Book of Abstracts

12th European Meeting on Game Theory

(SING 12)

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Organized by The Department of Business and Economics
University of Southern Denmark, Odense, Denmark.

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Welcome Letter

Dear Colleagues,

The Organizing Committee would like to welcome each of you to the 12th European Meeting on Game Theory (SING12). The conference is organized by the Department of Business and Economics of the University of Southern Denmark and takes place at the campus located in Campusvej 55 in the city of Odense.

The scientific program consists of 129 presentations of 20 minutes in up to five parallel sessions and four plenary talks. The 146 participants come from the 27 countries Bulgaria, Canada, Columbia, Czech Republic, Denmark, France, Germany, Greece, Hungary, India, Israel, Italy, Japan, Lebanon, Mexico, Netherlands, New Zealand, Poland, Russia, Singapore, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States.

We should like to thank the presenters and invited speakers for their contributions and each of you for attending the conference. Moreover, we are grateful to the vice-dean Torben Munk Damgaard for valuable advice, to Sandra Kaiser, Sanne Timmermann and Andreas Eriksen for technical assistance, and to Helena Grovn and Jesper Breinbjerg for practical assistance. Finally, we acknowledge financial support from Danmarks Nationalbank and logistic support from the University of Southern Denmark.

We wish you inspiring and interesting discussions and presentations at this conference and a pleasant stay in Odense.

Sincerely yours,

The Organizing Committee of the SING12 conference

History of SING

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". From then on meetings have taken place almost annually called "Convegno di Teoria dei Giochi ed Applicazioni": In Pavia (1984, organised by Pierangelo Mori and Fioravante Patrone), Florence (1986, 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 organized in 1994 in Bilbao by Federico Valenciano and José 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 were held and impromptu conferences. 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 René 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 organized 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 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 1970s the groups working on game theory and related topics in Warsaw and Wroc?aw held regular seminars that used to be rather interdisciplinary. In 2004 Andrzej Wieczorek organised an international conference in game theory and mathematical economics in Warsaw, and in 2008 the 13th International Symposium of Dynamic Games was organised by Andrzej Nowak in Wroc?aw just after SING4.

The joint venture

In 2000 Federico Valenciano organised GAMES 2000, the first Meeting of the Game Theory Society in Bilbao. During this conference, Fioravante Patrone took the initiative of setting up a "joint venture" between Italy and Spain, suggesting meetings be held alternately in Italy and Spain. The agreement on this idea by the researchers involved led to the meetings in Ischia (2001), Sevilla (2002), Urbino (2003) and Elche (2004). During the meeting in Urbino, the Netherlands asked to join the Italian-Spanish alternating agreement and so SING (Spanish-Italian-Netherlands Game Theory Meeting) was set up. The first Dutch edition was organised by Hans Peters in Maastricht from 24th to 26th June 2005; the subsequent meetings are shown in the table below. 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. As a result the following countries acted as guest organisers, Poland in 2008 (Wroc?aw, organised by Jacek Mercik), France in 2011 (Paris, Michel Grabisch), and Hungary in 2012 (Budapest, Laszlo Koczy). Poland was the guest organiser for the second time in 2014 (Krakw, Izabella Stach) and so it became a 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 also involved the 9th International Conference on Game Theory and Management (GTM2015). The 2016 edition is scheduled to take place in Odense (DK), organized by Peter Sudhlter. Paris Dauphine (with Stefano Moretti) and Bayreuth (with Frank Steffen) are candidates for the following meetings.

A SYNTHESIS OF THE JOINT VENTURE

Year	**Name**	**Location**		**Organizer**
2001	Italy/Spain 1	Ischia	IT	Jacqueline Morgan
2002	Italy/Spain 2	Sevilla	ES	Jesús Mario Bilbao & Francisco Fernández
2003	Italy/Spain 3	Urbino	IT	Gian Italo Bischi
2004	Italy/Spain 4	Elche	ES	Joaquín Sánchez-Soriano
2005	SING 1	Maastricht	NL	Hans Peters
2006	SING 2	Foggia	IT	Andrea Di Liddo
2007	SING 3	Madrid	ES	Juan Tejada
2008	SING 4	Wrocław	PL*	Jacek Mercik
2009	SING 5	Amsterdam	NL	René van den Brink
2010	SING 6	Palermo	IT	Dario Bauso
2011	SING 7	Paris	FR*	Michel Grabisch
2012	SING 8	Budapest	HU*	Laszlo Koczy
2013	SING 9	Vigo	ES	Gustavo Bergantiños
2014	SING 10	Kraków	PL*	Izabella Stach
2015	SING 11	St.Petersburg	RU*	Leon Petrosyan
2016	SING 12	Odense	DK*	Peter Sudhölter

* Guest Organising Country

Invited Lectures

Rankings on data: The one and two-sided settings

Gabrielle Demange
Paris School of Economics – EHESS, France

The enormous increase in interest in ranking methods based on data is evident in academic life, where students, researchers, universities are graded, or on Internet, where pages are ranked, movies and books are rated. Rankings may rely on a simple count by adding up the ratings, or on more sophisticated computations, as in the recursive methods on which Google PageRank is based for example. Methods can produce different results and arguments for and against each method can be put forward. This difficulty arises in the so-called peers' settings in which the items (or agents) are ranked according to data provided by these items (or agents), as in the two above examples, it also arises in more general settings in which the items to be ranked differ from the agents providing evaluations. Viewing a ranking method as aggregating evaluations or preferences of several individuals, no method is universally good as known from social choice theory; there is a variety of reasonable methods and the choice of a method should depend on the context under consideration. The axiomatization approach, which aims to characterize methods through properties or 'axioms', provides a useful guide for choosing a method. I will review some recent results in the one-sided setting, in which some experts provide evaluations on the items to be ranked (based on Demange, 2014). Then I consider two-sided settings. Indeed a large number of situations involve two sides, each providing data on the other side. For example, buyers rate sellers and vice versa on eBay, students evaluate their professors and professors grade them.

In a two-sided setting, there are two sets (the sides), M and N, and the

members of one side provide *evaluations* on the other side's members. A ranking method assigns a ranking of each side to these mutual evaluations. Here the rankings are cardinal: the ranking of M is described by the *scores* of its members defined up to a multiplicative factor, and similarly for the ranking of N.

The ranking on one side naturally depends on the evaluations on its members, say the ranking on M depends on the evaluations provided by N. It may also depend on their own evaluations on N if these convey information on the relevance of the evaluations provided by N's members. Consider students and professors for example. The professors' scores naturally depend on the students' evaluations on them. One may also think that the evaluations provided by a highly-graded student are more relevant than those by a low-graded one. In that case, the professors' scores should depend not only on how students evaluate them, but also on how professors grade the students. This introduces a feedback between the evaluations of each side. I characterize a method, called *mutual centrality method*, that takes this feedback into account. The method is based on the dominant eigenvector of the bipartite graph associated to the two-sided setting and weighted by the evaluations. The characterization involves two axioms. The first one, called additivity under unanimity, pertains to the situation where all members of one side are unanimous on their evaluations. The second one, called consistency across sides, is a form of the well-known consistency property.

The feedback between the two sides' evaluations may be thought as non desirable in some situations. A method that forbids this feedback is said to be *impartial across sides*. Specifically, impartiality across sides requires the ranking of one side to be independent of the evaluations provided by its members on the other side. Impartiality can be justified by strategic issues: if i's evaluations on the other side do not impact i's score, then i has no incentive to lie. There are many impartial methods, each obtained by specifying the ranking method on each side as a function of the sole evaluations on them (which are provided by the other side). The counting method is a prominent impartial method. I characterize it through two axioms, uniformity and homogeneity, in addition to impartiality. Finally, another impartial method, called *congruence method*, accounts not only on the received evaluations' totals, but also on the joint pattern of these evaluations. The method reflects the idea that a concentration of good evaluations by a group of evaluators is a good signal, hence reinforce each other. The ranking on one side is defined by a dominant eigenvector of the evaluation matrix multiplied by its transpose. The congruence ranking can be shown to minimize the distance in the joint evaluations between the observed matrix and that associated to a unanimous ranking.

Reference

Demange, G., 2014. A ranking method based on handicaps. Theoretical Economics, 9(3), 915-942.

Sharing the cost of access to a set of public goods

Jens Leth Hougaard
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The Problem: We consider situations where a group of agents share access to a set of public goods in the sense that all agents can obtain "service" from these goods without rivalry. Each good has a cost and the total cost of all goods must be shared among the agents. The benefits from having access to the set of public goods are described by a set of service sets for each agent, i.e., subsets of the set of goods that provides the agent with service. As such, demands are binary: either the agent is served or not. Agents prefer a low cost share, but other differences in their individual preferences are irrelevant, making demand fully inelastic. The set of public goods is not necessarily designed to match the agents service demands. Rather the situation can be construed as the agents "taking over" an existing set of goods. That is, there may be some goods which are redundant and even useless for everyone. This deviates from the vast majority of models in the cost sharing literature where first an optimal (cost minimizing) set of goods is determined given agents service demands; and second, the total cost of the optimal set of goods is shared. As such, we are not concerned with the welfare of the agents, they are all happy getting access independent of their cost share, which seem reasonable in cases where the benefits of having access far exceeds the costs (as in the potential applications we have in mind). Moreover, it highlights the issue of fairness in allocation given the individual service constraints of the agents.

Potential Applications: The model captures central aspects of several classes of practical problems and therefore has many potential applications. For instance, it concerns cost allocation in existing network structures: here agents share public links (edges) in the network and each link is connected with a (maintenance) cost. This situation may occur in some power grids where consumers access an existing network structure that often involves redundancies due to the historical evolution of the grid structure itself. Yet, redundant links provide consumers with increased connectivity and the associated maintenance costs needs to be shared. Commodity trading networks constitutes another example. Historically, associations of merchants have shared the cost of obtaining trading privileges and of keeping transportation networks safe for commodity transport. Here the existing markets, roads and sea ways are the public goods that are accessed by the merchants and the costs of ensuring smooth trade (which may be substantial, but nevertheless outranked by the potential gains from trade) are shared among members of the association according to their

trading patterns. A historical example is the German Hansa, a more recent example is the multinational coalition "CTF-150" and their anti-piracy operations off the coast of Somalia involving more than 25 nations and their direct commercial interests in safe sea transport. The model further has relevance at company level. Streaming services like Netflix and Spotify sell access to a collection of digital goods (e.g., in the form of movies and music). Since consumption is based on streaming it is non-rival (unlike traditional libraries) and the costs of covering Intellectual Property rights may differ between the products while it is the total cost that has to be covered by the consumers. As it is now, consumers pay a flat (monthly) access fee, but observed consumption history could potentially justify different types of allocations. Moreover, companies (for example in the pharmaceutical industry) may find it beneficial to enter into joint ventures such as common R&D projects where each company in the group has access to the obtained results, but may have heterogeneous needs.

Characterization Results: In case of non-redundant problems Moulin/Laigret (2011) demonstrate that the only reasonable cost additive allocation rule satisfying the stand alone core conditions is a rule dubbed the Equal Need rule: here the cost of a good a is shared equally among all the agents for whom a is needed for service. Hougaard/Moulin (2014) allow for redundancies in the problem. They search for allocation rules for which the individual cost shares are proportional to a so-called liability index intended to measure the extend to which a given agent is liable for a given good based solely on the agent's own service constraints. They give several examples of relevant liability indices, but end up focussing on a particular class of counting indices: agent i's liability for good a is given by the ratio between the number of minimal service sets containing a over the total number of minimal service sets in i's service constraint. A family of counting indices are characterized by standard axioms of Anonymity, Neutrality, Consistency, Cost Additivity and Replication together with an axiom dubbed Irrelevance of Supplementary Goods. The latter property states that adding goods which do not create new service opportunities for agent i, should not affect i's liability for the original goods. Hougaard/Moulin (2016) add the feature that the public goods may have limited reliability; as when the public goods are links in a network, digital goods that can be streamed from a database, or any other kind of project which may turn out successful or not. Adding limited reliability to the model has a fundamental impact on the notion of fairness. In search of desirable allocation rules, three powerful separability properties are imposed: Independence of Timing ensures that the cost shares computed ex ante are the expectation, over the random realization of the goods, of shares computed ex post. Cost Additivity together with Separability Across Items ensure that the cost shares of a good depend only upon the service provided by that good for a given realization of all other goods. Combining these with fair bounds on the liability of agents with more or less flexible needs, and of agents for whom a good is either indispensable or useless, two rules are singled out: the Ex Post Service rule is the expectation of the equal division of costs between the agents who end up being served; the Needs Priority rule splits the

cost first between those agents for whom an item is critical ex post, or if there are no such agents between those who end up being served.

The strategic use of sellers information in first-price auction

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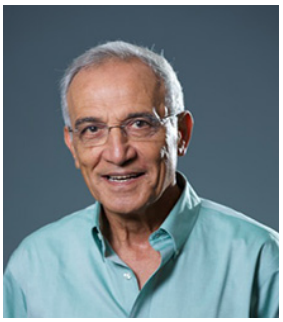
Co-author: Todd Kaplan



In the framework of a first-price private-value auction, we study the seller as a player in a game with the buyers in which he has private information about their realized valuations. We ask whether the seller can benefit by using his private information strategically. We find that in fact, depending upon his information, set of signals, and commitment power he may indeed increase his revenue by strategic transmission of information.

Strong equilibrium in network congestion games

Ron Holzman
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A network congestion game is played on a directed, two-terminal network. Every player chooses a route from his origin to his destination. The cost of a route is the sum of the costs of the arcs on it. The arc cost is a function of the number of players who use it. Rosenthal proved that such a game always has a Nash equilibrium in pure strategies. In this lecture we present a systematic study of the classes of networks for which a strong equilibrium is guaranteed to exist, under either of two opposite monotonicity assumptions on the arc cost functions. The main results are: (a) If costs are increasing, strong equilibrium is guaranteed on extension-parallel networks, regardless of whether the players' origins and destinations are the same or may differ. (b) If costs are decreasing, and the players have the same origin but possibly different destinations, strong equilibrium is guaranteed on series-parallel networks. (c) If costs are decreasing, and both origins and destinations may differ, strong equilibrium is guaranteed on multiextension-parallel networks. In each case, the network condition is not only sufficient but also necessary in order to guarantee strong equilibrium. The presentation is based on old results by Holzman and Law-Yone in the increasing case, on newer results by Epstein, Feldman and Mansour in the decreasing case, and on recent extensions by Holzman and Monderer of both sets of results.

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Abstracts

Efficiency and the core in cooperative games with positive and negative externalities

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In this paper, we study cooperative games with externalities. In the presence of externalities, the worth of a coalition, namely a group of players, depends on the coalition itself and a partition of the player set, namely a coalition structure of players. If externalities exist, superadditivity is no longer sufficient for the efficiency of the grand coalition: some partitions may yield more surplus than the grand coalition. This result was indicated by Hafalir (2007, GEB) which proposed convexity in environments with externalities and proved that convexity is a sufficient condition to accomplish the efficiency of the grand coalition. We attempt to develop the result of Hafalir (2007, GEB) and to explore some weaker conditions to achieve the efficiency of the grand coalition. This is motivated by the fact that Hafalir's convexity rules out many games reflecting economic situations. Our approach features two types of externalities: positive and negative externalities. By focusing on these externalities, we provide two weaker sufficient conditions for the efficiency of the grand coalition with respect to the type of externality. Furthermore, we examine a condition for non-emptiness of the core. When externalities exist, the definition of the core is not unique. In this light, we specifically analyze the optimistic-core which is the smallest core in all types of cores. We prove that a combination of negative externality and a certain condition induces the nonempty optimistic-core.

