that buyers share, there is the threat of strategic behaviour. On the other hand, the performance of the system that operates with posted prices can also be sub-optimal even if the GPO possess complete information regarding the buyers. We propose a bidding mechanism for the GPO to moderate collaborative replenishment. In a bidding mechanism buyers submit bids for different order quantities and the GPO determines the allocated (winning) bids and the cost to be paid by each buyer. The choices of winner determination process and the cost share rule characterise the bidding mechanism. We propose a bidding mechanism that is budget-balanced, i.e. distributes the total purchasing cost among the buyers, satisfies individual-rationality, and guarantees a lower bound on the buyers' profits. We prove that under the proportional cost-sharing rule this lower bound is at least as good as the maximum profit that can be obtained from the optimal posted-price mechanism that takes advantage of complete information.

Externality Assessments, Value Judgments, and Mechanism Design

Thomas Daske

Technical University of Munich, thomas.daske@tum.de

How agents (ir-)rationally assess the (in-)tangible externalities that others might impose on them can strongly influence strategic interaction. This study explores mechanism design for agents whose externality assessments and private payoffs, exclusive of externalities, are all subject to asymmetric information. Under reasonable assumptions, the following result is established: Let the allocation rule f be the maximizer of a social welfare measure W that satisfies the Pareto property; then f is Bayesian implementable with an ex post budget-balanced mechanism if and only if W sums private payoffs exclusive of externalities. The result emphasizes the critical role of the value judgment inherent to the allocation rule. Bayesian implementation of a value judgment inconsistent with externality-ignoring utilitarianism violates budget balance and, thus, involves incentive costs. Cooperative models of bargaining are discussed in this light.

Choosing the winner of a competition using natural mechanisms: conditions based on the jury

Pablo Amorós

Universidad de Málaga, pag@uma.es

A possibly partial jury has to choose the winner of a competition. A deserving winner exists and her identity is common knowledge among the jurors, but it is not known by the planner. Jurors may be biased in favor (friend) or against (enemy) some contestants. We study the conditions based on the configuration of the jury such that it is possible to implement the deserving winner in Nash equilibrium when we restrict ourselves to mechanisms that satisfy two conditions: (1) each juror only has to announce the contestant she thinks should win the competition, and (2) announcing the deserving winner is always an equilibrium. We refer to this notion as natural implementation. We show that in order to naturally implement the deserving winner, the jury must have either a minimum number of jurors with known friends or a minimum number of jurors with known enemies. Specifically, the minimum number of jurors with known friends required to naturally implement the deserving winner is less than the minimum number of jurors with known enemies required.

Minimum price Walrasian equilibrium for general preferences: Serial Vickrey algorithms

Shigehiro Serizawa[1], Yu Zhou[2]

Osaka University [1]serizawa@iser.osaka-u.ac.jp, [2]zhouyu_0105@hotmail.com

We consider the allocation problem how to assign objects among a group of agents and to determine how much they should pay. Each agent has unit-demand. Agents have general (non-quasi-linear) preferences over bundles, each consisting of an object and a payment. In the model of general unit-demand preferences, the minimum price Walrasian equilibrium (MPWE) is well defined. The MPWE rules mapping each preference profile to its MPWE, are remarkable rules to solve the allocation problems satisfying desirable properties such as efficiency, incentive compatibility, individual rationality, and no subsidy. Moreover, in a variety of environments, only MPWE rules satisfy those properties. However, technical difficulties impede the process of investigation of algorithm designs to compute the MPWE for general preferences. We propose the Serial Vickrey (SV) algorithm to compute the MPWE for general preferences in finite steps. The SV algorithm introduces objects to the economy one by one, and inductively compute the MPWE for the economy with k+1 objects by using the MPWE for the economy with k objects in two steps. In the first step, we derive a Walrasian equilibrium (WE) for the economy with k+1 objects from the MPWE for the economy with k objects. In the second step, we derive the MPWE for the economy with k+1 objects from the established WE. We also propose the greedy SV algorithm which, if not for the worst case, takes less time to obtain the MPWE for general preferences. In particular, we apply the greedy SV algorithm to restricted preferences such as quasi-linear preferences, and non-quasi-linear single-crossing preferences, etc, and conclude that the MPWE can be obtained in polynomial time.

Session: Non-cooperative games: applications - Room: Salle C - July 5th, 11:00-12:30

Quality competition in healthcare services based on regional Diagnosis Related Group (DRG) mechanism

Luca Grilli[1], Michele Bisceglia[2], Roberto Cellini[3]

[1]Universit di Foggia, luca.grilli@unifg.it, [2]Università di Bergamo, m.bisceglia@studenti.unibg.it, [3]Università di Catania, cellini@unict.it

In several countries, healthcare services are provided by public and/or private subjects, and they are reimbursed by the Government, typically on the basis of a prospective per case payment system, with the ultimate goal of leading providers to compete on quality, in order to attract consumers/patients. In the specific case of hospital services the payment system is based on DRG (Diagnosis Related Group) mechanism: each specific diagnosis treatment is associated with a specific price and healthcare providers are reimbursed according to a fixed tariff based on DRG classifications. Thus, providers take price as given and the competition is mainly based on quality. In some countries, the payment design differs across regions. In this paper we aim to study how price-setters of different regions interact in a simple but realistic framework, where three different classes of subjects are relevant: (1) the patients, who choose the hospital (within or outside the region where they live); (2) the healthcare providers facing given prices fixed by the (regional) price-setter, they benefit from a spatial monopoly position and they can compete on quality to attract patients; (3) the regional price-setters; they fix the prices (ideally, taking into due account the regional welfare) and they are aware that interdependence links with other regional price-setters exist. For simplicity's sake, we assume that the patients are uniformly distributed along the perimeter of a Salop circle. We consider four equidistant hospitals, two for each region. We study a 2-stage non cooperative game: firstly, the regions fix their DRGs in order to maximize a regional social welfare function, secondly the hospitals choose the quality levels which maximize their profits. We consider different efficiency levels for the hospitals in form of differentiated unitary costs. Finally, we consider a benchmark case with an unique central authority which fixes the DRGs in order to maximize the overall social welfare.

Information Design with Noisy Signaling Structure

Maël Le Treust[1], Tristan Tomala[2]

[1] ETIS UMR 8051, Université Paris Seine, Université de Cergy-Pontoise, ENSEA, CNRS, F-95000, Cergy, France, mael.le-treust@ensea.fr, [2]HEC Paris, Greghec UMR 2959, tomala@hec.fr

We investigate the problem of Information Design la Kamenica-Gentzkow, in which the message of the sender is not received correctly by the receiver. The signaling structure is said to be noisy since it is defined by a conditional probability distribution of the message received given the message sent. This problem is related to the information transmission over a noisy channel in Information Theory, but we study it from a strategic perspective. We characterize the different equilibrium solutions depending on whether the transmission occurs in one-shot or by blocks. The use of blocks of symbols creates degrees of freedom for the strategic transmission of information. Finally, we provide an example of utility functions coming from the literature of Numerical Communication, called parallel fading multiple access channels, for which we characterize the equilibria.

The Catalan health budget rationing problem

Maria José Solis-Baltodano

Universitat Rovira i Virgili, mariajose.solis@urv.cat

The financial and economic crisis in Spain during recent years has induced public budget adjustments. The crisis has caused a great social impact due to the way the austerity measures have been implemented, affecting mainly key economic sectors such as the civil service, justice, education and health. Among all of these sector, the current paper focuses on the health budget distribution, since the changes in the provision of the health services induce faster and clearer impacts in the social welfare. Spain is divided into 17 regions, and each region manages its own health system. Specifically, we analyse the Catalan health budget assignment since Catalonia is one of the most populated regions and one where the restrictions have been more evident. We study the health budget distribution for the period 1998-2014, from the point of view of the conflicting claims problem (O'Neill1982). Accordingly, alternative allocations of the health budget are proposed by using some of the most used solutions in the body of literature. Finally, in order to choose the most appropriate solution, we require the fulfilment of (i) some commonly accepted social constraints, (ii) some criteria of fairness and stability, and (iii) low inequality indexes.

Session: Experimental studies - Room: Salle D - July 5th, 11:00-12:30

Routing games and the Braess paradox - some numerical experiments

Zbigniew Świtalski[1], Paweł Skałecki[2]
University of Zielona Góra[1]Z.Switalski@wmie.uz.zgora.pl, [2]skalecki.pawel@gmail.com

The well-known Braess paradox [1] is related to players' behavior in noncooperative routing games (see [4]) and may be treated as a kind of prisoners dilemma. Many experimental studies on behavior of real decision-makers in routing games are reported in the literature (see, e.g. [2], [3]), but relatively few papers are devoted to numerical experiments showing how often the Braess paradox (BP) may occur in a given road network. Steinberg and Zangwill [5] (see also [2]) claim that "under reasonable assumptions, Braess paradox is not a curious anomaly but in fact may occur quite frequently". Valiant and Roughgarden [6] show that in a random network model (with linear time functions) BP may occur with high probability. In our presentation we show that in the Braess network (used originally by Braess) with spline time functions (which, as we think, are more realistic for road networks), the BP will occur with relatively small probability.

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Influences on logic and rationality on buying decisions

Sean Schroepfer[1], Ivica Rogina[2]
University of Applied Sciences Karlsruhe [1]sean.schroepfer@gmail.com, [2]ivica.rogina@hs-karlsruhe.de

At SING 10 in 2014, Ariel Rubinstein presented an experiment in which the participants had to select between two presented vacation packages the one which appeared more favorable. Rubinstein found that the subjects' relations were generally not transitive over all answers. He correlated the amount of intransitivity with the response time.

In our research project at the University of Applied Sciences in Karlsruhe, we extended Ariel Rubinstein's experiment in respect to various parameters. However, the focus of this research has not only been about the connection between response time and mistakes, but on the effects on transitivity due to several influencing actions. In our study, subjects were given the task to rank three offered vacation packages. Diverse actions about wording, appearance and framing have been implemented in order to vary the trip's attributes like price, duration, level of accommodation, catering and transportation. Therefore, the total number of trips in the experiment appeared larger than it actually was. There were two holiday packages to each of the four destinations. On top of these variations, we also influenced the decision process for some questions by limiting the decision time and by modifying the appearance of the presentation by adding pictures. From our almost 300 subjects, we collected socio-demographic data and correlated them to their decision behavior.

All decisions were collected in a directed graph, such that every cycle in the graph could be considered as an illogical transitivity and thus a partially irrational choice. The cycles lengths could vary from two (A¿B and B¿A) to eight, the total number of trips. We found that several modifications of the presentation had negative impact on the rationality, while similar to Rubinstein's study time pressure, on the other hand, had positive effects on the transitivity of the subjects' decisions.

Choosing from your opponent's actions - A framing effect in the prisoner's dilemma game

Manuel Laszlo Mago
Tilburg University, Department of Econometrics and Operations Research, m.l.mago@uvt.nl

We experimentally study the effect of playing a two-player one-shot prisoner's dilemma game with a different framing. Playing a two-player game in the Berge way means that the players are choosing an action from their opponents' action set rather from their own. If the actions of the players are interchanged in a two-player game, then playing the resulting game in the Berge way is equivalent to playing the original game in the normal way. We find that under the new framing there is a significant increase in the cooperation level despite the fact that playing the resulting game in the Berge way is theoretically equivalent to the original framing.

(New) experimental results on unconstrained bargaining from Tokyo and Paris

Róbert Veszteg[1], Noemi Navarro[2]

[1]School of political science and economics at Waseda University in Tokyo, rveszteg@gmail.com, [2]Faculty of economics, management and business, University of Bordeaux, navarro.prada@gmail.com

We report results from a series of laboratory experiments on two-person unconstrained bargaining. Participants considered different situations in randomly formed pairs and had to decide in a fixed amount of time how to share a scarce resource. The main goal of our novel experimental design is to systematically study the empirical relevance of the axioms behind the bargaining solutions proposed by Nash (Nash, 1950) and Kalai and Smorodinsky (Kalai and Smorodinsky, 1975) and to test a number of alternative solution concepts. In line with the existing literature, we find evidence for violations of both the axiom of independence of irrelevant alternative and the axiom of scale covariance. The best-performing solution concept turns out to be "deal-me-out" (Binmore et al., 1989) followed by the "maximum" solution (Roth and Malouf, 1982). Although prescriptions by axiomatic bargaining theory are independent from culture, our experiment and the post-experimental survey reveal noticeable differences in individual attitudes and bargaining outcomes between the two metropoles (Tokyo and Paris) where we collected data.

Parallel Sessions II - July 5th, 14:00-15:30

Session: Non-cooperative games: solutions - Room: Amphi 5 - July 5th, 14:00-15:30

A note on Evolution of Preferences

Oliver Pardo

Pontificia Universidad Javeriana, pardoo@javeriana.edu.co

This note checks the robustness of a surprising result in Dekel et al. (2007). The result states that strict Nash equilibria might cease to be evolutionary stable when agents are able to observe a signal that fully reveals the opponent's preferences, even if the frequency of the signal is very low. I show that when the signal a player receives on her opponent's preferences is almost uninformative, all strict Nash equilibria are evolutionary stable, no matter the frequency of the signal.

Strong Strategic Support of Cooperation in Multistage Games

Leon Petrosyan

Saint Petersburg State University, l.petrosyan@spbu.ru

The paper deals with the strategic support of cooperation in n-person infinite-stage games with discounted payoffs and is close to classical works on repeated games [1] and some of our previous publications [2], [3]. Under strategic support we previously understood the construction of Nash equilibrium with payoffs coinciding with those under cooperation. This construction was based on introduction of strategies punishing players for the deviation from cooperation. In this research we try to go further and construct Strong Nash Equilibrium supporting the cooperation in the sense that not only single players but also coalitions will be punished for the deviation. If the deviation of coalitions is one-shot and the composition of deviating coalition is the same in all stage games, under some natural condition such Strong Nash Equilibrium can be constructed (see [2], [3]). Now we try to investigate a more general case in which there is no restriction on coalition deviation forms and on the stability of composition of deviating coalition in time. Each player has the information about other player payoffs on all previous stages. According to this information a player can fix the first stage game in which the payoffs are different from those, which players expect to get under cooperation. The punishment strategies of players use this information: if the payoffs in previous stages coincide with payoffs under cooperation they continue to follow the cooperative behavior, if on stage k first time the player checks the difference in payoffs compared with cooperative behavior he uses his optimal strategy (as minimizing player) in zero-sum game against player $N \setminus \{i\}$ (coalition of all players except himself), by other words he starts to play against all, and so do all other non deviating players. Note that in this setting it is not important which is the size or composition or form of deviating coalition. The sufficient conditions are derived under which the proposed way of behavior will be Strong Nash Equilibrium.

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A Microfoundation of Social Norms and Their Implications for Normal Form Games

Sebastiano Della Lena[1], Pietro Dindo[2]

Ca' Foscari University of Venice [1]sebastiano.dellalena@unive.it, [2]pietro.dindo@unive.it

Different social norms shape agents' preferences and behaviors leading to different strategic outcomes, at the same time different socio-economic environments can have an effect on the selection of norms. With this paper we offer a model to study the interplay between social norms and strategic environments. Our final purpose is to propose a microfundation for the emergence of norms depending on the underlying strategic environment.

Our model has three main ingredients: the strategic environment, the norm selection process, and the dynamics between the two. To model the environment we use different symmetric 2×2 games, which are meant to be representative of tasks that people can face. The actions of the game are binary (0 or 1 such as no effort-max effort, to pay-not to pay taxes, vote yes-vote no etc.) and each agent's norm is a preference over an action that modifies the payoff associated with playing it. If there are no norms the payoffs do not change and agents play the classical 2×2 game, while for extreme norms agents stick to the associated action, giving no importance to material payoffs.

Norms are chosen by agents interacting together in the society. We assume that each agent faces trade-off between individual preferences and a social coordination payoff as in Kuran & Sandholm (2009). The main novelty that we introduce at this stage is heterogeneity in flexibility parameter; this implies that the emergent social norm can deviate

from the mean of exogenous preferences in the population, differently from classical naive learning models (e.g. DeGroot [1974]).

In order to characterize the feedback between strategic games and norms, we exploit the tendency of people to seek consistency between preference of actions and behavior. In particular, we let agents move their preferences toward the action predominantly played in the games of the previous period, to reduce cognitive dissonance.

Our preliminary results show that depending on the game played by the population (coordination game or chicken game) both a common shared social norms or even two polarized norms can emerge. Moreover for some flexibility parameters the dynamics leads to an equilibrium in which norms, even if initially quite strong, disappear in the long run. Thus in some cases the classical analysis is, in the long run, enough to understand the strategic interaction, while in some other situations norms significantly affect agents decisions.

Nash-Walras Equilibrium

Sjur Didrik Flåm

University of Bergen, Norway, sjur.flaam@uib.no

This paper connects strategic games, la Nash closely to pure exchange economies, la Walras. The combined solution concept features endogenous linear pricing of tranferable items. Motivation stems from imperfect competition in sale of outputs, conditioned by perfect competition in trade of inputs. Chief instances comprise relatively few firms' use of widely held production factors - pollution permits being a case in point. Beyond existence, stability and uniqueness of equilibrium, the paper considers eventual attainment and learning of steady state play. It's noteworthy that no smoothness assumptions are needed.

Session: Learning - Room: Amphi 6 - July 5th, 14:00-15:30

Persuasion Games and Bayes Communication Equilibrium

Michele Crescenzi

University of Helsinki, micrescenzi@gmail.com

We examine the problem of a mediator who wants to persuade a group of receivers to take a certain action. Every receiver is uncertain about the true state of nature but observes a private signal about it before interacting with the mediator and the other receivers. The mediator is fully informed and can send recommendations that are contingent on both the true state of nature and the types that receivers choose to report. To identify the set of attainable outcomes, we introduce the solution concept of Bayes Communication Equilibrium (BME). It is a strict generalization of Communication Equilibrium (ME) where state-contingent mediation plans are allowed. We show that, for a given Bayesian game, the set of BME distributions is a subset of the Bayes Correlated Equilibrium distributions and a superset of the ME distributions. Furthermore, the set of BME distributions is equivalent to set of all ME distributions that one obtains by expanding the information structure of the given game. Finally, for a class of games where receivers types satisfy a conditional independence property, the mediator can span the whole set of BME distributions just by sending recommendations that are contingent on the true state of nature but independent of the reported types.

Full Enumeration of Sampling Equilibria for 3×3 Matrix Games

Rainer Berkemer

AKAD University Stuttgart, rainer.berkemer@akad.de

The sampling dynamics (Sethi (2000)) is a non-payoff monotonic dynamics which is based on the concept of sampling equilibria (Osborne and Rubinstein (1998)). Ordinal payoffs are sufficient to determine all the equations constituting a sampling equilibrium (SE). For that reason it is feasible to perform a full enumeration of all symmetric 3×3 matrix games without ties (for 2×2 games this had been already achieved earlier by Ramsza).

This will enable us to classify 3×3 games accordingly. Of course, many cases will be trivial in the sense that there is a single SE corresponding to a strict Nash equilibrium (NE) of the game. On the other hand there are very interesting cases where despite of an unique strict NE there is an interior SE in addition which is even stable under the sampling dynamics. This means that even strictly dominated strategies can survive the selection process, due to the non-payoff monotonicity of the dynamics. Sethi showed this for a voluntary contribution game and many related cases could be found. Stability considerations for the SE involve just an eigenvalue check of a 2×2 jacobian.

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Rationalizability and Learning in Games with Strategic Heterogeneity

Eric Hoffmann[1], Anne-Christine Barthel[2]

West Texas A& M University [1]ehoffmann@wtamu.edu, [2]abarthel@wtamu.edu

It is shown that in games of strategic heterogenity (GSH), where both strategic complements and substitutes are present, there exist upper and lower serial undominated strategies which provide a bound for all other rationalizable strategies. We establish a connection between learning in a repeated setting and the iterated deletion of strictly dominated strategies which provides necessary and sufficient conditions for dominance solvability and stability of equilibria. These results not only extend monotonicity analysis to a wider class of games, but generalize many results in the literature on games of strategic complements and substitutes. Lastly, we provide conditions under which games that do not exhibit monotone best responses can be analyzed as a GSH. Multiple examples are given.

Session: TU-games on graphs - Room: Amphi 8 - July 5th, 14:00-15:30

A Bird's rule for fixed tree games with fuzzy agents

Inés Gallego[1], Andrés Jiménez-Losada[2], Julio Rodrigo Fernández[3], Manuel Ordóñez[4]

Universidad de Sevilla [1]inesgal@us.es, [2]ajlosada@us.es, [3]julio@us.es, [4]mordonez@us.es

Bird (1976) proposed an allocation rule for networks. This rule establishes a cost allocation for each spanning tree of the network and the average of these allocations later on. We present a fuzzy Bird's rule for situations in which we need to distribute the maintenance cost of a fixed network, more specifically a rooted tree in which players use each plant (node) a percentage of time and are connected to the central supplier (root). We provide this rule with an axiomatization. Obviously, this is the first step to define the rule for networks in general.

A family of games with coincidence between the nucleolus and the Shapley value

Christian Trudeau[1] and Juan Vidal-Puga[2]

[1]University of Windsor, trudeauc@uwindsor.ca, [2]Universidade de Vigo, vidalpuga@uvigo.es

We introduce a new family of cooperative games for which there is coincidence between the nucleolus and the Shapley value. These so-called clique games are such that players are divided into cliques, with the value created by a coalition linearly increasing with the number of agents belonging to the same clique. Agents can belong to multiple cliques, but for a pair of cliques, at most a single agent belong to their intersection. Finally, if two players do not belong to the same clique, there is at most one way to link the two players through a chain of players, with any two adjacent players in the chain belonging to a common clique. Kar et al. (Math Soc Sci 57:16-25, 2009) have proposed the family of PS-games that also have this coincidence. Clique games and PS-games have a non-empty intersection but there are no inclusion relation between the two families. We provide multiple examples for clique games, chief among them minimum cost spanning tree problems. This allows us to obtain new correspondence results between the nucleolus and famous cost sharing methods for the minimum cost spanning tree problem.

The degree value for games with communication structures

Guang Zhang[1], Erfang Shan[2], Guangming Wang[3]

School of Management, Shanghai University [1]G.Zhang@uvt.nl, [2]efshan@shu.edu.cn

A new value concept, called degree value, is proposed by employing the degree game induced by an original game for hypergraph communication situations (including graph communication situations). We provide an axiomatic characterization of the degree value for arbitrary hypergraph communication situations by applying component efficiency and balanced conference contributions, which is a natural extension of balance link contributions introduced in Slikker (Int J Game Theory 33: 505-514, 2005) for graph communication situations. By comparing the degree value with the position value and the Myerson value, it is verified that the degree value is a new allocation rule that differs from both the Myerson value and the position value, and the degree value highlights the important role of the degree of a player in hypergraph communication situations. Particularly, in a uniform hypergraph communication situation, where every conference contains the same number of players, we show that the degree value coincides with the position value.

