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研究成果の概要(和文)：人々の意思決定は、実験室における緊張感には影響されないように見えるが、あまり馴染みのない実験環境においては、少数参加者のみが、合理的に行動している。自由に応答ができる構造無し協力ゲーム実験においてさえ、多くの理論的仮定の下での行動予測を経験的に裏付けることは難しい。特に、交渉の結果は共同利益がどのように生成されるかによって影響される。基本となる個人的・社会的選好関係と共に、交渉の結果は実験の記述に大きく影響される。中でも、利益生成方法の小さな変化が交渉結果に大きな変化をもたらす。抽象的な効用尺度のような観察不可能変数を基にした古典理論交渉解と実験結果の関連性は限定的であることがわかった。

研究成果の学術的意義や社会的意義

Our research highlights the shortcomings of theoretical models written in terms of unobservable utility functions (a common technique in economics) and based on abstract rules. While accepting welfarism, we argue that different utility representations of a problem might lead to different outcomes.

研究成果の概要(英文)：Although human decision-making seems to be unaltered by acute stress in the experimental laboratory (Veszteg et al., 2021), only a minority of participants (4-11%) behave fully rationally in a newly-designed unfamiliar environment (Guillen & Veszteg, 2020). Even cooperative models of free (unstructured) interaction struggle predicting behavior as many of the underlying theoretical assumptions have scarce empirical support (Navarro & Veszteg, 2020, 2023; Takeuchi et al., 2022).

In particular, bargaining outcomes might be affected by how the joint profits have been created. Together with the underlying preferences (social or not), bargaining outcomes are very much context dependent, as a relatively small change in the production process triggers notable changes in bargaining outcomes. Also, we find that classic theoretical bargaining solutions based on unobservables, like abstract utility units, have limited empirical relevance.

研究分野：experimental economics

キーワード：unstructured bargaining Nash bargaining solution cooperative bargaining experiments axiom

1. 研究開始当初の背景

Economists and economics typically rely on the fields of mechanism design and market design (a collection of mathematical models known as classic game theory) when looking for solutions to all sorts of problems that affect society – ranging from localized market inefficiencies to nationwide poverty. Ever since the 1970s, economists have been using models of rational decision-makers who are assumed to have clear goals that are possible to summarize with the help of a single mathematical function. That function does not necessarily have to be simple, as economic agents are allowed to pursue complex objectives described by exotic utility function, but behavior is simply the end result of a utility-maximization problem. This “max U” approach has dominated economic thinking for past five decades and it has proven to be robust to the recent behavioralist movement which has incorporated new ideas (evolutionary constraints from biology, culture and social norms from sociology, identity from psychology) in this neoclassical model without changing it fundamentally. Economists still believe that by creating the right institutions (the right game) those rational decision-makers are going to act to maximize their utility functions under the new constraints, and for that reason they can be “tricked” to achieve a new, more desirable, overall better social and economic outcome.

2. 研究の目的

In this research project, we have sought to analyze decentralized and unconstrained human interaction to empirically test some of the key assumptions behind the neoclassical model in economics with the help of controlled laboratory experiments. The main goal has been to analyze rationality in human decision-making. We believe that before creating any new social institution (defined through sophisticated rules that aim to take advantage of human psychological and behavioral biases for the sake of the common good), one should consider an important question: whether a new (typically centralized) institution is necessary at all. Also, if we wish to understand human behavior, laboratory experiments based on meaningful (typically decentralized and largely unconstrained) context can deliver a more accurate picture than experimental designs based on neutral and unnatural institutions (like the popular ultimatum game or the celebrated top-trading-cycles mechanism) in which rationality can be impaired by subjects not understanding the problem at hand. By observing decision-makers in carefully crafted environments that closely resemble familiar real-life problems (in particular, social dilemmas, problems of bargaining and partner search) and without them having to make sense of and master any artificial setting, we aim at better understanding bargaining and other types of social interaction (that belong to the domain of economic theory) in the absence of a central authority and more accurately measuring the potential benefits that a centralized solution could offer.

