Abstracts

Efficient Disposal Equilibria of Pseudomarkets

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ABSTRACT

For an economy with compact consumption and production sets and free disposal, an *efficient disposal equilibrium* is a price vector-allocation-production plan triple such that: a) each agent is maximizing utility among bundles costing no more and minimizing expenditure among bundles providing the same utility; b) unsated agents consume bundles that are at least as valuable as their incomes; c) profits are maximized; d) the aggregate allocation does not exceed the aggregate endowment; e) goods that are not completely consumed have the minimal price. We prove an existence of equilibrium result that nests those of Hylland and Zeckhauser [1], Mas-Colell [2], and Budish, Che, Kojima, and Milgrom [3], and significantly improves the latter by increasing flexibility and relaxing assumptions that are not satisfied by applications such as course allocation. Open problems concerning generic finiteness of the set of equilibria and efficient algorithms for computing equilibria are described.

References

[1] Hylland, A. and R. Zeckhauser, "The Efficient Allocation of Individuals to Positions," *Journal of Political Economy* 87 (1979) 293–314.

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Truthtelling and liespotting

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ABSTRACT

An agent privately observes a Markov chain online and reports it to a designer. To what patterns in the reported data should the designer pay attention? We show that, in general, keeping track of the empirical frequency of transition counts in the agent's reports is insufficient, despite the true state being Markovian. Nonetheless, we derive conditions under which any deviation that can be distinguished from truth-telling by checking the frequency of strings of an arbitrary (finite) size can be detected by "checking pairs." Further, we find that some undetectable deviations cannot be profitable, independent of the agent's preferences. Hence, we provide weaker sufficient conditions that ensure that the agent finds honesty to be the best strategy. We explore the implications of these results for the literature on (i) linking incentives, (ii) dynamic implementation, and (iii) repeated games and agency models.

Non-equivalence between all and Canonical Elaborations

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ABSTRACT

This notes shows that in a minimal diversity game, the set of potential maximizers is robust to canonical elaborations, but not to all elaborations.

Coordination on Networks

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ABSTRACT

We study a coordination game among agents on a network, who choose whether or not to take an action that yields value increasing in the actions of neighbors. In a standard global game setting, players receive noisy information of the technology's common state-dependent value. At the noiseless limit, equilibrium strategies are threshold strategies: each agent adopts if the signal received is above a certain cutoff value. We characterize properties of the cutoffs as a function of the network structure. This characterization allows to partition players into coordination sets, i.e., sets of players where all members take a common cutoff strategy and are path connected. We also show that there is a single coordination set (all players use the same strategies, so they perfectly coordinate) if and only if the network is balanced, i.e., the average degree of each subnetwork is no larger than the average degree of the network. Comparative statics exercises as well as welfare properties are investigated. We show that, in order to maximize aggregate welfare or adoption, the planner needs to target coordination sets and not individuals.

Pure-Strategy Equilibria in Bayesian Games

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ABSTRACT

A general condition called "coarser inter-player information" is introduced and shown to be necessary and sufficient for the validity of several fundamental properties on pure-strategy equilibria in Bayesian games, such as existence, purification from behavioral strategies, and convergence for a sequence of games. Our sufficiency results cover various earlier results on pure-strategy equilibria in Bayesian games as special cases. New applications are presented as illustrative examples, including auctions with externalities and risk-neutral bidders, Bertrand pricing games with asymmetric information, and all-pay auctions with risk-averse bidders and interdependent values.

Ambiguity and the Centipede Game: Strategic Uncertainty in Multi-Stage Games with Almost Perfect Information

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ABSTRACT

We propose a solution concept, consistent-planning equilibrium under ambiguity (CP-EUA), for two-player multi-stage games with almost perfect information. Players are neo-expected payoff maximizers. The associated (ambiguous) beliefs are revised by Generalized Bayesian Updating. Individuals take account of possible changes in their preferences by using consistent planning. We show that if there is ambiguity in the centipede game and players are sufficiently optimistic then it is possible to sustain 'cooperation' for many periods. Similarly, in a non-cooperative bargaining game we show that there may be delay in agreement being reached.

