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Better foundations for better social institutions - theory and experiments

Veszteg, Robert

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Our empirical results deliver important feedback to theoreticians on some of the widely-used basic assumptions on human rationality and axioms of fairness. By identifying more realistic assumptions, we contribute to creating better institutions for human interaction.

Our studies in the experimental laboratory focus on decentralized and unconstrained human interaction. Our emphasis lies on understanding how people search for a partner (matching problem) and how they split certain joint benefits (bargaining problem).

In terms of behavior, we have observed important deviations from what most theoretical models assume. In matching problems, individual myopic rationality (decisions that improve upon the status quo, without being the overall best) dominates on decentralized markets, and centralized solutions (introduced to solve market failures) are typically unable to induce the intended outcomes as only a small fraction of decision-makers act in sophisticated manner and have full understanding of the strategic situation. The behavior that we have observed in unstructured bargaining scenarios also violates some "standard" axioms (e.g., scale invariance, midpoint domination) that widely-used theoretical solution concepts rely on.

experimental economics

experiments matching bargaining decentralized markets unstructured interaction fairness stability

１．研究開始当初の背景
(1) Institutions play a central role in organizing our societies and in determining their success. In search for better institutions and better incentives, most economists would typically turn to the field of *mechanism design*. Even though *mechanism design* has engineered a large number of new institutions, its methods and assumptions have remained true to its theoretical roots, and its empirical relevance —with the notable exception of auctions and matching markets— is rather limited. It has kept its distance from real-life applications.

(2) Recent developments known as *behavioral economics*, *behavioral game theory*, *behavioral finance* and *behavioral political economy* intend to reduce the distance between theory and practice by incorporating psychological and behavioral insights into economic models and economic policy. All of them rely on observations and data gathered through systematic studies of human decision-making. In other words, they use the experimental method to economics.

(3) In its early years (1960s), *experimental economics* explored markets and market behavior from a neoclassical perspective, then turned towards game theory and strategic interaction among decision-makers (1980s). Although experimental findings brought important factors, like biological constraints, culture, social norms, and identity, back to economics, those have typically been incorporated as minor fixes into the mainstream neoclassical models without challenging its main assumptions and methods. As a consequence, the experimentalist and behavioralist revolutions unfortunately failed to deliver their promises.

２．研究の目的
(1) In this project, we test empirically some of the key assumptions behind mechanism design by **analyzing decentralized and essentially unconstrained human interaction** as opposed to testing structured models. With novel experimental designs, we aim at identifying and documenting human behavioral patterns. Our goal is to describe how real people act in situations that closely resemble real-life problems and to better understand markets and other types of social interaction —like partner search, bargaining, information processing— in the absence of a central authority.

(2) Understanding human behavior in decentralized and unconstrained interactions is a crucial first step towards the design of successful social institutions. It constitutes a reference point without which it is impossible to tell 1) whether new (possibly centralized) institutions are necessary, and 2) which behavioral assumptions are appropriate as a foundation for those new institutions and as a starting point for theoretical work.

(3) Our experimental studies seek to understand how humans make decisions in decentralized and largely unconstrained environments: for example, how do they find a trading partner (without imposing a random encounter or a sequential structure which frequently appear in theoretical models); whether they try to act rationally (as assumed by most theoretical models) to find the best possible match; how do they split some joint profits when no external authority decides the rules of interaction; how do they learn and aggregate information when information arrives in an unstructured way; whether they find the properties of theoretical solutions —like efficiency, stability, consistency— as crucial and appealing as theorists do, etc.

(4) In other words, with the help of experimental data, **our goal is to form more realistic assumptions on human decision-making** both for theoretical and practical research. We wish to contribute to the broader scientific fields of *behavioral economics* (by critically assessing some of its key assumptions) and *experimental economics* (by reflecting on its standard methodological rules).