- **Questioning the “max U” approach:** Economics heavily relies on game-theoretical models when analyzing conflict situations. Those models typically specify the list of involved parties, the set of strategies available to them, and how they rank all possible outcomes of the interaction (utility levels). While the first two ingredients of the problem – the lists of players and strategies – are usually observable and well-defined to the “outside” researcher, payoffs are only indirectly revealed through behavior, that is through the strategies chosen by the decision-makers. Measuring payoffs correctly, however, is an essential prerequisite for applying game theory to accurately analyze any conflict situation, as rational decision-makers are assumed to act to maximize utility (“max U” approach).
- **Unstructured bargaining:** Bargaining is ubiquitous and often considered the key to success in life. We bargain with prospective and current employers, with sellers and service providers, with editors, and even with our partners. Yet bargaining is poorly understood by economic theory in spite of decades of dedicated research. As most of the time bargaining occurs in an unstructured environment without pre-specified fixed rules and without the presence of a central authority, the unstructured design that we propose for studying bargaining creates an intuitive conflict situation and allows for exploring behavior without having to impose a complex strategic environment. This design constitutes the counterpart of the axiomatic approach which promises to analyze and even predict behavior in environments whose structures cannot be modelled precisely.

3. 研究の方法

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. Although we also work with data collected outside Waseda University, we try to 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. 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.

Note that due to the restrictions imposed by the Japanese authorities and Waseda University on social interaction between 2020 and 2022, many of the experimental sessions were carried out at the Parisian Experimental Economics Laboratory (LEEP) in Paris, France.

4. 研究成果

Two of our early studies explore human rationality in a setting well known to economists.

- In Veszteg et al. (2021), we report statistical results from a laboratory experiment in which participants were required to make decisions with monetary consequences in several solitary and interactive situations under acute stress. Our approach, particularly our situation list, follows the tradition of behavioral and experimental economics, while our experimental design and procedures incorporate elements from medical and psychological research in the way stress is induced and measured. Note that the dominant (standard) economic model of human decision-making lacks reference to any kind of stress and other modifiers of subjective well-being.

The main conclusion, drawn from binary comparisons between the treatment and reference groups, is that acute stress does not have a significant impact on cognitive skills, strategic sophistication, risk attitudes, altruism, cooperativeness, or nastiness. Regression analysis, controlling for individual psychosocial characteristics, corroborates these findings but also suggests that acute stress significantly decreases men's risk aversion (as measured by the lottery-choice task).

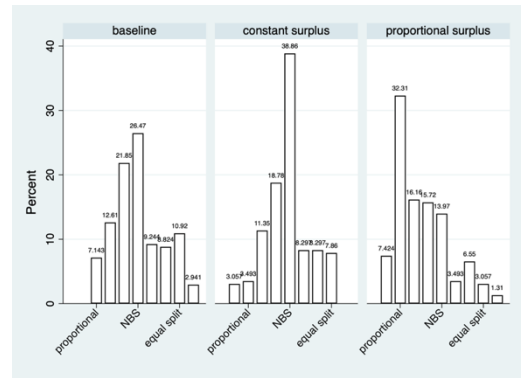
- In Guillen and Veszteg (2021), we take a critical look at the experimental results related to individual behavior (especially, truthful preference reporting) in the so-called school-choice problem. Our primary research goal is to measure strategic sophistication and determine whether most participants tell the truth because they understand their incentives (created by the market designer and the experimenter) to do so or because they simply follow a default and choose a salient strategy. Indeed, the essential problem with experiments on similar environments lies in the complexity of the games under study and that the induced preference order constitutes a strong focal point.

We find that merely 4-11% of participants act in sophisticated (strategic) manner and are fully compatible with the theoretical assumptions. These results question the applicability and relevance of matching theory as a whole. In other words, although some may argue that *strategy-proof* mechanisms (which create incentives to tell the truth) offer a reasonable solution by inviting both sophisticated and naïve decision-makers to act in line with its equilibrium, it is not clear whether they would perform better than other (much simpler) mechanisms in real life. After all, a large part of the population belongs to other groups in terms of strategic sophistication (between or beside the above-mentioned extremes), and mechanisms designed specifically for them could outperform the “standard” *strategy-proof* mechanisms.

The remaining studies carried out in this project look at problems of bargaining. They do so through an unstructured approach and rely on the so-called *cooperative theory of bargaining* and cooperative game theory. It is not only that, considering our above-mentioned results, structured interaction might turn out to be too challenging for strategically unsophisticated participants, but oftentimes it is simply impossible to model human interaction precisely enough. Our unstructured experimental designs create intuitive conflict situations for participants and allow us to explore bargaining behavior without having to impose and to explain a strategic environment whose successful implementation would not only need to rely on the usual *payoff-bridging principle* but also on participants' cognitive and strategic sophistication.