Retail competition based on calorie content differentiation when consumers care for products' energy

Abdulfatah Adam
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Increasing obesity awareness may affect the utility of consuming a good for which a low energy density substitute is available. The objective of our study is to understand the health related quality choices facing retail supermarkets and to provide policies that would align private choices with the social welfare optimum. We specifically look at effect of heterogeneous consumer preferences, i.e., when supermarket customers care about energy density of the concerned food, and the market implication of such product differentiation. The paper utilizes the spatial duopoly model to find out how health concern affects prices, food characteristics and market shares of the competing supermarket chains. The analysis is based on a two-stage game, where at the first stage each chain chooses the characteristic of its food product. At the second stage, each chain chooses its price. Equilibrium prices and market shares are affected by consumer responses towards the products' energy density as well as by the higher costs for producing & selling the low-calorie density foods. When it comes to the Nash equilibria in the characteristics, three equilibria are found based on alternative parameter constellations. In order to determine whether the market of the differentiated food functions optimally, an outcome based on welfare maximizing authority is compared to the private choices of product health characteristics.

Testable implications of fair allocations

Yasushi Agatsuma
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We explore testable implications of fair allocations (allocations which are Pareto efficient and envy free), that is, we aim to answer the question when observed allocations can be regarded as fair allocations without the information of preferences. By employing the revealed preference approach, we provide a necessary and sufficient condition that observed allocations can be seen as fair allocations; we prove that the solvability of a system of inequalities which is constructed from the observed allocation data is equivalent to the data is consistent with Pareto efficiency and envy freeness. We alter assumptions on preferences and compare differences between obtained testable implications.

Claims-separable consistency and potential for claims problems

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In this paper we introduce an axiom, referred to as claims-separable consistency, that is satisfied by several classical division rules defined for claims problems. It is satisfied by the uniform gains rule, the uniform losses rule, the Talmud rule, Piniles' rule, the minimal overlap rule and the proportional rule. This new axiom is also satisfied by the rules in the TAL-family defined by Moreno-Ternero and Villar (2006). Claims-separable consistency follows from the fact that if agent j claims more than agent i, then the claim of agent j is formed by the claim of agent i plus the remaining claim of agent j. Claims-separable consistency requires the allocation of agent j to be equal to the allocation of agent i plus the allocation of agent j in a remaining claims problem. We determine the entire family of division rules that satisfy this new axiom. We introduce the concept of potential for claims problems and we relate it to claims-separable consistency. In addition, we use claims-separable consistency to characterize axiomatically the minimal overlap rule given by O'Neill (1982).

Combined tickets in a public transport system

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In this paper we consider the problem of a set of transportation companies that operate in the same area, with different transportation modes. The companies offer to their customers combined tickets that allow the travellers to use more than one means of transport, independently from the company that operates the service. We face the problem of allocating the profit of using an infrastructure among all the agents that are involved in providing the service. We consider a theoretical traveller that goes from a given origin to a given destination according to a probability based on the origin-destination matrix; for each pair origin-destination the theoretical traveller chooses with equal probability one of the feasible paths available. We define a cooperative game in characteristic form, where the set of players corresponds to the set of companies and the characteristic function assigns to each subset of companies the worth associated to the set of feasible paths they may operate. We propose a simple way to allocate the price of the ticket among the companies that offer the combined ticket. The

price of each feasible path is equally divided among all the companies that actually operate it. This rule turns out to be the Shapley value of the cooperative game.

The RTAL-family of rules for bankruptcy problems: A characterization

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We characterize a family of bankruptcy rules on the basis of the consistency and additivity in a limited domain called "restricted additivity". The axioms characterize the RTAL-family which includes several standard rules such as the constrained equal awards, the constrained equal losses and the reverse Talmud rules. Each member of the family is characterized using consistency and additivity in broader domains than restricted additivity. We also show that the reverse Talmud rule is the only rule satisfying consistency, restricted additivity and half-claim boundedness.

Multi-sided assignment games on m-partite graphs

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We consider a multi-sided assignment game with the following characteristics: (a) the agents are organized in m sectors that are connected by a graph G^* associated with a weighted m-partite graph G on the set of agents, (b) a basic coalition is formed by agents from different sectors that are connected by G^* and (c) the worth of a basic coalition is the addition of the worths of all its pairs that belong to connected sectors. We provide a sufficient condition on the weights to guarantee balancedness of the related multi-sided assignment game. Moreover, when the graph G^* is a tree, we prove the game is strongly balanced and the core is described by means of the cores of the underlying two-sided assignment games associated with the edges of G^*. If the tree G^* is a star (there is a node that belongs to all edges), then the core can be characterized by means of the competitive prices.

From spanning trees to arborescences: new and extended cost sharing solutions

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The paper examines minimum cost arborescence problems, which generalize the well-known minimum cost spanning tree (mcst) problems. We propose a new family of cost sharing methods that are easy to compute, as they closely relate to the network-building algorithm. These methods, called minimum incoming cost rules for arborescences (MICRAs), include as a particular case the extension of the folk solution introduced by Dutta and Mishra (2012). A simpler computational procedure thus obtains for this method. We also provide new axiomatizations of (a) the set of stable and symmetric MICRAs and (b) the folk solution. Finally, we closely examine two remarkable MICRAs. The first one relates to the cycle-complete rule for mcst problems introduced in Trudeau (2012). The second one contrasts with the folk rule by fully rewarding agents who help others connect to the source.

Distributional perfect equilibrium in bayesian games with applications to auctions

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In second-price auctions with interdependent values, bidders do not necessarily have dominant strategies. Moreover, such auctions may have many equilibria. In order to rule out the less intuitive equilibria, we define the notion of distributional perfect equilibrium for Bayesian games with infinite type and action spaces. We prove that every Bayesian game has a distributional perfect equilibrium provided that the information structure of the game is absolutely continuous and the payoffs are continuous in actions for every type. We apply distributional perfection to a class of symmetric second-price auctions with interdependent values and demonstrate that a specific type of equilibrium is perfect, while many of less intuitive equilibria are not.

Nothing so certain as your anchors? A consumer bias that lowers prices and might prevent cartels

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Anchoring is a well-known decision-making bias: original guesses for a certain question could act as anchors and could influence our final answers. Reference prices - in a similar fashion - can lead to a bias in consumer valuations, and thus consumer demand will be coherent but not one derived from a utility framework. In our paper we investigate the effect of the existence of anchoring on how oligopolistic firms might change their pricing strategy. More specifically, we analyze pricing strategies and equilibrium when differentiated firms compete in Bertrand fashion in the presence of price anchoring. First we show that anchoring may ensure that prices charged in the steady-state are lower than in the no-anchoring case. We discuss factors that increase the likelihood that the presence of anchoring is going to lead to lower prices. Furthermore, we claim that the existence of anchoring makes collusion among firms less stable. This might have implications on optimal allocations of regulatory resources.

Sophisticatedly stable equilibria in the local public goods game

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We study heterogeneous player rationality in games on networks with strategic substitutes. In the local public good game we distinguish two types of players, myopic (one-shot optimizers), and sophisticated (long-run optimizers). Starting from a static equilibrium, the game advances in two ways: by the sophisticated players' deviations to progress the game into a state where they hope to earn higher payoffs, and by the myopic players' reactions to the deviations. We call Nash equilibria with no possible profitable deviations sophisticatedly stable. We derive conditions of stability in some networks and find that only experts and free riders equilibria can be stable. Stable equilibria also conflict with principles of efficiency and equality.

The stability of the core in multi-sided assignment games

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We consider von Neumann-Morgenstern stable sets in multi-sided assignment games. We show that the characterization of core stability by Solymosi and Raghavan (2001) in the classical two-sided case also holds for any type of multi-sided assignment games (the core is stable if and only if there is a matching between the players such that the corresponding entries in the underlying matrix are all row, column,... maximums.).

Voting power on a linear political space

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In a voting game, a set of players must make a yes-or-no decision on a given issue. Players move different number of votes, e.g. weights, so that they are appointed of different "power". Classic methods to measure such power are the Shapley-Shubik and the Banzhaf indexes, that are defined on the condition that all players coalitions can form, that voters are perfectly symmetric, and that preferences about the voting issue do not play any role in the game. As a consequence, voting game and power indexes were applied only to the a-priory analysis of a legislature, for example to the abstract and theoretical power of European nations under different scenarios of votes/weights distribution.

To make the power analysis an empiric tools to analyze a real voting situation, in which players have preferences on the outcome of a negotiation, we analyze a recently proposed voting model in which players are located in a political space in correspondence to their bliss points, with more than one voters located on the same point. Then coalitions can form on the condition that voters are connected. As a result, the political space and connections can be embedded on a graph. It can be shown that the Banzhaf and Shapley-Shubik indexes can be defined in this setting and that they are computable efficiently, a.g. in pseudo-polynomial time.

The index of Banzhaf with constrained coalitions is used to analyze a data base, which describe the negotiations in European Council of the last 20 years. The data base report the bliss point of each nations on a given negotiations, the saliency of the issue for each nation, and the outcome of the decision. Data are fitted with an econometric model that include the revised Banzhaf index, that appears to be significant under many control variables. In other words, the

revised Banzhaf index is a predictive variable of the outcome of a negotiations in a realistic setting.

How to apply penalties for avoiding delays in projects

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A planner wants to carry on a project involving several firms. In many cases the planner, for instance the Spanish Administration, includes in the contract with the firms some penalties to be paid by the firms in case the project is delayed. We discuss two ways of include penalties. In the first one penalties are applied only when the whole project is delayed. In the second one is applied always. We compare both. The optimal penalty (for the planner) is larger in the second one. The utility of the planner is always lager or equal in the second one. The utility of the firms is always larger or equal in the first one.

A package for finding asymptotic stable states in the sampling dynamics

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The selection dynamics under consideration is the so called sampling dynamics. It is not only highly non linear but in addition a non payoff monotonic dynamics. Due to this last feature it is possible that a strict Nash equilibrium (NE) might lack local stability under such a dynamics.

This is a crucial difference to the much wider known replicator dynamics. Strict Nash equilibria are always evolutionary stable strategies (ESS) and it is well known that every ESS corresponds to an asymptotically stable fix point in the replicator dynamics. In fact, any payoff monotonic selection dynamics produces some basin of attraction for every strict NE which means that one can always find a belief system which justifies the strict NE in question.

However, many experiments, in particular in the framework of social dilemmas, indicate that subjects often do not behave rational, and in most cases where NE is a bad predictor it turns out, that the NE in question is asymptotically unstable under the sampling dynamics. Therefore it would be beneficial to look systematically at the sampling dynamics in addition to other approaches.

Unfortunately it is quite tedious for researchers to deal with the sampling dynamics. For symmetric 2x2-games one can find closed analytical expressions

for all sampling equilibria (hence rest points of the dynamics). On the other hand there is no guarantee that closed forms for larger games even exist. Due to the high non linearity the constituting equations might fill whole pages for medium sized matrix games already.

However, calculating numerical solutions is always feasible. The solution package discussed in this paper will enable researchers to find at least numerical solutions of asymptotically stable rest points. It suffices to define the game matrices. The limits of the approach with respect to computational efficiency will be also discussed.

Individual power In social exchange networks - A theoretical analysis using cooperative game theory

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This paper theoretically analyzes a model of exchange networks. Here, a resource pool is provided for every relation in the network which describes the exchange opportunities of the agents. Agents negotiate how to split this pool. Former research already analyzed power differences in networks in which every actor is permitted to exchange once per round (one-exchange networks). The present paper uses an N-person cooperative game with transferable utility for networks based on the model suggested by Jackson and Wolinsky (1996) to formalize an exchange network. In order to predict power differences in one-exchange networks, two specific characteristic functions are defined modeling the underlying exchange situation. The equal bargaining rule is applied to calculate the power index of each individual in the network. This index is used to define the relative power relationship in a bilateral exchange which works as a multiplier in the calculation of the profit pool split. While former research concentrates on the core as a solution of this game, this paper applies an allocation rule which provides a unique solution. Regarding experimental results the present model provides better exact outcome predictions than previous research. The representation of exchange networks with this model helps to define the scope conditions of network exchange theory more precisely. An application to buyer-seller networks points out the usefulness in bargaining theory.

A wavelet-game theory approach to the modelling of contagion: The case of energy markets

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The goal of this paper is to develop a wavelet-game theory approach for the modelling of dynamic dependencies between two economic systems, where the focus is set on the transmission of adverse events. A game theory model of contagion is employed in order to derive the conditional probability of a crash in the second system upon occurrence of a negative shock in the first one. We build on the model developed by (Ahnert & Bertsch, 2015), where global coordination games of regime change in two regions are used to describe the equilibrium conditions as well as to obtain the probability of a crisis in region 2, conditional upon crisis in region 1. The correlation of regional fundamentals plays a key role in the empirical prediction of this probability. However, we argue that in terms of the available (market) data, the correlation measure could not capture effectively the dependence between regional fundamentals. On the other hand, the wavelet coherence measure has proven to be able to extract deeper knowledge on the analyzed dependencies structures. Therefore, we augment the model with the introduction of this concept, furthermore, we outline an algorithm for its empirical application. Finally, the advantages of the developed approach are demonstrated in terms of energy markets' data. Its performance is compared to the results delivered via its simpler alternative (i.e. when the correlation coefficient is used as a measure of dependence). A major conclusion is the improved accuracy of a crash prediction in region 2, conditional upon occurrence of a crisis in region 1.

Cost allocation in rural electrification projects: Case study of an Indian village

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Energy access allows populations of rural areas in Developing Countries to grow economically. Cost allocation methodologies represent an important step in electrification projects of those areas, since they may help defining tariffs or sharing investment costs of transmission and generation systems. Cost allocation problems of electricity network expansion situation are often faced and solved with a

game theoretical approach. In our work we compare different solution concepts of cooperative game theory: Shapley value, Nucleolus, Kernel. The authors want to highlight the advantages and the drawbacks of the application of such cost allocation methods in rural projects. In the present case study, we used the energy needs of the project beneficiaries - three farmers of a village in the rural India - to find the Net Present Cost (NPC) of the energy system. For the technical solution we allocated the NPC among the players, using different cooperative game theory solution concepts. Finally, we propose the most appropriate solution concept for rural context, emphasizing the relevance of the propensity to disrupt and the transparency of cost assignments.

Decomposition, value, and power

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We suggest a foundation of the Shapley value via the decomposition of solutions for cooperative games with transferable utility. A decomposer of a solution is another solution that splits the former into a direct part and an indirect part. While the direct part (the decomposer) measures a player's contribution in a game as such, the indirect part indicates how she affects the other players' direct contributions by leaving the game. The Shapley value turns out to be unique decomposable decomposer of the naïve solution, which assigns to any player the difference between the worth of the grand coalition and its worth after this player left the game. Moreover, we apply the decomposition of solutions to the measurement of power in voting games and obtain two new power indices with appealing properties.

On strategy-proofness and the salience of single-peakedness

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We consider strategy-proof social choice functions operating on a rich domain of preference profiles. We show that if the social choice function satisfies in addition tops-onlyness, anonymity and unanimity then the preferences in the domain have to satisfy a variant of single-peakedness (referred to as semilattice single-peakedness). We do so by deriving from the social choice function an endogenous partial order (a semilattice) from which the notion of a semilattice

single-peaked preference can be defined. We also provide a converse of this main finding. Finally, we show how well-known restricted domains under which nontrivial strategy-proof social choice functions are admissible are semilattice single-peaked domains. Our characterization of a semi-lattice single-peaked domain may be viewed as a converse to the Gibbard-Satterthwaite theorem.