３．研究の方法
(1) Our research project relies on the experimental approach to economics. This means that the data that we analyze —to test existing theories and to form new ones— stem from carefully designed and tightly controlled environments in which we observe how human volunteers make decisions that typically have monetary consequences. We analyze the collected data with standard statistical techniques, and we reach our conclusions —related to important assumptions behind formal economic models— from the obtained statistical results.

(2) Although in our research we also work with data collected outside Waseda University, we make extensive use of our experimental laboratory at the School of Political Science and Economics, mostly in the early stages of designing experiments (in particular, for programming and for

running pilot sessions). This laboratory consists of two dedicated computer rooms specially equipped (with 30 computers each) for implementing laboratory experiments related to human decision-making. Our participants communicate and interact with each other anonymously through computer terminals located in separated booths and receive performance-based monetary rewards in line with the usual methodological requirements for experimental research in economics.

４．研究成果
This section is based on our findings summarized in two recent peer-reviewed publications and a working paper (currently in the peer-reviewing process at a scientific journal).

* Decentralized matching markets with(out) frictions: a laboratory experiment (joint with Joana Pais and Agnes Pinter), published in: **Experimental Economics** (2020) 23: 212–239, https://doi.org/10.1007/s10683-019-09606-1

(1) On a decentralized (matching) market there is no central authority to arrange deals, therefore agents must search actively in order to find a partner and get matched to each other (be it to perform a task, a job, or to trade goods). How market culture and other market features affect the matching that ultimately prevails, as well as the behavior that leads to it, are open questions, both theoretically and empirically. Possibly one of the most relevant questions is whether decentralized market interaction leads to a stable outcome (in which existing partnerships would not break, nor new ones would be formed on a voluntary basis). Even if we consider a frictionless market with free interaction, we should not expect agents to be perfect automata. Furthermore, the level of information that agents have about the others, the cost of conducting partner search, and the level of commitment may dictate whether or not all mutually beneficial partnerships form, and whether a stable final matching is reached.

(2) We designed and ran laboratory experiments that allow for partner search in an essentially unconstrained manner, that is subjects are free to make proposals and are free to accept or reject any proposal received at any time throughout the session. We implemented different scenarios that differ in market size and, more importantly, in the level of information subjects hold about others' preferences (information can be complete or limited to one's own preferences), in the cost of issuing proposals (either free or with a fixed positive cost), and in the degree of commitment (when a proposal is accepted, the subjects involved may either stay in the market or must immediately leave the market).

(3) Several findings emerge from our study. Where the features of the outcome are concerned, stable final matchings are not the norm even in the absence of frictions, and it is only in small markets that stability —the rationale behind some centralized matching markets— acts as a very powerful driving force. Large markets show disappointingly low stability levels. Independently of market size, while stability is not sensitive to the information level, it is to other market characteristics: the proportion of stable final matchings is particularly low when search is costly and is also negatively affected, to a lesser extent, when commitment is combined with a large market size. Surprisingly, and despite harming stability in some instances, commitment appears to boost efficiency. The treatments with commitment deliver the final matchings with the highest aggregate payoffs. Costly proposals and low information do not prevent markets from moving toward payoff-maximizing matchings. The effect of a large market size is less clear, but it never affects efficiency negatively.

	stability	efficiency
(larger) market size	−	×
(more) information	×	×
(larger) search cost	−	×
(more) commitment	×	+

(4) Our data suggest that decentralized interaction makes blocking pairs gradually disappear over time in all treatments, even though the pace at which they vanish depends on the treatment. The main driving force behind the aggregate results is individual myopic rationality (making proposals and acceptance decisions that improve upon the status quo, without being the overall best). The intensity of market activity and the varying strength of this force together offer an explanation to the observed changes in stability and efficiency of the market outcome across treatments.

