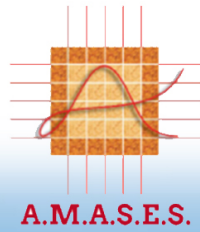


XLV CONVEGNO
ama
ses



Contents

About	3
AMASES Conference 2021	
Parallel Session on "Decision Theory, Bounded Rationality, and Preference Modeling"	3
Organizers	3
Timetable	4
Wednesday, 15 of Septmber	4
Thursday, 16 of September	5
List of Abstracts	6
Wednesday 20th	6
Thursday 22nd	9

AMASES Conference 2021 Parallel Session on "Decision Theory, Bounded Rationality, and Preference Modeling"

The purpose of the AMASES conference is to stimulate discussion among scholars and practitioners, from Italy and all around the world, on different aspects of Mathematics applied to Economic and Social Sciences.

Topics of this session include but are not limited to:

- Decision theory;
- Decision analysis;
- Choice theory;
- Bounded rationality;
- Preference modeling;
- Mathematical utility theory.

The meeting will be held on September 15-16 on Teams. Attendance is open. You can join the meeting clicking on

https://teams.microsoft.com/l/meetup-join/19%3ameeting_NDE3NGJhMzEtYTFiYy00Mjk2LWE5M2UtZDBjOTk3ZjNkMGM4%40thread.v2/0?context=%7b%22Tid%22%3a%22baeefbc8-3c8b-4382-9126-e86bfe46ce6%22%2c%220id%22%3a%2213ee6289-0fb7-46cc-910f-859aef575c69%22%7d

Organizers

Alfio Giarlotta
Angelo Petralia

Timetable

CT: Contributed Talk.

Wednesday, 15 of September

9:40–10.00	Welcome remarks		
10:00–10:30	CT	Giovanna Apicella University of St. Gallen	A behavioral gap in survival beliefs
10:30–11:00	CT	Giovanni Burro Bocconi University	Make hay while the sun shines: An empirical study of maximum price, regret and trading decisions
11:00–11:30	CT	Imma Lory Aprea University of Naples "Parthenope"	A Binary Signal Model for Herding Behaviour with Imprecise Probabilities
11:30–12:00	Coffee break		
12:00–12:30	CT	M. Ali Khan Johns Hopkins University	Methodological Individualism and Social Conformity: The One- Many Ordering
12:30–13:00	CT	Jean-Paul Doignon Université libre de Bruxelles	Resolutions of Path-Independent Choice Spaces
13:00–15:00	Lunch break		
15:00–15:30	CT	Stephen Watson York University	Some novel notions for NaP-preferences
15:30–16:00	CT	Davide Carpentiere University of Catania	Transitivity vs Completeness: Generalized NaP- preferences

Thursday, 16 of September

10:00-10:30	CT	Giovanni Bosi University of Trieste	Characterization of Useful Topologies in Mathematical Utility Theory: Recent Results
10:30-11:00	CT	Hailemariam Abebe Tekile University of Trento	Constrained Eigenvalue Minimization of Incomplete Pairwise Comparison Matrices by Nelder-Mead Algorithm
11:00-11:30	CT	Pietro Maugeri University of Catania	Extending Choice Rationality: Lifting and Satisfiability
11:00-12:00	Coffee break		
12:00-12:30	CT	Ester Sudano Queen Mary University of London	Stochastic choice resolutions
12:30-13:00	CT	Daniele Pennesi University of Turin and Collegio Carlo Alberto	Between commitment and flexibility: revealing anticipated regret and elation
13:00-15:00	Lunch break		
15:00-15:30	CT	Alfio Giarlotta University of Catania	Bounded rationality is asymptotically rare
15:30-16:00	CT	Angelo Petralia University of Turin and Collegio Carlo Alberto	Choice by Saliency
16:00-16:30	CT	Federico Quartieri University of Florence	Existence of maximals via right traces
16:30	Closing ceremony		