A game-theoretic approach to networks

Encarnación Algaba[1], Susana López[2], Guillermo Owen[3], Martha Saboyá[4]

[1] Departamento de Economía, Universidad de Sevilla, ealgaba@us.es, [2]Departamento de Economía Cuantitativa, Universidad Autónoma de Madrid, susana.lopez@uam.es, [3]Department of Applied Mathematics, Naval Postgraduate School, Monterey, California, GOwen@nps.edu, [4]Departamento de Economía Cuantitativa, Universidad Autónoma de Madrid, martha.saboya@uam.es

In this article, we consider teams whose members (a manager, workers, robots, etc.) are represented as nodes of a graph (network). The links in the graph allow the several team members to communicate. By collaboration, the several members can normally accomplish much more than by acting individually. This is represented by a super-additive n-person game in characteristic function form. This collaboration is however only possible if the several team members can communicate, which is the reason for the links in the graph. The links can be more or less efficient; more efficient links are generally more costly. Using the Myerson approach to games on graphs, we introduce the notion of a supergame to represent the amount of work that can be done, and the amount that is wasted because of inefficient links. The method of multilinear extensions is then used to modify the Shapley value by changing the "expected time of arrival" of the links: A more efficient link has an earlier time of arrival, while a less efficient link has a later arrival. This modification allows us to represent more or less efficient links. (The Beta distribution is useful in this regard.) We can then look for optimal links, subject to budgetary constraints. Some examples are worked out in detail.

Session: Bargaining - Room: Salle A - July 5th, 14:00-15:30

Bargaining with forward looking buyers and price discrimination

Arieh Gavious[1], Ella Segev[2], Smadar Kalifa[3]

[1]Ben Gurion University, ariehg@bgu.ac.il [2]Ben Gurion University of the Negev, ellasgv@bgu.ac.il, [3]Ben Gurion University, slk25@netvision.net.il

Resale between a seller and a buyer enables the seller to record the buyers purchase history and change his prices accordingly. He can then discriminate between buyers based on their purchase history. Advances in technology now make it feasible for sellers to condition their price offers on consumers past behavior. We ask the question whether it is really profitable for the seller to set different prices for consumers with a different purchase history. We describe a model in which the seller wishes to sell two units of the same object, one by one to the same buyer. We assume that the sellers valuation for the object is normalized to zero and is common knowledge among the players. The buyers valuation is her own private information and may vary between periods. However it is common knowledge that her value in the first period is drawn from a uniform distribution on the interval $[1, 2]$ and her value in the second period is close to her value in the first period but with some noise. We also assume that both the seller and the buyer are risk neutral, and they discount time by a discount factor $\delta \in (0, 1]$. The seller reacts to the buyers past behavior when he decides what price to charge in the second period. The buyer is forward looking and anticipates that her behavior will affect the future prices she will face. We characterize a perfect Bayesian equilibrium (PBE) for the no commitment game. We show that the seller discriminates between buyers based on if they have purchased in the first period and buyers best respond to the sellers prices taking into account their behaviors influence on future price. The perfect Bayesian equilibrium strategy for the seller is therefore a pricing plan that depends on the purchase history of the buyer and allows for discrimination between buyers with different histories. We show that the noise decreases the expected payoffs of both players in the commitment game. We also show numerically that the higher the noise the smaller are the expected payoffs of the seller in the no commitment game (the noise is the maximum difference between the buyers valuation in the first period to the buyers valuation in the second period) and if the seller can commit in advance to the prices (the commitment game) he commits to charge the monopoly price in both periods and it is always more profitable for him than the no commitment game. We show numerically that this is not always the case for the buyer. We show that the buyers ex-ante payoff is higher in most cases, when the seller will not be allowed to commit in advance to the prices but there might be cases in which the buyer prefers the commitment game. We also show that as δ increase, the seller is willing to pay more for the power to commit. Moreover the seller offers a lower opening price in the no commitment game compared to the commitment game, but less buyer types accept this price. Finally, the seller may sometimes offer a price in the first period which is less than the minimal value of the buyer in the no-commitment game (dumping pricing).

Do workers negotiate collectively or separately?An application of a coalitional bargaining game with externalities

Fumi Kiyotaki[1], Toshiji Miyakawa[2]

[1]Kindai University, kiyotaki@eco.kindai.co.jp, [2]Osaka University of Economics, toshiji.miyakawa@gmail.com

This study proposes a non-cooperative coalitional bargaining game model to analyze wage negotiations between one employer and two workers. Here, randomly selected workers choose whether to negotiate their wage contracts together or separately, considering wage contract externalities. We show that if the two workers are sufficiently complementary or if externalities are more positive, there exists a grand-coalition stationary subgame-perfect equilibrium (SSPE) of the bargaining game for any discount factor, where the workers negotiate together. However, if the two workers are sufficiently substitutable, there is no grand-coalition SSPE. Furthermore, we provide a sufficient condition for an SSPE to exist, in which each worker selects separate negotiations with the employer.

Rent-seeking and surplus destruction in unanimity bargaining

Volker Britz
ETH Zurich, vbritz@ethz.ch

Non-cooperative bargaining games in the tradition of Rubinstein consist of rounds which take place at discrete points in time. In each round, one player is designated as the proposer. If there is no agreement on the proposal made in the current round, then the bargaining process is delayed until the following round. This delay is costly to all players because they are impatient. The prospect of a costly delay following the rejection of a proposal is a source of bargaining power for the current proposer. In this paper, we consider a unanimity bargaining game in which the length of this prospective delay is chosen endogenously. More specifically, we assume that, in each round, the current proposer does not only make a proposal, but also decides on the length of the delay which occurs if the proposal is rejected. In this way, the proposer can "threaten" the other players with delay and thus reduce their continuation utility from rejecting. However, issuing such a threat involves a social cost. Indeed, it is assumed to reduce the size of the surplus. This social loss cannot be recovered, even if the proposal is unanimously accepted. Therefore, threatening other players with the prospective delay is essentially a rent–seeking activity: The current proposer can use it to improve her bargaining position, while destroying some share of the surplus. To give one example, a politically motivated strike is a socially wasteful activity which attracts attention and gives clout to the demands of an interest group. We use an appropriate refinement of stationary subgame-perfect equilibrium as the solution concept, and characterize equilibrium strategies and payoffs. We show that a unique equilibrium exists, and derive parameter conditions under which this equilibrium is or is not efficient. For inefficient equilibria, we investigate the relation between basic model parameters and the degree of the inefficiency. In particular, for any given number of players, we establish an upper bound on the social loss. We show that the rate of time preference has a non–monotonic effect on the extent of the inefficiency. Nevertheless, our model preserves the monotonic relation between the rate of time preference and the size of the proposer premium, which is familiar from the Rubinstein bargaining model.

Stable Licensing Schemes in Technology Transfer

Shin Kishimoto
Chiba University, skishimoto@chiba-u.jp

We consider stable licensing schemes that are combinations of lump-sum fee and per-unit royalty realized as bargaining outcomes in transferring a new technology from a technology holder to oligopolistic firms through licensing. The licensing schemes on which the technology holder and licensees can agree are necessarily rejection-proof; that is, no subgroup of licensees has an incentive to reject the licensing schemes. We define the rejection-proof core for each group of licensees as the set of rejection-proof licensing schemes for its group that are not dominated by any other rejection-proof licensing schemes for any licensees' group. Our findings are as follows: For the group of licensees that maximizes the sum of the technology holder's profit and licensees' total surplus, the rejection-proof core is always non-empty. Further, the non-empty rejection-proof cores suggest that it should be optimal for the technology holder to license the new technology to such a group from the viewpoint of his/her profit maximization.

Session: Voting - Room: Salle C - July 5th, 14:00-15:30

On the costly voting model

Anna Panova

NRU HSE, apanova@hse.ru

We study collective decision making in which a policy is chosen by a committee formed by some members of fixed group of people. Participation in the decision-making process is costly and the outcome is based on the participants' preferences. All members of the group are affected by the decision. We show that in the case when the compromise function is the mean and the voting is non-strategic, a pure Nash equilibrium always exists. In the case when the compromise function is chosen to be the median we give a simple example of a game with three players, where no pure Nash equilibrium exists. We analyze as well how different types of cost function (constant or sharing cost) affect the equilibrium.

Losers turning winners: Intra-party dynamics of political competition between leaders and activists

Cesar Garcia Perez de Leon[1], Maoz Rosenthal[2]

[1]Sciences Po, Paris, cesar.garciaperezdeleon@sciencespo.fr, [2]IDC Herzliya, mrosenthal@idc.ac.il

We present a general theory of m-dimensional intra-party bargaining stating the conditions under which party activists who supported a losing intra-party faction in primary contests turn to support the party's winning faction the activists campaigned against. We show that as aggregate uncertainty about the preferences of the party's main representative voter increases, the leading party elites will need to seek the support of a minority coalition of loser activists in order to remain electorally competitive. Under these conditions, losing activists will extract significant policy concessions and redistributive budgetary rewards by supporting the rival faction. We also show that when marginal constituencies become relevant in the electoral competition, winning elites will hold incentives propose a policy proposal closer to the one preferred to the loser activists at the cost of compensating their own supporters. We apply this scheme to varying conditions of multiple activist groups, party cohesion and, party system fragmentation.

Robust Voting under Uncertainty

Satoshi Nakada[1], Shmuel Nitzan[2], Takashi Ui [3]

[1]Hitotsubashi University, s.nakada0911@gmail.com, [2]Bar-Ilan University, Shmuel.Nitzan@biu.ac.il, [3]Hitotsubashi University, oui@econ.hit-u.ac.jp

This paper proposes a normative criterion for voting rules under Knightian uncertainty about individuals' preferences to characterize a weighted majority rule (WMR). This criterion, which is referred to as robustness, stresses the significance of responsiveness: the probability that the social outcome coincides with the realized individual preferences. A voting rule is said to be robust if, for any probability distribution of preferences, the responsiveness of at least one voter is greater than one-half. The main result of this paper establishes that a voting rule is robust if and only if it is a WMR without any ties. Robustness is a stronger requirement than weak efficiency because a voting rule is weakly efficient if and only if it is a WMR in which ties are allowed with an arbitrary tie-breaking rule.

An Optimal Voting Procedure for Public Good Provision Based on Semi-Flexible Majority Thresholds

Hans Gersbach[1], Oriol Tejada[2]

ETH Zürich [1]hgersbach@ethz.ch, [2]toriol@ethz.ch

We introduce a two-stage, multiple-round voting procedure where approval thresholds vary with the proposal on the table and require a qualified majority. We apply such a procedure to public good provision where the citizen's valuations can take two values and are private. We show that the procedure elicits the citizens' valuations and as a result implements the utilitarian optimal public good level, which is always chosen after all feasible policies have been considered. We also develop a compounding procedure to ensure utilitarian optimality when there are more than two types of citizens.

Session: Transboundary pollution - Room: Salle D - July 5th, 14:00-15:30

On Spatial Effects in Cooperative and Non-Cooperative Transboundary Pollution Dynamic Games

Javier De Frutos[1], Guiomar Martin-Herran[2]

IMUVA, Universidad de Valladolid [1]frutos@mac.uva.es, [2]guiomar@eco.uva.es

We analyze a transboundary pollution differential game where, in addition to the standard time dimension, a spatial dimension is introduced to capture the different geographical relationships among regions. Each region behaves strategically and aims to maximize its welfare net of environmental damage caused by the stock of pollution. The emission-output ratio in each region can be reduced by investment in clean technology which is region specific and evolves over time. The spatio-temporal dynamics of the stock of pollution is described by a parabolic partial differential equation. Using aggregate variables for the environmental variables of the model we study the feedback Nash equilibrium of a discrete-space model which could be seen as a space discretization of the continuous-space model. The discrete-space model still presents the three main feature of the original formulation: first, the model is truly dynamic; second, the decision agents behave strategically; third, the model incorporates spatial aspects. For special functional forms previously used in the literature of transboundary pollution dynamic games we characterize analytically the feedback Nash equilibrium and evaluate the impact of the introduction of the spatial dimension in the economic-environmental model. We show that our spatial model is a generalization of the model that disregards the spatial aspects in the sense that the behavior of the environmental variables at the equilibrium in the non-spatial setting can be reproduced as a limit case of the spatial setting. In particular, this link is obtained when the parameter describing how pollution diffuses among regions tends to infinity and the stocks of pollution in the regions are mixed instantaneously, which is the main hypothesis made in the non-spatial differential game.

Incentives and Emission Responsibility Allocation in Supply Chains

Greys Sosic[1], Daniel Granot[2], Frieda Granot[3], Sanjith Gopalakrishnan[4], Hailong Cui[5]

[1]University of Southern California, sosic@marshall.usc.edu, [2]UBC, daniel.granot@sauder.ubc.ca, [3]UBC, frieda.granot@sauder.ubc.ca, [4]UBC, sanjith.gopalakrishnan@sauder.ubc.ca, [5]USC, Hailong.Cui.2019@marshall.usc.edu

In view of the urgency and challenges of mitigating climate change, it should be noted that Greenhouse Gas (GHG) emitted from the supply chains of the 2,500 largest global corporations accounts for about 18% of global GHG emissions. Therefore, rationalizing CO2 emissions in supply chains could make an important contribution to achieve the global objectives for emission reduction agreed upon in the Paris Agreement.

In this paper we consider supply chains with a motivated dominant leader, such as Walmart, who strives to reduce emissions in their supply chains. These supply chain leaders are assumed to be knowledgeable about causes of pollution in their supply chains, to the extent that they are able to assign their suppliers responsibilities for both direct and indirect GHG emissions in the supply chain. Given these pollution responsibility assignments, we use cooperative game theory methodology to derive a scheme for allocating the responsibilities of the total GHG emissions to the firms in the supply chain.

The allocation scheme that we derive, which is the Shapley value of an associated cooperative game, is shown to have several desirable properties. In particular, (i) it is footprint-balanced, (ii) it is transparent and easy to compute, (iii) it lends itself to several intuitive and insightful axiomatic characterizations, and (iv) when the abatement cost functions of the firms are private information, it is shown to incentivize suppliers to exert pollution abatement efforts that, among all footprint-balanced allocation schemes, minimize the maximum deviation from the socially optimal pollution level.

A correlated equilibrium approach for the president's place in climate change negotiations

Raja Trabelsi[1], Tarik Tazdait[2], Saoussen Krichen[3]

[1]LARODEC, trabelsirraja@gmail.com, [2]CNRS - EHESS - CIRED, Tazdait@centre-cired.fr, [3]LARODEC, krichen_s@yahoo.fr

Nowadays, climate change is considered as the most important issue that faces humanity. In this context, different studies have treated it evoking its harmful consequences and have worked on determining several types of accord forms to reduce in-countries gazes' emission which may be eligible to be unanimously adopted by all countries. This literature is based on the small stable coalition model. This one has been enhanced taking on consideration new parameters such as countries' heterogeneity, uncertainty, the minimum participation's principle. . .. Nevertheless, one key parameter, president's place in negotiations, has been ignored. Unlike most of the studies which treated this issue as a cooperative game, our purpose in this paper is to treat it as a non-cooperative one. In fact, our study propose to consider a neutral person defined as negotiation's president in charge of the negotiations process and to determine both his role and impact on reaching an agreement, using the correlated equilibrium.

Cooperation and Subgame Perfect Equilibria in Global Pollution Problems with Critical Threshold

Eric Bahel

Virginia Tech, erbahel@vt.edu

The paper examines the issue of international pollution control under a dynamic framework involving heterogeneous countries and a critical threshold. We propose an appealing specification for this type of problem, and its novelty is illustrated by the fact that countries use linear strategies in equilibrium, although their utility and damage functions are highly convex. The stock of pollution under cooperation is always lower. Surprisingly, emissions are always higher in distant periods under the cooperative scenario; and we show through examples that this is a significant finding rather than some marginal effect. It is also shown that the efficient allocation of pollution abatement is driven only by the respective technologies of the countries. Finally, a dynamic transfer scheme allowing to implement the cooperative solution is proposed.

Parallel Sessions III - July 5th, 15:50-17:20

Session: Social choice - Room: Amphi 5 - July 5th, 15:50-17:20

Binary Collective Choice with Multiple Premises

Masaki Miyashita

University of Tokyo, nucleolus11@gmail.com

Imagine a group of individuals facing with a complicated yes-no question whose truth value is logically driven from multiple premises. Their purpose is to make a correct group judgment on the question based on their individual judgments. There are two types of ways to aggregate individual judgments: "the premise driven way" (PDW) and "the conclusion driven way" (CDW). We analyze which way is superior to the other to find a correct answer. In our analysis, we introduce a Boolean algebraic approach to formulate a general class of such judgment aggregation problems. We find that if a group faces with a conjunctive decision problem, then PDW is more likely to avoid "false acquittance", while CDW is more likely avoid "false conviction". In a disjunctive case, the converse of this result holds. However, as the size of a group goes to infinity, PDW ensures that the probability that the voting outcome is correct converges to one, while CDW does not.

On Strategy-Proofness and Single Peakedness: A Full Characterization

Makoto Hagiwara[1], Goro Ochiai[2], Hirofumi Yamamura[3]

[1]Tokyo Institute of Technology, hagiwara.m.af@m.titech.ac.jp, [2]Tokyo Institute of Technology, ochiai.g.aa@gmail.com, [3]Hokusei Gakuen University, h-yamamura@hokusei.ac.jp

We study strategy-proof rules when agents have possibly asymmetric single-peaked preferences. While Moulin[2] and Ching[1] characterize the class of strategy-proof rules, their characterizations do not take the possibility of feasibility constraints into consideration. We then provide a full characterization of strategy-proof rules without any other assumptions by covering the cases where the range of a rule may not be an interval. We newly introduce the class of minimax rules with tie-breaking rules and show that these rules are characterized by strategy-proofness.

Restricting the domain allows for weaker independence

Justin Kruger[1], Remzi Sanver[2]

LAMSADE - Université Paris-Dauphine [1]justin.g.kruger@gmail.com, [2]remzi.sanver@lamsade.dauphine.fr

Arrow's classical axiom of independence of irrelevant alternatives may be more descriptively thought of as binary independence. This can then be weakened to ternary independence, quaternary independence, etc. It is known that under the full domain these are not real weakenings as they all collapse into binary independence (except for independence over the whole set of alternatives which is trivially satisfied). Here we investigate whether this still happens under restricted domains. We show that for different domains these different levels of independence may or may not be equivalent. We specify when and to what extent different versions of independence collapse into the same condition.

On the aggregation of incomplete preferences

Laszlo Csato

Institute for Computer Science and Control, Hungarian Academy of Sciences (MTA SZTAKI) and Corvinus University of Budapest (BCE), laszlo.csato@uni-corvinus.hu

Assume a set of objects is given with information about their bilateral relationships, allowing for incomplete and multiple comparisons as well as different preference intensities. An axiomatic approach is applied for the problem of ranking the objects. Consistency requires the preservation of two obects' relative ranking if two sets of such preferences are aggregated. Self-consistency assigns the same rank for objects with the same performance, furthermore, any object should be ranked strictly higher if it shows an obviously better performance than another. It is revealed that these two properties cannot be satisfied simultaneously. The impossibility holds under various restrictions on the domain. However, a positive result emerges if only the aggregation of ranking problems with the same comparison structure is allowed, for example, we have two round-robin tournaments.

Session: TU-games applications - Room: Amphi 6 - July 5th, 15:50-17:20

Nullified equal loss property and equal division values

Sylvain Ferrières

Universit de Franche-Comté, CRESE (EA 3190), sylvain.ferrieres@univ-fcomte.fr

We provide characterizations of the equal division values and their convex mixtures, using a new axiom on a fixed player set based on player nullification which requires that if a player becomes null, then any two other players are equally affected. Two economic applications are also introduced concerning bargaining under risk and common-pool resource appropriation.

Supporting sustainable business models for rural electrification: a method for sharing operation and maintenance costs

Giorgio Bonamini[1], Emanuela Colombo[2], Vito Fragnelli[3], Natividad Llorca[4], Roberto Lucchetti[5], Joaquin Sanchez-Soriano[6]

[1]Mathematics Department, Politecnico di Milano, giorgio.bonamini@polimi.it, [2]Energy Department, Politecnico di Milano, emanuela.colombo@polimi.it, [3]Department of Science and Advanced Technology University of Eastern Piedmont, vito.fragnelli@uniupo.it, [4]Operations Research Center and Department of Statistics, Mathematics and Computer Science, Miguel Hernández University, nllorca@umh.es, [5]Mathematics Department, Politecnico di Milano, roberto.lucchetti@polimi.it, [6]Operations Research Center and Department of Statistics, Mathematics and Computer Science, Miguel Hernández University, joaquin@umh.es

With World Banks forecast that in 2030 still 900 million people will lack access to electricity, the United Nations goal for sustainable development to reach universal energy access seems hard to achieve. For this reason, electrifying rural areas is becoming a more and more pressing need. Evidences from rural electrification business cases demonstrate that, after deploying a rural micro-grid, local energy cooperatives should be involved to distribute electricity and to define tariffs. In this framework, we define a realistic model to support tariff definition in case of an off-grid micro-grid, powered by photovoltaic solar panels with batteries, managed by a local energy cooperative. We start from a linear production game to locate the generators of the micro-grid and share the costs among the users. In case we consider capacity constraints, we proof that defining a CERO-rationing problem we can share the investment costs. To define tariffs, we explicit the storage components in the linear program without capacity constraints. For each candidate facility we can size the energy storage, changing the power balance constraints into energy balances. Deriving the corresponding dual problem, we show that one group of variables corresponds to the users willingness to pay for electricity for a given time period. Finally, we analyse the stability and the fairness of the tariffs allocations of the dual.

Game theory for an internet search quality evaluation

Ilya Katsev

National Research University Higher School of Economics, katsev@yandex.ru

The market of search engines is very large and competitive. In Russia the leader of this market is russian company Yandex (it is more popular than Google, Bing and others). We need to measure the quality of our search carefully. I will tell how we construct some cost-revenue model of internet user and use game theory in search quality evaluation.

Sharing revenues in a public transport system: The Seville Metropolitan Consortium

Encarnación Algaba[1], Vito Fragnelli[2], Natividad Llorca[3], Joaquín Sánchez-Soriano[4]

[1]Seville University, ealgaba@us.es, [2]University of Eastern Piemont, vito.fragnelli@uniupo.it, [3]University Miguel Hernández of Elche, nllorca@umh.es, [4]University Miguel Hernández of Elche, joaquin@umh.es

This work deals with the problem of sharing ravenues among different transport companies in a multimodal public transport system. We assume that they cooperate offering combined tickets that allow for using all the available transport means. We propose a game theoretical approach to answer the question how to distribute the revenue among the involved companies. We introduce a new allocation rule and we axiomatically characterize it. Moreover, we prove that it coincides with the Shapley value of a game. We illustrate these results applying them to the Seville Metropolitan Consortium and it is shown how this solution works, highlighting its advantages.