Cyclical evolution in finance-growth nexus: Theory and evidence

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Since the 1980s, financial crises have tended to reoccur with increasing frequency and growing intensity. They are endogenously generated by the established OTD (originate-to-distribute) model within the new finance-growth paradigm. Good finance fosters the correct allocation of financial resources, the fair redistribution of wealth and positive economic growth (the virtuous cycle), whereas bad finance captures part of the created wealth and, thanks to a highly technologically advanced financial system with the ability to create money ex nihilo, over time it drags the economy down to recession or negative growth, destroying wealth and consequentially social welfare (the unvirtuous cycle). Therefore, structural factors are at the foundation of the persistence of instability and thus of what we define as the unvirtuous cycle, which can generate what we label the wealth trap. A VUC index has been developed by us to capture the status quo of the finance-growth relationship. A cross country analysis for the US, UK and Euro area economies has been made in order to verify the validity of the index. A core variable is identified: the degree of financial innovation. This is an endogenous variable within the endogenous money/credit creation process; its identification is of crucial importance, as it is the key to full understanding of the finance-growth relationship and is the element of originality in this field of studies. The VUC index for all countries shows clearly the exponential effect of the degree of financial innovation over time. It is important for scholars and policymakers to understand the mechanism underpinning the finance-growth relationship and that it is their responsibility to return the economic system to what we will call the virtuous cycle.

Behavioral game theory: A study in the decision making process of university students in Lebanon in relation with grade allocation

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In the process of maximizing their utility, university students tend to allocate study time in a way as to maximize their final grade or their leisure time. The concept of maximizing utility within the scope of game theory analysis has been already treated by the literature in the domain and especially the pioneer work of Baumol (1977) through the maximin and minimax strategies among others. Simon (1959) has also touched on the theories of decision making in economics and behavioral science, but student's decision making process remains thus far not developed in the literature.

Our work has considered the system of grade allocation as devised by the university as an integral part in the student's decision making process. A university allocating 50% or more of the final grade to tests done throughout the year and another 50% to the final examination create an environment with symmetric information allowing the student to make decisions regarding the time allocated for studies. A considerable number of the student body will minimize the time and effort allocated to studies especially if they have a grade close to a passing one.

Our work has developed quite extensively the elements of the game; the players (students, teachers, and administration), the available information and moves for each player and the outcome of each game. Once the outcomes defined, we aim to use the information in order to stimulate student motivation and performance thus increasing the overall educational level.

This work also aims at providing on the one hand new insight into the production of education by determining the impact of symmetry of information on the demand of education and thus its impact on general equilibrium, and on the other determining the characteristics of each group of players in the population to increase productivity.

Optimal strategy and effort input in group work evaluation in higher education

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This model applies the model for team performance developed by Holmstrom (1982) to a setting in which the good produced by the team is a public good. It shows that when the team good is a public good, for example an essay mark then the team members are inclined to exert the efficient level of effort and no free-riding occurs. Contrary to this results, group members are not willing to acknowledge each others contribution since this diminishes the value they can assign to their own contribution.

Decentralized clearing in financial networks

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We consider a situation in which agents have mutual claims on each other, summarized in a liability matrix. Agents' assets might be insufficient to satisfy their liabilities leading to defaults. We assume the primitives to be denoted in some unit of account. In case of default, bankruptcy rules are used to specify the way agents are going to be rationed. We present a convenient representation of bankruptcy rules.

A clearing payment matrix is a payment matrix consistent with the prevailing bankruptcy rules that satisfies limited liability and priority of creditors. Both clearing payment matrices and the corresponding values of equity are not uniquely determined. We provide bounds on the possible levels equity can take. We analyze decentralized clearing processes and show the convergence of any such process in finitely many steps to the least clearing payment matrix. When the unit of account is sufficiently small, all decentralized clearing processes lead essentially to the same value of equity as a centralized clearing procedure. As a policy implication, it is not necessary to collect and process all the sensitive data of all the agents simultaneously and run a centralized clearing procedure.

Position value for link weighted graph

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In this work we deal with weighted communication situations i.e., cooperative TU games in which cooperation is restricted by means of a weighted network. We admit several interpretations for the weight of a link: capacity of the communication channel, flow across it, intimacy or intensity in the relation, distance between both incident nodes/players, cost of building or maintaining the communication link or even probability of the relation (as in Calvo, Lasaga and van den Nouweland, 1999). Then, according to the different interpretations, we define appropriated (weighted) link games in a way parallel to the familiar environment of the position value and we define the corresponding point solutions that extend the position value for these situations. Finally we characterize these values in terms of the (adapted) component efficiency and balanced link contributions properties as in Slikker (2005) and we analyze the extent to which they satisfy a link/weight monotonicity property.

Bankruptcy problems with nontransferable utility

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Providing a new approach to bargaining problems with claims, this paper introduces bankruptcy problems with nontransferable utility as a generalization of bankruptcy problems with monetary estate and claims. Following the classical axiomatic theory of bankruptcy we formulate some appropriate properties for NTU-bankruptcy rules and study their implications. We derive several characterizations of the generalized proportional rule and constrained equal awards rule, and we explore duality.

Several remarks on the role of certain positional and social games in the creation of the selected

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The game theory was created upon the basis of social as well as gambling games, such as chess, poker, baccarat, hex or one armed bandit. The aforementioned games lay solid foundations for analogous mathematical models (e.g. hex), artificial intelligence algorithms (hex), theoretical analysis of computational complexity attributable to various numerical problems (baccarat), as well as for illustration of several economic dilemmas - particularly in the case where the winner takes everything (e.g. noughts and crosses). A certain gambling games, such as a horse racing, may be successfully applied to verify a wide spectrum of market mechanism e.g. market effectiveness or customer behavior in light of incoming information regarding a specific product. One of a lot applications of the slot machine (one armed bandit) is asymptotically efficient allocation rule, which was assigned by T.L. Lai and H. Robbins (1985). In the next years the rule was developed by another and it was named a multi armed. The aim of the paper is to discuss these social games along with their potential mathematical models, which are governed by the rules predominantly applicable to the social and natural sciences.

Truncated Leximin Solutions

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This paper shows that three classic properties for bargaining solutions in an environment with a variable number of agents - Anonymity, Individual Monotonicity and Consistency - characterize a one-parameter class of Truncated Leximin solutions. Given a positive and possibly infinite α, a Truncated Leximin solution gives each agent the minimum of α and their Leximin solution payoff.

Incentive pay for policy-makers

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We study how to motivate policy-makers to solve political multi-task problems efficiently. Political multi-task problems typically have difficult-to-measure outcomes. Moreover, there are conflicts among citizens about optimal policies and

the agents have the power to tax the citizens to invest in better outcomes of some tasks. We develop a political agency model with two tasks and only one measurable outcome. In such an environment, policy-makers choose inefficient public good levels and expropriate minorities. A judicious combination of constitutional limits on taxation and incentive pay for policy-makers can improve welfare. Incentive pay is based on the public good level.

Analysis of mating fights from observable behavior in Boil and doily spiders

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Mating fights between Boil and doily spiders involve two combatants competing for eggs to fertilize. Observable data compiled by Austad [1982], allowed for determination of a payoff matrix, based on the number of eggs fertilized after each encounter and on the impact of an encounter to the player's lifespan. Analysis of the fights' dynamics as a series of repeated games with strategies based on previous interactions shows that the observed behavior is not Pareto efficient, since no cooperation did evolve. We show that the observed results fit theory when using a model with strategies based only on the current combat rather than previous interactions. These findings were supported by evolutionary simulations. In this talk, we will present the results of our analyses and discuss the meaning of the corrected model.

On the structure of the set of embedded coalitions

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Partition function form games provides a framework that enables to model cooperative games when the value of a coalition depends not only on their members but also on how the rest of the agents organized themselves. Several values have been proposed extending the Shapley value, proposed for transferable utility games, to the model of partition function form games. The values differ on how they compare the embedded coalitions, among other issues. In this paper we study the structure of the set of embedded coalitions considering the ordering used in Clippel and Serrano (2008).

Reference

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Bankruptcy solutions for TU-games

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A bankruptcy problem is a classical example of a situation in which it is possible to compute a solution that is fair for all the agents involved and requires a very low computational effort. On the other hand, TU-games usually have a very high complexity, for computing both the characteristic function and the solution. In this paper we propose a method that provides a solution for a TU-game profiting of the advantage of a suitably defined bankruptcy problem. The simplest idea is to use only the worth of the grand coalition and the marginal contributions of the players; then we add other information: first the worth of each player standing alone, and finally we take into account all the coalitions.

The balanced contribution property for equal contributors

Yukihiko Funaki
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In this paper we introduce a weaker version of the balanced contribution property by Myerson (1980), and explore the class of solutions characterized by the axiom. Our new axiom, the balanced contribution property for equal contributors, states the if two players' contributions to the grand coalition are the same, then their contributions to each other's payoffs are the same. We prove that this axiom, together with efficiency and weak strategic invariance, characterizes the class of r-egalitarian Shapley values. This class includes the egalitarian Shapley values (Joosten,1960) and the generalized solidarity values (Casajus and Huettner, 2014) as special cases. We also provide a non-cooperative implementation of the solution.

A new rule for allocating costs of cleaning a river: fairness versus incentive compatibility

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The problem of sharing the costs of cleaning a river was studied in several papers from a theoretical point of view. Ni and Wang (2007) model a river as a segment which is divided into n subsegments from upstream to downstream such that each region is located in one of them. They propose two rules for sharing the cost. However, they do not take into consideration properly the responsibility that each region has in the pollution. Following that model, Alcalde-Unzu et al. (2015) explicitly assume that the pollution is transmitted to some rate t. When the transfer rate is unknown, the cost cleaning vector can provide useful information to estimate certain limits of that rate. In that paper, the Upstream Responsibility (UR) rule is proposed. It assigns to each region the responsibility that it would have if the transfer rate would be its expected value. However, although the UR rule improves the preceding ones in the literature, in this paper we prove that it could be biasing the estimation of the responsibility of each region. We prove that the expected responsibility of each region differs from the responsibility that this region would have if the transfer rate would be its expected value. We propose to assign directly the expected responsibility to each region in our new rule, the Estimated Responsibility rule. This new rule can be calculated with the UR rule but using a biased estimator of the transfer rate, t that correct the non-linearity of the responsibility function. Then, the Estimated Responsibility Rule improves in terms of fairness the UR rule. We also study a basic property of incentive compatibility: monotonicity, which states that if, ceteris paribus, a region has discharged more waste into the river, then it should not pay less. We prove that the new proposed rule does not satisfy monotonicity while the less fair UR rule does. Given this trade-off between fairness and incentive compatibility, we aim to find the fairest rule which satisfies monotonicity.

Soft cooperation and games

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Cooperative game theory studies situations where a set of players bargain a fair allocation of a common profit resulting from their collaboration, namely a

payoff vector. In a coalitional game the characteristic function assigns a number for each coalition representing the profit obtained by them. The Shapley value is one of the point solutions for cooperative games mostly used and studied. It is a function obtaining a payoff vector for each game based in a set of reasonable conditions. The Shapley value considered symmetric players, i.e. there in not any condition a priori which differentiates their treatment except the characteristic function. Numerous studies have analyzed asymmetric situations for the players introducing certain conditions about their relations: coalition structures, a priori unions, communication structures, permission structures, etc. Later several situations with fuzzy relations among the players were introduced: fuzzy coalitions, fuzzy communication, fuzzy authorization, proximity, cohesion... Now we introduce a new model to study asymmetric problems in cooperative games. The concept of soft is a mathematical tool for dealing with uncertainties in an opener way than fuzzy sets or similar. During the last years a lot of papers about soft sets and operations have been published. Our proposition is about the application of soft sets for cooperative games. The asymmetry properties of the players in a cooperative game are the parameters to define a soft set of players. We consider then a characteristic function over the soft subsets of players, the soft coalitions. The meaning of this worth for a soft coalition is the profit obtained for the coalition depending on the parameters satisfied by the players in the coalition. We introduce soft cooperative games, several interesting subfamilies and the concepts of soft imputation. We also show a version of Shapley value for soft cooperative games which is provided with an axiomatization.

Transforming games with affinities from characteristic into normal form

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As is known, while introducing games in extensive form in (1944), von Neumann and Morgenstern also supplied a method for transforming such games into normal form. Once more in (1944), the same authors provided a method for transforming games from characteristic function form into normal form, although limited to constant-sum games. In (2007) Gambarelli proposed a generalization of this method to variable-sum games. In this generalization, the strategies are the requests made by players to join any coalition, with each player making the same request to all coalitions. Each player's payment consists of the player's request multiplied by the probability that the player is part of a coalition really formed. Gambarelli introduced a solution for the game in characteristic

function form, made up of the set of Pareto-Optimal payoffs generated by Nash Equilibria of the transformed game. In this paper, the above transformation method is generalized to the case in which each player's requests vary according to the coalition being addressed. Theorems regarding the existence of a solution are proved. Software for the automatic generation of the solution is supplied.

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Approximation of (k, t)-robust equilibria

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Game theory models strategic and conflicting situations offering several solution concepts known as game equilibria, among which probably the most popular one is the Nash equilibrium. A less known equilibrium, called (k, t)-robust, has recently been used in the context of distributed computing. The (k, t)-robust equilibrium combines the concepts of k-resiliency and t-immunity: a strategy profile is k-resilient if there is no coalition of k players that can benefit from improving their payoffs by collective deviation, and it is t-immune if any action of any t players does not decrease the payoffs of the others. A strategy profile is (k, t)-robust if it is both k-resilient and t-immune. In this paper an evolutionary method of approximating (k, t)-robust equilibria is proposed and tested by means of numerical experiments on a benchmark constructed from a game that studies node behavior in a distributed system.

Finding vertices of the core of a cooperative game

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The purpose of this paper is to present a computational scheme for the determination of all vertices in the core of a cooperative game, which is the solution of a finite system of linear inequalities and a linear equation. Our computational scheme is based on the application of the Γ-algorithm introduced by Jubete

(1991) and developed by Castillo et al. (1999) to obtain the dual of a given cone. Following this idea, we transform the system of linear inequalities of the core to a cone by adding a new variable and we apply the Γ-algorithm to build a tableau containing all the generators of the dual cone and finally, when we eliminate the added variable, we obtain all vertices of the core of our cooperative game.

Extractive structures in networks: Definition, measurement and formation

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It is well-known that critical nodes or "middlemen" control information and trade flows in a directed network and take advantage of these positions to extract excess rents from controlling such chains in these networks. We extend this concept to critical node sets, introduced as sets of nodes with similar properties. In particular, the nodes considered provide critical intermediation services in the network.

First, we characterise these critical nodes sets through the notion of "contestation". Here, a critical node set is contested by another node set if these other nodes can provide the same intermediation services to the network as the nodes in the critical node set.

Second, we introduce innovative intermediation measures to assign a value to the membership of a critical node set. These intermediation measures function as extended centrality measures. This, in turn, allows the introduction of new network centrality measures that are based on potential membership of these critical node sets.

Third, our methodology allows us to introduce a game theoretic approach to analyse the formation of critical node sets. We introduce a non-cooperative game theoretic approach to analyse the formation of certain critical node sets. We show that the Strong Nash equilibrium in a critical node set formation game identifies the maximally controlling critical node sets in any network. This provides a foundation to an innovative way of identifying brokerage structures in directed networks.

Finally, we develop applications of our framework to the Renaissance Florentine elite network and the networks formed by the 9/11 terrorists. New insights in the functioning and evolution of these networks are derived and quantified using tools from our approach.

Revisiting game theoretical closeness and betweenness centrality measures

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In this work we revisit the additive decomposition that Gómez et al. (2003) introduced for the Myerson value of a symmetric game when viewed as a centrality measure. In this decomposition one of the summands was interpreted as a closeness centrality measure and the other as a betweenness one. The aim of this work is to explore the extent to which each one of these measures satisfy properties that enforce the previous interpretation. In particular, the closeness centrality satisfies symmetry and, under convexity of the game, it is link monotonous, it is maximal for players connected with all the others (for example, the hub of a star) and it is minimal for isolated nodes; it does not decrease from the end nodes to the median one(s) in a chain. Similarly, the betweenness centrality also satisfies symmetry and, if the game is superadditive, it satisfies link monotonicity; it is maximal in the hub of a star, it is minimal for isolated nodes and for nodes with only an incident tie and, if the game is convex, in a chain, it does not decrease from the end nodes to the median one(s). Finally these measures are obtained for nodes in several classical networks with a general symmetric game.