(5) As a final remark on the grounds of mechanism design, we wish to emphasize the importance of frictions. While the lack of information on others' preferences by itself does not have to be a concern, as our results suggest, policy makers and matching theorists should be concerned by the

presence of market frictions, particularly search costs, which appear to affect the desirable properties of the market outcome. For instance, the combination of low information levels and costly search is particularly detrimental to stability. Therefore, the benefits of introducing a centralized clearinghouse in markets that exhibit these features are potentially high.

* <u>Strategy-proofness in experimental matching markets</u> (joint with Pablo Guillen), published as: **WINPEC Working Paper Series** No. E1913, https://www.waseda.jp/fpse/winpec/en/public/working-paper/
(6) The theory of market design relies on the rationality of decision-makers who are expected to be able to fully understand the decision problem at hand and find the optimal (theoretically, dominant) strategy before playing it. Mechanisms that induce truth-telling and discourage strategizing have been preferred by theorists, irrespective of how complicated those mechanisms are.

(7) We designed and ran a laboratory experiment to investigate this property (known as strategy-proofness) in case of two celebrated centralized matching mechanisms that are often recommended by theorists to policy-makers. Our goal was to determine whether the majority of participants tell the truth because they understand their incentives to do so or because they simply follow a default and choose a salient strategy. This way, we are able to check the robustness of the commonly reported high truth-telling rates of 60-80% in matching laboratory experiments, as well.

(8) Our result show that roughly half of truth-telling (in the typical school-choice problem based on the deferred-acceptance or the top-trading-cycles mechanism) is the result of naïve behavior and that only a small fraction (around 4-11%) of decision-makers act in sophisticated manner and have full understanding of the strategic properties of the situation. These results not only question empirical relevance of strategy-proofness, but also the applicability and relevance of matching theory as a whole.

* <u>On the empirical validity of axioms in unstructured bargaining</u> (joint with Noemi Navarro), published in: **Games and Economic Behavior** (2020) 121: 117–145, https://doi.org/10.1016/j.geb.2020.01.003
(9) Game theorists have been interested in bargaining problems since the early years (1940s). The availability of formal models and testable predictions has attracted also experimental economists to studying bargaining and especially the empirical relevance of the proposed models (1980s). The main motivation for our study stems from the lack of consensus in the experimental literature. Even after having received more than half a century of attention from the economics profession, bargaining remains a black box that produces unexpected results for any of the reigning paradigms.

(10) We designed and ran laboratory experiments to study unstructured bargaining through a series of treatments (bargaining situations) with a minimal set of restrictions. Our participants were allowed to interact with each other: they could chat, send and decide over proposals in any moment during a 5-minute frame. This unstructured design created an intuitive conflict situation for participants that allowed us to explore bargaining behavior without having to impose and to explain a strategic environment whose study would also have to rely on participants' cognitive and strategic sophistication. We searched for empirical support for seven well-known axioms (or properties) and six bargaining solution concepts including some of the most widely-used ones in axiomatic bargaining theory.

(11) In light of the observed agreements, we conclude that solutions that best explain the data are the ones that satisfy the axioms of efficiency, symmetry, independence of irrelevant alternatives, monotonicity, and that do not satisfy scale invariance or midpoint domination. As for individual rationality, we have not found such a clear-cut conclusion. A significant proportion of our participants seem to display preferences for equality over individual rationality. Three well-known solutions that satisfy the properties with empirical support are (i) the equal-division solution, where both bargainers obtain the same payoff, the (ii) deal-me-out (DMO)

○	efficiency	symmetry
○	independence of irrelevant alternatives	monotonicity
△	individual rationality	
×	scale invariance	midpoint domination

solution, which delivers the individually rational agreement that is closest to the equal division of payoffs, and (iii) the egalitarian solution, that gives bargainers the same increase in payoffs compared to the disagreement payoffs. With the help of the axiom of midpoint domination and our experimental data we are able to refine this list further and discard the egalitarian solution. Importantly, our experimental results dethrone the Nash bargaining solution and the Kalai-Smorodinsky solution which have been used by theorists disproportionately too often.

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(Funaki Yukihiko)		
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