Structural Rationality in Dynamic Games

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ABSTRACT

The analysis of dynamic games hinges on assumptions about players' actions and beliefs at information sets that are not expected to be reached during game play. However, under the standard assumption that players are sequentially rational, beliefs at such information sets cannot be elicited. Hence, key concepts such as backward and forward induction are not directly testable on the basis of observed behavior. This paper introduces a novel optimality criterion, structural rationality, which addresses this concern. In any dynamic game, structural rationality implies sequential rationality. In addition, if players are structurally rational, their beliefs can be elicited via the strategy method [1]. In addition, structural rationality is consistent with experimental evidence about play in the extensive and strategic form, and justifies the use of the strategy method in experiments.

References

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Compromising Quality to Stay Relevant

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ABSTRACT

We study a novel dynamic principal-agent framework which features adverse selection, moral hazard and no transfers. The model can be described as a bandit problem where the principal chooses between a safe and risky arm. The risky arm's type is known, and output is controlled, by a strategic agent. The principal prefers to pull the risky arm only if it is the high type whereas, irrespective of type, the agent wants to maximize the number of times the risky arm is pulled. Our main result shows that when the principal can commit, there are conditions under which the optimal dynamic mechanism induces efficient output from the risky arm. By contrast, in the absence of commitment, inefficient output must arise on path in all equilibria (subject to a mild refinement). We use our model to discuss reputation management by online content providers and by experts in organizations.

When to Ask for an Update: Timing in Strategic Communication

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ABSTRACT

A principal (receiver) considers whether to accept or reject a project of uncertain value. The total value depends on the values of two aspects. In each period, an agent (sender) privately learns the value of one aspect with positive probability. We compare two reporting protocols: frequent updating and infrequent updating. Frequent updating requires the sender to report in each period; infrequent updating requires him to report only at the end of the second period. The sender is biased towards acceptance; he may conceal his signal, but cannot misrepresent his information in other ways.

If the prior expected value of the project is lower than the receiver's acceptance threshold, then under certain regularity conditions, the equilibrium outcome is the same regardless of the reporting protocol. This implies that if soliciting a report is costly, then frequent updating is inefficient, but if there is gain from early resolution, then frequent updating is optimal. In contrast, if the prior expected value of the project is sufficiently high, then the reporting protocol matters. Specifically, if it is sufficiently unlikely for the sender to observe an informative signal in a later period or the divergence of interests between the players is sufficiently low, then the receiver is better off asking for an update in every period. This is because frequent updating encourages the sender to reveal unfavorable information early on for fear that concealment will lead to the project being accepted even if its total expected value is low. If the probability of the sender observing an informative signal in a later period is sufficiently high and the divergence of interests is also high, then the receiver is better off asking for only one report at the end of the learning process.

Equal-quantile rules in resource allocation with uncertain demands

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ABSTRACT

We consider the allocation problems in which agents have uncertain demands over a resource and allocation of the resource has to be made before the uncertainty resolves. We propose the class of *equal-quantile rules* that ensure all agents equal probability of being fully satisfied, with the probability bounded by a parameter $\lambda \in (0,1]$. If the welfare loss due to unsatisfied demands and wasted resource are both linear, then an equal-quantile rule with a properly chosen parameter always selects the allocation that minimizes the total expected welfare loss. We further show that the class of equal-quantile rules are the only rules satisfying the following properties: *consistency, continuity, strong ranking*, and *ordinality*. *Ordinality* requires the allocation to be invariant under any continuous and non-decreasing transformation of a problem.

The weak α-core of large games

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ABSTRACT

We consider large non-atomic games where a player's payoff depends on the choice of own action and the action distribution of all others. A coalition is a subset of the players of nonzero measure. A coalition E strongly blocks a strategy profile f if the coalition has a strategy h_E such that for any strategy of the complement of the coalition h_{E^c} and $h = (h_E, h_{E^c})$, the payoff to each member of the coalition under h exceeds by ϵ the payoff from f for some $\epsilon > 0$. The (weak) α-core is the set of strategy profiles which is not (strongly) blocked by any coalition. We show, under some conditions, that the weak α-core is nonempty. The relationship among Nash equilibria, strong Nash equilibria and the α-core is explored.

Perfect equilibria in large games

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ABSTRACT

This paper studies pure strategy perfect equilibria for games with non-atomic measure spaces of players and infinitely many actions. A richness condition (nowhere equivalence) on the measure space of players is both necessary and sufficient for the existence of such equilibria. We also consider the limit admissibility of perfect equilibria.