List of Abstracts

Wednesday 20th

A behavioral gap in survival beliefs

G. Apicella¹, *Enrico G. De Giorgi*¹

CT

¹Faculty of Mathematics and Statistics, University of St. Gallen

Residual lifetime is an uncertain outcome on which individuals form subjective beliefs, that affect the economic decisions they make. Existing literature documents a gap between survival subjective beliefs and actuarial estimates, consisting in survival under-estimation at younger ages and over-estimation at older ages. We demonstrate that psychological biases drive subjective survival beliefs more than private information, e.g. about the own health status. In this respect, we propose a novel modelling framework in which we study the role of optimism in relation to longevity expectations. In particular, our model of sentiment assumes that survival beliefs depend on individuals' emotional reaction to health information. For instance, individuals who switch to a pessimistic sentiment will believe more likely the event of experiencing negative health shocks in the future, and therefore will attribute lower values to their chance to survive. Our model of sentiment jointly predicts survival under-estimation at young ages and over-estimation at old ages when individual's optimism is persistent over time, that is consistent with psychological literature. An empirical analysis based on the longitudinal data from the US Health and Retirement Study (HRS) validates our model. One of the novelties of our approach consists in comparing subjective survival expectations to health-specific actuarial probabilities, revealing how survival chances should objectively change because of a health shock.

Make hay while the sun shines: An empirical study of maximum price, regret and trading decisions

¹ *J. Brettschneider*, ² *G. Burro*, ¹ *Vicky Henderson*

¹ University of Warwick, Department of Statistics

² Bocconi University, Department of Finance and IGIER

Using a dynamic extension of Regret Theory, we test how the regret induced by not selling a stock when the maximum price in an investment episode is attained shapes the propensity to sell a stock. We use a large discount brokerage dataset containing US households trading records between 1991 and 1996. Expected utility predicts that investors should stop at a threshold, whilst a Regret agent does not necessarily stop there. We observe that investors do not follow a threshold strategy in our data. Only 31.6% of the gains are sold on the day when the maximum is attained and 25.8% of the losses are sold on the day when the minimum is attained. We find that more sophisticated and younger investors are more likely to follow a threshold strategy. Second, we find that investors are more likely to sell a stock for a gain in a moment closer in time to the maximum occurrence and at a price further from the running maximum price of the stock in the investment episode. Anticipated regret and belief updating might explain this pattern. The propensity to sell a gain steadily declines a short time after the maximum was attained. We suggest that traders might regret not selling at a time close to the maximum day and hold onto the stock if a long time has passed.

A Binary Signal Model for Herding Behaviour with Imprecise Probabilities

¹ *I. L. Aprea*, ¹ *A. Sacco*

CT

¹ Department of Business and Quantitative Studies, University of Naples "Parthenope"

The paper addresses uncertainty analysis in decision theory, by applying Imprecise Probabilities to a Herding Behaviour model, which describes imitative behaviour and explains informational cascades phenomenon in the financial market. The work refers to a herding model proposed in Bikhchandani et al., in which agents act sequentially and observe independent private signals, each of which can be high or low. The application of the principle of rationality generates informational cascades, which are sequences of actions in which each agent makes his choice by taking into account the decisions taken by those who acted before him, regardless of the private information he owns. In the classical approach, the uncertainty that agents have about the future value of a security is represented by a signal probability, later updated to a posterior probability by the Bayesian updating rule to allow the agent to choose whether to invest or not. Since the probability distribution of the signal may be hard to identify in some cases, our paper studies the herding behaviour model by considering imprecise the signal probability, which is precise in the referring model. The model tests the herding behaviour model robustness when some assumptions no longer hold due to imprecise probabilities. In the simplest case of the binary signal model, the agent's private information is described by using a set of probability measures and assuming that the signal probability ranges in a probability interval. Through this representation, agents' decisions depend on the interval extreme values. The aim is to prove that an informational cascade may occur even with imprecise probabilities, as long as certain assumptions hold.

Methodological Individualism and Social Conformity: The One-Many Ordering

¹ A. Giarlotta, ² A. Petralia, ³ M. Ali Khan, ¹ Francesco Reito

CT

¹ Department of Economics and Business, University of Catania, Italy

² University of Turin and Collegio Carlo Alberto, Italy

³ Department of Economics, Johns Hopkins University, Baltimore, MD 21218 USA.