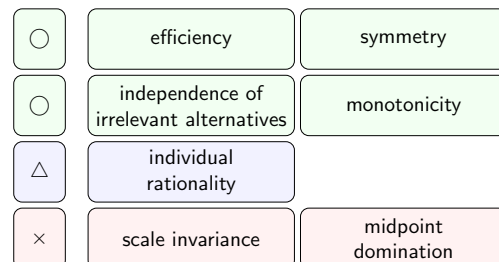
Overall, our research highlights some of the shortcomings of the theoretical models of bargaining. In particular, we argue that bargaining outcomes might be affected by how the joint profits have been created. Also, together with the underlying preferences (social or not), bargaining outcomes are very much context dependent, as a relatively small change in the production process triggers notable changes in bargaining outcomes. In addition, we find that predictions (that is, bargaining solutions proposed classic theoretical models) based on unobservables, like abstract utility units, have rather limited empirical relevance.

- In Takeuchi et al. (2022), we show that the bargaining problem cannot be solved in isolation from the production stage. Our main finding is that when joint profits are proportional to individual efforts, bargaining results in significantly more proportional agreements (as compared to the baseline treatment). When individual efforts are additive in creating joint profits, we observe an increase in the frequency of agreements in line with the *Nash bargaining solution* (NBS).



Based on our findings, we argue that there do not exist fixed preferences for fairness in bargaining outcomes. While cooperative bargaining theory is agnostic about how to choose among the solution concepts that it proposes and characterizes, it might very well be the case that the form of the production function acts as a solution-selection device in a particular bargaining problem that has no obvious unique solution.

- In Navarro and Veszteg (2020), we report experimental results on unstructured bargaining. We search 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. We rely on a sequence of bargaining situations for which the analyzed solution concepts predict different sequences of bargaining outcomes. We conclude that bargaining solutions that satisfy *strong efficiency*, *symmetry*, *independence of irrelevant alternatives* and *monotonicity* explain reasonably well the agreements observed in the experimental laboratory. Three well-known solutions that satisfy all these properties are (i) the *equal-division* solution, where both bargainers obtain the same payoff, the (ii) *deal-me-out* (DMO) 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*, we are able to refine this list further and discard the egalitarian solution (and the considered, but less well-known proportional solution as well). On the negative side, our data do not support the axioms of *scale invariance* and *midpoint domination*. As for *individual rationality*, we have not found such a clear-cut conclusion.



In summary, the *deal-me-out* solution arises as a good predictor for outcomes in our unstructured bargaining environment, just like in the much more structured and constrained setup of the *alternating-offer bargaining game*. Our experimental results dethrone the *Nash bargaining solution* and the *Kalai-Smorodinsky solution* which – to the best of our knowledge – have been used by theorists disproportionately too often.

- In Navarro & Veszteg (2023), we take another (and even more careful) look at the axiom of *scale invariance* and the so-called hidden axiom of *welfarism* in cooperative bargaining theory. *Welfarism* refers to the fact that theory typically solves the bargaining problem in utilities and offers the same solution to all bargaining problems that are identical when formulated in utilities. Operating with the utility representation of preferences is not without problems. On the one hand, utility functions are not uniquely defined. On the other hand, utility functions are not directly observable or even measurable. In the absence of reliable estimates for them, simplifying assumptions are needed to give empirical relevance to the theoretical model. It is the axiom of *scale invariance* that saves the day by requiring that, as long as the set of feasible agreements is unaltered, the bargaining agreement should not be affected by changes in the utility representation (provided those are affine mathematical transformations). All this, however, comes at a high price. Paired with the *welfarist axiom*, *scale invariance* imposes too much structure and makes the bargaining solution irresponsive to changes in the bargaining environment that many people would consider as relevant and would want to adjust the bargaining solution accordingly.

This study of ours uses a context-rich bargaining environment that varies the parameters of the bargaining problem along with the information that bargaining parties have about each other. It aims at understanding whether bargaining is guided by utilities as assumed by the classic version of cooperative bargaining theory or rather by comparisons in observables (e.g., money) as often assumed by behavioral models of decision-making. This time, the experimental results show that *welfarism* and *scale invariance* are supported when the relevant information is only privately known. In general, bargaining outcomes are robust to rescaling that only affects the anchoring points of the utility scale (*welfarism*), but not to rescaling that affects the units on the utility scale (*scale invariance*). Overall, our experimental data deliver scarce empirical support to classic theoretical bargaining solutions based on unobservables, like abstract utility units. Once again, our results do not support the use of the *Nash bargaining solution* or the *Kalai-Smorodinsky solution*.