A new contribution to the validity of the Coase theorem using the core

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This article is a contribution to the literature that analyzes the validity of the Coase theorem using the core of a cooperative game. We identify in a new framework the conditions for which the core is not necessarily empty and we show that, contrary to the classical statement of the Coase theorem, the payoffs strongly depend on the distribution of rights.

A value for stochastic coalition formation processes with externalities

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Standard values for classical TU-games assume that the final structure of the society of agents will be the grand coalition, which is reached by adding one agent at each step, in any order. This classical framework has been generalized in at least two ways. First, the final state of the structure of the society is not necessarily the grand coalition, and the way to reach it is not necessarily a regular process of adding one agent at each step. Faigle and Grabisch have proposed a general definition of a value, considering an arbitrary stochastic evolution of the current coalition. Second, the worth obtained by a coalition may depend of the structure of the society, viewed as a partition. This leads to games in partition function form (PFF games). Many values have been proposed in the literature for PFF games, and Grabisch and Funaki have proposed a value based on the idea of coalition formation, considering that the structure of the society evolves from the (unstructured) society of individual players till the grand coalition. The present work tries to put the two views in the same framework: considering a stochastic evolution of the structure of the society which does not necessarily stop at the grand coalition, and defining a value for individual players. Our definition contains the value of Grabisch and Funaki as a particular case. We study its properties and characterization.

Compromises and rewards: Stable and non-manipulable probabilistic pairing

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Can we reconcile stability with non-manipulability in pairing problems by selecting lotteries over matchings? We examine the problem of eliciting preferences to make pairs as introduced by Gale and Shapley (1962). We develop ex-ante notions of stability and non-manipulability that are parametrized by collections of utility functions. In particular, we study the collection of utility functions with increasing differences for which stability and non-manipulability turn out to characterize Compromises and Rewards. This is a novel rule that is fundamentally different from the one that has attracted most attention in the literature, Deferred Acceptance.

Graphical algorithms for the nucleolus of binary assignment games

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An assignment game is a cooperative game with its player set divided into two groups, where a coalition receives a positive payoff only if it contains at least one player from both groups. In other words, it concerns a bipartite matching, with a payoff defined for each pair (payoffs for larger coalitions are determined additively). The 1994 paper by Solymosi and Raghavan gives an algorithm for finding the nucleolus (an optimal solution) of such a game. In this paper, we examine the special case in which the payoffs for each pair take binary values, an indicator of whether or not the pair is compatible. For this case, we present two new, simpler algorithms which capitalize on the graphical aspect of the previous one. These algorithms require $O(n^4)$ operations. We also discuss sociological implications of this solution, considering each pair's split of the payoff to be their relationship's balance of power.

The proportionate prenucleolus

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The prenucleolus lexicographically minimises the excesses of all coalitions, i.e. the differences between their worth and what they are allocated. In this paper, we introduce the proportionate prenucleolus, which instead of the excess of a coalition looks at the ratio between its allocated amount and its worth. We need to take special care of games in which one or more coalitions have worth zero, in order to ensure that the solution is single-valued. We show that the proportionate prenucleolus is a core selector and we derive a Kohlberg-type criterium for checking whether a particular allocation is the proportionate prenucleolus. Finally, we characterise the new solution by, among others, a reduced game property and a proportionality property.

A centralized matching market with early matches

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A common practice for centralized clearinghouses is to compute, once and for all, the final allocation of students at a given authorized date. Sometimes, however, the centralized system proceeds sequentially by computing allocations at preliminary dates. At the authorized final date, the market is already partially cleared and remain active only the agents who still do hope (correctly or not) for better schools. This multistage system can account for an additional source of heterogeneity among students, including scheduling constraints, which has been ignored so far in the matching literature. We propose a model of centralized matching with gradual acceptance dates to assess whether these unconventional clearinghouses succeed in maintaining the expected properties of two-sided matching. Our results can be used to evaluate (part of) the French system for college admissions.

Purification without common knowledge of priors

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We show generically that the Purification Theorem of Harsanyi (1973) does not hold for 2x2 games without the assumption of common knowledge of priors. We obtain that the limit of the Mirage Equilibrium – the corresponding generalization of Bayesian Equilibrium – of the perturbed game does not coincide with the mixed strategy equilibrium of the unperturbed game, rather it yields a pure strategy.

How Jeremy Bentham would defend against coordinated attacks

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We analyze the problem of a single player who is threatened by a coordinated attack. For example, consider a central bank defending a currency peg, a government facing a revolution or a prison warden trying to prevent a riot. The defending player would like to deter his opponents from attacking by using

their coordination problem against them and thus exerting as little resources as possible. Bentham (1787) proposed the "panopticon", an innovative prison concept, as an ideal solution to this problem. We consider different information structures in a stylized model of a prison. We show that Bentham's intuition was correct and that the panopticon often performs best, especially if there are many prisoners. This provides recommendations for the more general problem of defense against coordinated attacks as well as insights into the applications of Bentham's ideas across the social sciences.

Inclusive Collusion Neutrality on Networks

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In the context of cooperative games with transferable utility, an inclusive collusion grants each colluding player access to resources of all colluding players and therefore transforms a given game. Inclusive collusion neutrality requires that no group of players can change their total payoff with an inclusive collusion. Assuming that collusion formation is governed by a network defined over players, we show that if the network is cyclic, no solution satisfies inclusive collusion neutrality, efficiency, and the null-player property. Tree (acyclic) networks allow us to escape the impossibility: affine combinations of the hierarchical solutions satisfy the three axioms. Further, we establish that the latter family of solutions are characterized by the three axioms and linearity.

Context Dependence in Two-Sided Matching

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We consider one-to-one matching problems where individuals pay attention not only to the identity of the agents from the opposite market side but also to their corresponding histories. Context dependence is supposed to be one-sided, that is, a history in our model assigns to each woman a subset of men. A stable matching in such situations may fail to exists even if men's preferences are single-peaked with respect to the size of the corresponding histories. We formulate a condition stipulating the idea that shorter histories are more appealing to men than larger ones, and show that it guarantees the existence of stable matchings. More precisely, we use women's initial history as to induce a standard two-sided matching problem and show that each stable matching for

that problem is also stable in the context dependent problem with respect to the correspondingly updated history. It turns out that the set of stable matchings for the context dependent problem might be strictly larger than the core of the induced standard matching problem. Additionally, there need not be a men optimal stable matching for the context dependent problem. Having established these facts, we turn to the study of the structure of the set of stable matchings in our setup. Without further ado we can show that the set of stable matchings forms a lattice, provided the matchings are stable with respect to the same updated history. We then focus on matchings that are stable at different (updated) histories that are homogeneous, that is, each woman has been together with the same number of men. Provided that an independence condition is satisfied, we show how to derive matchings and construct histories such that stability is preserved. Finally, we show that the same independence condition allows us to construct stability intervals (a set of homogeneous histories with degree of homogeneity in an interval) within which the stability properties of a matching are inherited.

The SD-prenucleolus and the SD-prekernel

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The SD-prenucleolus was defined in 2014 by J. Arin and I. Katsev. This is a new TU-game solution with many interesting properties. For present moment the SD-prenucleolus is the only known continuous solution which satisfies core stability for balanced games and coalition monotonicity for two important classes: convex games and veto-monotone games. The SD-prekernel is an analogue of prekernel, but based on the the same definition of excess function as the SD-prenucleolus. We will give an axiomatization of the SD-prekernel, proving some facts about it and discussing the question "when the SD-prekernel is single-valued?".

Generalization of binomial coefficients to numbers on the nodes of graphs

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This topic does not relate directly to game theory, but the interest for this study is strongly influenced by our study of Shapley-type solutions for cooperative games with limited cooperation introduced by communication graphs. Without restrictions on cooperation the classical Shapley value assigns to each player the average of his marginal contributions with respect to all orderings of the players. When cooperation is limited by a graph not all orderings are feasible but only those that are consistent with the graph. When the graph is a line-graph, the numbers of feasible orderings starting from each of its nodes are given by the binomial coefficients.

The triangular array of binomial coefficients, or Pascal's triangle, is formed by starting with an apex of 1. Every its row can be seen as a line-graph to each node of which the corresponding binomial coefficient is assigned. We show that the binomial coefficient of a node is equal to the number of ways the line-graph can be constructed when starting with this node and adding subsequently neighboring nodes one by one. Using this interpretation we generalize the sequences of binomial coefficients on rows of Pascal's triangle to so-called Pascal graph numbers assigned to the nodes of an arbitrary (connected) graph. We show that on the class of connected cycle-free graphs the Pascal graph numbers have properties similar to that of binomial coefficients. We also show that for a given connected cycle-free graph the Pascal graph numbers, when normalized to sum up to one, are equal to the steady state probabilities of some Markov process on the nodes. Properties of the Pascal graph numbers for arbitrary connected graphs are also discussed. Since the Pascal graph number of a node in a connected graph is defined as the number of ways the graph can be constructed by a sequence of increasing connected subgraphs starting from this node, the Pascal graph numbers can be seen as a measure of centrality in the graph.

Ranking asymmetric auctions with several bidders

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Ranking the profitability of the first-price auction (FPA) and the second-price auction (SPA) is of fundamental importance to auction theory. However, the theoretical literature on bidder asymmetry has primarily focused on auctions

with two bidders. Here, I consider auctions with several asymmetric bidders. As in the empirical literature, it is assumed that any bidder is either weak or strong. There is no unambiguous revenue ranking in this environment. Indeed, I show that the ranking may depend on both the size of the reserve price and the number of bidders. However, there always exists a range of reserve prices for which the FPA strictly dominates the SPA. Moreover, if the asymmetry is not too large, there exists seller own-use valuations for which the FPA with an optimal reserve price is strictly more profitable than the SPA with an optimal reserve price. The FPA may in fact be both more profitable and more efficient than the SPA when the reserve price is endogenous. These results are founded on the methodological insight that the combination of reserve prices and several bidders may allow the use of mechanism design arguments that are simpler than those required when just two bidders are present.

Reforms of the common agricultural policy of the EU: Theory of moves approach

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From over a quarter of century from its establishment, the Common Agricultural Policy of the EU (CAP) remained largely unchanged. It provided protection for EU agriculture against world market fluctuations and support of farm incomes through high product prices. As a result, the EU was facing long-standing problems relating to overproduction and escalating budgetary costs. Replacing price intervention with a system of direct payments to farmers made the policy more market oriented. However, it did not radically reduce its cost. The CAP still accounts for about 40% of the total EU budget. Many observers assume that agricultural subsidies have been largely a consequence of lobbying organized by the beneficiaries. Different possible scenarios of the future reforms of the CAP are currently being discussed. The question is the extent and type of the intervention. The objective of the paper is to make prediction on the future changes of the CAP, on the basis of a game played between the EU Commission and agricultural producers' lobby. To model the game, I use the Theory of Moves (TOM) - a branch of game theory proposed by S. Brams (1994). Based on the classical theory of games, TOM introduces several changes in its rules to make it a dynamic theory. Similar to the classical theory, the TOM focuses on interdependent strategic situations in which the outcome depends on the choices that all players make. However, it thoroughly changes the principle of play by allowing participants, before they make the next move, to look a few steps forward. Therefore, by demanding that players foresee the consequences of making both moves and counter moves, TOM puts off conflict analysis into future. The payoffs for the game are based on the results of the simulations of the partial equilibrium model for agricultural sector (CAPRI-Common Agricultural Policy

Regionalized Impact model), assuming different scenarios of policy changes.

Dictate a dictator, succeed a successor

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This paper considers a simple model to explain why the direct succession mechanism fails and the indirect counterpart succeeds in making smooth leadership transitions in the Chinese Communist Party. Under direct succession where the successor is dictated by the incumbent leader, the successor with unconstrained power will deviate from the policy set by predecessors for a greater political surplus, leading to unstable political outcomes. In contrast, under indirect succession where the successor is dictated by the former leader, a patient successor prefers the continuation of the existing policy since the former leader can punish the successor via intensifying the ensuing political competition should the successor deviate.

Marginalism and egalitarianism under the equal effect of players' nullification on the others

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We provide an axiomatization of the convex combinations of the equal surplus division value and equal division value for the class of all cooperative games on a fixed player set that contains at least three players. These values are characterized by three axioms, namely efficiency (EF), α-marginalism in almost null games (α-MANG, where $\alpha \in [0, 1]$), and the equal effect of players' nullification on others (EENO). EF simply requires that all players fully divide the worth of the grand coalition among them. α-MANG requires something only in particular circumstances in which all players but one are null players (we call these situations almost null games). The axiom requires that the difference between the amounts a non-null player receives and any null player receives in almost null games is determined by the difference between their marginal contributions discounted by α. The axiom exemplifies marginalism (resp. egalitarianism) in almost null games if $\alpha = 1$ (resp. $\alpha = 0$). EENO requires that the effects of a player becoming a null player (player nullification) on the other players are the same. When $\alpha = 1$ (resp. $\alpha = 0$), these three axioms axiomatize the equal surplus division value (resp. the equal division value). Therefore, we succeed in distinguishing the two values by the difference between applying marginalism and egalitarianism only in very limited situations. In addition, we show that EF, EENO, and the null game property characterize the linear combinations of the two values.

Stable networks in peer-to-peer based sharing economies

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The rise of online marketplaces and social networks has led to the widespread sharing of goods and services among people. This kind of peer-to-peer based sharing economies help individuals make money and build relationships from sharing their idle resources (including time and skills), and help individuals looking for services or resources for short-term use, obtain them.

As a sharing economy grows, there seems to be a need to understand how the relationships between the members of the sharing economy evolve. This paper uses the concept of pairwise stability as defined by Jackson and Wolinsky (JET, 1996), to understand which agents in the sharing economy will be willing to form links, and hence, which networks will be stable. To model the relationships among the agents, preferences of customers (using Domination Game, as defined by Zhang, Lakshmanan and Tung (TKDD, 2009)), geographic distances and capacities of agents (including those of their contacts) who are sharing their resources (goods or services), are taken into account. We also discuss examples of stable networks in the context of additive manufacturing (3D printing).

Equilibria representing preferences of the players in multicriteria noncooperative games

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The paper deals with multicriteria decision support in conflict situations described by multicriteria noncooperative games in which each player has some number of criteria measuring his payoff. The decision support system is considered as a computer-based tool that allows the players to make an analysis of the conflict situation, taking into account their preferences. The analysis can be done using an interactive, learning procedure utilizing methods of multicriteria optimization. To construct such procedures, a development of the theory of noncooperative games and its generalization on the multicriteria case is required, that is, on the case where different objectives of the players are considered explicitly without the use of a given utility function. New theoretical results in this case are presented in the form of proved theorems. They include parametric characterization of the multicriteria gains representing preferences of the players as well as relations of equilibria in the multicriteria games and respective classical games. An algorithm supporting analysis of payoffs in the

multicriteria game and derivation of the best response strategies satisfying preferences of the players is proposed. It is shown that proposed parametrization of the multicriteria game allows to derive equilibria representing preferences of the players.

Inducing stability in hedonic games

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In many applications of coalition formation games, a key issue is that some desirable coalition structures are not elements of the core of these games. In these cases, it would be useful for an authority which aims to implement a certain outcome to know how far from the original game is the nearest game where the desirable outcome is part of the core. The distance between the two games is defined on the differences between the two corresponding preference profiles. Here we employ a standard measure of a swap distance in orders – the Kemeny distance.