This exploratory paper takes inspiration from Akerlof and Sen, and proposes a non-standard way to realize the tradeoff between personal choice and social pressure. In mainstream neoclassical consumer theory, market prices are the only determinants of individual actions, and the other or the social enters criteria of choice either only through these prices, or through the other's actions or his/her maximized payoffs. Furthermore, whenever a social reference point in the agent's preferences is considered, a fully decisive and immediate response that compensates for social costs is always assumed. Contrary to standard models, our approach deconstructs consumer choice to two stages inspired by a dichotomous but harmonized philosophic conception. In a non-compensatory first stage, a binary relation, called one-many ordering, yields an optimal interval to which choice is confined. In a compensatory second stage, the agent maximizes present utility, but taking future social expectations into account. Finally, we consider a setting in which this non-neoclassical consumer is embedded in a game-theoretic situation.

Resolutions of Path-Independent Choice Spaces

¹ D. Cantone, ² J. P. Doignon, ³ A. Giarlotta, ⁴ S. Watson

CT

¹ Department of Mathematics and Computer Science, University of Catania

² Department of Mathematics, Université libre de Bruxelles

³ Department of Economics and Business, University of Catania

⁴ Department of Mathematics and Statistics, York University

A resolution of choice spaces formalizes a hierarchical process of choice: a new choice space results from the replacement of each element in a *base* choice space with a *fiber* choice space. Here we deal with resolutions of special choice spaces, named by Plott path-independent choice spaces. Koshevoy proves that these choice spaces are equivalent to the so-called convex geometries, thus building a bridge between bounded rationality theory and combinatorial mathematics. Convex geometries have made several other appearances in economics papers, as well as in the psychological literature under the name learning spaces. Resolutions of convex geometries (equivalently, of path-independent choice spaces) look similar to compositions of set systems. The two constructions coincide only in some specific situations, which we identify. Resolutions lead to a notion of primitivity for convex geometries, which extends primitivity of partially ordered sets. We list all primitive convex geometries on at most 4 elements. The affine convex geometries can be thought of as numerical representations of particular path-independent choice spaces. We consider the problem of identifying those that are primitive.

Some novel notions for NaP-preferences

¹ D. Carpentiere, ² A. Giarlotta, ³ S. Watson

CT

¹ Department of Mathematics and Computer Science, University of Catania

² Department of Economics and Business, University of Catania

³ Department of Mathematics and Statistics, York University

We describe how some novel notions illuminate the relationship between the necessary and the possible component of a NaP-preference. Although these notions are set primarily in the context of NaP-preferences, they apply more widely. These notions are: (i) the perfect intersection of a family of preferences, and (ii) a conservative extension of a preference. We show that perfect intersections bring insight to the representation of a NaP- preference as the union and intersection of a family of (not necessarily total) preorders. We give simple examples of conservative extensions, and show how this approach give us an explicit and constructive novel characterization of NaP-preferences. The notions introduced here pave the way to prove a characterization for the more complex structure given by a GNaP-preference (generalized NaP-preference)

Transitivity vs Completeness: Generalized NaP- preferences

¹ D. Carpentiere, ² A. Giarlotta, ³ S. Watson

CT

¹ Department of Mathematics and Computer Science, University of Catania

² Department of Economics and Business, University of Catania

³ Department of Mathematics and Statistics, York University

We explore the interaction between two tenets of rationality for preferences: transitivity and completeness. For a single binary relation, their combination results into a total preorder. For two binary relations, their interaction is synthesized by a NaP-preference (necessary and possible preference). This is a pair of binary relations on the same set such that the necessary preference is transitive, the possible preference is a transitively coherent extension of the necessary one, and a form of mixed completeness between the two. The authors characterize NaP-preferences by a family of total preorders such that their intersection gives the necessary preference and their union the possible preference. Applications of NaP-preferences naturally arise in decision theory and choice theory.