Session: Matching - Room: Amphi 8 - July 5th, 15:50-17:20

Matching Soulmates

Myrna Wooders[1], Greg Leo[2], Martin van der Linden[3], Jian Lou[4], Eugene Vorobeychik[5]

Vanderbilt University [1]myrna.wooders@gmail.com, [2]greg.leo@gmail.com, [3]martin.van.der.linden@vanderbilt.edu, [4]jian.lou@vanderbilt.edu, [5]eug.vorobey@gmail.com

We study iterated matching of soulmates (IMS), the process of matching coalitions that are the favorite for each member (soulmates), coalitions of soulmates in the remaining group, and so on. Coalitions produced by IMS belong to any stable partition and mechanisms that implement IMS give players in these coalitions (or who at least believe they are) no incentive to deviate from truthful preference reporting, even jointly. When everyone is matched by IMS, mechanisms that match soulmates are stable and have a truthful strong Nash equilibrium. Furthermore, we show, using real-world data and simulation, that scenarios in which many people are matched by IMS are common under natural kinds of preferences.

On Stable Outcomes of the Multilateral Matching

Keisuke Bando[1], Toshiyuki Hirai[2]

[1]Tokyo University of Science, k.bando@rs.tus.ac.jp, [2]University of Toyama, thirai@eco.u-toyama.ac.jp

This paper considers the multilateral matching market, where two or more agents can make a contract on a joint venture multilaterally. The possible joint ventures are exogenously given, and the preference relation of each agent is represented by a quasilinear utility function consisting of the valuation on the joint venture and the monetary transfer. We investigate three stability concepts: the weak setwise stable outcome, the stable outcome, and the strongly group stable outcome. We show that if the structure of the possible joint ventures satisfies a condition called the acyclicity, then these three stability concepts are equivalent with each other, are efficient, and exist for any continuous valuation functions. We also show that the acyclicity is necessary to guarantee the equivalence and the efficiency of the stability concepts for any continuous and concave valuation functions. For the existence, the acyclicity is is a necessary condition for the stable and the strongly group stable outcomes. On the other hand, we need an additional condition to obtain a necessary condition for the existence of the weakly setwise stable outcome.

Strategic 'Mistakes': Implications for Market Design Research

Georgy Artemov[1], Yeon-Koo Che[2], Yinghua He[3]

[1]The University of Melbourne, gartemov@unimelb.edu.au, [2]Columbia University, yc2271@columbia.edu, [3]Rice University, yinghua.he@gmail.com

A number of recent papers, using diverse methodologies, argue that participants in strategy-proof mechanisms do not play their truthful strategies. In this paper, we argue that most deviations from truthful behavior are payoff-irrelevant. We first present a theoretical argument based on approximate Nash equilibrium. Next, we employ a field data from Australian college admissions to investigate the instances in which applicants choose strategies (or rank-ordered lists) that are unambiguously dominated. A non-negligible fraction of applicants neglected to list a no-fee position of a program while listing a full-fee position of the same program, even though the former choice could have been added for free. Nevertheless, the majority of these "mistakes" are payoff irrelevant; correcting them would not have altered the outcome. Our rich micro data shed light on who made the mistakes, whether they were payoff relevant and under what circumstances. The observed frequency of strategic mistakes exposes the potential weakness of empirical methodologies based on the observed strategies, but the relative paucity of payoff relevant mistakes reassures the robustness of the methodologies based on an observed outcome.

Session: Non-cooperative games: solutions - Room: Salle A - July 5th, 15:50-17:20

A General limit perfect folk theorem

Ghislain Herman Demeze Jouatsa

Bielefeld University, demeze_jouatsa@uni-bielefeld.de

I introduce two concepts: The "n-effective minimax" and the "set of Nash-feasible payoffs". I use those indicators to provide a full characterization of the limit, as the time horizon increases, of the set of pure strategy subgame perfect Nash equilibrium payoffs of the finitely repeated game.

Expectational Stability in Aggregative Games

Luciana Fiorini[1], Wilfredo Maldonado[2], Richard Cornes[3]

[1]University of Western Australia, Luciana.Fiorini@uwa.edu.au, [2]Catholic University of Brasilia, wilfredo@pos.ucb.br, [3]Australian National University

Using the replacement function associated to aggregative games, we analyze the expectational dynamics on the aggregate strategy of the game. The Nash equilibrium of the game can be interpreted as the Rational Expectational Equilibrium (REE) of the system and we examine the expectational stability of that REE. We characterize the local stability in terms of fundamentals and the REE itself. We illustrate the results through well-known aggregative games (Cournot games, Bertrand competition with differentiated goods, rent seeking games and the public good provision game) and analyze the global expectational dynamics for those games.

Application of the Informational Extended Games for decision-making problems

Ludmila Novac

Moldova State University, novac-ludmila@yandex.com

We provide the informational extension concept for games, which has at its basis the assumptions that the participants of the game have possibility to send and to receive, (or to guess) information about the chosen strategies of other participants and about their behavior. Our aim is to show the importance of the information' possession for all decision-making problems.

We analyze a static informational extended game with n players, who choose their actions simultaneously. The game will assume that players' payoff functions are common knowledge. In this informational extended game we will consider, that each player is informed about the strategies that will be chosen by other players. In this case the set of strategies for each player will be a set of functions defined on the product of strategies' sets of all other players.

An informational extended game can be described in the normal form by: the set of players, the sets of strategies for players defined by sets of functions, and the payoff functions defined on the product of the extended strategies' sets. In this case we analyze the informational extended game in which we consider that all players know the chosen strategies of all other players, and each player chooses his strategy from his informational extended set.

If some players don't know the chosen strategies of other players, then they will choose their strategies from their initial sets without information. Thus, we can define some different informational extended games in which the outcome will consist of strategies from the extended sets of strategies or from the initial set of strategies.

We can consider some games with continuous sets of strategies, or various cases when the sets of strategies are discrete and finite. For the informational extended games, in the both cases (games with continuous or discrete sets of strategies), we can determine the solutions (Nash equilibria), using the best-response sets.

Quantifying commitment in Nash equilibria

Thomas A. Weber
ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, thomas.weber@epfl.ch

How much commitment ability is needed to credibly deter market entry? How much adjustment flexibility is enough to guarantee a second-mover advantage in a pricing game? What lock-in is required to reach an advantageous outcome in a coordination game? In the absence of informational asymmetries, dynamic games can have many Nash equilibria, but almost always only one of them relies exclusively on credible threats and is therefore singled out as a subgame-perfect Nash equilibrium. Which of the Nash equilibria is subgame-perfect depends on the structure of the dynamic game, in terms of the players' move order. Changing this structure does not change the set of Nash equilibria, only the specific one thought of as "credible." Instead of viewing subgame-perfection, i.e., credibility, as a binary qualification, this paper aims to quantify how much credibility each player in any given Nash equilibrium of a dynamic game really has. Indeed, the set of Nash equilibria of a dynamic game is equivalent to the set of Nash equilibria of the corresponding normal-form game where all players move simultaneously. In the normal-form game, the players' feasible actions are the same as their available strategies in the dynamic game (each viewed as a complete contingent plan). Ignoring the players' move order, the normal-form game corresponds to an entire class of dynamic games. Independent of the particular structure of a dynamic game, our goal is to quantify credibility for any pure-strategy Nash equilibrium. The key idea for a neutral evaluation of a given Nash equilibrium is to map it to a subgame-perfect equilibrium of a canonical supergame. In this supergame, each player i has the option to adjust an earlier action with probability p_i. The probability vectors $p = (p_i)$ that allow implementation of a given Nash equilibrium $a*$ of the normal-form game then determine the set $P(a*)$ of credibility levels for all players consistent with $a*$. The higher the required continuation probability p_i, the lower player i's required commitment ability in order to sustain $a*$. The set $P(a*)$ provides information about all players' flexibility required to sustain it. The paper illustrates the notions using a detailed example for a well-known coordination game.

Session: Recursive solutions - Room: Salle C - July 5th, 15:50-17:20

Repeated oligopoly with search : games of overcutting

Louis-Marie Harpedanne de Belleville

Paris School of Economics, harpedanne@gmail.com

We combine a repeated purchase model la Phelps and Winter (1970) with consumer search. In Phelps and Winter, consumers learn exogenously about competitors' prices, while here consumer search is endogenous to pricing by firms. Consumers search by buying over time in different stores. They stay in a store as long as the price they pay is lower than the last price they observed in the other store.

First, we show that in the simple and realistic framework of perfect monitoring (i.e. past competitor prices are perfectly known to each firm), there exists in general no equilibrium price nor equilibrium price distribution in repeated purchase models when assuming continuous prices. Thus we consider discrete prices, which are used in repeated competition (Phelps and Winter, 1970; Maskin and Tirole, 1988) but not in search models.

When setting prices, firms must consider all past prices to which consumers have been exposed. So the game dynamic. Furthermore, contrary to Maskin and Tirole, we do not assume that the game is markovian, and that firms commit on price: in our model firms can change price at each period and thus simultaneously, which may make the game stochastic (e.g. if both firms accidentally choose the same price).

We introduce the simple but instrumental concept of "extractable price", which is the highest price consumers are ready to pay indefinitely in a store and which does not induce a new search (i.e. a move to another store). We evidence a surjection from all past histories into contemporaneous combinations of extractable prices, which makes it possible to define the strategy with regard to these combinations. That is, "extractable prices" make it possible to analyze the game in a markovian way.

Thanks to this tool, we evidence an "overcutting" mechanism through which, after an initial period of low prices, a store moves to monopoly prices to induce a competitor to do the same. This mechanism is distinct from "captive consumers" mechanisms (in the present model, at equilibrium, each time a firm increases his price, consumers leave next period), and from mechanisms la Hotelling (1929) or Salop (1979) which rely on goods, consumers or stores heterogeneity.

Contrary to menu-costs or Hotelling-like models, the present model explains the coexistence of very large individual price increases with small individual price decreases, which has been documented empirically, for instance, by Berardi, Gauthier and Le Bihan (2011).

Co-management and cooperative self-enforcement

Lone Grønbæk[1], Marko Lindroos[2]

[1]University of Southern Denmark, lg@sam.sdu.dk, [2]University of Helsinki, marko.lindroos@helsinki.fi

The paper combines the cooperative fisheries management with the non-cooperative literature. It has important modeling contributions by creating a new framework on co-management. We investigate a repeated coalition game with the possibility to deviate. In addition, we introduce a model where acting as a singleton may be more costly compared to joint production. This model provides a more optimistic view of coalition formation. The model can explain the real world cases of strong fishing community cooperation arising even with a large set of players.

The Recursive Bargaining Solution for NTU Differential Games

Simon Hoof

Paderborn University, simon.hoof@upb.de

I present a novel solution mechanism for nperson noncooperative NTU differential games. It is shown that the so called recursive bargaining solution increases efciency against the noncooperative Nash equilibrium. The crucial difference to the standard cooperative approach is that agents do not mutually agree to maximize overall payoffs and distribute them appropriately, but that they bargain over the actions. The idea is that all agents meet before the game has started and bargain over stationary Markovian strategy proles. To dene a bargaining solution we rst set up a bargaining problem. A bargaining problem is a tuple of noncooperative Nash strategies and a set of alternative feasible actions. Actions are feasible if the implementation yields a higher value than the noncooperative Nash value. An agreeable bargaining solution is then dened as a mapping from the family of bargaining problems into the set of feasible actions. Since agreement is not enforced by a binding contract, we need to ensure that the agents stick to the agreed upon bargaining solution. Unilateral deviations from the bargaining agreement is punished by a grim trigger strategy. We consider games with almost perfect state information. The agents thus observe if the state evolves according to the bargaining solution or if at least one agent has deviated. If deviation occurs, all agents stick to the noncooperative equilibrium strategies. Under the framework specied above we can show that there always exists a recursive bargaining equilibrium. That is, there always exists a bargaining solution which payoff dominates the noncooperative Nash strategies and that the bargaining solution is dynamically stable (therefore the recursiveness). In particular I can show that the Nash (1950) bargaining solution implements Pareto efcient actions.

Evolution of Social Preferences and Cognitive Intelligence

Olena Orlova

University of Bielefeld, University Paris 1 Pantheon-Sorbonne, elena.j.orlova@gmail.com

I build a theoretical model to investigate co-evolution of social preferences and cognitive intelligence as the ability to retrieve hidden preferences of others. This study contributes to the literature on evolution of preferences, developing a model with endogenous observability.

Session: Games and centrality - Room: Salle D - July 5th, 15:50-17:20

On Shapley ratings in brain networks

Marieke Musegaas[1], Bas Dietzenbacher[2], Peter Borm[3]

[1]Erasmus University Rotterdam, musegaas@ese.eur.nl, [2]Tilburg University, b.j.dietzenbacher@tilburguniversity.edu, [3]Tilburg University, p.e.m.borm@tilburguniversity.edu

We consider the problem of computing the influence of a neuronal structure in a brain network. Abraham, Ktter, Krumnack, and Wanke (2006) computed this influence by using the Shapley value of a coalitional game corresponding to a directed network as a rating. Ktter, Reid, Krumnack, Wanke, and Sporns (2007) applied this rating to large-scale brain networks, in particular to the macaque visual cortex and the macaque prefrontal cortex. Our aim is to improve upon the above technique by measuring the importance of subgroups of neuronal structures in a different way. This new modelling technique not only leads to a more intuitive coalitional game, but also allows for specifying the relative influence of neuronal structures and a direct extension to a setting with missing information on the existence of certain connections. Also technical details about how we computed the Shapley value for large-scale brain networks will be discussed.

A game theoretic neighborhood-based relevance index to evaluate nodes in gene co-expression networks

Giulia Cesari[1], Encarnación Algaba[2], Stefano Moretti[3], Juan Antonio Nepomuceno[4]

[1]LAMSADE, Universit Paris-Dauphine, giulia.cesari@polimi.it, [2]Universidad de Sevilla, ealgaba@us.es, [3]LAMSADE, Universit Paris-Dauphine, stefano.moretti@dauphine.fr, [4]Universidad de Sevilla, janepo@us.es

Centrality measures are used in network analysis to identify the relevant elements in a network. Recently, several centrality measures based on coalitional game theory have been successfully applied to different kinds of biological networks, such as brain networks, gene networks, and metabolic networks. We propose an approach, using coalitional games, to the problem of identifying relevant genes in a biological network. The problem has been firstly addressed by means of a game-theoretical model in Moretti et al. (2010), where the Shapley value for coalitional games is used to express the power of each gene in interaction with the others and to stress the centrality of certain hub genes in the regulation of biological pathways of interest. Our model represents a refinement of this approach, which generalizes the notion of degree centrality, whose correlation with the relevance of genes for different biological functions is supported by several practical evidences in the literature. The new relevance index we propose is characterized by a set of axioms defined on gene networks and a formula for its computation is provided. Furthermore, an application to the analysis of gene expression data from microarrays is presented, as well as a comparison with classical centrality indices.

How to identify experts in a community?

Balázs Sziklai

Game Theory Research Group, Centre for Economics and Regional Science, sziklai.balazs@krtk.mta.hu

The group identification literature mostly revolves around the problem of identifying individuals in the community who belong to ethnic or religious groups. Here we use the same model framework to identify individuals who play key role in some sense. In particular we will focus on expert selection in social networks. Ethnic groups and expert groups need completely different approaches and different type of selection rules are successful for one and for the other. We argue that stability is a key property in expert selection. The idea is that experts are more effective in identifying each other, thus the selected individuals should support each other's membership. We propose an algorithm based on the so called top candidate relation. We establish an axiomatization to show that it is theoretically well-founded. Furthermore we present a case study using citation data to demonstrate its effectiveness. We compare its performance with classical centrality.

Centrality rewarding Shapley and Myerson values for undirected graph games

Anna Khmelnitskaya[1], Gerard van der Laan[2], Dolf Talman[3]

[1]Saint-Petersburg State University, a.b.khmelnitskaya@utwente.nl, [2]VU University, Amsterdam, g.vander.laan@vu.nl, [3]Tilburg University, talman@tilburguniversity.edu

We introduce two values for cooperative games with communication graph structure. In cooperative games without restrictions on cooperation the classical Shapley value distributes the worth of the grand coalition among the players by taking into account the worths that can be obtained by any coalition of players, however it does not take into account the role of the players when communication between the players is restricted. Existing values for communication graph games such as the Myerson value and the average tree solution only consider the worths of connected coalitions and only in this way they respect the communication restrictions. They do not take into account the position of a player in the graph in the sense that in the unanimity game on the grand coalition all players are treated equally when the graph is connected, and so, the players with a more central position in the graph get the same payo, as players which are not central. The two new values take into account the position of a player in the graph. The first one respects centrality, but not the communication ability of a player. The second value respects both centrality and the communication ability of each player, which implies that in unanimity games players that do not generate worth but are needed to connect worth generating players are treated similar to the latter players, and simultaneously players that are more central in the graph get bigger shares than players which are less central. For both newly introduced values we provide axiomatic characterization on the class of connected cycle-free graph games.

Free-riding and Cost Allocation in Common Facilities Sharing

Vito Fragnelli[1], Federica Briata[2]

[1]University of Eastern Piedmont, Department of Sciences and Innovative, vito.fragnelli@uniupo.it, [2]University of Genova, Department of Mechanical, Energy, Management and Transportation Engineering federica.briata@libero.it

In these last years, highly technological facilities were widely used for facing important problems; we may think of sophisticated instruments for medical diagnosis, or supercomputers. Clearly, it is difficult for small hospitals and firms to have an own facility, consequently an interesting alternative is to share a common one. In order to do this, two problems arise: how to share the building (or purchasing) and maintenance costs and which are the rules for accessing the facility, e.g. the scheduling for each firm. The last question is a classical subject in management science, while the first question is often answered using a game theoretical approach.

In Briata (2011) a non-cooperative game theoretical approach is introduced for managing the sharing cost of a facility available to several potential users; if someone actually does not use it, the trivial equal sharing of the maintenance cost of the facility is unfair because the non-users are charged for a service they do not exploit; in order to increase the fairness, the non-users have the possibility of asking that a check for establishing who the users are is made, but they have to pay its cost; the cost for getting the information was already considered in Moretti and Patrone (2004) in a cooperative situation, leading to TU games with information cost, or TUIC games, that is a family of cost games with an additional cost to get the information about each coalition.

The solutions of the game in Briata (2011) may be unfair and cause free-riding situations that may arise when non-users pay for the cost of users and when a non-user decides not to ask for the check, with the hope that the other non-users ask and pay for it.

First, we deal with these free-riding situations in a non-cooperative setting. We look for reducing the advantage of a free-riding behavior of both the users and the non-users, modifying the rules for making the check and the rules for sharing the maintenance cost and the check cost; then we suppose that the check provides information on the intensity of usage of the facility.

Second, in a cooperative setting, we want to improve the fairness, looking for a Transferable Utility cooperative cost game that assigns to each agent in the coalition that asked for the check a quota of the total cost that is satisfactory.

References

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Day 2 - July 6th

Plenary Session III - Room: Amphi 8 - July 6th, 9:15-10:15

The Complexity of Pricing

Noam Nisan

School of Computer Science and Engineering, The Hebrew University of Jerusalem, noam.nisan@gmail.com

As economic systems "move" to the Internet, they can become much more complex and this new complexity often becomes their defining characteristic. We will consider a very simple scenario of this form: a single seller that is selling multiple items to a single buyer. We will discuss the question of how *complex* must the pricing scheme be in order for the seller to maximize (approximately, at least) his revenue.

Based on joint works with Sergiu Hart, with Shaddin Duhgmi and Li Han and with Moshe Babioff and Yannai Gonczarowski.

Parallel Sessions IV - July 6th, 10:35-11:45

Session: Fair division - Room: Amphi 5 - July 6th, 10:35-11:45

The competition utility profiles for mixed fair division problems

Elena Yanovskaya

National Resesarch University Higher School of Economics, eyanovskaya@hse.ru

The problems of fair division of a finite number of goods among a finite set of agents are well-known. When preferences are represented by homothetic, concave and monotone utility functions the Competitive Equilibrium with Equal Incomes is a fair and efficient division of the goods.: Gale and Eisenberg showed that it maximizes the Nash product of utilities.

For linear preferences H.Moulin et al. (https://arxiv.org/abs/1702.00616) recently generalized this problem to the general case, where the objects to divide may contain goods, bads, and even objects that are goods to some agents, but are bads for other.

The competitive (utility) profiles are the critical points of the Nash product of utilities or disutilities. If the zero utility profile is Pareto dominated, the competitive profile is unique and maximizes the product of utilities. If the zero profile is unfeasible, the competitive profiles are critical for the product of disutilities on the efficiency frontier.

In the third case the zero profile is feasible, but not dominated. For all problems of this case the competitive equilibrum profile is unique: it is the zero point. This point cannot be characterized with the corresponding Nash max-product solution. However, it can be characterized with the help of the Suppes-Sen domination applied by Mariotti (1999) for a characterization of the Nash bargaining solutions for BPs whose collections of bargaining sets contain those feasible utility profiles for FD problems of the third class.

A solution ϕ for a class of BPs satisfies the Suppes-Sen proofness (SSP), if for every BP from this class the solution set X satisfies the relation: if $x \in \phi(X)$, and $y > \pi x$ for some permutation π, then $y \notin X$.

Theorem. *Let Γ be the class of BP whose bargaining sets contain a zero point that is not dominated. A solution $\phi : \Gamma \to \mathbb{R}^n$ satisfies SI and SSP if and only if for every BP from this class it is unique and equals zero point.*

How to divide fairly a cake among several people?

Erzsébet Romsics

Budapest University of Technology and Economics, romsics.csore@gmail.com

An unceasing problem of prevailing society is fair division of goods. Therefore, it is essential that the mathematical models behind these procedures lie on a solid basis. The problem of fair cake cutting is dividing a divisible and heterogenous resource in a given ratio, where each player strives to receive as much of the resource as she can. The difficulty of this task is that all player values a piece differently, thus in a fortunate case everyone could receive bigger piece than her fair share. In this research, some new fair division algorithms were created. The motivation to construct the equally dividing Happiness in Unity Algorithm (HUA) was to develop the principles of the otherwise optimal Divide and Conquer Algorithm (DCA) further, so as to eliminate the role of the passive player on one hand and to give every player equal rights to get more than their fair share on the other hand. The division is strong fair (so it guarantees for everybody more than her fair share) if everyone decides to cut the cake in different places at the first round. This property is achieved by expanding the number of cuts with a linear content hence it does not change the optimal O(n log n) complexity. The k-person Stock Company Splitting Algorithm (SCSA(k)) (on a cake of total value n) successfully solves the unequal cake division problems for k participants. Similarly, we can compare it with the Divide and Conquer Algorithm. Fair division with unequal shares can be reduced to DCA, so unequal division can be accomplished with O(n log n) cuts. The complexity of SCSA(k) is $O(2^k \cdot \log n)$, thus it can be proved that when the cake has total value $n > 2^k$ then SCSA(k) performs better than DCA. Note that the estimate on the number of cuts of SCSA(k) is not sharp. Our future research objective is finding a sharp estimate for the number of cuts of SCSA(k) so as to achieve the complexity of the Multiplayer Unequaly Divider Algorithm (MUDA) in the Robertson-Webb book that uses $O(k^2 \cdot \log n)$ cuts.