For the purposes of this exercise we translate the hedonic game into a transferrable utility (TU) game using the rankings of players and the specified desirable coalition structure, P The value of each coalition in the TU game can be interpreted as the claim this coalition makes against the formation of P. To analyse this game we develop a tailored solution concept for the TU game that assumes the presence of an external authority that has a budget to satisfy all claims by the coalition. We name this concept the implementation core and show that the implementation core when the budget is zero is non-empty if and only if P is an element of the core of the hedonic game. In case the implementation core is empty, we consider a minimal increase in the authority's budget to render the implementation core at the new budget level non-empty. We show that this minimal increase in the budget equals the Kemeny distance between the original game and a hedonic game where P is a core element. We further show how the extreme implementation core elements are used to construct the new hedonic game. Thus one can interpret the changes in the players' preference profiles to the new games as compensations measured in coalitional ranking that these players receive when P is implemented.

Cournot competition with an external supplier under capacity constraints and demand uncertainty

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We study a single product market with affine inverse demand function in which two producers/retailers, producing under capacity constraints, may order additional quantities from a single profit maximizing supplier. We express this chain as a two stage game and show that it has a unique subgame perfect Nash equilibrium, which we explicitly calculate. If the supplier faces uncertainty about the demand intercept and whenever a Bayesian Nash equilibrium exists, the supplier's profit margin at equilibrium is a fixed point of a translation of the MRL function of his belief under the assumption that his belief is non-atomic and the retailers are identical. If the supplier's belief is of Decreasing Mean Residual Lifetime (DMRL), the game has a unique subgame perfect Bayesian Nash equilibrium. Various properties of the equilibrium solution are established, inefficiencies at equilibrium generated by the lack of information of the supplier are investigated, and examples are provided for various interesting cases. Finally, the main results are generalized for more than two identical producers/retailers.

Dynamic Shapley Value for Irreducible Networks

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The dynamic Shapley Value for N-person k-stage minimum cost spanning tree game is considered. The cooperative behavior of players is defined. Selecting strategies, players build a minimum cost spanning tree at each stage. Using the irreducible form of a network the characteristic function is defined as in[Gustavo Bergantiños, Juan J. Vidal-Puga, 2007]. After each stage a particular player m may leave the game with probability p that depends on the previous behavior of players. After player m leaves the game, on next stages the set of players is not changing. As optimality principle the modified Shapley Value is proposed. Computation of the Shapley Value along different cooperative path scenarios shows its subgame inconsistency. Using the IDP (Imputation Distribution Procedure) the subgame-consistent modified Shapley Value is constructed. The example is provided.

Consistency: The difference between the (weighted) Shapley value and the (weighted) equal surplus division value

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Recently, Casajus and Huettner (2014) and van den Brink (2007) study how far is, from an axiomatic point of view, the equal surplus division value (Driessen and Funaki, 1991) from the characterization of the Shapley value provided by Shapley (1953). Moreover, van den Brink (2007) also proposes an axiomatic approach to the equal surplus division value inspired by the axiomatization of the Shapley value in Chun (1991). Theorem B' in Hart and Mas-Colell (1989) characterizes the Shapley value using, among other properties, self-consistency. Driessen and Funaki (1997) obtain a characterization of the equal surplus division value replacing self-consistency by projected consistency (Funaki, 1998). In this work, we characterize the weighted equal surplus division value (Calleja and Llerena, 2015). This way, the difference between the weighted Shapley value and the weighted equal surplus division value is pinpointed to consistency. Additionally, we provide some new characterizations of the (weighted) Shapley value and the equal surplus division value.

Sustainable allocation of a greenhouse gas emission permits among firms with linear technologies

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Inspired by the Paris Agreement, in this paper we deal with linear production situations in which there is a cap or limit on the amount of a greenhouse gas that may be emitted. In order to achieve two important purposes of the agreement, a price for each ton of pollutant emitted is considered. We use bankruptcy rules to define cooperative games with externalities associated with these situations, and analyze the existence of coalitionally stable allocations of the emission permits.

Implementation in partial equilibrium

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Consider a society with a finite number of sectors (social issues or commodities). In a partial equilibrium (PE) mechanism a sector authority (SA) aims to elicit agents' preference rankings for outcomes at hand, presuming separability of preferences, while such presumption is false in general and such isolated rankings might be artifacts. Therefore, its participants are required to behave as if they had separable preferences. This paper studies what can be Nash implemented if we take such misspecification of PE analysis as a given institutional constraint. The objective is to uncover the kinds of complementarity across sectors that this institutional constraint is able to accommodate. Thus, in our implementation model there are several SAs, agents are constrained to submit their rankings to each SA separately and, moreover, SAs cannot communicate with each other. When a social choice rule (SCR) can be Nash implemented by a product set of PE mechanisms, we say that it can be Nash implemented in PE. We identify necessary conditions for SCRs to be Nash implemented in PE and show that they are also sufficient under mild auxiliary conditions. Thus, the Nash implementation in PE of SCRs is examined in auction and matching environments.

Minimum cost spanning tree problems with multiple sources

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A group of agents demands specific services which are provided by several suppliers, called sources. Agents will be served through connections which entail some cost and they do not care whether they are connected directly or indirectly to the sources. We can think in a group of villagers than need water, which can come from several dams. These situations generalize classical minimum cost spanning tree problems, where there is a unique source.

One of the most popular rules in the classical minimum cost spanning tree problem is the folk rule, which has been defined in several ways:

– As the Shapley value of the irreducible form: Bergantiños and Vidal-Puga (Journal of Economic Theory, 2007).

– Through Kruskal's algorithm: Tijs et al (European Journal of Operational Research, 2006) and Bergantiños and Kar (Games and Economic Behavior, 2010).

– Through a cone-wise decomposition: Branzei et al (Theory and Decision, 2004) and Bergantiños and Vidal-Puga (Journal of Mathematical Economics, 2009).

We extend these definitions of the folk rule to our setting.

On solutions in games with graph-restricted communication and coalition structure

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In Myerson (1977) a modification of the Shapley value for cooperative games with graph-restricted communication is introduced. Later on, Vázquez-Brage et al. (1996) give two different characterizations of one solution for cooperative games with graph-restricted communication and coalition structure. This solution is the Owen graph value. Other solutions for cooperative games with graph-restricted communication and coalition structure are the Banzhaf-Owen and the symmetric coalitional Banzhaf graph values, both defined in Alonso-Meijide et al. (2009).

In this framework we provide new characterizations of these solutions. In these characterizations we have used, among others, new properties based on the principle of balanced contributions introduced in Calvo et al. (1996). Since the cooperative games with graph-restricted communication and coalition structure can be adapted to describe different economic and political situations, a real example is considered.

Game theory, Extremal optimization, and Community Structure Detection in Complex Networks

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The network community detection problem consists in identifying groups of nodes that are more densely connected to each other than to the rest of the network. The lack of a formal definition for the notion of community led to the design of various solution concepts and computational approaches to this problem, among which those based on optimization and, more recently, on game

theory, received a special attention from the heuristic community. The former ones define the community structure as an optimum value of a fitness function, while the latter as a game equilibrium. Both are appealing as they allowed the design and use of various heuristics. This paper analyses the behavior of such a heuristic that is based on extremal optimization, when used either as an optimizer or within a game theoretic setting. Numerical results, while significantly better than those provided by other state-of-art methods, for some networks show that differences between tested scenarios do not indicate any superior behavior when using game theoretic concepts; moreover, those obtained without using any selection for survival suggest that the search is actually guided by the inner mechanism of the extremal optimization method and by the fitness function used to evaluate and compare components within an individual.

Properties and characterization of a general equilibrium concept in multi-agent decision problems

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In some decision problems a group of decision makers may need to agree on the alternatives to be chosen. For example, citizens of several cities are choosing representatives in a council, but some are chosen by more cities. In order to formalize such problems, we extend the standard strategic form of a non-cooperative game with two objects. The first is a set of issues which the players are making decisions about. A strategy set is interpreted as a set of alternatives regarding an issue. The set of strategy profiles is then the set of possible outcomes. The second is a family of sets, defining the connections between the players and the issues. We define an equilibrium for such problems. The general equilibrium is a bridge between Pareto optimality and Nash equilibria. In a general equilibrium outcome, there is no deviation such that it is preferred by all of the players and strongly by at least one of them, given the decisions about issues they are not assigned to. The existence of such equilibria is shown for any structure between the players and the issues. An important result of the paper is that with the help of a social welfare function, equilibria can be found, and under certain assumptions the set of equilibria can be characterized. The main theorem of the paper connects general equilibria with an equilibrium concept defined by Shapley in 1959, and concludes that general equilibria are specific equilibria of that kind.

Associations of players, tree-restricted games and external neutrality

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As observed by van den Brink [1], "neutrality" of a specific form of collusion between players in a cooperative game is, in general, incompatible with efficiency and null player property, but becomes compatible when the collusion possibilities are restricted to coalitions of players which are connected in a tree imposed on the player set. In that case, all three properties are fulfilled by hierarchical solutions as defined by Demange [2] and by their convex combinations. We prove analogous results for another form of players' collusion, namely association (Haller [3]) under which all players in a colluding group are treated as members of a coalition as soon as anyone of them enters that coalition. Moreover, we characterize the sets of all solutions satisfying neutrality of association together with some sets of additional properties. One such interesting property is "external neutrality", stating that forming an association by a group of players does not influence the payoffs to other players. More general consequences of external neutrality are also drawn, and possibilities of replacing neutrality by profitability of association are discussed.

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The closeness and the betweenness Myerson values

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In this communication we revisit the additive decomposition that Gómez et al. (2003) introduced for the Myerson value of a symmetric game when viewed as a centrality measure. First, we generalize this decomposition, extending it to general games. The new values permit us to look at the Myerson value of a

player as a certain modulus of a two component vector, one of them measuring the closeness relational abilities of the player whereas the other evaluating the opportunities that player has as intermediary in the communication among others. These two values are then characterized using additivity and other properties related with previous interpretation: a) the competitive advantages (or disadvantages) of a null player in a game with restrictions given by a graph, these advantages measured in terms of his Myerson value, are necessarily due to his ability to intermediate among the others, and b) in the same context, for those players that are essential to coalitions generate worth, the advantages are entirely of the closeness type.

Two-person pairwise solvable games

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According to Nash (1951), a game is solvable if the set of Nash equilibria is nonempty and interchangeable. We introduce a new class of games: the pairwise solvable games. A two-person symmetric game is pairwise solvable if any restricted game generated by a pair of strategies is solvable in the sense of Nash. We show that the set of equilibria in a pairwise solvable game is interchangeable, that a pairwise solvable game is solvable if it is quasiconcave at the diagonal, and that if in addition the game is finite then an iterated elimination of weakly dominated strategies converges precisely to the set of all Nash equilibria. In particular, the game is dominance solvable in the sense of Moulin (1979), in that every player's surviving strategies are equivalent. Applying these results to relative payoff games, we establish simultaneous existence of Nash equilibrium and evolutionary equilibrium in a class of pairwise solvable games, and an unambiguous welfare comparison between them. The class of pairwise solvable games is rich enough to merit a special attention. It is straightforward to see that any two-person symmetric constant-sum game is pairwise solvable. It turns out that the pairwise solvability goes much further. We show that a two-person symmetric contest is pairwise solvable, in which each player is rewarded as either the winner or the loser, depending on the winning probability that is jointly and symmetrically determined, with or without externality, by a pair of costly actions. For example, the tournament game of Lazear and Rosen (1981) and the rent-seeking game of Tullock (1980) are two-person symmetric contests. Other examples of pairwise solvable games include weakly unilaterally competitive games (Katz and Thisse 1992) and games with weak payoff externalities (Ania 2008).

Comparing voting by committees according to their manipulability

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We consider the class of voting by committees to be used by a society to collectively choose a subset of a given set of objects. We offer a simple criterion to compare two voting by committees without dummy agents according to their manipulability. This criterion is based on the set-inclusion relationships of the two corresponding decisive and vetoer sets of agents. We show that the binary relation "to be as manipulable as" endows the set of equivalence classes of anonymous voting by committees (i.e., voting by quotas) with a complete upper semilattice structure, whose supremum is the equivalence class containing all voting by quotas with the property that the quota of each object is strictly larger than one and strictly lower than the number of agents. Finally, we extend the comparability criterion to the full class of all voting by committees.

Accuracy and retaliation in repeated games with imperfect private monitoring: Experiments and theory

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This paper experimentally examines repeated prisoners' dilemma with random termination, where monitoring is imperfect and private. Our estimation of individual strategies, based on the Strategy Frequency Estimation Method, indicates that a significant proportion of our subjects follow generous tit-for-tat strategies. However, their retaliation policies are systematically inconsistent with the standard-theoretical predictions implied by the generous tit-for-tat equilibria. Contrary to the standard theory, our subjects tend to retaliate more in the high accuracy treatment than in the low accuracy treatment. They also tend to retaliate more than the standard theory predicts in the high accuracy treatment, while they tend to retaliate lesser than the standard theory predicts in the low accuracy treatment. In order to describe our experimental results as equilibrium behavior, we demonstrate an alternative equilibrium theory from the behavioral viewpoint, which permits players to be motivated by not only pure self-interest but also naïveté and reciprocity.

Individual utility and social choice generated by choice of attitudes

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In the paper we construct foundations for utility function and models of consumer behavior, voter's behavior, and social choice which are based on a model of attitude choice. The model provides justifications for the use of neoclassical utility functions dependent on characteristics of goods. The key idea of our approach is that the consumer's decision in any situation of choice has a dual nature since it relates both (1) a choice of a bundle of characteristics of goods from a set of choice which characterizes the particular situation, and (2) a choice of an attitude (i.e. vector of weights of characteristics) from a behavior menu. The same behavior menu may serve in various potential situations of choice. The individual behavior menu is a subject of external influence as well as of emotional fluctuations. We show that in the Nash collective bargaining model, arbitrator possesses a social behavior menu and acts in a similar way as an individual. The social behavior menu consists of vectors of average attitudes of the members of the collective. We provide examples of formation of the individual behavior menus as results of an evolutionary process and of spreading of attitudes in network. By use of our approach we develop Hillman's political economy games. Also we discuss potential applications of this approach to other models of decision-making and behavioral economics.

On dynamic stability of equilibrium in network game with production and externalities

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We consider a network game which describes a situation typical for many social, economic, and political systems. In the first period agents in a network receive endowments and distribute them for consumption and investment. In the second period consumption depends on the own investment as well as on investments of the neighbors in the network. The payoff is determined by consumption in two periods. The concept of equilibrium is specified as Nash equilibrium with externalities: the player is more tied to the situation than under usual Nash equilibrium. The existence and the structure of the equilibrium depend on the network's structure. Ways of agent's behavior are identified: passive (no investment), active, and hyperactive (the whole endowment is invested). Correspondingly, there are inner and corner equilibria. When the inner equilibrium

exists, it is unique; conditions of existence are found. We propose a definition of the dynamics which starts after a disturbance of the inner equilibrium. We find dynamic instability of the inner equilibrium and study convergence to a new corner equilibrium and stability of the latter. The pattern of the dynamics and the resulting equilibrium depend on the parameters of the model. An important fact we find is a special role of conditions of the presence and the absence of productivity, both in the static and in the dynamic frameworks. In particular, if initially an agent overinvests (underinvests) comparatively to her inner-equilibrium investment, then under presence of productivity the game converges to the corner equilibrium in which all agents are hyperactive (passive, correspondingly). Under absence of productivity this is true if initially the agent underinvests, but if initially the agent overinvests this fact is true under some conditions.

Inventory games: Myopic vs. farsighted stability

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Meca, Timmer, García-Jurado and Borm (2004) introduce the class of inventory cost games. It arises when a group of retailers who observe demand for a common good decide to cooperate and make join orders following the EOQ policy. By placing joint orders, these retailers can reduce their total cost of operations and get some benefits for the group. They focus on the stability of grand coalition and prove that it is always a myopic stable outcome. Multiple and various extensions of inventory cost games studied in Meca et al. (2004) can be found in the literature of game theory and inventory management.