Thursday 22nd

Characterization of Useful Topologies in Mathematical Utility Theory: Recent Results

G. Bosi

CT

University of Trieste, Italy

The problem of identifying all the useful topologies on a set (i.e., all the topologies on a set such that every continuous total preorder has a continuous utility representation) may be considered as the most important problem in Mathematical Utility Theory. The concept of a useful topology was introduced by Herden, who also provided, on my opinion, the most interesting results in this field (see e.g. Herden). A very important result in Mathematical Utility Theory was proven by Estévez and Hervés, who showed that separability is a necessary condition on a metric space, in order that every continuous total preorder admits a continuous utility representation. Recently, Bosi and Herden introduced the concept of a complete separable system, and they presented a simple characterization of useful topologies in terms of second countability of all the topologies generated by complete separable systems. The most recent results have been presented, to the best of our knowledge, by Bosi and Zuanon, who, in particular, showed that a completely regular useful topology must be separable. In this paper, I am concerned with completely regular topologies. Based on the concept of weak open and closed countable chain condition (WOCC) of a topology (which generalizes the concept of open and closed countable chain condition (OCC), introduced by Herden and Pallack), I show that a completely regular topology is useful if and only if it is separable and it satisfies WOCC. Finally, I incorporate the Souslin Hypothesis (SH), and I prove that the validity of SH is equivalent to the equivalence between a topology to be useful and to satisfy WOCC.

Constrained Eigenvalue Minimization of Incomplete Pairwise Comparison Matrices by Nelder-Mead Algorithm

¹ H. A. Tekile, ¹ M. Fedrizzi, ¹ M. Brunelli

CT

¹ Department of Industrial Engineering, University of Trento, Trento, Italy

Pairwise comparison matrices have a key role in multi-criteria decision-making, especially in the analytic hierarchy process (AHP). An incomplete pairwise comparison matrix occurs when one or more entries are missing. We propose an algorithm for the optimal completion of an incomplete pairwise comparison matrix. Our goal is to numerically minimize a Perron eigenvalue function with interval constraints, where the objective function cannot be expressed explicitly in terms of variables. Several numerical simulations have been performed in order to study the performance of the algorithm. Our simulation results show that the proposed algorithm is capable of solving the constrained eigenvalue minimization problem. Examples are provided to demonstrate the proposed algorithm's simplex procedures and how well it fills in the gaps in the given incomplete matrices.

Extending Choice Rationality: Lifting and Satisfiability

¹ D. Cantone, ² A. Giarlotta, ¹ P. Maugeri, ³ S. Watson

CT

¹ Department of Mathematics and Computer Science, University of Catania

² Department of Economics and Business, University of Catania

³ Department of Mathematics and Statistics, York University

According to the theory of revealed preferences pioneered by Samuelson, a choice is rationalizable if it can be retrieved from a binary relation by taking all maximal elements of each menu. Under suitable assumptions on the domain Ω , rationalizable choices are characterized by the satisfaction of two axioms of consistency, namely α and γ . These axioms are second order logic formulae quantified over menus and items, which codify rules of coherent behavior. Several additional axioms of consistency have been introduced in the specialized literature, such as β , the weak axiom of revealed preference (WARP), and ρ . If the domain Ω satisfies some closure properties, then c is rationalizable by a total preorder (a reflexive, transitive, and complete binary relation) if and only if WARP holds if and only if α and β hold, and c is rationalizable by a preorder (reflexive and transitive) if and only if α , γ , and ρ hold. We first address the lifting problem: given a partial choice c satisfying some axioms of consistency, find necessary and sufficient conditions such that c can be extended to a total choice satisfying the same axioms. The authors solve this problem for all combinations of α and β . As an application, they also solve the related satisfiability problem for the Boolean Set Theory with Choice correspondence (BSTC), which comprises unquantified formulae of an elementary fragment of set theory involving the Boolean set operators and the singleton, the equality and inclusion predicates, the propositional connectives, and a choice function symbol c . Here we solve the lifting problem for ρ and γ , in combination with α , thus also addressing the lifting of rationalizability. As an application, we solve the satisfiability problem for BSTC under α and γ . Note that when BSTC is deprived of the choice function symbol c , we obtain the theory BST, whose satisfiability problem belongs to the NP-complete class.