The problem of dividing a budget among several districts

Ricardo Martinez

Universidad de Granada, ricardomartinez@ugr.es

We study the problem of dividing a budget among the district of a city taking into account their population and wealth. We focus on monotonicity properties that ensure higher transfers to those districts with larger populations and, at the same time, introduce a policy redistribution so that district with lower wealth per capita obtain higher transfers per capita. We characterize the allocation methods that fulfills both requirement. In addition, we also introduce several extension of proportional criterion than can be applied to this particular problem.

Session: Multi-criteria games - Amphi 6 - July 6th, 10:35-11:45

Tensor Sum and Separable Multi Objective Games

Pierre Von Mouche

Wageningen Universiteit, pvmouche@gmx.net

The notion of separable multi objective game is introduced. The formal mathematical structure of such a game is studied and it is shown that a completely separable multi objective game and a simple tensor sum game, which appeared in the literature of linking, are essentially the same mathematical objects. From this literature a canonical analysis of simple tensor sum games and their importance for Folk theorems for repeated games is briefly revisited.

A new Shapley value for multichoice games

Mustapha Ridaoui[1], Michel Grabisch[2], Christophe Labreuche[3]

[1]Paris School of Economics, Universit Paris I - Panthon-Sorbonne, mustapha.ridaoui@univ-paris1.fr, [2]Paris School of Economics, Universit Paris I - Panthon-Sorbonne,michel.grabisch@univ-paris1.fr , [3]Thales Research & Technology, Palaiseau, France, christophe.labreuche@thalesgroup.com

In classical cooperative games each player can either join a coalition or stay. This can be interpreted as two levels of activity: active or inactive. A central question in game theory is to dene the notion of value or power index for a game. A value is a function $\phi : \mathcal{G}(2^N) \to \mathbb{R}^N$ that assigns to every game v a payo vector $\phi(v)$. A classical example for usual games is the Shapley value. A multichoice game is a generalization of classical cooperative game in which each player has a certain number of activity levels at which he can choose to play. Hsiao and Raghavan (1990) have originally introduced multichoice games in which all players have the same number of activity levels. A multichoice game or k-ary game is a function $v : \{0, \ldots, k\}^N \to \mathbb{R}$, where N is the set of attributes(in Multi Criteria Decision Analysis (MCDA)), players (in cooperative game theory), etc. We consider the framework o fMCDA, thatis,N is the set of attributes. Then the levels $\{0, \ldots, k\}$ represent the set of values taken by each attribute, $x \in \{0, \ldots, k\}^N$ represents an alternative, and $v(x)$ is the evaluation of x. Since we do not assume monotonicity of v, v is any multichoice game. Our aim is to introduce a Shapley value suitable to this context. We propose an axiomatic definition, where the chosen axioms are close to those of the original Shapley value. However, in this framework, the classical efficiency axiom does not make sense, because of the non-monotonicity of v. The new axioms that we introduce instead are inspired by the calculus of variations: we define the importance index of an attribute as the average variation of v when the value of attribute i is increased by one unit. We also show that this solution on continuous attributes is the integrated local importance.

Aligned extensions in a 2-additive monotone game: how to compute robust weights in MultiCriteria Decision Aid?

Brice Mayag[1], Stefano Moretti[2]

University of Paris Dauphine, [1]brice.mayag@dauphine.fr, [2]stefano.moretti@.dauphine.fr

In the context of game theory, a total preorder on the set of all subsets of players, called extension, is aligned with some probabilistic value if for any utility function representing this extension, the ranking of the players preserves the primitive preorder on the singleton. A characterization of families of aligned extensions, using a variant of responsiveness property, has been proposed recently. Clearly, this result allows to extend a ranking over single players to another ranking over all possible collection of players, taking into account their possibly mutual interaction.

We propose to translate these properties in the context of 2-additive monotone game. This is particular case of a game where it is assume that the interactions between more than two players do not exist. In MultiCriteria Decision Aid, we show that the obtained results are useful to determine the robust weights (importance of criteria) from a preference information, given by a Decision Maker, over a set of some prototypical alternatives called binary alternatives. These weights are computed by using the Shapley index.

Session: Non-cooperative games: tax problems - Room: Amphi 8 - July 6th, 10:35-11:45

The tax dodger's dilemma

Gianfranco Gambarelli[1], Nicola Gatti[2], Daniele Gervasio[3]

[1]University of Bergamo, gianfranco.gambarelli@unibg.it, [2]Politecnico di Milano, nicola.gatti@polimi.it, [3]University of Bergamo, daniele.gervasio@unibg.it

A non-cooperative game is presented involving a national or local tax authority and various categories of taxpayers. The model is applied to a real Italian case.

A Linear-Quadratic Common Resource Extraction Game with Many Players and Binding Constraints

Rajani Singh[1], Agnieszka Wiszniewska-Matyszkiel[2]

University of Warsaw [1]rajanibabu7@gmail.com, [2]agnese@mimuw.edu.pl

In this paper, we analyse a linear quadratic multistage game of extraction of a common renewable resource by many players with state dependent constraints for exploitation and infinite time horizon. We analyse social optimum and Nash equilibrium for feedback information structure and compare the results obtained in both. For Nash equilibria, we obtain a value function that is contrary to intuitions from standard linear quadratic games. We also study introduction of a tax in order to enforce socially optimal behavior of the players. Besides, this game constitutes a counterexample to two techniques regarded as standard in computation of Nash equilibrium and/or optimal control.

On the Computation of Equilibrium in Discontinuous Economic Games

Pim Heijnen

University of Groningen, p.heijnen@rug.nl

In many game-theoretic models of price competition, mixed-strategy Nash-equilibria naturally occur. For firms, it is an equilibrium to randomly draw a price from a non-degenerate distribution whose support is an interval on the real line. The computation of this distribution is a nontrivial task except in special cases. This paper proposes a procedure that allows the researcher to numerically calculate such an equilibrium. Examples illustrate that the procedure is fast and accurate.

Session: Auctions - Room: Salle A - July 6th, 10:35-11:45

A double auction game for a Limit Order Book market

Matthijs Ruijgrok

Utrecht University, m.ruijgrok@uu.nl

I introduce a double auction game which models a simple version of a Limit Order Book (LOB) market. The game has an unique equilibrium, under some generic conditions. If supply and demand are linear, this equilibrium is explicitly calculated. Also, the expected sum of the profits of sellers and buyers (efficiency) are found in this case. In this LOB market, only one unit is involved in each trade. There are no market orders. After each trade, the order books are reset and players may enter or exit the market. The game, therefore, describes the trade of one unit (one-shot auction). All sellers possess one unit of a good, all buyers desire to buy one unit. Each seller and each buyer has a private valuation of the good. At successive time instances, a player is randomly selected to make a bid (buyer) or an ask (seller). The bids and asks are stored in their respective books. When the highest bid and lowest ask cross, a transaction occurs. The players choose the value of their bid or ask before the auction starts and use this value when they are selected. The distribution of the valuations define supply and demand functions. Assuming that these are known, expected profits as functions of the strategies are derived, as well as expected transaction prices. I assume a continuum of traders, so that the problem of finding Bayesian Nash equilibria (BNE) can be studied using coupled differential equations. This method is very similar to the analysis of the k-double auction. In marked contrast with the k-double auction, which has an infinite number of BNE, this game has either one ore zero BNE. A slight variation of this model also gives an expression for the expected transaction prices in the ZI-C model of a double auction. Finally, using classic results from mechanism design theory, I compare this market with other one-shot auctions and find that for linear supply and demand, they all have the same efficiency.

On the Core of Auctions with Externalities: Stability and Fairness

Seungwon Eugene Jeong

University of Bristol, eugene.jeong@gmail.com

In auctions with externalities, it is well-known that the core can be empty, which is undesirable in terms of stability and "fairness." Nevertheless, some auction outcome should be chosen, and we show that the core is nonempty if payment refusals (often unrealistic in practice) are not allowed. In fact, we can categorize deviations into two: "pay more" and "refuse to pay." While "refuse to pay" may be unrealistic since normally bidders cannot refuse to pay, "pay more" is undesirable since there exist bidders who are willing to pay more than the final price, i.e., "justified envy." We show that there always exists an efficient outcome that might be unstable (by refusing to pay) but free of justified envy. The core and the Vickrey-Clarke-Groves (VCG) mechanism are closely related, e.g., any core payment of bidders is at least the VCG payment. While a loser's payment is necessary for core-selecting mechanisms, auctions with no loser's payment are widely used. Interestingly, when a loser's payment is not allowed, a core outcome no longer needs to be efficient, and no payment refusals ensure a nonempty core.

An Approximation Algorithm for Single-item Multi-unit Auctions: An Experimental Study

Satoshi Takahashi[1], Yoichi Izunaga[2], Naoki Watanabe[3]

[1]University of Electro-Communications, stakahashi@uec.ac.jp,[2]Institute of Behavioral Sciences, yizunaga@ibs.or.jp, [3]Keio University, naoki50@keio.jp

In single-item multi-unit auctions, the VCG algorithm induces allocative efficiency, but suffers from computational complexity. The item allocation problem is, in fact, known to be NP-hard, and thus it is necessary for us to apply some approximation algorithm to that problem. Takahashi and Shigeno (2011) proposed a greedy-based 2-approximation algorithm (GBA). This paper experimentally investigates a greedy based algorithm (GBA) for the approximation of VCG mechanism. The main results are as follows. (1) In our numerical experiment, a GBA computed faster and approximated better than a linear knapsack based algorithm (LKBA). (2) In our subject experiment, we could not observed significant difference in seller's revenue between the GBA and the VCG mechanism.

Session: Power indices - Room: Salle C - July 6th, 10:35-11:45

Indirect Control in Corporate Networks

Cesarino Bertini[1], Jacek Mercik[2], Izabella Stach[3]

[1]University of Bergamo, Department of Management, Economics and Quantitative Methods, cesarino.bertini@unibg.it
[2]WSB University in Wroclaw, jacek.mercik@wsb.wroclaw.pl [3]AGH University of Science and Technology, istach@zarz.agh.edu.pl

In our research, we compare several game-theoretic frameworks proposed by different authors in order to analyzing and measuring the amount of control hold by both direct and indirect shareholders in complex corporate networks. To determine who has the power within a stock corporate company can be a quite complex problem, especially when control is achieved through coalitions between shareholders. This problem arises especially in cases of indirect control of corporations, that is, in situations involving shareholders and companies with cross-shareholdings. The first to solve the problem of measuring power in the case of indirect share control were Gianfranco Gambarelli and Guillermo Owen in 1994. In the following years, numerous other models were introduced. In this work, we critically examine the models of: Gambarelli and Owen, Denti and Prati, Crama and Leruth, Karos and Peters, as well as Mercik and Lobos, taking into account some examples of both acyclic and cyclic corporate networks.

Power indices for games with abstention

Giulia Bernardi[1], Josep Freixas[2]

[1]Politecnico di Milano, giulia.bernardi@polimi.it, [2]Universitat politcnica de Catalunya, josep.freixas@upc.de

Simple games are usually used as a model for binary voting situations. However, in some voting systems players have a third intermediate and separate option: to abstain. These more general voting situations are modelled by (3,2) simple games or ternary voting games. In this work we study solution concepts for (3,2) simple games analogous to those defined for simple games, such as the Banzhaf or the Shapley-Shubik indices. We mainly focus on axioms and bargaining procedures associated to these indices.

Bloc Formation in Lebanese Politics

Frank Steffen[1], Mostapha Diss[2]

[1]University of Bayreuth, frank_b_steffen@yahoo.de, [2]UJM Staint-Etienne, diss@gate.cnrs.fr

The democratic system of the Lebanese Republic is particularly characterised by its confessional nature which ensures a representation of Christians and Muslims and its sectarian subgroups in its governance structure. Moreover, the political system of the Lebanon is not only characterised by a diversity of parties being represented in the Lebanese parliament and government, but also by the existence of two large blocs called 'March 8' and 'March 14' each containing members from different political parties and from both religious groups: Christians and Muslims. Currently, in the public discussion the further existence of both blocs is put in question. In our paper applying the Penrose-Banzhaf measure we analyse the stability conditions for both blocs in the Lebanese parliament and government, i.e., whether there exist conditions for the bloc members to affiliate themselves to one the two blocs.

The Procedural Egalitarian Solution

Bas Dietzenbacher[1], Peter Borm[2], Ruud Hendrickx[3]

Tilburg University [1]b.j.dietzenbacher@tilburguniversity.edu, [2]p.e.m.borm@tilburguniversity.edu, [3]r.l.p.hendrickx@tilburguniversity.edu

In this paper we introduce and analyze the procedural egalitarian solution for transferable utility games. This new concept is based on the result of a coalitional bargaining procedure in which egalitarian considerations play a central role. The procedural egalitarian solution is the first single-valued solution which coincides with the constrained egalitarian solution of Dutta and Ray (1989) on the class of convex games and which exists for any TU-game.

Owen value estimation based on sampling

Alejandro Saavedra-Nieves[1], M. Gloria Fiestras-Janeiro[2], Ignacio García-Jurado[3]

[1]University of Vigo, asaavedra@uvigo.es, [2]University of Vigo, fiestras@uvigo.es, [3]University of Coruña, igjurado@udc.es

The Owen value (Owen, 1977) is an important solution concept in cooperative game theory. It provides a modification of the Shapley value for TU-games with a priori unions. Vzquez-Brage et al. (1997), Fragnelli and Iandolino (2004) and Costa (2016) are some applications of the Owen value in cost allocation problems.

The calculation of the Shapley value and the Owen value are difficult tasks when the number of players is large. Castro et al. (2009) provide a sampling procedure to estimate the Shapley value that is useful in problems with large player sets. In this work, we propose a variation of Castro et al.'s procedure to estimate the Owen value in polynomial time. We analyze our procedure from a statistical perspective and evaluate it in several examples treated in the literature, with positive results.

Axiomatic and bargaining foundations of an allocation rule for ordered tree TU-games

Sylvain Béal[1], Sylvain Ferrières[2], Eric Rémila[3], Philippe Solal[4]

[1]CRESE, sylvain.beal@univ-fcomte.fr, [2]CRESE, sylvain.ferrieres@univ-fcomte.fr, [3]GATE LSE, eric.remila@univ-st-etienne.fr [4]GATE LSE, solal@univ-st-etienne.fr

We consider the class of ordered tree TU-games, i.e. a tree TU-game augmented by a linear order over the set of edges of the tree. An interpretation is that the edges are added one by one according to this order. An example is a set of bridges that are sequentially build to connect a set of islands.

Firstly, we introduce three axioms for allocation rules on this class. The first one is the classical axiom of Standardness (Hart and Mas-Colell, 1989, Ecta). Top-consistency is an invariance axiom with respect to a restricted ordered-tree TU-game defined over the set of agents contained in one of the two components existing before the addition of the top edge (the edge eventually added). The worth of this component is computed by assuming that the agents outside the component leave the game with their payoffs. The worth of each sub-coalition of the component is not affected. The tree and the order in this restricted situation are defined as the restriction of the original tree and order. Top-consistency says that all payoffs are invariant to this restriction. Contraction is also an invariance axiom. Consider an operation of edge contraction which removes an edge from the tree while simultaneously merging its two incident agents. The coalition function is altered accordingly: the worth a coalition not containing the merged agent is not affected; otherwise it is equal to the worth of the corresponding coalition containing the two merged agents. Contraction imposes that the payoffs of the agents incident to an edge which enters after the contracted edge are not affected by this contraction. The combination of these three axioms yields a unique efficient allocation rule, for which we provide a natural expression constructed recursively by following the order over the edges.

Secondly, we provide a bargaining foundation of this allocation rule by designing a bidding mechanism. First, the order of the edges is taken into account in the construction of the bidding mechanism. The latter starts with the top edge. Both agents incident to this edge play in a bidding stage and, in a second stage, bargain over the surplus of cooperation. At this end of the bargaining stage, both agents obtain an intermediary payoff. Then, the mechanism continues its route on both components that the top edge connects, and so on until there is no edge to consider. We show that this bidding mechanism implements the above-mentioned allocation rule in subgame perfect Nash equilibrium.

Plenary Session IV - Room: Amphi 8 - July 6th, 11:45-12:45

Some remarkable polyhedra in cooperative game theory

Michel Grabisch

School of Economics, Université Paris 1 Panthon-Sorbonne, michel.grabisch@univ-paris1.fr

The characteristic function of a TU-game is a set function defined on a finite universe vanishing at the empty set. Set functions appear in many domains of Operations Research and decision theory (capacities, pseudo-Boolean functions, polymatroids, etc.) and induce interesting polyhedra. Remarkable families of set functions form polyhedra, e.g., the polytope of capacities (monotone TU-games), the polytope of p-additive capacities, the cone of supermodular games, etc. Also, the core of a set function, defined as the set of additive set functions dominating that set function, is a polyhedron which is of fundamental importance in game theory, decision making and combinatorial optimization. This survey gives an overview of these notions and studies all these polyhedra. We put an emphasis on the (still unsolved) problem of finding the vertices of the core.

Parallel Sessions V - July 6th, 14:00-15:30

Session: Contagion and influence - Room: Amphi 5 - July 6th, 14:00-15:30

A model of anonymous influence with anti-conformist agents

Alexis Poindron[1], Michel Grabisch[2], Agnieszka Rusinowska[3]

[1],Université Paris I Panthéon Sorbonne - Centre d'économie de la Sorbonne, alexis.poindron@laposte.net, [2]Paris School of Economics, Université Paris I Panthéon-Sorbonne, Centre dEconomie de la Sorbonne, michel.grabisch@univ-paris1.fr, [3]Paris School of Economics - CNRS, Université Paris I Panthéon-Sorbonne, Centre d'Economie de la Sorbonne, agnieszka.rusinowska@univ-paris1.fr

We propose a stochastic model of anonymous influence with conformist and anti-conformist agents. Each agent with a yes' or no' initial opinion on a certain issue can change his opinion at each period due to social influence. In this model, influence is entirely anonymous: the opinion of an agent at each period only depends on the number of people having a certain opinion, but not on their identity.

Contrarily to opinion conformity which has been widely studied in various fields, settings, and using different approaches, anti-conformism has received little attention in the literature. Despite the fact that anti-conformism is very natural to explain human behavior and dynamic phenomena, and plays a crucial role in many social and economic situations (for example, the choice of a firm to go compatible or not with other firms can be seen as a problem of anti-conformism), there are only a few works related to this phenomenon.

In our model of influence, an individual is conformist/anti-conformist if his probability of saying yes' increases/decreases with the number of yes'- agents. In order to consider both conformists and anti-conformists in a society, we investigate a generalized aggregation mechanism. It uses a formulation of the ordered weighted averages in which every agent has a coefficient of conformism. We assume that both conformists and anti-conformists are present in a society, and we deliver a qualitative analysis of convergence in the model, i.e., find all terminal classes and conditions for their occurrence.

Our framework can explain various phenomena like stable and persistent shocks, large fluctuations, stylized facts in the industry of fashion, in particular its intrinsic dynamics, booms and burst in the frequency of surnames, etc.

Influence Structure, Epsilon-Approximation, and Nash Equilibrium

Shuige Liu

Waseda University, shuige_liu@aoni.waseda.jp

We introduce I(influence)-structure of a game which describes that for each player, who influence his payoff, and study its relation with players' behavior in social context. We first give a necessary and sufficient condition for the existence of pure-strategy Nash equilibrium (NE) in terms of I-structure. This result has some intriguing applications, while it is too stringent to be applied directly to social games. We then use it as an approximation. We introduce epsilon-I-structure which describes only salient influencers of each player and define epsilon-approximation of the original game. We show that each NE of an epsilon-approximation is an approximated NE of the original game, and connect epsilon-I-structure with those approximated NE's. Since epsilon-I-structure can be interpreted by players' bounded cognitive ability, those results relate behavior pattern in a social game and subjective individual worlds .

A zero-sum game for opinion dynamics in a social network with competing camps

Swapnil Dhamal[1], Walid Ben-Ameur[2], Tijani Chahed[3], Eitan Altman[4]

[1]Telecom SudParis, swapnil.dhamal@gmail.com, [2]Telecom SudParis, walid.benameur@telecom-sudparis.eu, [3]Telecom SudParis, tijani.chahed@telecom-sudparis.eu, [4]INRIA Sophia Antipolis - Mediterranee, eitan.altman@inria.fr

Opinion dynamics is a natural and well-known phenomenon in a system of cognitive agents, and is a well-studied topic across several disciplines. In this work, we study opinion dynamics in a social network. Specifically, we study the problem of optimally investing in nodes of a social network in a competitive setting, wherein two camps attempt to drive the opinion of the population towards them. This problem is highly relevant to applications such as elections, viral marketing, propagation of ideas or behaviors, etc. We propose a natural model of opinion dynamics, show its convergence, and hence formulate the problem as a zero-sum game, where the players are the two camps and their strategies are the amounts to be invested on each node of the social network. We study this game under a class of cost functions, and hence characterize the trade-off between efficiency and fairness with respect to the cost function. In particular, a very efficient cost function leads to a highly skewed investment strategy, while a very inefficient cost function leads to a strategy that invests on a node proportional to its value to the player.

We also study this game under common coupled constraints, where the constraints of one player are satisfied if and only if the constraints of the other player are satisfied for every strategy profile. We analytically derive the optimal strategies of both the camps, and deduce that the introduction of common coupled constraints results in maxmin value to be greater than or equal to the minmax value, an opposite inequality to the case of general functions. In fact, for

the specific game under study, this can be perceived as a direct consequence of the first mover advantage. We further study a variant of the above game where one of the camps aims to maximize the minimum investment required by the other camp to drive the opinion of the population in its favor. We also study the game when there is a possibility of campaigning in multiple phases, where we compare the utilities of the players when they are myopic as against when they are farsighted. We finally conduct a simulation study on synthetic and real-world social networks.

Modeling Contagion by Aggregation Functions

Agnieszka Rusinowska[1], Michel Grabisch[2]

[1]Paris School of Economics - CNRS, Centre d'Economie de la Sorbonne, agnieszka.rusinowska@univ-paris1.fr, [2]Univ. Paris I, michel.grabisch@univ-paris1.fr

The paper concerns the phenomenon of contagion, which occurs if an action can spread from a finite set of individuals to the whole population. An important contribution to the analysis of contagion is presented in Morris (2000), where the author focuses on the characterization of the contagion threshold. Closely related to contagion are the phenomena of influence, opinion and consensus formation. In the present paper, we apply a model of influence based on aggregation functions (Grabisch and Rusinowska, 2013) to the framework of contagion. In the model of influence, each agent modifies its opinion independently of the others by aggregating the current opinions of all agents. We show that the contagion model of Morris (2000) can be seen as a particular model of influence based on aggregation functions. We provide an analysis of convergence in the contagion model and find terminal classes and states. No regular terminal class exists, but the consensus and non trivial terminal states as well as cycles (finite trajectories) of nonempty sets incomparable w.r.t. set inclusion and infinite trajectories may exist in the contagion model.