A recent extension, very close to Meca et al. (2004), is Li, Feng and Zeng (2014). They present the class of inventory games with permissible delay in payments. The benefits retailers can obtain from permissible delay in payments by the supplier are obvious (i.e., a source of financing when they are short of cash). For suppliers, permissible delay in payments can promote their sales and reduce their on-hand stock. They prove that the grand coalition is shown to be stable from a farsighted point of view.

Taleizadeh, Meca and Halat (2016) present a new class of inventory games that is strategically equivalent to that class of inventory cost games: inventory games with advance payments. This model extends the inventory model by Meca et al (2004) to the situation where advance payments of retailers are required. Advance payment purchasing systems are very common in supply chain transactions. For instance, when the supplier is powerful or the market is exclusive, retailers are required to pay prior to delivering the product. They examine the stability of grand coalition from both a myopic and farsighted perspective, and conclude that it is always stable from both points of view. This study is completed by developing a sensitivity analysis for the model and evaluating the changes produced on the proposed core distribution.

The structure of Nash equilibria in Poisson games

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In finite games, the graph of the Nash equilibrium correspondence is a semi-algebraic set (i.e. it is defined by finitely many polynomial inequalities). This fact implies many game theoretical results about the structure of equilibria. We show that many of these results can be readily exported to Poisson games even if the expected utility functions are not polynomials. We do this proving that, in Poisson games, the graph of the Nash equilibrium correspondence is a globaly subanalytic set. Many of the properties of semialgebraic sets follow from a set of axioms that the collection of globaly subanalytic sets also satisfy. Hence, we easily show that every Poisson game has finitely many connected components and that at least one of them contains a stable set of equilibria. By the same reasoning, we also show how generic determinacy results in finite games can be extended to Poisson games.

Non-cooperative games with prospect theory players and dominated strategies

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We investigate a framework for non-cooperative games in normal form where players have behavioral preferences following Prospect Theory (PT) or Cumulative Prospect Theory (CPT). On theoretical grounds CPT is usually considered to be the superior model, since it normally does not violate first order stochastic dominance in lottery choices. We find, however, that CPT when applied to games may select purely dominated strategies, while PT does not. For both models we also characterize the cases where mixed dominated strategies are preserved and where violations may occur.

Clan information market games

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We introduce a TU-game that describes a market where information is distributed among several agents and all these pieces of information are necessary to produce a good. This situation will be called clan information market. The class of the corresponding TU-games, the clan information market games (CIGs), is a subset of the class of clan games. We provide some well-known point solutions for CIGs in terms of the market data.

Communication situations with partially verifiable information: An experimental study

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We study the effect of verification control in a communication game with partially verifiable information. In this game, an informed party (the sender) sends a two-dimensional message to a decision-maker (the receiver), but only one dimension of the sender's claim can be verified. We compare strategic behavior in situations where the receiver chooses which dimension to verify and cases where the sender has this verification control. Glazer and Rubinstein (2004, 2006) have analysed these models from the point of view of mechanism design, assuming that the receiver can commit to a strategy. We remove the possibility of commitment and analyse the two models as extensive-form games. Both models have multiple perfect Bayesian equilibria that survive standard refinements, but one equilibrium appears particularly salient when the sender has verification control. In this equilibrium, which is connected to the optimal mechanism of Glazer and Rubinstein (2006), the sender always reveals the most favorable of the two pieces of information, and the receiver realizes this and behaves accordingly; this is also the equilibrium preferred by the receiver. Selecting an equilibrium when the receiver has verification control is far less obvious, so we would expect behavior to be more noisy in this case, and the receiver to be worse-off. We use laboratory experiments to study strategic behavior in these two settings. Surprisingly, we find that both parties earn more when the receiver decides which dimension to verify. This is due to excessive scepticism on the receiver's part when the sender retains control over which dimension is verified. We conjecture that having no control over which dimension of the message will

be verified makes the receiver more averse to being deceived by the sender.

Population monotonic path schemes in coalitional games

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The notion of Population Monotonic Path Scheme (in short, PMPS) was introduced by Cruijssen et al. (2005), where is applied this notion to a case in logistic and transportation. A path scheme for a game is composed of a sequence of coalitions that is formed during the coalition formation process and an efficient payoff vector for each coalition of the sequence. A path scheme is population monotonic when the payoff of any player satisfies individual rationality and it cannot decrease as the path coalition to which he belongs enlarges. So, the payoff vector for each coalition in the path of a PMPS is an imputation of the respective subgame, but in general it is not a core allocation.

We find a wide class of cooperative games, which contains the class of totally balanced games, having a PMPS. Moreover, we show that each almost-convex balanced game (Nuñez and Rafels, 1998) has a PMPS such that the payoff vector for each coalition in the path is in the core of the respective subgame.

On cooperative connection situations where the players are located at the edges

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In cooperative connection situations, the players are often located at some nodes of a network (see, for instance, the survey Borm et al. 2001). In many cases, however, the focus of interest of rational agents are the edges of a network. For instance, Hougaard and Moulin (2014) have recently proposed a model that can be applied to the problem where agents may require the connection between certain nodes of a network, using a single link or via longer paths, and where it is assumed that the set of implemented edges is exogenously fixed and may be "redundant" (see also Moulin and Laigret, 2011). A still different class of games has been studied in Aziz et al.(2009), where the players are the edges of a graph and a coalition of edges gets value one if it is a connected component in the graph, and zero otherwise. All the aforementioned approaches deal with coalitional games where the optimization problem used to compute the cost of a coalition is not based on the problem of finding a minimum cost network in

the corresponding sub-graph. Instead, in this paper we assume that the optimal network associated to each coalition (of edges) is not fixed and follows a cost optimization procedure. The proposed model share some similarities with the classical one about minimum cost spanning tree games (Bird 1976), but also substantial differences with respect to the appropriate way to allocate the costs among the players located at some edges.

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Three-valued simple games and applications to minimum coloring problems

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We introduce the model of three-valued simple games as a natural extension of simple games. We analyze the core and the Shapley value of three-valued simple games. Using the concept of vital players as an extension of veto players, the vital core is constructed and we show that the vital core is a subset of the core. The Shapley value is characterized on the class of all three-valued simple games. As an application, we characterize the class of conflict graphs inducing simple or three-valued simple minimum coloring games. We provide an upper bound on the number of maximum cliques of conflict graphs inducing such games. Moreover, it is seen that in case of a perfect conflict graph, the core of an induced three-valued simple minimum coloring game equals the vital core.

Bertrand-Edgeworth duopoly with a socially concerned firm

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In their seminal paper Merrill and Schneider (1966) investigated the welfare effect of a public firm in a quantity-setting oligopoly. The case of a so-called semi-public firm or socially concerned firm with an objective function obtained as a weighted sum of firm's profit and social surplus was analyzed by Matsumura (1998) for which he determined the optimal governmental share and found an interior solution, that is the pure public firm case and the standard profit-maximizing case does not emerge in equilibrium. Similar investigations have been out for the heterogeneous good price-setting duopoly game by Barcéna-Ruiz and Sedano (2011).

The current paper investigates the homogeneous good price-setting semi-public duopoly game. The simpler mixed duopoly game with a purely public firm was investigated by Balogh and Tasnádi (2012) for which they found that an equilibrium in pure strategies always exists in contrast to the purely private firm duopoly. However, since in the semi-public setting both firms objective functions have a profit component, there is a significant capacity region for which a pure-strategy equilibrium does not exist. Hence, the analysis of the semi-public case becomes much more difficult. Tasnádi (2013) gave a necessary and sufficient condition for the existence of a pure-strategy equilibrium and established the existence of a mixed-strategy equilibrium. In this paper we derive certain properties of the mixed-strategy equilibrium and determine the mixed-strategy equilibrium in explicit form for the case of symmetric capacity constraints and linear demand. We relate our results to both the standard and the mixed versions of the Bertrand-Edgeworth game.

Reactive and semi-reactive bargaining sets for games with restricted cooperation

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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.

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).

Sudhölter and Potters (2001) defined a semi-reactive bargaining set. An imputation x^0 belongs to the semi–reactive bargaining set of a cooperative game if for each players i, j for each coalition P which is suitable for objection of i against 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).

Then the kernel is contained in the reactive bargaining set, the reactive bargaining set is contained in the semi–reactive bargaining set, and the semi–reactive bargaining set is contained in the classical bargaining set.

This presentation gives existence conditions of reactive and semi–reactive bargaining sets for the case when objections and counter–objections are permited between the members of a collection of coalitions $\mathcal{A}$. Existence conditions for generalizations of the kernel and the classical bargaining set were considered by Naumova (1976, 1978, 2007, 2015). All these conditions are different.

Weak necessary players, Myerson fairness and the concept of equality

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This article addresses linear sharing rules on TU-games with various structures, namely communication structures and conference structures as defined by Myerson in two papers (1977, 1980). Using matrix expressions, we rewrite those sharing rules. That presentation makes it possible to identify the tight relationship between the fairness property and a weak necessary players axiom. Moreover, we show that the latter is implied by the equal treatment of equals, linking the fairness property to the notion of equality.

The strategic formation of interbank networks

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We study the endogenous formation of an interbank network. Banks benefit from the connections in the network since they can coinsure their uncertain liquidity needs. However, the same connections can be risky since banks have an incentive to gamble with depositors' money when not sufficiently capitalized.

The bankruptcy of a bank can negatively affect the banks connected to it in the network (counterparty risk). We establish conditions under which banks endogenously form an interbank network with a core-periphery structure, meaning that a group of banks (the core) is internally densely connected, and the rest of banks (the periphery) connect to a few (possible only one) bank in the core. Our conditions allow us to note that the core banks with counterparties in the periphery (the bridges) face less risk in terms of investment behavior than core banks with only counterparties in the core. Nevertheless, the counterparty risk suffered by the core banks at the bridges make them in all more fragile than the core banks who only have counterparties in the core. We also find that banks that are identical a priori can take completely different positions in the network, together with opposite investment behavior.

An axiomatic analysis of joint liability problems with rooted-tree structure

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For joint liability problems concerning tort law, a legal compensation scheme may be based on lower and upper bounds of compensation for injury and on the case-system consistency. Introducing several properties inspired from this observation, we analyze compensation schemes axiomatically under the situation where causation of the cumulative injury appears in multiple sequences of wrongful acts. The situation underlying the model is described by a rooted-tree graph. We show that there is a unique compensation scheme that satisfies three axioms, one about lower bounds of individual compensations, one about upper bounds of individual compensations, and one about case-system consistency. This unique compensation scheme is the nucleolus

Solutions for vectorial cooperative games with matrix characteristic function

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In this work we present a model of vectorial cooperative games, where the characteristic function is given by a mapping from a set of feasible matrices with n rows and k columns to the set of k-dimensional vectors with real entries,

where the solution associated to a game is a real matrix. We provide some applications of the model to allocation problems as a motivation for this modeling and we show its relation with classical multi-choice games. Also, we show that this kind of games could be considered as a generalization of cooperative games with transferable utility on characteristic function form. We present some characterizations of solutions for these problems and how are related these solutions to classical solutions for TU-games. Finally, we provide some ideas for adapting the classical concepts of TU-games (the core, individual rationality, etc.) to these games.

The Tinder stable marriage problem

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We study the many-to-many matching problem induced by the popular dating app Tinder. We provide empirical evidence suggesting that its matching procedure is unstable, and we show, in a simplified setting, that its assignments can be setwise and even pairwise blocked. Tinder's mechanism can be improved by a two-step procedure which guarantees setwise stability whenever achievable, i.e. when agents' preferences are strongly substitutable, a restriction compatible with men preferences in online dating. We establish a link between strong substitutability and the maximin property that connects two areas of the literature that remained unrelated, and that can be merged to obtain a useful result: deciding who proposes first generates a tradeoff between the optimality versus the simplicity and privacy of the matching.

Effect of strike pays in wage bargaining model

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In this study, we consider a sequential wage bargaining model between a trade union and a firm in which the unions must decide either to strike or hold out during the disagreement periods. In the literature it is assumed that during strike periods, all pay and bonus payments are ceased, but in real life workers who strike have a substantial strike pay financed by the strike fund of the trade unions in order to help workers in meeting their basic needs. In our model, substantial strike pays, assumed a constant amount, is introduced to the bargaining model when the union decides to strike. First, we describe the necessary conditions for the supremum of union's payoffs and infimum of the firm's payoffs under subgame perfect equilibrium in all periods when the given party makes an offer. Then, we determine the equilibrium payoffs of both parties when the union has substantial strike pay in case of strike. We show that a substantial

strike pay has a positive effect on equilibrium wage level according to the parties' discount rates.

Collective deliberation under non-common prior

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The well-known jury paradox - the more demanding the hurdle for conviction is, the more likely it is that a jury will convict an innocent defendant - heavily relies on Bayesian updating. However, with ambiguous information (e.g., a forensic test with accuracy of 60%, or more), Bayesian updating becomes invalid, challenging the existence of this paradox. To advance our understanding of collective decision-making, we study deliberations given the unmeasured the information, informing the institutional design of collective deliberation, for small to large group decision-making.

Potential competition and quality disclosure

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This paper presents a model of quality disclosure in which an incumbent, through its quality and disclosure choices, influences the possibility of a new entrant entering a market. In this regard, we consider a sequential framework in which the incumbent chooses its quality and decides whether to disclose it to the market; subsequently, the entrant makes the same decisions if it enters the market. We show that potential competition can create strategic incentives for the incumbent to choose non-disclosure because the availability of information about the incumbent's quality promotes entry by enhancing the entrant's expected profit from the market. In addition, an analysis of the effects of mandatory disclosure law suggests that such law can be effective in promoting a new entrant into a market and improving the product quality of established firms.

Managing innovation in the presence of spillover risks: A game-theoretic model

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We use a game theoretic model to study optimal sourcing strategies of a technology firm facing a competitive supplier (a supplier who is also a competitor) and a non-competitive supplier, in the presence of technology spillover risk. The technology firm develops a new technology product which has innovation uncertainty and needs to source from either the competitive or the non-competitive supplier. The competitive supplier has a regular product which could be improved through technology spillover, should a contract with the technology firm be secured.

We fully characterize the equilibria of the underlying game. We then establish that the technology firm can use technology spillover to pool the risk of innovation with the competitive supplier,so it might be optimal for the competitive supplier to enter the market late in exchange for lower risk (i.e., it might be optimal not to participate in Cournot competition and to be the follower in Stackelberg competition in exchange for technology spillover opportunity). Moreover, when the competitive supplier has an advantage in production quality over the noncompetitive supplier, it could be optimal for the technology firm to disregard other factors and source from the competitive supplier decidedly for its production excellence. In contrast, when the non-competitive supplier has a quality advantage, it could never be the case that the non-competitive supplier is the optimal choice merely for its production excellence, without assessing the risk pooling benefit of sourcing from the competitive supplier.

A cardinally convex game with empty core

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In this note we present a cardinally convex game (Sharkey, 1981) with empty core. Sharkey assumed that $V(N)$ is convex, we do not do so, hence we do not contradict Sharkey's result.

Truth-revealing voting rules for large populations

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We propose a new solution to the problem of strategic voting in large electorates. For any deterministic voting rule F, we can design a stochastic rule G that asymptotically approximates F in the following sense: for a sufficiently large population of voters, the rule G incentivizes every voter to reveal her true preferences, but also produces the same outcome as F, with very high probability.

To illustrate, suppose that F was an "ordinal" voting rule (i.e. one which depends only on the ordinal preferences of the voter, such as the Borda rule). The G would work roughly as follows:

1. Every voter declares her preference order.
2. With a very high probability, G simply produces the same outcome as F.
3. However, with a small probability P, G selects two alternatives A and B at random, and a voter N at random. Then G chooses one of A or B depending on N's declared preference between A and B.

The probability P is very small, but in a large population, it is still much larger than N's subjective probability of being a pivotal voter in Step 2. Thus, N's strategic voting behaviour will be determined by the possibility of Step 3 occurring, so that her optimal strategy is to express her true preferences. We can even decrease P as the population grows. Thus, in a very large population, G will agree with F almost all the time. We can develop similar rules when F is the approval voting rule or a cardinal voting rule (i.e. one which depends only on the normalized von Neumann-Morgenstern utility functions of the voters).