Joint work with Yishu Zeng.

On Hurwicz-Nash Equilibria of Non-Bayesian Games under Incomplete Information

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ABSTRACT

We consider finite-player simultaneous-play games of private information in which a player has no prior belief concerning the information under which the other players take their decisions, and which he or she therefore cannot discern. This dissonance leads us to develop the notion of Hurwicz-Nash equilibria of non-Bayesian games, and to present a theorem on the existence of such an equilibrium in a finite-action setting. Our pure-strategy equilibrium is based on non-expected utility under ambiguity as developed in Gul-Pesendorfer (2015). We do not assume a linear structure on the individual action sets, but do assume private information to be "diffused" and "dispersed." The proof involves a multi-valued extension of an individual's prior to the join of the finest σ-algebra $\mathcal{F}$ of the information of the other players, an absolute-continuity assumption on an individual's belief with respect to the extended beliefs on $\mathcal{F}$, as well as an assumption on the existence of independent atomless supplements, original to Aumann (1974).

This is joint work with Patrick Beissner of Bielefeld and the Australian National University.

Dynamics of Environmental Policy

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ABSTRACT

We consider a dynamic political economy model in discrete time in which two parties decide environmental policy in each period. A higher level of environmental stock corresponds to tighter policies which improve the environment but reduce flexibility of the individuals and businesses. As a consequence of this trade-off, parties have different preferences over the level of the environmental stock even when there is no cost of changing policy. The possibility of costly policy change introduces an additional conflict of interest. Reducing the environmental stock is costless but increasing the environmental stock involves direct transaction costs in addition to the indirect costs of tighter policies. We establish the existence of Markov Perfect Equilibrium, and show that, depending on the parameter values, the equilibrium is either unique, or its structure is unique. After fully characterizing the equilibrium, we analyze its efficiency implications. We show that when polarization is high, the equilibrium is inefficient due to perpetual policy reversals, and when favoritism is high, the equilibrium is inefficient due to an "overshooting" effect. When neither polarization nor favoritism is high, equilibrium is efficient in the long run.

Gradual Bargaining in Decentralized Asset Markets

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ABSTRACT

We introduce a new approach to bargaining, with both axiomatic and strategic foundations, into models of decentralized asset market. Gradual bargaining, which assumes that portfolios of assets are sold sequentially, one unit of asset at a time, has strong normative justifications: it increases the surplus of asset owners, it reduces asset misallocation, and it can implement first best. In the presence of multiple assets our theory generates a pecking order, a structure of asset returns based on asset negotiability, and differences in turnover. We apply our model to the study of open-market operations and the determination of the exchange rate in the presence of multiple (crypto-)currencies.

JEL Classiffication: D83
Keywords: decentralized asset markets, negotiability, gradual bargaining

The very odd lattice of cumulative distributions

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ABSTRACT

Extending the fixed-point theorem of Cellina–Fryszkowski, which is for functions on decomposable sets, to decomposable-set-valued corre- spondences has been an unresolved challenge since the early attempt of Cellina, Colombo, and Fonda. Motivated by the fixed point problem of Reny arising in Bayesian games, this paper proves such a theorem.

Modeling Infinitely Many Agents: Why Countable Additivity Is Necessary

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ABSTRACT

The economic literature with a measure space of agents is enormous, where one usually works with an atomless countably additive measure space to model individual negligibility. However, there have been a number of attempts to drop the countable additivity assumption by working with countably many agents with a purely finitely additive measure. The main purpose of this paper is to illustrate the necessity of countable additivity in modeling infinitely many agents in terms of the existence of equilibria and the idealized limit property in general equilibrium theory and game theory.

Mislaid Pieces in Finitely Additive Population Games

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ABSTRACT

If a probability μ on a measurable space $(T, \mathcal{T})$ fails to be countably additive, then T is missing points representing some of the mass. Missing points can be a useful device, but the device can also mislead. If $(T, \mathcal{T}, \mu)$ models a non-atomic population of players for a game, then if pieces are mislaid pieces, they can be players *and* their characteristics. If the game fails a condition called c-tightness, this may preclude even approximate equilibrium existence. The mislaid parts of the game can be found using nonstandard analysis or a new class of compactifications, adding them restores equilibrium existence, and analyses of models with mislaid pieces are misleading.