Session: Bounded rationality - Room: Amphi 6 - July 6th, 14:00-15:30

Evolution with Heterogenous Heuristics in 3×3 Bimatrix Population Games

Marius Ochea

THEMA, Universit Cergy-Pontoise, ochea.marius@gmail.com

We investigate population-level evolutionary dynamics resulting from individual-level, adaptive play both under homogenous ("self-play") and heterogenous ("mixed play") heuristics scenarios. The set of heuristics includes imitation rule, perturbed best-reply and the unconditional regret-matching of Hart and Mas-Colell (2000). In a class of bi-matrix 3×3 normal form games (Sparrow and van Strien, 2009), for which Rock-Paper-Scissors is a special case, rich limit behavior unfolds as certain heuristics and/or game parameters are modulated.

Divide and Invest: Bargaining in a Dynamic Framework

Francesca Flamini

University of Glasgow, francesca.flamini@glasgow.ac.uk

Many negotiations (for instance, among political parties or partners in a business) are characterized by dynamic bargaining: current agreements affect future bargaining possibilities. We study such situations using bargaining games la Rubinstein (1982), with the novelty that players can decide how much to invest, as well as how to share the residual surplus for their own consumption. We show that under certain conditions, there is a unique (stationary) Markov Perfect Equilibrium characterized by immediate agreement. Moreover, standard results in bargaining theory can be overturned. For instance, despite the complexity of the bargaining game, there are equilibrium strategies as in an ultimatum, where the responder does not consume anything. Also, a more patient proposer may consumes less than his opponent. Additionally, a higher discount factor for one player may decrease the MPE investment rates for both players. However, in a frictionless world, bargaining is efficient.

Dynamic price dispersion with anecdotally reasoning consumers

Bartlomiej Wisnicki

Warsaw School of Economics, bart.wisnicki@gmail.com

The neoclassical economics, among others, significantly relies on the principle of complete information and perfect rationality of consumers. In particular, the agents are able to fully identify and assign quality to the offered product, which may involve sophisticated knowledge of its specification or they can draw conclusions that may involve the usage of advanced analytical tools. The empirical evidence however indicates that consumers make their purchasing decisions based on partial, anecdotal information that is often obtained from their own experience or heard from other parties. This quality accessing rule may be biased due to depending only on a sample of information instead of a whole market situation which can generate an advantage for profit-maximizing firms.

The research takes a game theoretic approach to model the situation of an industry in which consumers are accessing the information of a subjective product value based on a sample of observations rather than on a full distribution of outcomes. For a framework has been chosen a repeated Bertrand duopoly with heterogeneous consumers in terms of reservation prices. The consumers behavior is modelled by the Markov process of choosing a company which is approximated using differential equations. The result of a model is a quasi-symmetric Subgame Perfect Nash Equilibrium in mixed strategies, which can generate a price distribution that is in accord with related research concerning the price dispersion in the market. Therefore the research delivers another adequate concept of causality of price differences for a single product that is purely based on the bounded rationality of consumers.

K-level reasoning in beliefs

Marco Serena

Max Planck Institute for Tax Law and Public Finance, marco.serena85@gmail.com

In a Bayes-Nash Equilibrium of a private information game players engage in an iterative beliefs formation process of the form "I believe that you believe that I believe...", and so on, ad infinitum. However, in reality beliefs might extend only a few steps. We propose a non-equilibrium concept in which a player is Lk (i.e., her depth of reasoning is k) if she correctly forms up to k^{th}-order belief. Thus, an $L0$ does not process the reciprocal belief formation process of the game at all, in that she simplistically believes that her rival is of her same type. We propose a simple game to test our level-k concept, and we show its prediction in standard games. In some games there is a sharp discontinuity between the infinite unraveling of reciprocal beliefs formation process and the Bayes-Nash Equilibrium.

Session: Bankruptcy problems - Room: Amphi 8 - July 6th, 14:00-15:30

Relations among the central rules in bankruptcy problems: a strategic justification perspective

Min-Hung Tsay[1], Chun-Hsien Yeh[2]

[1]National Chung Cheng University, tsaymh@gmail.com, [2]Academia Sinica, chyeh@econ.sinica.edu.tw

We consider the so-called bankruptcy problem in which the liquidation value of a bankrupt firm has to be allocated among its creditors. On the Nash program for bankruptcy problems, traditionally bilateral negotiations are solved by exogenously given rules. For instance, Dagan et al. (1997). This design is not in line with the purpose of the Nash program and leaves some room for improvement. Without involving any exogenously given rule, we introduce three-stage extensive form games to strategically justify the central (bankruptcy) rules. The first two stages of the games are the same, and each final stage contains one unique non-cooperative bilateral bargaining procedure that captures the spirit of one central rule. Our results unveil novel connections among the central rules by focusing on features of different non-cooperative bilateral bargaining procedures, and enhance our understanding of the situations under which one rule may be more proper to use than other rules.

A Mood Value for Fair Resource Allocations

Francesca Fossati[1], Stefano Moretti[2], Stefano Secci[3]

[1]Lip6, francesca.fossati@lip6.fr, [2]PSL Dauphine University - CNRS UMR7243, stefano.moretti@dauphine.fr, [3]Lip6, stefano.secci@lip6.fr

In networking and computing, resource allocation is typically addressed using classical sharing protocols as, for instance, the proportional division rule, the max-min fair allocation, or other solutions inspired by cooperative game theory. Describing the resource allocation problem as a cooperative game, such classical resource allocation approaches, as well as associated notions of fairness, show important limitations. The resource allocation problem is historically solved as a single-decision maker problem in which users are possibly not aware of the other users' demands and of the total amount of available resource. It follows that the most natural and intuitive way to quantify the user satisfaction is through the proportion of the demand that is satisfied by an allocation. We identify in this individual satisfaction rate the key aspect of the challenge of defining a new notion of fairness. We generalize the concept of user satisfaction considering the set of admissible solutions for bankruptcy games and we adapt the Jain's fairness index, used to measure the fairness of the system, including the new user satisfaction rate. Accordingly to this new index, we propose an allocation rule, we call Mood Value, such that for each user it equalizes our novel game-theoretic definition of user satisfaction with respect to a distribution of the resource. Due to the link between the player satisfaction rate and the propensity to disrupt of players, the allocation can be interpreted as the one that equalizes the propensity to disrupt of players. Furthermore, being a linear combination of the minimum and maximum portion of resource that the players can receive, it coincides with the Tau-value solution for bankruptcy game. The proposed allocation has some good properties as low computational time, equal treatment of greedy claimants and guarantee of minimal right to each player. We test the mood value and the new fairness index through extensive simulations showing how they better support the fairness analysis.

Bankruptcy Games Where the Estate is a Player

Péter Csóka[1], P. Jean-Jacques Herings[2]

[1]Corvinus University Budapest and CERS Hungarian Academy of Scientes, peter.csoka@uni-corvinus.hu, [2]Maastricht University, p.herings@maastrichtuniversity.nl

A group of agents have claims on the estate of a bankrupt agent, not being able to honor all of the claims. There is a huge literature on how to divide the estate among the claimants. Bankruptcy games are standard cooperative games built from what claimants can get before going to court. In order to capture the bargaining power of the bankrupt firm, being able to decide whom to pay, we introduce the estate holder as an explicit player and define a new class of bankruptcy games. We analyze the Shapley value and the Nucleolus of the game. It turns out that the estate is justified to get a positive amount when the sum of the claims is strictly less than the estate.

New properties of rules to adjudicate conflicting claims

William Thomson

University of Rochester, williamthomson7@gmail.com

When a firm goes bankrupt how should its liquidation value be divided among its creditors? A "rule" associates with each situation of this type, called a "claims problem", a recommendation as to what to do. We propose new properties of division rules, and study their preservation under certain operators on the space of rules. These properties mainly have to do with changes in claims and changes in the population of claimants.

Session: Mechanism design - Room: Salle A - July 6th, 14:00-15:30

Knowing What Others Know: Information Choice In Mechanism Design

Nina Bobkova

University of Bonn, nbobkova@uni-bonn.de

Consider selling an oil field: before the start of the auction, bidders can perform an exploratory drilling or gather seismic data. Should bidders drill at the same location? If they analyze the same location, their results are strongly correlated. The further away bidders perform their analysis, the less correlated their results are. This also bears a strategic decision for the seller of the oil field: in what proximity of each other should potential bidders be allowed to drill, in order to increase revenue?

In a common value environment I analyze how bidders incentive to know what others know differ with the chosen mechanism (first price auction, second price auction, and full surplus extraction). When bidders have the choice which information channel to choose, full surplus extraction as in Cremer and McLean is generically impossible.

A standard approach in mechanism design is to take an exogenous joint distribution of private information as given. The literature on information acquisition has challenged that, by asking how the chosen mechanism affects the incentives to acquire information about the state of the world, and thus, influences the distribution of private information. The novelty of this paper is not on the choice of informativeness of private information, but on the correlation of information between bidders. A more informative signal in a common value environment has two implications: a better estimate of the value of the object, and a better estimate of the private information realization of the opponent. I untangle those two effects by isolating the latter: given the same informativeness, what correlation do bidders prefer between their private information? I keep the marginal distribution of private information fixed, while endogenizing the degree of correlation.

Implementation in undominated strategies by bounded mechanisms: The Pareto Correspondence

Saptarshi Mukherjee[1], Nozomu Muto[2], Eve Ramaekers[3], Arunava Sen[4]

[1] Indian Institute of Technology, Delhi, saptarshi.isi@gmail.com, [2] Yokohama National University, nozomu.muto@gmail.com, [3]Universite Catholique de Louvain, CORE, eve.ramaekers@uclouvain.be [4]Indian Statistical Institute, asen@isid.ac.in

We consider implementation in weakly undominated strategies by bounded mechanisms. In the literature, no good sufficient condition of implementability is known, and most results are negative. In this paper, we show that the Pareto correspondence can be implemented by a bounded mechanism in the exact sense. This addresses an issue raised by Borgers (1991, Social Choice and Welfare).

Lemons versus Collusion

Colin von Negenborn[1], Martin Pollrich[2]

[1]Humboldt University Berlin, von.negenborn@hu-berlin.de, [2]University of Bonn, martin.pollrich@uni-bonn.de

This paper analyzes a mechanism design problem in which agents are symmetrically informed and can communicate with each other, thus can collude. We derive optimal one-stage mechanisms that only ask the agents to send messages to the mechanism. These mechanism are strictly dominated by two-stage mechanisms that first send private signals to the agents and then ask the agents to send a message back to the mechanism. In one-stage mechanisms, the agents' possibility to collude under symmetric information severely limits the principal's ability to extract information rents. In two-stage mechanisms the private signals create asymmetric information. With appropriately chosen transfers the agents face a "lemons problem" la Akerlof (1970), making it impossible to reach a mutually beneficial collusive agreement. Our results challenge existing results on optimal organizational responses to the threat of collusion, which all restrict attention to one-stage mechanisms.

On non-monetary incentives for the provision of public goods

Michela Chessa[1], Jens Grossklags[2], Patrick Loiseau[3]

[1]Université Côte d'Azur, GREDEG, CNRS, Michela.CHESSA@unice.fr, [2]Technical University of Munich, jens.grossklags@in.tum.de, [3]EURECOM, patrick.loiseau@eurecom.fr

In standard microeconomics literature, public goods are defined as having two distinct aspects: they are perfectly non-rival in consumption and are non-excludable. In many public good settings, provision levels rely on the voluntary contributions of the individuals. As a consequence of the non-excludability aspect, the resulting equilibrium prediction may suffer of (partial) free-riding problems, where some individuals decide to contribute (almost) zero, and enjoy the benefits of the good by exploiting the contribution of the others. This behavior yields inefficient outcomes. As a solution, spontaneous coordination may arise, when the individuals decide to contribute more for altruism or fairness. However, as observed by Ledyard (1995) "one cannot rely on these approaches as a permanent organizing feature without expecting an eventual decline to self-interested behavior". When the aim is of reaching an efficient and stable outcome, some coercion or some monetary incentives are needed. In this paper, we propose a model in which we provide some non-monetary incentives for a voluntary higher level of contribution in a public good setting. Given the initial game, we implement a variation based on a restriction of the individuals' strategy space. We impose a minimum contribution level and we give individuals the choice between respecting it, if they decide to contribute, or free-riding and contributing zero. Restricting the strategy set can stimulate the individuals toward higher efforts; letting them the possibility of choosing a zero level, we ensure that such efforts remain voluntary. We investigate how to tune such a level in order to optimize the total contribution and to reach a stable outcome where none of the individuals has incentives to free-ride. Exploiting the potential nature of our game, we show that there exists a minimum contribution level s.t., regardless of the multitude of NE in which some of the individuals free-ride, there exists a unique equilibrium which is a potential maximizer and in which all the individuals contribute to the public good. Potential maximizer NE, according to Monderer and Shapley (1996), are the unique ones which are expected to accurately predict the results obtained through an experimental implementation of the model, and as such they represent a refinement of the equilibrium set. As on field motivation, we provide an application of our model to data analytics projects with privacy implications, a domain where monetary compensation has so-far received little traction in the market for privacy and has met little acceptance in consumer surveys.

Session: TU-games - Room: Salle C - July 6th, 14:00-15:30

Myerson values and marginality

Mónica Del Pozo[1], Conrado Manuel[2], Eduardo Ortega[3]

[1]Carlos III University of Madrid, mopozoj@eco.uc3m.es, [2]Complutense University of Madrid, conrado@estad.ucm.es
[3]Complutense University of Madrid, eduardo.ortega.castello@estad.ucm.es

In game theory, marginality is a principle which states that if the marginal contributions of a player to different coalitions are greater or equal in a game (N, v) than in a game (N, w) then, a fair rule must assign at least the same payoff in (N, v) than in (N, w). It is known that the Myerson value does not satisfy marginality. In this communication we consider different types of marginality and we explore the extent to which they serve us to characterize the Whithin Groups Myerson value, the Between Groups Myerson value and the Myerson value itself. The Within Groups Myerson value can be characterized using classical marginality. The Between Groups Myerson value can be characterized using L-marginality. This property states that if the marginal contributions of the player's links to all coalitions in the communication situation (N, v, γ) are greater or equal than in (N, w, γ) then the value of such a player must be at least as greater in (N, v, γ) than in (N, w, γ). Finally, the Myerson value can be characterized using LP-marginality. LP-marginality states that if the marginal contributions of a player with his links to all coalitions are greater or equal in (N, v, γ) than in (N, w, γ) his payoff in (N, w, γ) must be lesser or equal than in (N, v, γ).

Sharing the revenues from broadcasting sport events

Gustavo Bergantiños[1], Juan D. Moreno-Ternero[2]

[1] ECOSOT, Universidade de Vigo, gbergant@uvigo.es, [2] Department of Economics, Universidad Pablo de Olavide, and CORE, Universit catholique de Louvain, jdmoreno@upo.es

We study the problem of sharing the revenue from broadcasting sport events, among participating players. We provide direct, axiomatic and game-theoretical foundations for two focal (and somewhat polar) rules: the Shapley rule and the OLS rule. The former allocates the revenues from each game equally among the participating players. The latter assigns to each player the revenue from the differential audience with respect to the average audience per game that the rest of the players yield (in the remaining games they play).

TU games with players having different cooperation levels

Conrado M. Manuel[1], Daniel Martin[2], Mónica Del Pozo[3]

[1]Complutense University of Madrid, conrado@estad.ucm.es, [2]Complutense University of Madrid, daniel.martin.w@gmail.com, [3]Carlos III University of Madrid, mopozoj@eco.uc3m.es

In this communication we extend the classical concept of TU games to take into account that players possibly have different cooperation levels or different bargaining abilities. Then, a weight in [0,1] is assigned to each player. Greater weight indicates higher level of cooperation. Using ideas "a la Myerson" the original value of each coalition is modified to take into account the bargaining abilities of players in that coalition. In this way, the new game coincides with the original one if all players have weights equal to 1 and becomes inessential if they all have null weight. Then, we propose as point solution for games with players having different cooperation levels the Shapley value of the modified game. This allocation rule satisfies several interesting properties. In particular, increasing the weight of a player his value does not decrease. Moreover, different characterizations for this rule can be obtained. They are parallel to those existing in the literature for the Shapley value.

Session: Taxes and prices - Room: Salle D - July 6th, 14:00-15:30

Asymmetric Dynamic Price Mechanism for Symmetric Buyers

Shraman Banerjee[1], Bo Chen[2]

[1]O.P. Jindal Global University, shraman.banerjee14@gmail.com [2]Southern Methodist University

The paper deals with dynamic posted price mechanisms for a seller. We consider a monopolist who wants to sell a good to a fixed number of buyers with private valuations. There is a deadline within which the good needs to be sold as the good becomes obsolete after the deadline. The buyers are ex-ante homogeneous in the sense that these buyers draw their values from i.i.d. distributions. The seller can set prices in each of the finite instants of time which the buyers can either accept and end the game, or can reject in which case the game moves on to the next period for possible price revisions. The seller cannot ex-ante pre-commit to any fixed price paths, so in our model each price has to be sequentially rational and the equilibrium that we focus on is the perfect Bayesian equilibrium. The allocation rule of the seller is somewhat different from the standard literature. The standard allocation rule in such mechanisms entails a basic norm of equal treatment of equals and unequal treatment of unequals. For example the optimal allocation rule for strategic buyers in Horner and Samuelson (2011) is a symmetric mechanism which involves posting a single price in each period and allocate the good if any one buyer accepts in that period. If none of the buyers accept in a particular period the game moves to the next period for price revisions. If more than one buyer accept the good in a particular period, the seller randomly allocates the good to the accepting buyers. It is in this tie-breaking allocation rule that our mechanism differs. We construct an asymmetric mechanism and show that if the seller treats the buyers differently in the sense that instead of randomly allocating the good if he allocates the good arbitrarily to any one of the accepting buyers in the case of a tie, our asymmetric mechanism increases the revenue of the seller than the symmetric mechanism even though the sellers are ex-ante homogeneous. Our research shows that under symmetric setting, the random tie-breaking allocation rule that we so frequently use in the literature is not as innocuous as it might appear to be.

Axiomatization of Social Dilemma Games and their Egalitarian Solutions in Populations

Tadeusz Platkowski

University of Warsaw, tplatk@mimuw.edu.pl

We propose an axiomatization of multiperson social dilemmas. For the symmetric two-person social dilemma games the axiomatization leads to three types of the social dilemmas only: the Prisoner's Dilemma (PD) game, the Chicken (Snowdrift) game and the Stag Hunt game. The popular multiperson games, such as for example the N-person PD, the Public Goods, the Tragedy of the Commons, the Volunteer's Dilemma, the Assurance game, are included in the proposed frame. For the multiperson social dilemma games played in large populations for which the evolution is governed by the replicator equations we show that the egalitarian distribution of the social welfare generated in such games fosters the long run cooperation.

Competition with Constrained Consumer Perception

Stefanie Schmitt

University of Bamberg, stefanie.schmitt@uni-bamberg.de

This paper proposes a model of firm competition with constrained consumer perception. The purpose of the model is to investigate how firms set product characteristics in the presence of consumers who are unable to perceive small differences between products. I model this blindness to product differences as a perception threshold. Only if the differences exceed the threshold, do consumers consider the products as distinct and buy the product that maximizes utility. Otherwise, they randomize. Due to, e.g., expertise, consumers differ in their ability to discriminate between products. This means that consumers have different perception thresholds: Some consumers are able to perceive differences that are indiscernible to others. I assume that perception thresholds are uniformly distributed across consumers. The model highlights how market equilibria depend on the perception of the consumers. The results deviate from the results obtained under perfect perception at the expense of the consumers. For example, under price competition in a duopoly with an absolute perception threshold, prices are higher than under Bertrand competition in equilibrium. Consequently, profits are higher and consumer surplus is lower. In addition, I demonstrate that results depend on the choice of the perception threshold (relative or absolute).

A Differential Game in a Duopoly with Instantaneous Incentives

Michele Bisceglia[1], Luca Grilli[2]

[1]Università degli Studi di Bergamo, bisceglia_michele@yahoo.it, [2]Università di Foggia, luca.grilli@unifg.it

In this paper we study a differential game in which two competing firms exploit a public renewable resource that is relevant from a landscape point of view, e.g. a state forest. We consider a policy maker which licenses the use of the natural resource to the two firms up to a fixed time and provides them, continuously during all the time, with a monetary incentive which is proportional to the existing resource stock, in order to ensure that it remains substantial during the whole extraction period. We compute an Open Loop Nash Equilibrium of the differential game, showing that it coincides with a Linear Feedback Nash Equilibrium. Finally we compute the value of the incentive that leads to the maximization of a social welfare function that takes into account, together with the consumers' surplus and the firms' profits, also the amount of the resource stock in every time instant and the public authority's budget.

Parallel Sessions VI - July 6th, 15:50-17:00

Session: TU-games - Room: Amphi 5 - July 6th, 15:50-17:00

Binomial Semivalues, the Inverse Problem and the Gas Routing

Irinel Dragan

University of Texas, Arlington, dragan@uta.edu

The Inverse Problem for Binomial Semivalues has been discussed in an earlier paper (see [1]). It is well known that the set of cooperative TU games with a fixed set of players, and the operations of addition and scalar multiplication, forms a vector space. In this space we introduced a special basis, we called the potential basis, which allowed us to obtain a formula that is giving the set of all games with a fixed Semivalue, associated to a special weight vector. This is the solution of what was called the Inverse Problem relative to the Semivalues. The Binomial Semivalues form a class of Semivalues that was introduced by M.A.Puente (see [2]), who defined the class by means of a weight vector depending on one parameter, satisfying a proportionality condition. The Inverse Problem allowed us to determine a new class of games in the Inverse Set, such that its Binomial Semivalue is coalitional rational, that is belongs to the Core of the Power Game. These facts are based upon the results included in two more recent papers, in which we introduced the concepts of Inverse Problem relative to efficient and non efficient values, like the Shapley and the Banzhaf values, respectively (see [3], [4]). The Gas Routing Problem is an allocation problem for a Flow game with total cooperation, that was discussed in another paper (see [5]). In this paper, we explain all the introductory facts shown above and give a family of solutions for the Inverse Problem relative to the Binomial Semivalues, for all values of a unique parameter in the interval [0,1]. All computations have been done for the Flow game associated to the Gas Routing Problem, and for the value 1 of the parameter we retrieve the results from [5] for the Banzhaf Value.

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Discrete cost sharing and monotonicity

M. Josune Albizuri[1], J. Manuel Zarzuelo[1]

[1]The University of the Basque Country, mj.albizuri@ehu.eus, [2]The University of the Basque Country, josemanuel.zarzuelo@ehu.eus

The discrete Aumann-Shapley cost-sharing method is a classical method for solving cost-sharing problems in which agents consume a quantity of possibly different goods and the consumption of each agent is represented by a non- negative integer. Unlike the Aumann-Shapley cost-sharing method por perfect divisible goods, the discrete method has not been given much attention in or- der to be characterized until the papers of Calvo and Santos (2000), Sprumont (2005) and Albizuri et al. (2015). In the last one, authors give an axiomatic characterization employing a monotonicity axiom and a merging axiom intro- duced by Sprumont (2005). In that monotonicity axiom marginal contributions of a player in different problems are compared. In this work we will consider a monotonicity axiom with marginal contributions of different agents in the same problem. The discrete Aumann- shapley will be axiomatically characterized employing this new axiom. And the gap with respect to the continous case would be Ölled. On the other hand, we define a new cost-sharing method, the least square prenucleolus for discrete problems, by means of the least square prenucleolus for transferable utility games (Ruiz et al., 1996). This new method will be characterized by several axioms, among them an average marginal monotonicity axiom.