Stochastic choice resolutions

E. Sudano

CT

Queen Mary University of London

Stochastic choice resolutions model choices by categorization, that is, involving the preliminary step of grouping available alternatives in virtue of their perceived similarity. For instance, a consumer who faces a set of goods to possibly purchase may proceed by (i) picking a favourite brand, (ii) selecting the best item of that brand. A general model of this sort, choice resolutions, is formulated in a deterministic environment by Cantone et al. . Adopting a shared spirit, stochastic choice resolutions are a two-step model of choice, that generalizes nested logit. Two characterizing axioms require the existence of at least one meaningful category, and impose consistency in the composition of each category. In particular, the crucial trait for isolating mutually similar items lies on the invariance of odds to the availability of non-similar alternatives. This general definition allows the agent to carry an even erratic process of choice, as long as similarity between items is consistently perceived. This single feature informs the structure of the model. Peculiarly, the partition in categories need not be unique. As a result, this enhanced flexibility induces a nuanced definition of similarity, that well represents substitution patterns. Finally, a notion of strong resolvability is introduced.

Between commitment and flexibility: revealing anticipated regret and elation

D. Pennesi

CT

University of Turin and Collegio Carlo Alberto

This paper introduces and characterizes behaviorally a model of choice over menus of actions in which the individual experiences regret or elation if, after uncertainty resolves, the choice from the menu is inferior or superior to available alternatives. The revealed preference characterization of the model combines two contrasting forces: a preference for having fewer options in order to reduce ex post regret, and a preference for having more options in order to increase ex post elation. An application of the model to information acquisition shows that instrumental information is always valuable. Anticipated elation drives an apparently irrational aversion to delegate choices to an informed agent. Lastly, anticipated elation also generates a desire to include options that will not be selected from the menu, a behavior that is often ascribed to naive time-inconsistency.

Bounded rationality is asymptotically rare

¹ **A. Giarlotta**, ² **A. Petralia**, ³ **S. Watson**

CT

Department of Economics and Business, University of Catania

²University of Turin and Collegio Carlo Alberto

³ Department of Mathematics and Statistics, York University

We define a class of properties of choices, called hereditary finitely violated (HFV), which encompasses several declinations of bounded rationality proposed in the literature. HFV properties asymptotically fail to hold for all choices. It follows that almost all finite choices cannot be explained by most known models of bounded rationality. We provide numerical estimates confirming the rarity of bounded rationality even for relatively small sets of alternatives.

Choice by Saliency

¹ **A. Giarlotta**, ² **A. Petralia**, ³ **S. Watson**

CT

Department of Economics and Business, University of Catania

²University of Turin and Collegio Carlo Alberto

³ Department of Mathematics and Statistics, York University

We describe a context-sensitive model of choice, in which selection is shaped by the epistemic value–*saliency*–of items. All alternatives are ranked by a binary relation of saliency, and a linear order is associated to each alternative. The selection on a menu is explained by maximizing one of the linear orders associated to the most salient items in the menu. Our approach is a semantic refinement of the *rationalization by multiple rationales* of Kalai, Rubinstein, and Spiegler (2002), because it reveals the underlying structure of the family of rationales. In the restricted model, the relation of saliency is well-behaved, being transitive and complete. Choice rationalizability is characterized by second order rationality: violations of Axiom α (equivalently, WARP), if any, are pairwise nonconflicting. The restricted model is independent from most bounded rationality approaches, although it is a special case of *choice with limited attention* of Masatlioglu, Nakajima, and Ozbay (2012). The general model, in which the structure of the saliency order is relaxed, provides a sound justification for any observed choice behavior. By this approach, we can single out truly chaotic behavior–*moodiness*–, which characterizes choices requiring as many rationales as items. Asymptotically, all choices are chaotic.

Existence of maximals via right traces

F. Quartieri

CT

Department of Economics and Management, University of Florence

This paper examines the conditions for the existence of a maximal element of a relation on every nonempty compact subset of its ground set. A preliminary analysis establishes some connections between the maximals of a relation and those of its right trace. Via this analysis, various results of the literature are unified by identifying a common property of their assumptions that concerns the right trace of the transitive closure of the objective relation. Next, a generalization is provided so as to accommodate some relations of interest to economics. Finally, a necessary and sufficient condition is presented for the existence of a maximal on every nonempty compact subset of the ground set of a relation.