Tolerance and Behavioral Diversity

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ABSTRACT

Globalization gives us a huge pool of potential transaction partners, but past behaviors of new partners are not perfectly known, making it difficult to punish defectors. The literature advocates trust-building/gradual cooperation. We found new equilibria, in which homogeneous players have varied lengths of the "tolerant phase" where they never terminate a partnership regardless of its history. Afterwards, many players cooperate as long as the partner does. Hence tolerance of behavioral diversity is an equilibrium phenomenon, and behavioral diversity can motivate tolerance and cooperation. Behavioral diversity is not necessarily due to player heterogeneity, nor less efficient than trust-building equilibria.

Order on Types based on Monotone Comparative Statics

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ABSTRACT

This paper introduces an order on types by which the so-called monotone comparative statics is valid in all supermodular games with incomplete information. We fully characterize this order in terms of what we call the *common certainty of optimism*. We say that type t_i' is higher than type t_i in the order of the common certainty of optimism if t_i' is more optimistic about state than t_i; t_i' is more optimistic that all players are more optimistic about state than t_i; and so on ad infinitum. First, we show that whenever the common certainty of optimism holds, monotone comparative statics holds in all supermodular games. Second, we show the converse. We construct an "optimism-elicitation game" as a single supermodular game with the property that whenever the common certainty of optimism fails, monotone comparative statics fails as well.

An Introduction to Mean Field Game Theory

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ABSTRACT

This tutorial on mean field games (MFG) consists of three parts. Part I provides background and motivation on the development of mean field game theory in stochastic dynamical systems involving a large number of non-cooperative agents, and next overviews the methodologies by different groups, including the so-called fixed point (or top-down) approach and the direct (or bottom-up) approach. Several concrete models are introduced to illustrate ideas. The key results and intuition underlying the analysis will be explained.

Part II first presents the fixed point approach for games involving weakly coupled diffusions. This translates to a special stochastic optimal control problem subject to consistent mean field approximations. The fixed point problem is formalized after solving the best response of a representative agent, and further used to determine a set of decentralized strategies for the N player model, which has an epsilon Nash equilibrium property. The general theory is developed in detail for (linear-quadratic) LQ models and extended to nonlinear models where the special role of McKean-Vlasov equations will be explained. An application to a stochastic growth problem with relative performance is presented.

Part III investigates the connection and difference of the two fundamental approaches of MFG in an LQ setting. In the remaining part we describe extensions of the basic modeling and analysis, which cover major player models with various information patters and its connection with common noise models, mean field social optimization, the efficiency issue, and the study of master equations by different researchers.

Incentivizing Team Production by Indivisible Prizes: Electoral Competition under Proportional Representation

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ABSTRACT

This paper formulates proportional representation in a parliamental election as a multi-prize contest among political parties. In particular, we analyze the performance of commonly-used list rule, and investigate what the optimal list rule is when candidates differ in their abilities to contribute. We show that, in order to maximize the aggregated effort exerted by the party candidates, each party should assign the highest ability candidates to the middle of the list, while the top priority rankings and low priority rankings should be assigned to lower ability candidates under the optimal list rule. Then, we turn to the optimal mechanism. When individual effort cost function is not too convex and the complemantarities of individual efforts are not too strong, we show that the optimal monotonic mechanism is the optimal list rule. Additional interesting observations are that under the same conditions, (i) if the optimal list rule gives the highest ability candidate rank k, then the optimal (nonmonotonic) rule also selects her as the winner if and only if the party wins k seats or more, and (ii) the optimal rule selects the lowest ability candidate to the parliament if only one seat is won, unless the party is very small.

Joint work with B. Crutzen, Flamand, and Sahuguet.

Obvious Dominance and Random Priority

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ABSTRACT

We characterize the full class of obviously strategy-proof mechanisms in environments without transfers as clinch-or-pass games that we call millipede games. Some millipede games are simple and widely used in practice, while others may be complex, requiring agents to perform lengthy backward induction, and are rarely observed. We introduce a natural strengthening of obvious strategy-proofness called strong obvious strategy-proofness, which eliminates these complex millipede games. We use our definition to characterize the well-known Random Priority mechanism as the unique mechanism that is efficient, fair, and simple to play, thereby explaining its popularity in practical applications.