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Characterization of TU games with stable cores by nested balancedness

Michel Grabisch[1], Peter Sudhölter[2]

[1]Univ. Paris I, michel.grabisch@univ-paris1.fr, [2]University of Southern Denmark, psu@sam.sdu.dk

We show that a balanced TU game has core that is a stable set if and only if the game satisfies a certain nested balancedness condition. Hence, it can be checked within finitely many steps if a TU game has a stable core.

Session: Congestion - Room: Amphi 6 - July 6th, 15:50-17:00

Efficiency of Game-Theoretic Energy Consumption in the Smart Grid

Paulin Jacquot[1], Olivier Beaude[2], Stéphane Gaubert[3], Nadia Oudjane[4]

[1]EDF R&D - Inria, CMAP École Polytechnique, jacquot.paulin@gmail.com, [2]EDF R&D, olivier.beaude@edf.fr, [3]Inria - CMAP École Polytechnique, stephane.gaubert@inria.fr, [4]EDF R&D, nadia.oudjane@edf.fr

Consumers in the smart grid interact as players in a congestion game. Here, the congested resources are the different time periods on which consumers can split their energy demand, according to personal constraints as power bounds and total amount of energy needed. The cost of energy at each time period increases with the global demand at this time, as production costs and energy losses become larger. We begin our work by studying the standard energy consumption game introduced in Mohsenian-Rad et al. (2010) in which players share the total cost of the system proportionally to their daily fixed demand of energy. Although this model enables to reach the social optimum because all players minimize the same objective up to a con- stant factor, we show that it might not reward consumers loading on off-peak hours. This motivates us to study an alternative consumption game, already formulated in Baharlouei and Hashemi (2014), where players share the cost of each time period pro- portionally to their load on this period. The proposed game is a constrained atomic splittable congestion game. Without the constraints, it would belong to type B class of games defined by Orda et al. (1993). We start by observing that this consumption game is indeed fairer than the previous one according to a criteria derived from the Shapley value. After specifying a class of cost functions that ensures existence and uniqueness of a Nash Equilibrium, we focus on the efficiency of the equilibrium. More precisely, we prove that the system is efficient by computing an upper bound on the price of anarchy that depends on the power bounds and cost functions parameters, and can be arbitrarily close to one. Our analysis follows Roughgarden and Schoppmann (2015) and its concept of local smoothness, but we compute a smaller upper bound by exploiting the parameters of our problem. We illustrate this theoretical work by simulations, showing that, in practice, the price of anarchy is even lower than the computed bound.

A Finite Bottleneck Game with Homogeneous Commuters

Ryo Kawasaki[1], Hideo Konishi[2], Junki Yukawa[3]

[1]Department of Industrial Engineering and Economics, School of Engineering, Tokyo Institute of Technology, kawasaki.r.aa@m.titech.ac.jp [2]Department of Economics, Boston College, hideo.konishi@bc.edu, [3]Department of Social Engineering, Graduate School of Decision Science and Technology, Tokyo Institute of Technology, yukawa.j.aa@m.titech.ac.jp

This paper investigates the finite bottleneck game, in which we assume a finite set of commuters and a finite set of departing time slots. We show that the set of Nash equilibria is equivalent to the set of strong Nash equilibria when we assume homogeneous commuters in their preferences. We also show that pure-strategy Nash equilibria do not exist in general in this setting. Moreover, when we allow commuters to differ in their preferences, we show that Nash equilibria may not exist, and the equivalence result no longer follows.

A Game formulation of the Energy Load Control problem solved via Particle Swarm Optimization

Panagiotis Kontogiorgos[1], George P. Papavassilopoulos[2]

[1]National Technical University of Athens & EPA Attikis, panko09@hotmail.com, [2] National Technical University of Athens, yorgos@netmode.ece.ntua.gr

Deregulation of energy markets has increased the complexity of the interactions among stakeholders. To study these interactions, the resulting complex systems can be modeled using game theory notions. The game formulated and addressed in this study is a load control program, where a player of the market that acts as the Leader, offers subsidies to the consumers, who are the Followers, in order to motivate them to reduce their energy demands. Such use of power supply interruption as a tool for reducing consumers' demands voluntarily, is known as Voluntary Load Curtailment (VLC). These types of programs are useful in high price periods or in system emergencies and can be treated as Stackelberg (Leader-Follower) games. In the case of one Leader and many Followers, the Followers play Nash among themselves. These problems belong to the category of Mathematical Programs with Equilibrium Constraints (MPEC) since the Leader seeks to optimize his objective function taking into account the Followers' reactions to his decisions, namely the Nash game conditions among the Followers, that act as constraints to the Leader's problem. Solving for Stackelberg equilibria is generally difficult due to the presence of nonconvexities, thus favoring the use of metaheuristic algorithms. An extension of Particle Swarm Optimization (PSO) has been developed, based on a UPSO variant, in order to solve the formulated games. The proposed algorithm takes into account each players constraints and all the interdependent optimization problems so as to converge to the respective Nash / Stackelberg equilibria. The algorithms efficiency and effectiveness are then tested by comparing the resulting solutions with those obtained from the usual mathematical programming techniques. The results suggest that the developed algorithm is efficient and

effective, especially as far as Nash equilibria are concerned. Using the proposed methodologies, interactions among all players in the market are studied by solving various examples of load control programs and finding the respective Nash / Stackelberg equilibria. This study takes into account various subsidy schemes and a large number of Followers with different characteristics, thus covering a broad range of load control programs. The results suggest that if adequate subsidy is offered, there is profit both for the Leader and the Followers and at the same time the goal of reducing the total energy demand is achieved.

Session: Power indices - Room: Amphi 8 - July 6th, 15:50-17:00

Orders of criticality in voting games

Marco Dall'Aglio[1], Vito Fragnelli[2], Stefano Moretti[3]

[1]LUISS University, mdallaglio@luiss.it, [2] University of Eastern Piedmont, Alessandria, vito.fragnelli@mfn.unipmn.it, [3]PSL Université Paris-Dauphine - CNRS, stefano.moretti@dauphine.fr

The authors focus on the problem of investigating the blackmail power of players in simple games, which is the possibility of players of threatening coalitions to cause them loss using arguments that are (apparently) unjustified. To this purpose, the classical notion of the criticality of players has been extended, in order to characterize situations where players may gain more power over the members of a coalition thanks to collusion with other players.

Ranking objects given preferences on the subsets of the objects

Roberto Lucchetti

Politecnico di Milano, roberto.lucchetti@polimi.it

Given a finite set N, and considering the set of the complete preorders on the subsets of N, find a suitable ranking function associating a ranking of the objects to each ranking on the subsets of the same objects. As a typical real life example of such a situation we could consider the case in which in a company the CEO needs to rank the employees having in mind a ranking of the performances of all possible teams among them. A classical approach in this setting is to list few reasonable properties and look for functions fulfilling this set of properties. Here we introduce some transparent properties, and we analyze a pair of natural ranking functions.

Effectivity and Power

Dominik Karos[1], Hans Peters[2]

Maastricht University [1]d.karos@maastrichtuniversity.nl, [2]h.peters@maastrichtuniversity.nl

We axiomatically develop a class of power indices for effectivity functions, both for the case where the set of alternatives is finite and where it is infinite. Such power indices make it possible to take the issues under consideration into account, in contrast to power indices defined just for simple games. As an example, we consider the US legislative system. We also show that our approach can be used to develop power indices for spatial political games.

Session: Operations Research games - Room: Salle A - July 6th, 15:50-17:00

Stability and Increasing Returns to Scale

Harborne Stuart

Columbia Business School, hws7@gsb.columbia.edu

In a many-to-one matching game between buyers and firms, it is well known that with increasing returns to scale, the core can be empty. Using a model in which buyers have unitary, but otherwise arbitrary, demand, we identify necessary and sufficient conditions for a non-empty core. We show that non-emptiness typically requires that a firm with increasing returns to scale either be a monopolist or have a credible capacity limitation. We also show how the brittleness of these results are related to the difficulties in identifying necessary and sufficient conditions for non-emptiness in completely general many-to-one matching games.

Monotonic allocation schemes in assignment games

Jesús Getán[1], Jesús Montes[2], Carlos Rafels[3]

[1]Universitat de Barcelona, jesus_getan@ub.edu, [2]Universitat Abat Oliba CEU, montes3@uao.es, [3]University of Barcelona, crafels@ub.edu

The notion of Population Monotonic Path Scheme (in short, PMPS) was introduced by Cruijssen et al. (2005), and applied in logistic and transportation problems. We characterize the class of TU-games having a PMPS and we find a class of cooperative games, which contains the assignment games, having a PMPS such that the payoff vector for each coalition in the path is in the core of the respective subgame.

Inspired by the concepts of Population Monotonic Allocation Scheme (in short, PMAS) of Sprumont (1990) and bi-Monotonic Allocation Scheme (in short, bi-MAS) of Voorneveld et al. (2002), for a cooperative game we introduce the concepts of PMAS and bi-MAS w.r.t. a coalition of players, and for every assignment game we show the existence of PMAS and bi-MAS w.r.t. the set of buyers and the set of sellers.

Production Facility Pooling Games under an Optimal Policy

Loe Schlicher[1], Marco Slikker[2], Willem van Jaarsveld[3], Geert-Jan van Houtum[4]

Technische Universiteit Eindhoven [1]l.p.j.schlicher@tue.nl, [2]M.Slikker@tue.nl, [3]W.L.v.Jaarsveld@tue.nl, [4]G.J.v.Houtum@tue.nl

We study a situation with several single-server, produce-to-stock production facilities that face different penalty costs for their lost sales. Total costs can be reduced by pooling inventories, customer streams, and production rates into a joint system where new products are produced by a single server with as production rate the sum of the individual production rates. In this new single-server, lost sales inventory model with multiple demand classes and with the objective to minimize long-run average (penalty) costs per time unit, the optimal policy is a critical level policy. We examine the allocation of the collective cost savings for such a pooled situation by studying an associated cooperative game. For this game, we illustrate that the decision problem per coalition can be modeled as a Markov Decision Process (MDP). In particular, this MDP modeling technique is used to prove non-emptiness of the core.

Session: Voting - Room: Salle C - July 6th, 15:50-17:00

The Good, The Bad, and The Not So Ugly: Unanimity Voting with Ambiguous Information

Addison Pan[1] and Simona Fabrizi[2]

University of Auckland [1]addisonpang@gmail.com, [2]s.fabrizi@auckland.ac.nz

The seeking of unanimous consensus in collective decision-making situations is notoriously bad due to the tendency for individuals within a group to vote strategically against their private information, especially as the size of group gets larger. In jury trials, this leads to the paradox that the more demanding the hurdle for conviction is, the more likely it is that a jury will convict an innocent defendant. We challenge these established results, by exploring voting behaviour when collective decision-making occurs based on information, the reliability of which is ambiguous. With ambiguity-averse voters, who are MaxMin Expected Utility maximizers, we demonstrate that unanimity voting is compatible with instances of informative voting, outperforming other voting rules, such as majority voting.

Manipulation by vote pairing of single-winner large elections

Hayrullah Dindar[1], Jean Lainé[2]

[1]Ístanbul Bilgi University, hayrullah.dindar@bilgi.edu.tr, [2]CNAM-LIRSA Paris, and Istanbul Bilgi University, Turkey, jean.laine@cnam.fr

We investigate vote-swapping in single-winner indirect elections, where groups of voters manipulate by forming pairs where votes are traded. We model a two-stage election procedure where in the first stage voters are distributed into (almost) equally sized districts (with fixed boundaries), each being assigned one delegate. Delegates' preferences result from aggregating voters' preferences district-wise by means of some aggregation rule. The final outcome is the alternative obtained at the second stage by applying some social choice function to delegate profiles. Combining an aggregation rule and a social choice function defines a constitution. Voters' preferences are linear orders over alternatives. A constitution is swapping-proof if no group of voters can get better of by organizing pairwise trade of votes. We show that in elections involving a large enough number of districts, each with a large enough size, no reasonable constitution is swapping-proof. Our results generalize those in Bervoets and Merlin (2016), where attention is paid to tops-only procedures.

Public Good Indices for Games with Several Levels of Approval

Sébastien Courtin[1], Bertrand Tchantcho[2]

[1]Univ Normandie, Unicaen, CREM, sebastien.courtin@unicaen.fr [2]ENS Yaounde, btchantcho@yahoo.fr

This paper analyses the relationship between the production of an output and the likelihood of an individual to be influent for the production of this output. This cardinal measure can be seen as the degree to which an individual is useful in this production. Such a problem can be modeled with simple games. Indeed, in simple game, it is standard to study the influence of an individual, by using power indices. The most famous are the Shapley-Shubik index, the Banzhaf index. There is a factor which is common to all these power index: the value of the coalition once formed can be interpreted as a privately good which can therefore be split among the coalition members even though it was created collectively. In Holler (1982) it has been argued that those measures are inadequate since the value of the coalition once formed could not be seen as a private good but as a public goods. He introduced the public good index (PGI) which assigns influence proportional to the number of minimal winning coalition an individual belongs to. Alonzo et al (2010,2011) introduced two extensions of the (PGI) index when considering a bigger set of coalition or a smaller set. The first one is the Null Player Free index in which they consider only winning coalition in which there is no null player. The second one is the Shift index based on winning coalition that contained no surplus individual in it, and no individual in it can be replaced by a weaker individual because, in this case, it could be no longer maintain the status of winning coalition. Our main contribution in this paper is to extend and fully characterize the PGI index and its two extensions when (j,2) games are considered. (j,2) games have been introduced by Freixas and Zwicker (2003). In such games, individual choose from among j levels of approval her degree of contribution to the production of the output, these individual choices partitioning all the society into j coalitions, and each possible partition facing two levels of collective approval.

Absorbing sets in hedonic games

Elena Molis[1], Elena Iñarra[2]
[1]Universidad de Granada, emolis@ugr.es, [2]Universidad del Pas Vasco, elena.inarra@ehu.eus

In this paper we consider hedonic coalition formation problems introduced by Dreze and Greenberg (1980). In these problems, there are a finite set of players who rank the coalitions they belong to, which means that the value of a coalition to a member depends solely on the identity of the other members of the coalition. This simple model is a generalization of the well-known two-sided and one-sided matching models, Gale and Shapley (1962).

Given strict preferences, if a coalition structure is stable, there is no coalition of players that strictly prefer to form this coalition to those in which they are currently participating.It is well known that the core of a hedonic coalition formation problem may be empty. Most of the paper on these problems analyze restrictions of preference profiles for the existence of stable coalition structures.

In the domain of games with a stable coalitional structure, one important issue, that as far as we know has not been analyzed yet, is the existence of random paths to stability. Specifically, the question is whether in absence of a centralized mechanism, there exists a finite sequence of successive myopic blocking coalitions leading to a stable coalition structure. The approach followed in this paper to study such problem is to associate each hedonic game with an hedonic abstract system. Such a system is formed by the set of coalition structures and a binary relation defined over this set. This binary relation is consistent with the standard blocking definition.

On the full domain of strict preferences, if stable partitions exist, There may not be a random path from any of them from a coalition structure. Hence, we study the conditions in preferences under which stable coalition structures are reached. We find a condition that ensures the existence of a path from any possible coalition structure to a stable partition.

Strong exchange stability in hedonic games

Seckin Ozbilen
Istanbul Bilgi University, seckin.ozbilen@bilgi.edu.tr

In this paper, we study hedonic coalition formation games. In a hedonic game, there exists finite number of individuals. Every individual only cares about which individuals are in her coalition, but does not care how other individuals are grouped. In another words, people are self interested in a hedonic game. Marriage problems and roommate are examples of hedonic games in which coalition size could be at most two. A solution of a hedonic game is a partitioning of individuals into disjoint coalitions whose union is equal to the set of individuals. A solution is called as coalition structure or just as partition. The quality of a solution (coalition structure) is analyzed using stability concepts.

We analyze a new stability concept called strong exchange stability which is stronger than both core stability and exchange stability. Firstly, we show that strongly exchange stable coalition structure exists when we impose preference restrictions on the whole preference profile or on individuals' preferences. Weak top coalition property is a domain restriction which is imposed on the whole preference profile and it is sufficient for the existence of a strongly exchange stable coalition structure. Top responsiveness is another domain restriction condition. It is imposed on individuals preferences. When every individuals preference profile satisfies top responsiveness, top covering algorithm gives a strongly exchange stable coalition structure. Secondly, we analyze strong exchange stability under different membership property rights. We show that under free exit approved entry membership property right, a strongly exchange stable coalition structure is core stable, and vice versa. Lastly, we analyze strong exchange stability when we equip every individual with foresight. We try to associate farsightedness and exchange stability concepts.

The Myopic Stable Set for Social Environments

Thomas Demuynck[1], Jean Jacques Herings[2], Riccardo Saulle[3], Christian Seel[4]
[1]Ecares, thomas.demuynck@ulb.ac.be, [2]Maastricht University, p.herings@maastrichtuniversity.nl, [3]Maastricht University, r.saulle@maastrichtuniversity.nl, [4]Maastricht University, c.seel@maastrichtuniversity.nl

We introduce a new solution concept for models of coalition formation, called the myopic stable set. The myopic stable set is defined for a very general class of social environments and allows for an infinite state space. We show that the myopic stable set exists and is non-empty. Under minor continuity conditions, we also demonstrate uniqueness. Furthermore, the myopic stable set is a superset of the core and of the set of pure strategy Nash equilibria in noncooperative games. Additionally, the myopic stable set generalizes and unifies various results from more specific environments. In particular, the myopic stable set coincides with the coalition structure core in coalition function form games if the coalition structure core is nonempty; with the set of stable matchings in the standard one-to-one matching model; with the set of pairwise stable networks and closed cycles in models of network formation; and with the set of pure strategy Nash equilibria in nite supermodular games, finite potential games, and aggregative games. We illustrate the versatility of our concept by characterizing the myopic stable set in a model of Bertrand competition with asymmetric costs, for which the literature so far has not been able to fully characterize the set of all (mixed) Nash equilibria.

Day 3 - July 7th

Parallel Sessions VII - July 7th, 9:20-10:50

Session: TU-games - Room: Amphi 5 - July 7th, 9:30-10:40

On Totally Balanced, Submodular and PMAS-admissible Weighted Minimum Colouring Games

Herbert Hamers[1], Nayat Horozoglu[2], Henk Norde[3], Trine Tornøe Platz[4]

[1]Tilburg University, [2]Willis Towers Watson, [3]Tilburg University, [4]University of Southern Denmark, tto@sam.sdu.dk

In this paper, we introduce the weighted minimum colouring (WMC) games, which is a class of cooperative combinatorial optimization games. A graph $G = (N, E)$ and a positive integer weight vector w that assigns a weight to each vertex in N induce a WMC game. A graph G is said to be globally (respectively, locally) WMC totally balanced, submodular, or PMAS-admissible, if for all positive integer weight vectors w (respectively, for at least one positive integer weight vector w), the corresponding WMC game is totally balanced, submodular, or admits a PMAS. We show that a graph G is globally WMC totally balanced if and only if it is perfect, and that any graph G is locally WMC totally balanced. Furthermore, we show that G is globally (respectively, locally) WMC submodular if and only if it is complete r-partite (respectively, $(2K_2, P_4)$-free). Finally, we show that G is globally PMAS-admissible if and only if it is $(2K_2, P_4)$-free.

The Unbinding Core for Coalitional Form Games

Takaaki Abe[1], Yukihiko Funaki[2]

Waseda University [1]takatomo3639@asagi.waseda.jp, [2]yukifunaki@gmail.com

The purpose of this paper is to extend the classical core of cooperative games and define a new concept of the core, the unbinding core.

The core of a cooperative game is defined as a set of payoff allocations from which no coalition has an incentive to deviate. In the definition, it is implicitly supposed that once the deviating players agree on how to allocate the payoff after the deviation, they must implement the agreed allocation among them. In other words, the allocation after the deviation is considered to be binding.

In this paper, we assume that the allocation is not binding, namely, the deviating players are uncertain about which one of allocations realizes after the deviation. To make this assumption clear, we introduce a new deviation concept: the players deviate from an allocation if any of the allocations which they can attain after the deviation guarantees to make them better off. This notion allows us to define a new concept of the core, the unbinding core.

We offer a general relationship between the classical core and the unbinding core, and a sufficient condition for them to coincide. Moreover, by imposing some restrictions on each coalitions feasible allocations, we explore how the restrictions affect the unbinding core. For example, we assume that each coalition allocates its payoff based on the equal division and, then, examine the unbinding core. We also provide the relationship between the unbinding core and some relevant concepts including the equal division core introduced by Selten (1972, 1987) and Bhattacharya (2004).

Reactive bargaining sets for games with restricted cooperation

Natalia Naumova

Saint Petersburg State University, nataliai.naumova@mail.ru

The theory of the bargaining set and the kernel for cooperative TU-games was born in papers of Aumann, Maschler, Davis (1964, 1964). For each imputation x of TU–cooperative game, an objection of a player i against a player j (S, y_S) at x and a counter–objection (D, z_D) to this objection were defined. An imputation x^0 belongs to the bargaining set $\mathcal{M}_1^i$ if for each players i, j for each objection of i against j at x^0 there exists a counter–objection. The kernel of a game is a nonempty set and is contained in the bargaining set.

At the same time objections and counter–objections between coalitions were defined and it was shown that the existence theorem is not fulfilled if objections and counter–objections are permited between all pairs of disjoint coalitions.

Granot (1994) defined a reactive bargaining set. An imputation x^0 belongs to the reactive bargaining set of a cooperative game if for each players i, j there exists a coalition D such that for each objection (S, y_S) of i against j at x^0 there exists a counter–objection (D, z_D).

Sudholter and Potters (2001) defined a semi-reactive bargaining set. Then the kernel is contained in the reactive bargaining set, in the semi–reactive bargaining set, and in the classical bargaining set. Therefore all these sets at each cooperative game are nonempty sets.

Naumova (2007, 2015, 2016) considered the case when objections and counter–objections are permited only between the members of a collection of coalitions $\mathcal{A}$ and objections and counter–objections can use only the members of a collection of coalitions $\mathcal{B} \supset \mathcal{A}$. She obtained conditions on $\mathcal{A}$ and $\mathcal{B}$ that ensure existence result for generalizations of semi–reactive and classical bargaining sets of each cooperative game.

This presentation describes conditions on $\mathcal{A}$ and $\mathcal{B}$ that ensure existence result for generalization of reactive bargaining sets of each cooperative game. For the cases when $\mathcal{B}$ is the collection of all subsets of the set of players N and $|N| \leq 5$, we enumerate all collections of coalitions $\mathcal{A}$ such that $\mathcal{A}$ and $\mathcal{B}$ satisfy these conditions.