This result does not depend on the voters having accurate beliefs about the preferences, beliefs or strategies of the other voters. Thus, it does not depend on any equilibrium concept from game theory. Nevertheless, we can also use the above technique to obtain an implementation of F in Bayesian Nash equilibrium, in a sufficiently large population.

Common value allocation mechanisms with private information: Contests or auctions?

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We consider stochastic (contests) and deterministic (auctions) mechanisms for allocating a common-value prize in an ex-ante symmetric setting with incomplete information. Each player receives an independent private signal about the prize value. The signals are from a discrete distribution and the value of the prize is a symmetric increasing function of the signals. For a specific setting with two players and two signals, we characterize symmetric equilibria in simple Tullock contests and in the standard (first-price, second-price, and all-pay) auctions. In these setting, we establish revenue equivalence of the auction mechanisms. We then compare equilibrium revenue from the contest and from the auctions and describe conditions under which the expected revenue is higher in the contest than in the auctions. We also identify an optimal mechanism in these settings and implement it using reserve prices in both contests and auction mechanisms. We then extent the analysis to check whether the results, in particular the revenue comparison one, are robust to having more players and signals and other forms of contests.

Solidarity properties of choice correspondences

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We consider the problem of choosing a set of locations of a public good on the real line $\mathbb{R}$. Similarly to Klaus and Storcken (2002), we ordinally extend the agents' preferences over closed subsets of $\mathbb{R}$, and extend the results of Ching and Thomson (1996), Vohra (1999), and Klaus (2001) to choice correspondences. Specifically, we show that Pareto-efficiency and either population-monotonicity or one-sided replacement-domination characterize the class of target set correspondences in the domains of single-peaked preferences and symmetric single-peaked preferences.

Solutions for sharing the cost of a set covering situation

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The (weighted) set covering problem is one of the classical problems in discrete location theory. In this problem, a set of customers requires a kind of service which is provided by a set of facilities. Any facility can only serve the subset of customers who are "close enough" to it. A setup cost must be paid for opening a facility and, at the same time, the total cost of locating a set of facilities must be minimized in such a way every customer is covered for at least one facility. In this paper, we focus on the cost sharing situation associated with a set covering problem. Our main goal is to share the optimal cost among all customers. Firstly, we study the corresponding cooperative game and introduce some desirable properties which any rule should accomplish. Secondly, we propose some core-like solutions and bankruptcy-like solutions which are close related to the structure of the set covering situation. Finally, we analyze the properties of those solutions.

Policy improvement for perfect information additive reward and additive transition stochastic games with discounted and average payoffs

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In this paper we give a policy improvement algorithm for solving two player zero-sum stochastic games with additive rewards and additive transitions (ARAT games) with respect to limiting average payoffs. The family of policy improvement algorithms begins with Howard's policy improvement algorithm for discounted Markov decision processes (MDPs). Policy improvement algorithms are widely recognized as fast in practice. Under certain regularity conditions, policy improvement for MDPs is equivalent to Newton's method. A policy improvement algorithm for zero sum stochastic games of perfect information with respect to the discounted criterion was given by Raghavan and Syed. Syed extended the algorithm to ARAT games with discounted payoff. Their proof techniques were based on an induction on the total number of actions available

in all states for the two players. They also observed empirically that the discounted values of MDPs along the algorithmic path were monotonic. A formal proof of this empirical observation, called the Patience Theorem is the key to our proof technique. It provides an alternative proof to the algorithm for discounted games. Unlike the discounted case, the Cesaro payoff involves not just the value but also the so called deviation vector. A key observation is that uniform optimal strategies and one optimal strategies have the same deviation vector and while we cannot nail down algorithmically the uniform optimal strategy, we can nail down one optimal strategy for MDP's via Vienott's algorithm. It also allows us to provide a policy improvement algorithm for zero-sum stochastic games of the ARAT type that include perfect information games.

Imagine-self perspective-taking promotes Nash choices in a simple experimental normal-form game

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Weizsäcker (2003) coined the hypothesis that decision-makers' tendency to ignore their opponents' incentives in experimental normal-form games is an artifact of the experimental environments in the laboratories, and in particular of the use of abstract payoff matrix presentations in experimental procedures. Weizsäcker (2003) further suggests that adding a context to the experiments (and probably developing a more realistic sense of strategic choice) would help the subjects to perceive their opponents' decision problems more vividly and clearer. From the viewpoint of game-theoretic models the subjects' tendency to ignore their opponents' incentives is an anomaly. The following article addresses the outlined behavioral "anomaly". In particular, we set out to investigate whether the subjects' tendency to ignore their opponents' incentives in a simple experimental normal-form game with an abstract payoff matrix presentation can be alleviated due to introduction of imagine-self perspective-taking by decision- makers. Taking the construal level theory (see e.g. Liberman et al. (2007); Liviatan et al. (2006)) as our point of departure, we hypothesize that introduction of imagine-self perspective-taking by decision-makers promotes Nash choices in the outlined game. In particular, we expect that adopting imagine-self perspective by the row player shortens the psychological distance between her and the column player. In consequence, the column player may appear to her more similar. If so, "socially closer" individual may seem to decision-maker more likely to be rational and self-interested, which is how decision-makers tend to perceive themselves (see e.g. O'Neill (1998)). As a result, row player's confidence that the opponent will play her dominant strategy should rise and so the

number of Nash choices made by row players in our experiment. The received experimental results are largely consistent with our expectations.

Axioms for a multi-item auction

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We consider a finite set of heterogeneous and indivisible objects to be allocated to a finite group of agents. Each agent has a non-negative valuation for each object and is interested in at most one object. Assuming that monetary transfers are allowed, agents' preferences are quasi-linear. We do not impose any condition over the number of agents neither the number of objects. It is known that the set of competitive equilibria of the market is non-empty and the set of competitive price vectors has a lattice structure (see for instance Shapley and Shubik, 1972). Demange et al. (1986) introduces an ascending multi-item auction with remarkable properties. It is known that, when the agents have quasi-linear preferences, this multi-item auction produces the minimum competitive equilibrium price vector of the market and an efficient allocation. Moreover, it is a generalization of the Vickrey auction (see for instance Roth and Sotomayor, 1990). In this paper, we offer two characterizations of the multi-item auction introduced by Demange et al. (1986). When the number of agents exceeds the number of objects, it is known that the Vickrey rule is the unique rule satisfying strategy-proofness, individual rationality and efficiency (we refer to Holmström, 1979 and Ashlagi and Serizawa, 2012). Notwithstanding, this characterization does not hold when the number of objects exceeds the number of agents. As a consequence, the multi-item auction rule cannot be characterized only by those three axioms. We show that the multi-item auction rule is the unique rule satisfying strategy-proofness, individual rationality, efficiency and non-wastefulness in prices. For a second result, we drop strategy-proofness, individual rationality and efficiency and we characterize the multi-item auction rule with envy-freeness, non-wastefulness in assignment, price antimonotonicity and non-wastefulness in prices.

Noncooperative dynamic contribution to a public project

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We consider a dynamic contribution game in which a group of agents collaborate to complete a public project. The agents exert efforts over time and get rewarded upon completion of the project, once the cumulative effort reaches a

prespecified level. We explicitly derive the cooperative solution and a noncooperative Markov-perfect Nash equilibrium. We characterize the set of socially efficient projects, i.e., projects that cooperative groups find worth completing. Comparing with the Markov-perfect Nash equilibrium, we find that noncooperative groups give up large socially efficient projects and take too much time to complete the others. We give two extensions of our benchmark model. The first one investigates whether positional preferences, i.e., when agents care about their ranks as contributors, can ameliorate the efficiency of the noncooperative Markov-perfect Nash equilibrium. The second one displays a reward mechanism capable of implementing the cooperative solution as a noncooperative Markov-perfect Nash equilibrium.

The degree measure as a utility function for positions in weighted graphs and digraphs

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The degree measure in weighted graphs and a class of the degree measures in weighted digraphs that contains the Copeland score, the outdegree and indegree measures are shown to be von Neumann-Morgenstern utility functions. First, we characterize the degree measure in a weighted graph using four natural axioms (anonymity, the isolated node property, scale invariance and additivity). Next, we show that the utility function is equal to a multiple of the degree measure if and only if it represents a preference relation that is neutral to ordinary risk. Similarly, we characterize a class of degree measures in a weighted directed graph by using four axioms analogous to the ones that characterize the degree measure in weighted undirected graphs. Furthermore, we deliver the interpretation of such a class of degree measures as a von Neumann-Morgenstern utility function. By adding a fifth axiom (the cycle property) we obtain the axiomatic characterization of the Copeland score. Strengthening in the set of four axioms the isolated node property by the strong isolated node property leads to the axiomatic characterizations of the outdegree measure. If we replace the isolated node property by the alternative strong isolated node property, then we obtain the axiomatization of the indegree measure.

Maximal covering location games

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We focus on the problem of allocating profit amongst different demand points in the maximal covering location problem. We use concepts from cooperative game theory. We formulate a maximal covering location (MCL) game and show that every MCL game is superadditive and monotonic. In addition, non-emptiness of the core is guaranteed up to (i) 3-person games and (ii) 5-person games when the underlying graph contains no cycles. Finally, we provide two examples: a 4-person MCL game with cycles in the underlying graph and a 6-person MCL game without cycles in the underlying graph of which both cores are empty.

Rational allocation of attention in decision-making

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This paper proposes a model of attention allocation in decision-making, where attention defines selecting information for costly processing. The paper investigates how an agent rationally allocates attention to two random variables that determine the utility of two options. Next to inattention, two strategies of allocating attention prevail that share similarities with, and thus provide a rational foundation for the existence of, bottom-up and top-down attention concepts reported in the psychological literature. The results also show that attention is context dependent and low processing costs do not guarantee processing. Exploring firms' strategic considerations reveals an incentive for firms to produce low quality and hide this, if agents expect high quality, and to produce high quality and highlight this, if consumers expect low quality. Consequently, in the model opportunities for exploiting agents' inattention exist.

Communication games with optional verification

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The literature on communication games knows two main strains: The cheap-talk models, going back to Crawford and Sobel (1982), and the models dealing with verifiable messages, e.g. Grossmann (1981) or Milgrom (1981). We consider a Sender-Receiver Game in which the Sender can send either a costless cheap-talk message or a costly verifiable message. While the Sender has private information about the state of the world, the Receiver chooses an action, which yields to a specific utility for both players. Since the preferences about the actions may differ, depending on the state of the world, the Receiver may or may not trust the messages if they are not verified. In a discrete setting we show under which conditions full revelation is possible and also describe the players optimal behaviour if full revelation is impossible. We also give necessary and sufficient conditions for fully revealing equilibria in a continuous model. If there is an action the Sender really dislikes, the Receiver may use that action as a reply to every cheap-talk message. By Definition of the Perfect Bayesian Equilibrium, this action has to be the Receiver's best reply to some belief system. If such an action exists, it enforces the Sender to use the verifiable message. In both models (discrete and continuous) we distinguish between equilibria where just one type of message is sent and where the Sender chooses the type of message depending on the state of the world. Furthermore we take common used properties, such as increasing differences and state which other conditions are necessary for the existence of fully or partial revealing equilibria.

Too good to be truthful: Why competent advisers are fired

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A decision maker asks an adviser repeatedly for advice. The adviser is either competent or incompetent and his preferences are not perfectly aligned with the decision maker's preferences. Over time the decision maker learns about the adviser's type and fires him if he is likely to be incompetent. If the adviser's reputation improves, it is more attractive for him to push his own agenda because he is less likely to be fired for incompetence. Consequently, advisers who are perceived as (very) competent do not give fitting advice and are fired with positive probability in equilibrium. The advice relationship is most likely to endure if the decision maker is unsure about the adviser's type. The decision maker also benefits more from an expert whose expertise is uncertain than from an expert who is likely to be very good. It is furthermore shown that the

expected length of the advice relationship is bounded from above by a finite number that does not depend on the equilibrium or the current belief. As a competent expert has useful information, this establishes a dynamic inefficiency caused by the informational asymmetry between adviser and decision maker. In many equilibria a strict Pareto improvement would be possible if the adviser could commit to a strategy ex ante.

Axiomatization of the average tree solution for TU-games with cycle-free communication structure

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TU-games with communication structure are cooperative games with transferable utility where the cooperation between players is limited by a communication structure on the set of players. The restricted communication among the players is represented by an undirected graph where only connected sets of players are able to cooperate. For TU-games where the restricted communication structure is represented by a cycle-free graph, the average tree solution is characterized by component efficiency and component fairness axioms. In this paper, we provide an alternative characterization of the average tree solution for TU-games with cycle-free communication structure. The axioms we use for this characterization are in the same spirit of the ones used in Young's characterization of the Shapley value.

Restricted games induced by minimum partitions: complexity of inheritance of convexity

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We consider restricted cooperative games associated with a communication graph $G = (N, E)$. Then a correspondence P associates to every subset A of N a partition $P(A)$ of A and to every game (N, v), the P-restricted game (N, v^*) defined by $v^*(A) = \sum_{F \in P(A)} v(F)$. If $P(A)$ is the set of connected components of $G_A = (A, E(A))$, then (N, v^*) corresponds to Myerson's game. Moreover we suppose that a weight $w(e)$ is associated with each edge e in E, the interpretation of which may depend on the context (e.g., a degree of friendship, a security level, etc.). Then an obvious way of partitioning a coalition A, which we denote by $P_{\min}$, is to remove all edges of minimum weight in G_A. In this

framework we have studied in a previous work under which conditions superadditivity and convexity are inherited from (N, v) to (N, v^*). We established five necessary and sufficient conditions on the edge-weights to have inheritance of F-convexity (corresponding to the restriction of convexity to connected subsets). In the present work we first highlight the link between $P_{\min}$-restricted game and Myerson's game and between F-convexity for $P_{\min}$ and convexity for P. We first show that Myerson's game corresponds to a restriction of the $P_{\min}$-restricted game associated to a specific weighted graph G'. Then we prove that inheritance of convexity for Myerson's game is equivalent to inheritance of F-convexity for the $P_{\min}$-restricted game. In particular we prove that cycle-completeness of G is satisfied if and only if one of the necessary conditions on adjacent cycles is satisfied on G'. Then we prove that to verify the five necessary conditions we only have to consider a polynomial number of paths, stars, pans and cycles. Therefore we can build a polynomial algorithm to decide for a given graph if there is inheritance of F-convexity.

Cost allocation rules for elastic single-attribute situations

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Many cooperative games, especially ones stemming from resource pooling in queueing or inventory systems, are based on situations in which each player is associated with a single attribute (a real number representing, say, a demand) and in which the cost to optimally serve any sum of attributes is described by an elastic function (which means that the per-demand cost is non-increasing in the total demand served). For this class of situations, we introduce and analyze several cost allocation rules: the proportional rule, the serial cost sharing rule, the benefit-proportional rule, and various Shapley-esque rules. We study their appeal with regard to fairness criteria such as coalitional rationality, benefit ordering, and relaxations thereof. After showing the impossibility of combining coalitional rationality and benefit ordering, we show for each of the cost allocation rules which fairness criteria it satisfies.

On computing the per-capita nucleolus in balanced games

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The nucleolus lexicographically maximizes the nondecreasingly ordered vector of the coalitional satisfactions (the difference between the payoff to and the value of the coalition) over the set of imputations. This satisfaction measure, however, does not take into account neither the size, nor the value (or any other characteristic that maybe important for an application) of the coalitions. Various weighted nucleoli (based on weighted satisfaction measures) were considered by several authors, but mostly from an axiomatization point of view.