In addition, we have carried out experimental sessions for two additional studies related to this project. They aim at generalizing our earlier results to bargaining problems involving more than two parties and to situations that allow for transfers between the bargaining parties (very much in line with the standard assumption of transferable utility in cooperative game theory).

- The preliminary results suggest that people do take advantage of transfer opportunities (whenever available) to increase the efficiency of the bargaining process. With transfers, bargaining outcomes tend to be significantly more unequal in physical units, but not in utilities or personal gains. In other words, transfers can change bargaining outcomes in a way that is simultaneously beneficial to both bargaining parties (as compared to the case in which transfers are not possible). These findings support the use of theoretical models from cooperative game theory to analyze bargaining.
- Regarding the bargaining problems with three parties, we observe a significant reduction of equal-split type agreements (as compared to the two-person settings). It seems that the reduction in the focality of 50-50 agreements is not only significant statistically, but also large (an average drop from 32% to 20% in physical units, and from 35% to 16% in utility units). Yet again, this result raises important concerns about the popular assumptions of *social* or *other-regarding preferences* in theoretical models.

5. 主な発表論文等

〔雑誌論文〕 計5件（うち査読付論文 5件/うち国際共著 5件/うちオープンアクセス 0件）

1. 著者名 Takeuchi Ai, Veszteg Robert F., Kamijo Yoshio, Funaki Yukihiro	4. 巻 134
2. 論文標題 Bargaining over a jointly produced pie: The effect of the production function on bargaining outcomes	5. 発行年 2022年
3. 雑誌名 Games and Economic Behavior	6. 最初と最後の頁 169 ~ 198
掲載論文のDOI (デジタルオブジェクト識別子) 10.1016/j.geb.2022.03.016	査読の有無 有
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1. 著者名 Guillen Pablo, Veszteg Robert F.	4. 巻 24
2. 論文標題 Strategy-proofness in experimental matching markets	5. 発行年 2021年
3. 雑誌名 Experimental Economics	6. 最初と最後の頁 650 ~ 668
掲載論文のDOI (デジタルオブジェクト識別子) 10.1007/s10683-020-09665-9	査読の有無 有
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1. 著者名 Veszteg Robert F., Yamakawa Kaori, Matsubayashi Tetsuya, Ueda Michiko	4. 巻 16
2. 論文標題 Acute stress does not affect economic behavior in the experimental laboratory	5. 発行年 2021年
3. 雑誌名 PLOS ONE	6. 最初と最後の頁 -
掲載論文のDOI (デジタルオブジェクト識別子) 10.1371/journal.pone.0244881	査読の有無 有
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1. 著者名 Guillen Pablo, Veszteg Robert F.	4. 巻 tbd
2. 論文標題 Strategy-proofness in experimental matching markets	5. 発行年 2020年
3. 雑誌名 Experimental Economics	6. 最初と最後の頁 tbd
掲載論文のDOI (デジタルオブジェクト識別子) 10.1007/s10683-020-09665-9	査読の有無 有
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〔学会発表〕 計2件 (うち招待講演 0件 / うち国際学会 1件)

1. 発表者名 Veszteg Robert Ferenc
2. 発表標題 On scale invariance: What do bargainers bargain about?
3. 学会等名 Experimental Social Science Conference
4. 発表年 2022年

1. 発表者名 Veszteg Robert Ferenc
2. 発表標題 On scale invariance: What do bargainers bargain about?
3. 学会等名 The 2022 North-American Economic Science Association Conference (国際学会)
4. 発表年 2022年

〔図書〕 計0件

〔産業財産権〕

〔その他〕

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6. 研究組織

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研究協力者	山川 香織 (Yamakawa Kaori)	Tokai Gakuen University	

7. 科研費を使用して開催した国際研究集会

〔国際研究集会〕 計0件

8 . 本研究に関連して実施した国際共同研究の実施状況

共同研究相手国	相手方研究機関			
フランス	Universite de Bordeaux	Universite de Rennes		
オーストラリア	University of Sydney			