Session: Congestion - Room: Amphi 6 - July 7th, 9:30-10:40

Adaptive Learning in Weighted Network Games

Péter Bayer[1], Jean-Jacques Herings[2], Ronald Peeters[3], Frank Thuijsman[4]

Maastricht University [1]peter.bayer7@gmail.com

We study the relationship between games of linear best replies and potential games. Games of linear best replies are games when each player's optimal choice is a linear function of his opponents' strategies. Best response potential games are games where optimal behavior of all players can be characterized with a single real-valued function. We first show that symmetry, in the sense of reciprocal relationship of best response functions between players is sufficient for the existence of a best response potential. We relate this result to the theory of exact potential functions. Additionally we show that hierarchy of best response functions also guarantees the existence of a best response potential. Finally, we show examples and sufficient conditions for the non-existence of a best response potential.

New results on uniqueness of Nash equilibrium in weighted potential games

Francesco Caruso[1], Maria Carmela Ceparano[2], Jacqueline Morgan[3]

University of Naples Federico II, [1]francesco.caruso@unina.it, [2]milena.ceparano@gmail.com, [3]morgan@unina.it

The literature results about the existence of Nash equilibria in continuous potential games exploits the fact that any maximum point of the potential function is a Nash equilibrium of the game (the vice versa being not true) and those on the uniqueness use the strict concavity of the potential function. Then, the following question arises: can we find sufficient conditions on the data of the game which guarantee existence and uniqueness of Nash equilibria under the lack of existence of a maximum of the potential function and of the strict concavity of the potential function? The presentation positively answers this question for two-player weighted potential games (Monderer and Shapley, 1996), first when the strategy sets are the set of real numbers, then when they are not necessarily finite dimensional spaces, allowing possible applications to differential games. Connections with other uniqueness results of Nash equilibria are provided, together with an economic application.

Efficiency and Correlation in Bottleneck Games

Thomas Rivera[1], Tristan Tomala[2], Marco Scarsini[3]

[1]HEC Paris, thomas.rivera@hec.edu, [2]HEC Paris, tomala@hec.edu, [3] LUISS, marco.scarsini@gmail.com

We consider a discrete bottleneck model of dynamic congestion whereby players, utilizing a common facility with fixed capacity and service time, choose how early to submit their request in order to minimize their waiting time subject to a penalty if the task is not completed prior to the deadline. We show that for large penalty costs the best and worst Nash equilibrium payoffs of the game are substantially bounded away from the social optimum. Next, we show that by utilizing correlated strategies the social planner can achieve a correlated equilibrium outcome (which we characterize) with payoffs arbitrarily close to the social optimum. When coupled with a simple toll pricing mechanism we show that such an approximate social optimum is available for any penalty cost and, in equilibrium, never requires players to pay tolls.

Competitors are welcome: why incumbents might embrace entrants?

Barna Bako[1], Andras Kalecz-Simon[2]
Corvinus University of Budapest [1]barna.bako@uni-corvinus.hu, [2]revelation.principle@gmail.com

One of the main proposition of economic theory is that competition leads to lower prices and profits. In this article we present a simple model with product differentiation where exactly the opposite happens. We consider the following set-up: there are two segments of consumers differing in their valuation of quality and price-elasticity. A single-product firm operates at the market without being able to price discriminate among segments. Our results show that if a low quality firm enters the market and captures a part of the price sensitive segment it might lead to price and profit increase. More specifically, if the difference in quality valuation is high enough the incumbent is better of after entry. Furthermore, we show that as the price-sensitive segment decreases the equilibrium prices increase. Hence, the incumbent may benefit from excluding some of its most price-sensitive consumers. Our main finding suggests that a high-quality firm quits the low-end market entirely if the quality valuation is high enough and the price-sensitive segment size is sufficiently low. These results indicate that an entry can be beneficial for the incumbent firm. In other words, established firms should not necessarily get involved in price competition after a new entrant enters their market but rather focus on (de)marketing strategies. Some implications of our model are the following. Firstly, the incumbent might favour deregulation, since it could increase its profits. Secondly, the incumbent might even create a spin-off as a pseudo-competitor. Thirdly, evaluating deregulation is more complex question than just looking at the number of competitors.

The Incentive to Share in the Intermediate Results Game

Remco Heesen
University of Cambridge, rdh51@cam.ac.uk

An important feature of academic science (in contrast with private R&D) is that discoveries are shared with the scientific community (Dasgupta and David 1994). This is generally incentive-compatible for individual scientists because rewards (in the form of credit or prestige) are given for sharing discoveries.

Received wisdom holds that an important exception to this occurs in the case of "intermediate results": scientists may have an incentive to withhold their progress on a research project from the community so as to maximize their chances of claiming a big reward for being the first to complete the overall project (e.g., Dasgupta and David 1994, Borgman 2012). Recent work has used game-theoretic models to challenge this (Banerjee et al. 2014, Boyer 2014).

Here I present the Intermediate Results Game, which unifies and generalizes this work. In the Game scientists productivity is modeled as a Poisson process, whose parameter (the productivity rate) may be different for each scientist and for each stage. I show that sharing intermediate results is the unique Nash equilibrium of the Game if the credit scientists receive for such work is at least as high (proportional to its difficulty) as the potential credit for future discoveries that depend on these intermediate results.

I consider two implications of this result. First, it generalizes a recent argument for the benefits of collaboration in science (Boyer-Kassem and Imbert 2015). Second, it raises a policy dilemma about how to assign credit for scientific work: previous work has argued that credit should be proportional to social contribution, while the present work suggests it should be proportional to difficulty.

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Spare parts pooling games under a critical level policy

Loe Schlicher[1], Marco Slikker[2], Geert-Jan van Houtum[3]
[1]Technische Universiteit Eindhoven, l.p.j.schlicher@tue.nl, [2]Technische Universiteit Eindhoven, M.Slikker@tue.nl, [3]Eindhoven University of Technology, G.J.v.Houtum@tue.nl

We consider an environment in which several service providers with possibly criticality differences can collaborate by pooling their spare parts. Every collaborating group of service providers uses a critical level policy that focusses on the long-term average cost. We examine the allocation of the collective cost savings for such pooled situation by studying an associated cooperative game, which we call a criticality game. We analyze various properties of these criticality games.

Session: Evolution and cooperation - Room: Salle C - July 7th, 9:30-10:40

From Game theory to Players game: Some insights from neurosciences

Christian Schmidt

Paris Dauphine University, schmidtchristian.fr@gmail.com

The communication proposes to survey the main impacts of brain functioning understanding upon Game theory modeling, thanks to recent developments of neurosciences. After a brief recall of the types of relationship between game theorists and neuroscientists researchers, 3 questions will be analyzed. 1-The reconsideration of players rationality, taking into account the emotive dimension in the process of strategies valuation, the complexity of decision-making process, but also the brain limits of computation. It leads to a re-definition of players knowledge and beliefs, on line with epistemic game theoretical approaches 2-The redefinition of the rules of the game from the view point of the players perception by each player of the other players expected intentions. The neural substrates of such mental mechanisms are now well identified. They explain the discrepancy between the experimental and the theoretical results largely documented by well-known game theory situations (dictator game, ultimatum game, trust game..) 3- The deepening of game theoretical dynamics in the light of the time perception mental process. Several neurosciences studies have demonstrated the impact of a Bayesian memory on players expectations, which engages interactive dynamics. Such dynamics takes often the form of an inter-intentionality system to be analyzed and extended. In conclusion the relevance of the solution concepts according to those new prospects on game theory will be discussed.

Control of incentives for promoting cooperation in Sanitation Boards

Rocío Botta[1], Gerardo Blanco[2], Christian E. Schaerer[3]

[1]Facultad Politécnica - Universidad Nacional de Asunción, rbotta@pol.una.py, [2]National University of Asunción, ing.blanco@gmail.com, [3]Programa de Ciencias de la Computación - Facultad Politécnica - Universidad Nacional de Asunción, cshaer@pol.una.py

Sanitation Boards (SBs) are community based organizations that are increasingly important for providing drinking water and sanitation. Access to drinking water improve the quality of life in a community: it reduces water-related diseases and shorten the time spent in collecting water, helping to achieve more productivity, a better education, gender equality and diminishing poverty.

SBs have very different levels of success; some are efficient and sustainable over the time, but others have problems to perform adequately and persist. This situation usually leads to an intervention from the government in order to overcome the crisis. There are several possible causes for these crisis because economical, social, environmental and institutional components are involved.

Most SBs have severe economic and financial problems such as inadequate tariffs, electricity cost, high rate of non-payment and the difficulty to apply existing rules with users that avoid paying their bills for several months, but still use the service. We are interested in the last two of them, the high rate of non-payment reached and the inability of SBs to apply existing norms with users that fail to pay their bills.

In this work we formulate the sustainability problem of SBs as a cooperation problem for which several evolutionary games models can be applied. Depending on the circumstances a rock-scissors-paper cycle behavior is observed in the SBs. For improving the sustainability, based on models from the literature we explore a control theory approach to regulate rewards and penalties used for promoting the cooperation. In addition, we explore how much influence has the applications of existing rules in sustaining the cooperation considering that even for successful SBs is difficult to apply them all the time.

The resulting model is implemented as a study case using data of SBs from Paraguay (South America). The results help to make decision regarding the rules applied for improving sustainability.

Dynamic cooperative advertising under manufacturer and retailer level competition

Anshuman Chutani[1], Suresh Sethi[2]

[1]University of Nottingham, anshuman.chutani@nottingham.ac.uk, [2]The University of Texas at Dallas, sethi@utdallas.edu

We study dynamic cooperative advertising decisions in a market that consists of a finite number of independent manufacturers and retailers. Each manufacturer sells its product through all retailers and can offer different levels of advertising support to the retailers. Each retailer sells every manufacturer's product and may choose to carry out a different amount of local advertising effort to promote the products. A manufacturer may offer to subsidize a fraction of the local advertising expense carried out by a retailer for its product, and this fraction is termed as that manufacturer's subsidy rate for that retailer. We model a Stackelberg differential game with manufacturers as leaders and retailers as followers. A Nash game between the manufacturers determines their respective subsidy rates for the retailers and another Nash game between the retailers determines their optimal advertising efforts for the products they sell in response to the subsidy rates offered by the manufacturers. We obtain optimal policies for all the players in feedback form. In some special cases, we explicitly write the incentives for cooperative advertising as functions of different model parameters including the number of manufacturers and retailers, and study the impact of the competition at the manufacturer and the retailer levels. We analyse the profits of the players and find the model parameters under which a manufacturer benefits from a cooperative advertising program. Furthermore, in the case of two manufacturers and two retailers, we study the effect of various model parameters on all four subsidy rates.

Session: Network formation - Room: Salle D - July 7th, 9:30-10:40

Signaling and herd behavior in the formation of social networks

Saptarshi Mukherjee[1], Ruhi Sonal[2]

Indian Institute of Technology, Delhi [1]saptarshi.isi@gmail.com, [2]ruhisonal@gmail.com

We model a network formation game in the presence of a given social norm which dictates a common preference over types for all individuals. Each player's type is private information, and every player is both a sender and receiver of a publicly observable signal. We explore herd behaviour as an equilibrium strategy for the players and the consequent network structures that evolve.

Information Centralization in Networks

Ana Mauleon[1], Simon Schopohl[2], Vincent Vannetelbosch[3]

[1]Saint-Louis University - Brussels and University of Louvain, ana.mauleon@usaintlouis.be, [2]Université Paris 1, Universität Bielefeld and Université catholique de Louvain, SimonSchopohl@googlemail.com [3] University of Louvain and Saint-Louis University - Brussels, vincent.vannetelbosch@uclouvain.be

We analyze a game in which players with unique information are arranged in a network. Over several periods the players can pass their information to their neighbors. Once a player has collected all information items the game ends and the players get a payoff. All players receive a positive utility for completing the task of centralization. The players who have centralized the information split an additional reward between them. Since the players also discount over time, they face the problem whether they should let another player centralize the information fast, or whether they should try to collect all information by themselves. For all possible network structures and all possible values of the parameters, we state conditions for the Subgame Perfect Nash Equilibria, we characterize the players who centralize the information and the time it takes them. We show that in equilibrium there is always a single player who collects all information items. Furthermore, we proof that only minimally connected networks can be pairwise stable. We state the set of all pairwise stable networks, for all values of the parameters and any number of players.

Parallel Sessions VIII - July 7th, 11:00-12:30

Session: Algorithms - Room: Amphi 5 - July 7th, 11:00-12:30

Constraint Games for Modeling and Solving Pure Nash Equilibria, Price of Anarchy and Pareto Efficient Equilibria

Anthony Palmieri[1], Arnaud Lallouet[2]

[1]Huawei, palmieri.anthony@hotmail.fr, [2]Huawei Technologies Ltd, Arnaud.Lallouet@unicaen.fr

In this paper, we propose to compute optimal and Pareto-optimal Nash equilibria, Price of Anarchy and Price of Stability using Constraint Games.

Connected graph searching

Ekaterina Rzhevskaya

St. Petersburg University, katrin8794@gmail.com

Mixed search and connected mixed search games on graphs are considered. We are interested in the ratio between connected mixed search number and non-connected ("price of connectivity") and "scale of unconnectedness", which characterises mixed search strategy.

Computing the per-capita nucleolus in assignment games

Tamás Solymosi

Hungary Corvinus University of Budapest, tamas.solymosi@uni-corvinus.hu

We present a strongly polynomial algorithm that computes the per-capita nucleolus in assignment games. It rests on the following known results: - Solymosi (2016) proves that in a balanced game the family of dually essential coalitions (which cannot be weakly minorized by a partition in the dual game) is sufficient to determine the per-capita nucleolus; - Nnez and Solymosi (2017) prove that in the dual game of an assignment game all dually essential coalitions are either single-player or mixed-pair coalitions; - Nnez and Solymosi (2017) present a polynomial time elementary method to obtain the dual game values for the single-player and mixed-pair coalitions from the pairwise profit matrix that generates the assignment game.

Our algorithm shares the following features with the algorithm of Solymosi and Raghavan (1994) designed to compute the (standard) nucleolus in assignment games: - starting from one of the two special vertices (here, the seller optimal corner) of the core, the algorithm generates the corresponding special vertices of the iterated per-capita least cores that are the optimal solutions to the linear programs in a Kopelowitz-type sequential optimization process (adjusted to determine the per-capita nucleolus from the dual coalitional values); - the subsequent points in this (polynomial size) series are found by solving a longest path problem on an associated directed network having no cycle of positive length.

Optimal locations and links and cost sharing in bipartite graphs

Marcin Malawski

Kozminski University, mmn@alk.edu.pl

In a bipartite graph (V1, V2, E), one subset (V1) of vertices represents the locations available for facilities and the other one (V2) the users, and the edges (E) represent connections between users and (potential) facilities. Every user requires a connection to at least one facility. Both edges and V1 vertices incur some exogenous costs. We address the problem of the cost-minimizing choice of facility locations and their connections with users, i.e. of finding the covering of user vertices generating minimal costs. We also study the 'just' rules of sharing the resulting cost among users. Extensions include situations when (1) the underlying graph is not complete (not all connections are physically feasible), and (2) there are capacity limitations in existing locations (a facility can only serve a limited number of users).

Session: TU-games on graphs - Room: Amphi 6 - July 7th, 11:00-12:30

A Shapley distance in graphs

José Manuel Gallardo Morilla[1], Andrés Jiménez-Losada[2], Nieves Jiménez Jiménez[3]
University of Sevilla [1]gallardomorilla@us.es, [2]ajlosada@us.es, [3]niejimjim@us.es

Myerson (1977) defined and characterized a Shapley value for games with communication restrictions. These restrictions were modeled through graphs. Since then, many studies in cooperative game theory have been carried out to deal with situations in which there is a cooperative game and a graph that delimits the communication among the players. This has led several game theorists to consider the study of graphs by using game-theoretic tools. The basic idea is the following. Given a graph, whose nodes will be identified with players, we can consider, instead of an exogenous game, a game determined by the graph itself. If the game is properly chosen, we can obtain useful information about the graph by applying a value to the game. In this paper, we use this approach to introduce a new distance in graphs. This distance is obtained through the Shapley value of certain cooperative TU games on the set of nodes. The distance indicates the level of difficulty in the communication between any pair of nodes, on the understanding that the fewer paths there are between two nodes and the more nodes there are that form those paths, the greater the distance is.

Positional cooperative games

William Olvera-Lopez[1], Josue Manzanarez Cardenas[2]
[1]School of Economics, UASLP, william@cimat.mx, [2]School of Economics, UASLP

In this work we study a special kind of TU-games where the characteristic function is defined on all the possible ways to fill an array of a given size using a set of agents, allowing empty positions as well as the repetition of agents into the array, and that is why we call them positional games. This model is useful in situations where the performance of a set of agents depends on their positions into a given configuration and we are interested on finding how each agent contributes to the worth obtained on each configuration, by example, in distribution of work spaces into a general office space, spots into a sales area or land distribution. We show two solutions characterized axiomatically for any size of the array and any number of agents, and we show a explicit solution when the number of available spaces is equal to the number of agents. Also, we refer to the current problematic finding for closed expression in the general case and how this ideas could be applied with an infinite set of available positions. On addition, we remark that this kind of TU-games could be seen as a generalization of several sets of TU-games, by example, the classical TU-games in characteristic function form and TU-games with generalized characteristic functions, and finally, we show that the solution we are presenting for positional games matchs with solutions in the generalized models.

Associated Consistency, Value and Graphs

Florian Navarro[1], Gérard Hamiache[2]
Laboratoire LEM UMR 9221 [1]floriannavarro.unipro@gmail.com, [2]gerard.hamiache@univ-lille3.fr

This article is an extension of the article "Associated consistency and Shapley Value" by Hamiache (IJGT, 2001) and offers a complete axiomatic characterization of a new extension of the Shapley value for cooperative games with communication structure. The result is obtained by a slight modification of the associated game, taking into account the graph generally representing a communication system, possibly incomplete. The construction of the associated game follows the scheme used in Hamiache (GEB, 1999). The main idea is that a given coalition covets the surplus generated by the cooperation with "satellite players" taken separately. In some sense, we apply the principle "divide and rule" on the set of players that are immediate neighbours of the considered coalition. Following that short sighted approach, coalitions only interact with players that are linked in the graph to at least one of its players. A particularity of the proposed associated game is that it can be represented by a matrix formula. Moreover the originality of this formula is that it does not involve any matrix and its inverse, for example $(SMS)^{(}1)$ where M is a matrix directly linked to the Shapley value, in which case the treatment is quite simple. This kind of formula is what is currently encountered in the literature. Here the involved matrix is of the form PMP where P is a matrix linked to the communication structure. The associated game is then defined as $v = PMPv$. The process of the associated game generates a sequence of games: the associated game of the game, the associated game of the associated game and so on. We show that this sequence converges to some inessential game. The proof partly develops matrix arguments and partly lies on combinatorial computations. Using our extended associated game axiom alongside with the continuity and the inessential game axioms we are able to characterize a unique sharing rule for cooperative games with communication structure. Of course, this new rule is the Shapley value for complete communication structures.

Inheritance of convexity for the Pmin-restricted game

Alexandre Skoda

Université Paris 1, alexandre.skoda@univ-paris1.fr

We consider cooperative games associated with a weighted communication network $G = (N, E, w)$. Each node of G represents a player and there is an edge between two nodes if the corresponding players can communicate directly. Moreover, each edge $e \in E$ has a weight $w(e)$, the interpretation of which may depend on the context (e.g., a level of relationship or of communication). We consider that two players have a privileged relation in a given coalition A if they are linked by a non-minimum weight edge in the subgraph GA induced by A and we assume that only players with privileged relations cooperate. For any coalition $A \subseteq N$, we denote by $Pmin(A)$ the partition of A into subgroups of players with privileged relations which is obtained by the removal of all minimum weight edges in GA. Then, for every game (N, v), the Pmin-restricted game (N, v) is defined by: $v(A) = \sum_{F \in Pmin(A)} v(F)$, for all $A \subseteq N$. In this framework we have studied in a previous work under which conditions superadditivity and convexity are inherited from (N, v) to (N, v). In particular we established five necessary and sufficient conditions on the edge-weights to have inheritance of F-convexity which corresponds to the restriction of convexity to connected subsets. We also highlighted a link between the Pmin-restricted game and the well-known Myerson's game. We showed that Myerson's game associated to a given graph G corresponds to a restriction of the Pmin-restricted game associated to a specific weighted graph G' with only two edge-weights built from G. Then, inheritance of convexity for Myerson's game is equivalent to inheritance of F-convexity for the Pmin-restricted game. In the present work we present supplementary necessary conditions for inheritance of classical convexity. Some of these conditions can be seen as extensions of the previous conditions for inheritance of F-convexity. They imply strong restrictions on edge-weights. In particular, we obtain that edge-weights can have at most three different values. Then, we present a characterization of graphs satisfying inheritance of convexity. Moreover, in parallel with the previous result on F-convexity, we establish for graphs with only two different edge-weights a stronger result which links inheritance of convexity for the Pmin-restricted game to inheritance of convexity for Myerson's game. We conclude with some remarks and suggestions for generalization of these results to other correspondences.

Session: Stackelberg games - Room: Salle A - July 7th, 11:00-12:30

Strategic decentralization and the provision of global public goods

Renaud Foucart[1], Cheng Wan[2]

[1]Humboldt University, renaud.foucart@hu-berlin.de, [2]Shanghai University of Finance and Economics, cheng.wan.2005@polytechnique.org

We study strategic decentralization in the provision of a global public good. A federation, with the aim of maximizing the aggregate utility of its members, may find it advantageous to decentralize the decision-making, so that its members act autonomously to maximize their own utility. If the political structures are chosen simultaneously, federations that are larger or more sensitive to the public good have more incentives to remain centralized. This is not always true if the political structures are chosen sequentially. A federation that always remains centralized in the simultaneous game may choose to commit to decentralization if it moves first. We build extensive form game models, then give explicit expression and properties of the subgame perfect equilibria in the linear-quadratic case.

Proximal algorithm and selection of subgame perfect Nash equilibria

Francesco Caruso[1], Maria Carmela Ceparano[2], Jacqueline Morgan[3]

University of Naples Federico II, [1]francesco.caruso@unina.it, [2]milena.ceparano@gmail.com, [3]morgan@unina.it

In one-leader one-follower games, multiple Subgame Perfect Nash Equilibria (henceforth SPNE) arise when the best reply of the follower is not single-valued. This presentation concerns a new selection method for SPNE based on the convergence of a sequence of SPNE of perturbed games where the best reply of the follower is single-valued. The perturbed games are designed using the proximal point algorithm (Martinet, 1972), a well-known optimization technique related to Moreau-Yosida regularization (Moreau, 1965). A mechanism selection through Tikhonov regularization has been previously introduced in Morgan and Patrone (2006). However, proximal point algorithm has a twofold advantage: on the one hand, it can provide improvements in numerical implementations (Rockafellar, 1976) and, on the other hand, it has a clear behavioural interpretation (Attouch and Soubeyran, 2009). The constructive method and the effectiveness are first illustrated; then, existence results for the selection are provided under mild assumptions on data also when the action sets of the follower depends on the leaders actions.