We focus on the per-capita nucleolus (defined in the same way as the nucleolus, but based on the per-capita satisfaction) from a computability perspective. We show that if the core of the game is not empty, coalitions which are not anti-essential (which can be weakly minorized by a partition) in the dual game can be ignored in the computation of the per-capita nucleolus. We demonstrate that in specific well-known classes of balanced games (standard tree games, assignment games) this implies a polynomial time computability of the per-capita (and other properly weighted versions of the) nucleolus.

Approval voting as tool of political predictions. Case of Poland 2015

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Approval voting was a voting method introduced by Brams and Fishburn in 1982. If you make decision by approval voting you may choose as many candidates as you want. We apply approval voting to predicting results of political elections in Poland. Polish presidential elections are two round elections. They took place in the spring of 2015. Analysing the presidential elections in 2005 we got that there was a high probability that the first run leader did not win the second run. The result of elections confirmed our predictions. We prepared a method of predicting on the basis of the experiment of 2005 and used this method during presidential elections in 2015. Again, the method showed who would win the second run. We also applied approval voting to prediction of parliamentary elections. Polish presidential elections took place in autumn 2015. We predicted which ruling coalition would be approved by an electorate of a given party. A ruling coalition did not formed because the winning party got majority. So, we could not check our predictions, but our results were similar

to cooperation of parties which had been observed before elections.The experiments were conducted over a representative samples with a cooperation of Polish poll agency Ariadna.

On power measures and public goods

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A power index for n-person cooperative simple games is a function giving a reasonable expectation of the sharing of the global winning among the players. In such games the payment of each coalition can only be 1 (winning coalition) or 0 (losing coalition).

A first concept of power index dates back to 1780s and is due to Luther Martin. Since then many other power indices have been formulated with various aims, such as respect for reasonable axiomatic systems or fairness criteria, or the best description of the result of a bargaining.

In the research presented here, we analyze some power indices well formulated in the social context where the goods are public. Some properties of power indices are considered. The aim is to achieve a global vision and to identify a group of properties that are desirable in the public good context.

The Distribution of Power in the Lebanese Parliament Revisited

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Many political analysts consider the Lebanese Republic to be one of the most democratic nations in the Arab world. One main peculiarity of Lebanese Republic is the confessional nature of its political system which is prescribed by its constitution. This adds to the system of democratic elections a guarantee for a pre-defied representation of Muslims and Christians and its various sectarian groups in parliament. In this sense, the composition of the Lebanese Parliament is based on the allocation of a specific number of seats to each of the two major religious groups and its sectarian groups. The allocation of seats to the two religious and its sectarian groups and the total size of the parliament have been, and still are, subject of intensive discussions by Lebanese political parties and political scientists. Recently, applying the theory of voting power

Diss and Zouache (2015) have studied the pure distributional power in the parliament. They compared the current parliamentary structure with a proposal for its amendment. Making use of the Banzhaf and the Shapley-Shubik index their study has revealed some paradoxical effects. In this paper, we re-examine their results applying the Banzhaf measure and extend the investigation by including the previous constitution into our analysis. Even under our approach which does not normalize the total amount of power in the parliament to one we are able to demonstrate that the paradoxical results remain to exist.

Pareto efficient school choice mechanism under distributional constraints with initial endowments

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We consider a school choice program where some distributional constraints are imposed (e.g., minimum quotas and maximum quotas), and the obtained matching must respect the initial endowments, i.e., each student must be assigned to a school that is at least as good as her initial endowment school. We adapt the Top Trading Cycles mechanism to our setting and develop a mechanism that is both strategy-proof and Pareto efficient, respects the initial endowments, and satisfies the distributional constraints. In the mechanism students 'trade' the seats of their initial endowment schools, and we make use of the notion of dummy student to utilize school seats that are not initially owned by any students.

Co-authorship and the measurement of individual productivity

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We propose a new index of individual scientific productivity that formally accounts for coauthorship, disentangling individual from collaborative productivity. In contrast to existing measures, our index, CoScore, reflects the complete coauthorship network, not only the publication record of the author being ranked. CoScore uses the varying levels of success of all academic partnerships to infer, simultaneously, an authors productivity and her credit on each paper. Crucially, the productivities of all authors are determined endogenously via the solution of a fixed point problem. We illustrate CoScore for a large database of

papers in economics.

The Shapley value for directed graph games

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The Shapley value for directed graph (digraph) TU games with limited cooperation induced by a digraph prescribing the dominance relation among the players is introduced. It is defined as the average of the marginal contribution vectors corresponding to all permutations which do not violate the induced subordination of players. Games under precedence constraints form the subclass of cycle-free digraph games. On this subclass the Shapley value for digraph games coincides with the Shapley value for games under precedence constraints introduced by Faigle and Kern. We study several properties of the solution and give conditions under which the solution is an element of the core. For digraph games for which the digraph is a directed cycle an axiomatization of the solution is obtained.

Customer and cost sharing in a Jackson network

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We consider a network of queues in which the independent operators of individual queues may cooperate to reduce the amount of waiting by their customers. More specifically, we focus on Jackson networks in which customers arrive to a queue and demand service, and the queue serves these demands. The total demand of the queues can be redistributed over all queues in any desired way. If we associate a cost to waiting that is linear in the queue lengths, we may calculate how the operators should share the total demand to minimize the long run total cost. However, this may result in negative demand for a queue. Since each original demand is nonnegative, we impose the restriction that the demands assigned to each queue should be nonnegative as well.

This work deals with the question whether or not (the operators of) the individual queues will indeed cooperate in this way, that is, if this will result in costs savings for the queues. And if so, how they can share the cost in the new cooperative situation such that each operator never pays more than his own cost without cooperation. For this, we define a cooperative cost game where the players are (the operators of) the individual queues in the network.

The main result of this work is an explicit cost allocation that is beneficial for all operators for any Jackson network. This cost allocation is an element of the core of the corresponding game. The approach we use also provides the corresponding redistribution of demands assigned to the queues.

Choosing when to delegate: endogenous cooperation and optimal voting rules

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We develop a model of collective decision making in which a group of countries may choose to delegate part of their national sovereignty on specific areas (environmental regulation, competition policy, national defense,. . .). Such cooperation then implies making repeated collective decisions at a qualified majority. The choice of integration reflects a basic trade off between the benefit of coordination externalities and the cost of disagreeing with the collective decision. Flexible participation rules, where a strict subset of countries may cooperate while the others remain sovereign, usually allow for a deeper level of integration, in particular when the externality is excludable. However, if participation is binding, the outcome may still be pretty inefficient as the countries who would benefit the most from cooperation may be driven out of the coalition. Composition efficiency is only guaranteed if countries ignore the influence of their vote on the collective decision.

Moves of the third kind in solving games of strategy

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The concept of move of the third kind or interpersonal move of reciprocal consent in games of strategy (cooperative and non-cooperative) is introduced to be used in conjunction with global preference measures and joint-mixed-strategies in a context of common good to narrow down the indeterminacy of (1) outcomes in pure bargaining games (2) Nash equilibrium solutions (3) von Neumann and Morgenstern stable sets (4) Fundamental equilibrium contingencies for the n-person cooperative game. Such moves are occasions for players to make choices after the transition from moves to strategies that give birth to the normal form. We show these moves of the third kind: to make explicit the strategic nature of cooperative games, to determine the emergence of joint strategic choices as

well as the formation of joint-mixed-strategies that provide us with a cooperative approach to address the subject of the likelihood of coalition formation and to recognize the existence of a fundamental equilibrium for the n-person cooperative game.

Polluted river problems and games with a permission structure

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Polluted rivers are harmful to human, animals and plants living along it. To reduce the harm, cleaning costs are generated. When the river passes through several different countries or regions, a relevant question is how should the costs be shared among the countries. Ni and Wang (2007) introduced polluted river problems with one spring, which is generalized by Dong, Ni and Wang (2012) to rivers with multiple springs, and study cost sharing methods. We show that these cost sharing methods can be obtained as the onjunctive permission value of an associated game with a permission structure, where the permission structure corresponds to the river structure and the game expresses the cleaning costs. Several axiomatizations of the conjunctive permission value give axiomatizations of these cleaning cost sharing methods that fit well with International Water Law. By applying the disjunctive permission value, we obtain a new cleaning cost sharing method.

Discrimination in a public goods experiment and gender inequality in the country of origin

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Subjects coming from four continents and 32 developing countries participate in a one-shot public goods game. In their decisions, subjects are allowed to discriminate based on gender and origin of their co-players. We characterize subjects' countries of origin by broadly used gender inequality indices. They stand as proxies for gender norms prevailing in the subjects' countries. By assumption, countries with higher gender inequality support more asymmetric gender norms. Subjects' contribution strategies in the experiment reveal that they import gender norms of their home countries into the laboratory. We also

find differences in how the two group associations, gender and origin, affect behavior, while both of them are made salient in the same artificial way in our experiment design.

von Neumann-Morgenstern stable sets of a patent licensing game

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This paper considers general bargaining outcomes in prices among a seller and buyers of information on patented technologies. The information generates a negative externality to the non-buyers in the market competition with the buyers. The bargaining followed by this situation is formulated as a TU game with a coalition structure, where the coalition structure is determined by the seller's choice of buyers. We provide some sufficient conditions for the (non-)existence of von Neumann-Morgenstern (vNM) stable sets of the game, paying our attention to the producer surplus. In the bargaining restricted to uniform prices, the vNM stable set exists for every permissible coalition structure, and it is completely characterized.

The game has three stages. At stage 1, the seller invites some firms as buyers to negotiate on prices of the information. The non-buyers cannot participate in this negotiation. At stage 2, each buyer negotiates with the seller over how much he or she should pay to the seller. The seller and buyers can communicate among themselves in the negotiation, but non-buyers cannot observe how the negotiation runs. When some or all buyers fail to negotiate over the prices, the seller can provide its information to any others at any prices. The payment to the seller is made at the end of this stage. At stage 3, the buyers and non-buyers compete in the market, knowing that who are buyers or non-buyers one another. Buyers and non-buyers are prohibited from forming any cartels to coordinate their production levels and market behaviors, because, as in the traditional literature on non-cooperative patent licensing games, they cannot make binding agreements on such cartels.

Sharing sequential profits in a network

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Consider a process where agents have individual values which might be different at every possible step. A planner is in charge of choosing steps and distributing the aggregate value of the process. In particular, there is a fixed group of agents and an acyclic-directed network with a common source and possibly multiple sinks. Each link in the network has an associated vector of non-negative numbers which represents the individual values obtained by the agents when this link is selected. A path connecting the source and a sink has to be chosen and the aggregate value of the path must be distributed among the agents.

In the case when all information of the network is known to the planner, we purpose four natural axioms and we show that they characterize a family of path selection rules that selects only efficient path(s), and the aggregate value is redistributed in fixed proportions to the agents where the proportions are independent of the network. Alternatively, suppose the planner know the structure of the network but not the individual values associated with the links. The planner wants to find a sharing rule that incentivize the agents to select an efficient path as a subgame perfect equilibrium in some games. We show that for a large class of games, most of the rules obtained under incomplete information coincide with the rules found in the case of complete information.

This model can be applied to various situations such as choosing production plan by a manager, developing connected public facilities (highways, rail-roads or irrigation canals) by a government, and deciding the processing sequence of tasks by a planner.

An Outcome Mechanism for Partially Honest Nash Implementation

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Dutta and Sen (2012) show that if there exists at least one partially honest agent, then no veto power is sufficient for partially honest implementation in Nash equilibria. Also, Kimya (2015) shows that if there are at least two partially honest agents, then unanimity is sufficient for partially honest implementation in Nash equilibria. While in Dutta and Sen (2012)'s mechanism and Kimya (2015)'s mechanism, each agent reports a preference prole, an outcome, and a

positive integer, it is in fact unnecessary to ask agents to reveal a preference profile. We introduce an outcome mechanism in which each agent only reports an outcome and a positive integer from 1 to n. We show that the results of Dutta and Sen (2012) and Kimya (2015) are still valid by our mechanism with a smaller strategy space.

A characterization of the Nash Maximum Product (NMP) solution for fair division problems

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The classical Fair Division (FD) problems, where each agent from a finite set N can get any number of objects (or shares of objects) from a finite set A is considered. The preferences of agents are given by utility functions $u_i : A \to \mathbb{R}^1_+$ that are additive on subsets of A. An allocation problem is defined by $(N, A, \{u_i\}), i \in N$.

If the objects are divisible, then every allocation of agent i is a vector $z^i \in [0,1]^A$, where z^i_a is the share of object a that agent i obtains. The equalities $\sum_{i\in A} z^i_a = 1$ for every $a \in A$ mean that each object is completely shared by agents. Let $Z = \{(z^1, ..., z^n)\}$ be the set of all feasible allocations. In the utility space the feasible set $U(Z) = \{(u_1(z^i), ..., u_n(z^n))\} \subset \mathbb{R}^n_+$ is a closed convex polyhedral set. A division rule f associates with every problem $G = (N, A, \{u_i)\})$ a utility profile $f(G) \in U(Z)$. The Nash maximum product rule NMP is defined by $NMP(N, A, \{u_i)\} = U(\arg\max_{z\in Z} \prod_{i\in N} u_i(z))$. The following axiomatization of the NMP rule is parallel to that of the known Nash bargaining solution. Consider the set of utility feasible sets for all FD problems with a fixed player set N. Then the definitions of the properties Efficiency, Anonymity, and Scale Covariance for division rules are not changed. The key Nash axiom Independence of Irrelevant Alternatives cannot be applied, since the set U of utility profiles is not comprehensive. We modify this axiom by using the complement of the comprehensive hull of the utility set U - the dominating set $D(U) = \mathbb{R}^n_+ \setminus \mathrm{compr}(U)$.

Independence of Dominating Alternatives. Let $G_1 = (N, A_1, \{u^i_1\}), G_2 = (N, A_2, \{u^i_2\})$ be two allocation problems such that$D(U_2) \subset D(U_1)$. Then $f(G_2) \in U_1$ implies $f(G_1) = f(G_2)$.

Theorem. *The Nash Max Product solution is the only division rule for FD problems that satisfies Efficiency, Anonymity, Scale Invariance, and Independence of Dominating Alternatives.*

The indivisible case is much more complicated. The NMP rule is a set-valued division rule. In the presentation an axiomatization of the NMP division rule is given only for the class of FD indivisible problems with $n = p$.

Cumulative offer process with continuous transfers

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The Kelso and Crawford (1982) model of job matching has been a basis for the analysis of two-sided many-to-one markets. They proved that, under the gross substitutes condition, the cumulative offer process finds a stable matching in the market with discrete transfers. On the other hand, the algorithm cannot be applied to the market with continuous transfers, and in particular, cannot find a competitive equilibrium. The purpose of this paper is to modify the cumulative offer process in a way that it can be applied to the market with continuous transfers. We show that our new algorithm, the cumulative offer process with continuous transfers, finds the maximal competitive price vector in finite steps. Our result provides a clear insight into how the maximal competitive price vector is determined.

On the the Owen-Shapley spatial power index

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We present an axiomatic characterization of the Owen-Shapley spatial power index for the case where issues are elements of two-dimensional space. This characterization employs a version of the transfer condition, which enables us to unravel a spatial game into spatial games connected to unanimity games. The other axioms include two conditions concerned particularly with the spatial positions of the players, besides spatial versions of anonymity and dummy. The last condition says that dummy players can be left out with changing the power of the other players; we show that this condition can be weakened by requiring dummies to have zero power, at least if we add a condition of continuity. We also show that the axioms in our characterization(s) are logically independent.

Catch games: Analysis of values

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We examine the values of a type of zero-sum games. In a catch game player 2's action set consists of all finite subsets of player 1's action set. It is a simultaneous game where player 2's goal is to catch player 1, so he wins if his action contains player 1's action. When taking different sigma-algebras over player 1's action space, the values also change in certain cases. We found that

the values heavily depend on set theoretic axioms. We also calculate the values for finitely-additive strategies. The solutions of catch games essentially differ among these setups.