A Stackelberg duopoly model with sticky prices and myopic follower

Katarzyna Kańska[1], Agnieszka Wiszniewska-Matyszkiel[2]

University of Warsaw, [1]katarzyna.m.kanska@gmail.com, [2]agnese@mimuw.edu.pl

In this paper, we present an extensive analysis of a dynamic model of a quasi Stackelberg duopoly with sticky prices, in which the leader, conscious about the dynamics of price, maximizes present value of their stream of prots, taking into account the best response of the follower to his strategy, while the the follower reacts only to current production of the leader as in the static Stackelberg model. The model is a continuation of works on models of oligopolies with sticky prices ([1]-[3]), in which Cournot oligopoly was studied, especially [3] in which an in-depth analysis of the problem was performed, while the idea of interaction between players is suggested by [4]. By extensive analysis of the model, we calculate all the optimal trajectories of price (depending on the initial price) and whole strategies of both players, not only steady states, both in open loop (dependent on time only) and feedback (dependent on price only) forms. Unlike in the Cournot oligopoly, results for those two informatiom structures are equivalent. If the initial price is below some level, we observe that the leader refrains from production to let the price increase, while the follower has large production without any competitor. We analyse also behaviour of equilibrium price and production of both forms as func- tions of parameters of the model and we obtain, among other things, monotone conver- gence of steady states of Stackelberg equilibrium price and productions to analogous levels of the static Stackelberg equilibrium as the speed of adjustment tends to infinity. The calculated results are also compared to Cournot oligopoly results (from [3]).

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Optimal Strategies in TV Show "The Voice"

Vladimir Mazalov

Institute of Applied Mathematical Research, Karelian Research Center, vmazalov@krc.karelia.ru

We consider a game-theoretic best choice model with incomplete information related with the popular TV show "The Voice". In this model, N players (experts) observe a sequence of M incoming objects each described by two random quality components. The first component is announced to players and the other one is hidden. A player accepts or declines an object based on the first quality component only. Players choose an object based on known information about it. Each player can choose at most k objects. The winner is the player having a higher sum of the quality components than the opponents do. The optimal strategies of the players and their payoffs in the game are derived.

Heterogeneous Risk/Loss Aversion in Complete Information All-pay Auctions

Zhuoqiong Chen[1], David Ong[2], Ella Segev[3]

[1]London School of Economics, chenzq926@gmail.com, [2]Peking University, dvdong@gmail.com, [3]Ben Gurion University of the Negev, ellasgv@bgu.ac.il

Little theory has focused on the influence of observable heterogeneous risk aversion (e.g., indicated by gender) in sunk cost contests where the slightly-better winner takes all. We extend previous theoretical work on n-players complete information all-pay auction to incorporate heterogeneous risk and loss averse utility functions. We provide sufficient and necessary conditions for the existence of equilibria with a given set of active players with any strictly increasing utility functions and characterize the players' equilibrium mixed strategies. Assuming that players can be ordered by their risk aversion we find that, in equilibrium, the more risk averse players either bid higher (in terms of first order stochastic dominance of their mixed strategy cumulative distribution) than the less risk averse players and win with higher ex-ante probability, or they drop out. Furthermore, while each player's expected bid decreases with the other players' risk aversion, her expected bid increases with her own risk aversion. Thus, increasing a player's risk aversion creates two opposing effects on total expected bid. A sufficient condition for the total expected bid to decrease with a player's risk aversion is that this player is relatively more risk averse compared to the rest of the players. Our findings have important implications for the literature on gender differences in competitiveness and for gender diversity in firms that use personnel contests for promotions.

Axioms for the minimum Walrasian equilibrium in assignment problems with unitary demands

Francisco Robles Jiménez

University of Barcelona, frobles@ub.edu

We consider a set of indivisible objects to be allocated to a group of agents. Each agent receives at most one object. Monetary transfers are allowed and each agent has a preference over bundles of an object and money. We do not impose any condition on the number of objects. Under general preference domains that contain quasi-linear preferences, we provide the following characterizations for the minimum Walrasian equilibrium rule. When the objects are heterogeneous, the minimum Walrasian equilibrium is the unique rule satisfying non-wastefulness, envy-freeness, desirability of positively priced objects and monotonicity with respect to willingness to pay. In the presence of homogeneity of objects, the minimum Walrasian equilibrium is the unique rule satisfying non-wastefulness, efficiency, desirability of positively priced objects, no subsidy and strategy-proofness. For the quasi-linear domain, the minimum Walrasian equilibrium rule is characterized by antimonotonicity, non-wastefulness, efficiency and desirability of positively priced objects.

Local sampling dynamics

Michal Ramsza

Warsaw School of Economics, michal.ramsza@gmail.com

Concept of sampling equilibrium was introduced in (Osborne, Rubinstein, 1998). This concept was further extended in (Sethi, 2000) resulting in sampling dynamics. The original concept requires sampling of all pure strategies thus is not suitable for games with a continuum of pure strategies. The current research offers a simplified version of the procedure that yields a new type of dynamics and is suitable for games with a continuum of pure strategies.

The new proposed model yields Markov chain that is consequently approximated with a system of differential equations. Basic properties of the resulting dynamics and relations to the static model are proven. The new type of dynamics is applied to model Cournot competition. For this model theorems about existence of equilibria, uniqueness of equilibria and global convergence are proved.

Second price all pay auctions, how much money do players lose ?

Gisèle Umbhauer

Bureau d'Economie Théorique et Appliquée Université de Strasbourg, umbhauer@unistra.fr

The paper studies second price all pay auctions (SPAPA) -static wars of attrition- in a new way, based on class room experiments and Kosfeld, Droste and Voornevelds Best Reply Matching (BRM) equilibrium (2002). Two players fight for a prize of value V, have a budget M, submit bids lower or equal to M. Both pay the lowest bid and the prize goes to the highest bidder; in case of a tie, each player gets the prize with probability 1/2. The mixed Nash equilibrium (NE) distribution has a special shape: there is an atom on M and the probabilities are decreasing in the bids, from 0 to M-V/2. Yet this shape is strikingly different from the ones obtained in our class room experiments (an experiment with 116 students, another with 109 students). The students bid 0 with a high probability, assign very low probabilities to small bids different from 0, and significant probabilities to M and other high bids. The students and the NE probability distributions are so different that we cant conclude on overbidding or underbidding in comparison with the NE behaviour. In fact, the students behaviour fits with the best reply matching philosophy, an ordinal logic according to which, if bid A is the best response to bid B, and if B is played with probability p, then A is also played with probability p. This namely explains the students atom on bid 0, in that bid 0 is the only best response to often played- bids higher than V. In fact, the meaning of probabilities in NE and in BRM equilibria is quite different: whereas NE probabilities are chosen to equalize the payoffs of the bids of the equilibrium support, probabilities in a BRM equilibrium just match best responses, each bid being played as often as the bid to which it is a best reply. The problem is that with the BRM logic- which better fits with real behaviour-, SPAPA may become dangerous. In the Nash equilibrium, no player loses money, in the BRM equilibrium, both may. In the paper, we study BRM equilibria for different values of M and V and we focus on the case with M large (in comparison to V). In that case, players lose in average 1/12th of their budget. We argue that our results give insights into how to regulate games to avoid pathological gambling with a huge waste of money.

Session: Games with externalities - Room: Salle D - July 7th, 11:00-12:30

Formation of coalition structures as a non-cooperative game 1: theory.

Dmitry Levando

NRU-HSE, dlevando@hse.ru

The paper defines a family of nested non-cooperative simultaneous finite games to study coalition structure formation with intra and inter-coalition externalities. The novelties of the paper are: a definition of every games embeds a coalition structure formation mechanism, and every game has two outcomes - an allocation of players over coalitions and a payoff for every player.

The family is parametrized by a maximum coalition size in every partition of a game. For every partition a player has a partition-specific set of strategies. The mechanism portions a set of strategies of the game (a Cartesian product) into partition-specific strategy domains, what makes every partition to be a non-cooperative game with partition-specific payoffs for every player. Payoffs are assigned separately for every partition and are independent from the mechanism.

Every game in the family has an equilibrium in mixed strategies. The equilibrium can generate more than one coalition and encompasses intra and inter group externalities, what makes it different from the Shapley value. Presence of individual payoff allocation makes it different from a strong Nash, coalition-proof equilibrium, and some other equilibrium concepts. The accompanying papers demonstrate applications of the proposed toolkit.

Social Norms and Social Pressure in Club Good Provision

Friederike Blönnigen

University of Dortmund (TU), friederike.bloennigen@tu-dortmund.de

This paper proposes two game-theoretical versions of a club framework in order to solve the problem of inefficient participation rates. Under typical assumptions, the individual participation in clubs is inefficiently low compared to the Pareto-optimum chosen by a social planner. While former research suggests entry costs to ensure the efficient provision of club goods and to internalize positive externalities, our model incorporates social norms and social pressure. This approach provides the opportunity of negative externalities. In our first version, players maximize their utility over commodities and time spent in a club (Church, sports club etc.) given the budget and time constraints. It is assumed that the average activity of the participants has not only an effect on the overall club quality but also on the players' income. We suggest the possibility that agents can acquire new customers in the club. The more time a player spends in club activities, the more potential customers he meets. This assumption is based on evidence from sports or rifle clubs in Germany. The assumption of wage influence can also lead to a negative externality if the individual participation is too low compared to other members and possible competitors. In this case a high participation rate of the club members produces social pressure. Our second version of the club framework assumes that the time spent in a club consists of voluntary public good contribution and the participation in club meetings and events. Different to former models, the quality of a club is defined as the willingness of its members to invest in the club owned public good. We suggest a two-stage game where the club members need to provide a public good in the first stage which is used in the second stage. The players anticipate the consequences of shirking in public good contribution and thus choose a positive participation rate. This social norm overcomes the problem of potential free-riding. Our representation of club goods falsifies, that a high average club activity decreases the individual choice of effort. A distinct rigidity of the clubs is thus unnecessary and high entry costs can be neglected.

Values for Environments with Externalities - The Average Approach

Ines Macho-Stadler[1], David Perez-Castrillo[2], David Wettstein[3]

[1]Universidad Autonoma de Barcelona, ines.macho@uab.es, [2]Universidad Autonoma de Barcelona, david.perez@uab.es, [3]Ben Gurion University of the Negev, wettstn@bgu.ac.il

We propose the "average approach" where the worth of a coalition is a weighted average of its worth for different partitions of the players' set, as a unifying method to extend values for characteristic function form games. Our method allows us to extend the equal division value, the equal surplus value, the consensus value, the -egalitarian Shapley value, and the family of least-square values. For each of the first three extensions, we also provide an axiomatic characterization of a particular value for partition function form games. And for each of the last two extensions, we find a family of values that satisfy the properties.

The lattice structure value for games with externalities

J.M. Alonso-Meijide[1], Mikel Álvarez-Mozos[2], M.G. Fiestras-Janeiro[3], A. Jiménez-Losada[4]

[1]Universidade de Santiago de Compostela, josemaria.alonso@usc.es, [2]Universitat de Barcelona, mikel.alvarez@ub.edu, [3]Universidade de Vigo, fiestras@uvigo.es [4]Universidad de Sevilla, ajlosada@us.es

A new value for games in partition function form is introduced and characterized. The idea behind the solution arises from the lattice structure of the set of embedded coalitions as studied in Alonso-Meijde et al. (2016). We relate it to other solution concepts of the literature (for instance de Clippel and Serrano, 2008; Dutta et al., 2010) from an axiomatic viewpoint. Finally, we present several examples in which it prescribes interesting outcomes.

Plenary Session V - Room: Amphi 8 - July 7th, 14:00-15:00

How to manage the allocation of CO2 emissions? Some proposals from the perspective of game theory

Joaquin Sanchez-Soriano

Center of Operations Research, Universidad Miguel Hernndez de Elche, joaquin@umh.es

Emissions of CO2 snd other greenhouse gases are a serious problem with unpredictable but almost certainly negative consequences. For this reason, different agreements have been reached over the last 25 years, more or less accepted by the different countries of the world, to reduce CO2 emissions. These agreements generally carry with them the problem of the allocation of quotas or permits of gas emissions to the different countries that sign the agreements. We will focus on those problems and consider how to approach them from the perspective of game theory. In particular, we will distinguish two levels, the allocation of greenhouse gas emission quotas to the countries and the allocation of quotas of emission to the companies. In both cases some assumptions will be done in order to obtain simpler and manageable models. Then we will study some allocation procedures and their properties.

Parallel Sessions IX - July 7th, 15:25-15:35

Session: Contract theory - Room: Amphi 5 - July 7th, 15:25-15:35

Partnership Profit Sharing

Yigal Gerchak[1], Eugene Khmelnitsky[2]

[1]Tel-Aviv University, yigal@post.tau.ac.il; [2]Tel-Aviv University, xmel@eng.tau.ac.il

Suppose that one party proposes to another a contract for sharing an uncertain profit which maximizes the formers expected utility, with respect to its beliefs, subject to a constraint on the latters expected utility, with respect to the latters beliefs. It turns out that the optimal contract, which we find, can be non-monotone, as well as non-linear, in the realized profit. To avoid the implausible lack of monotonicity, we formulate and solve a model constrained to have monotone increasing profits for both partners. If beliefs are identical, the (unconstrained) contract is shown to be monotone, and under certain conditions, linear. That might explain one famous contract from the history of jazz. If the other party can be assumed risk neutral, the linear contract reduces to the former receiving a constant amount, and the latter the residual net profit, as in the case of another famous contract from the history of jazz. Since in the type of partnerships we have in mind the partners are always motivated to exert high effort due to other factors like reputation, our setting has no moral hazard or adverse selection, and the partnerships do not involve a large initial investment.

Research among Copycats: R&D, Spillovers, and Feedback Strategies

Grega Smrkolj[1], Florian Wagener[2]

[1]Newcastle University, grega.smrkolj@newcastle.ac.uk, [2]University of Amsterdam, f.o.o.wagener@uva.nl

We study a stochastic dynamic game of process innovation in which firms can initiate and terminate R&D efforts and production at different times. We discern the impact of knowledge spillovers on the investments in existing markets, as well as on the likely structure of newly forming markets, for all possible asymmetries between firms. We show that the relation between spillovers, R&D efforts, and surpluses is non-monotonic and dependent on both the relative and absolute efficiency of firms. Larger spillovers increase the likelihood that a new technology is brought to production, but they do not necessarily make the industry more competitive.

Compensation contracts and career concerns

Evangelia Chalioti

Yale University, evangelia.chalioti@yale.edu

This paper studies compensation contracts and career concerns of team workers when an agent's individual production depends on her teammate's effort and ability. We show that a principal who commits herself to a life-time salary path and induces a low-risk averse agent to help her colleague, she may encourage her to sabotage, as her employment is extended to many periods. If commitment is not feasible, sabotage incentives emerge because of career concerns. Such incentives arise for both long-term and temporary workers. Negative contractual incentives now are used to diminish workers' appetite to sabotage.

Session: Social choice - Room: Amphi 6 - July 7th, 15:25-15:35

The Majoritarian Social Welfare Relation: Some Results

Mihir Bhattacharya[1], Nicolas Gravel[2]

Aix-Marseille School of Economics, [1]mihir.bhattacharya@gmail.com, [2]nicolas.gravel@univ-amu.fr

For any given preference profile of voters, a *social welfare relation* is a complete binary relation over the set of alternatives. A *social welfare relation* is *distance-minimising* if it selects a binary relation that is 'closest' to the given voter profile according to the a notion of distance defined over the set of all possible preference orderings. We define a *quaternary relation* over the set of all preference orderings and assume that it satisfies certain 'weak' assumptions. We show that under these conditions there exists a distance function over which the *class* of *majoritarian social welfare relations* is *distance-minimising*. We also characterize the *majority binary relation* over which these conditions become necessary.

On strategy-proofness and single-peakedness: median-voting over intervals

Panos Protopapas

University of Lausanne, panagiotis.protopapas@unil.ch

We consider the problem of choosing an interval of alternatives when agents have single-peaked preferences. Similar to Klaus and Storcken (2002), we ordinally extend these preferences over intervals. Loosely speaking, we extend the results of Moulin (1980) to solutions and show that other related results do not hold in this setting. Our main results show the following. First, strategy-proofness and peaks-onliness characterize the class of generalised median solutions; second, strategy-proofness, peaks-onliness, and anonymity, characterize the class of median solutions; and finally, in these results peaks-onliness cannot be replaced by the "weaker" property of continuity, as has been shown for rules (Ching, 1997).

Implementation in Undominated Strategies with Partially Honest Agents

Saptarshi Mukherjee[1], Nozomu Muto[2], Eve Ramaekers[3]

[1] Indian Institute of Technology Delhi, saptarshi.isi@gmail.com, [2]Yokohama National University, nozomu.muto@gmail.com, [3]CORE, eve.ramaekers@uclouvain.be

We consider implementation in undominated strategies by bounded mechanisms. We provide a complete characterization of the class of social choice correspondences that are implementable when agents are partially honest, in the sense that they have strict preferences for being sincere when truthfulness does not result in a worse outcome. As an application, we show that the Pareto correspondence is implemented by a finite mechanism.

Session: Coalition formation - Room: Salle D - July 7th, 15:25-15:35

Cooperative Differential Games with Dynamic Adaptation and Non-transferable Utility in the Oil Market

Maria Nastych[1], Ovanes Petrosian[2]

[1]SPbSU, nastych@bk.ru, [2]SPbSU PM-PU, petrosian.ovanes@yandex.ru

In the present research we examine a special case of cooperative differential games with non-transferable utility in which the game structure can change with time (time-dependent formulation). We assume that the players do not have full information about the change of the game structure, but they have certain information about the game structure on the truncated time interval. The duration of the period of this information is known in advance. Evidently, this truncated information is valid only for certain time and has to be updated. In order to define the best possible behavior for players in this type of cooperative differential game, it is needed to develop a special approach, which we call the Looking Forward Approach.

We model oil market as Cournot oligopoly differential game (Cellini, Lambertini, 2007) with largest oil exporters and other countries. In the paper (Salant, 1976) the author examines cartel formation in the world oil market under Cournot setting. The authors in (Berger at al., 1988) use the quantity competitive environment to model collusions and proportionate adjustment of production levels. Following this tradition, we use Cournot framework and define quotas of oil production as adjustment of production levels to admit nontransferable payoffs. Making an agreement about quotas on production levels is viewed as pure cooperative behavior. We use two types of agreements of solutions, first is a Nash bargaining solution. The second one is a solution which is based on the Nash equilibrium in the corresponding non-zero-sum game, this solution allows us to lower the production levels of all participants simultaneously. Obviously, the second solution is not time consistent, but it allows us to model latest real life market agreements. Both solutions are compared numerically.

Looking Forward Approach allows taking into account the variability of market demand, an adaptation of participants actions to changing the environment, actual planning horizons for demand. Therefore the approach can be successfully used to model continuous economic process as if it is being solved in the real time. Using the approach we can make the following conclusions. Firstly, the situation when players predict market demand on the truncated time interval leads to higher production levels comparing with a static model. Secondly, using the historical information about the total world oil supply, prices of oil of different benchmark crude and average costs of oil production for the largest oil exporters, we estimate the optimal quotas of oil production for OPEC countries.

Unbinding Deviations and Stable Coalition Structures in the Cournot Oligopoly

Yukihiko Funaki[1], Takaaki Abe[2]

Waseda University [1]yukifunaki@gmail.com, [2]takatomo3639@asagi.waseda.jp

In this paper, we introduce a new concept of the core, the unbinding core, and apply it to the Cournot oligopoly game. It gives a new insight to a relationship between coalition structures and payoff allocations in the game. In the cooperative game theory, we often employ one of the following two approaches: (i) restricting coalition structures to the grand coalition, we study how to allocate the payoff of the grand coalition among the players, or (ii) fixing an allocation for each coalition, e.g. the equal division, we study which coalition structure is considered to be stable. The first approach is to investigate payoff distributions among the players in view of an axiomatic desirability. The second approach is mainly used to analyze a stability of coalition structures. In contrast, this new concept allows us to treat both of coalition structures and payoff allocations under no assumption of the formation of the grand coalition. Moreover, we extend the classical core in the following way. We assume that the allocation resulting from a deviation of a coalition is not necessarily binding. Thus the players have uncertainty about an allocation implemented after the deviation. This implies that the unbinding core might include allocations feasible in coalition structures other than the grand coalition. We apply this new concept to the Cournot oligopoly game and discuss stable coalition structure and payoff allocations.

An Algorithmic Sequential Coalition Formation Model

Gizem Yildirim

Vienna University of Technology, gizem.yildirim@student.tuwien.ac.at

Coalition formation theories find themselves at the intersection of political science and economics. They deal with the creation of groups of agents as well as the determination of the outcome of many social, economic and political interactions. Although coalition formation is a well-studied concept in the domain of economics, particularly in game theory, the process of coalition formation has received less attention. Indeed, the process of coalition formation is the point of departure of my research. In my work, the focus is on the emergence and evolution of coalitions and issues of potential enlargement with the application of clustering methods borrowed from high energy physics. A game-theoretical coalition formation model is used and tailored to the EU and international coalitions in general. The aim is establishing links between the theoretical model and the formation of coalitions and thereby getting a better understanding of the dynamics of the coalition formation process. For this purpose, a sequential procedure is used in which players iteratively form subcoalitions. Two points are important when designing such a coalition formation game: (i) determining the players preferences and (ii) the procedure. The first point is addressed by defining a distance measure. The distance between countries is measured by a distance function containing geometrical and non-geometrical elements. The distance between two countries is defined as a product of distance in population, GDP and political regime space and the distance in physical space. The second point is addressed by using a sequential clustering algorithm. The sequential algorithm for country clustering is inspired by the study of jets in high energy physics were also used for experiments conducted at CERN which led to the discovery of the Higgs Boson. To illustrate the predictions made by this model, the formation of the European Coal and Steel Community (ECSC) is examined. I use concrete realizations of the general distance measure. The results including data from 28 European countries illustrate the impact of the distance measure in the process. In the presented research, three common aspects are considered necessary for studying coalition formation processes: geographic, economic and social elements. Interdisciplinary work can provide a new perspective and deeper understanding of technical matters such as defining a distance function and reducing the complexity of the solution method.

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SING13 is the thirteenth in the series of Spain-Italy-Netherlands Meetings on Game Theory. The conference consists of a number of invited lectures and contributed papers from all over the world. English is the language of the meeting. Contributions from all areas of game theory include, but are not limited to the following:
- Cooperative games and their applications;
- Mechanism design;
- Networks;
- Dynamic games;
- Evolutionary games;
- Stochastic games;
- Voting and power indices;
- Auctions;
- Bargaining;
- Learning and experimentation in games;
- Computational game theory;
- Game theory applications in fields such as: management, energy, health policy, industrial organization, and others.

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LAMSADE
Université Paris-Dauphine
Place du Maréchal de Lattre de Tassigny
75775 PARIS Cedex 16
Telephone: 0033 - (0) 1 44 05 45 70
email: secretariat[at]lamsade.dauphine.fr
webpage: www.lamsade.dauphine.fr