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研究課題名(和文) Efficient and Incentive-Compatible Auction Design Beyond Quasi-Linearity: Theory and Experiment

研究課題名(英文) Efficient and Incentive-Compatible Auction Design Beyond Quasi-Linearity: Theory and Experiment

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研究成果の概要(和文)：本プロジェクトは、準線形性を越えた効率的かつ誘因両立的であるオークション理論の系統的分析の提供を目的とする。本プロジェクトは順調に進み、2つの成果を得られた。1つ目は、3本の論文を完成させたことで、うち1本は査読付きの国際的なトップ経済紙に掲載され、他2本もワーキングペーパーとして発表した。2つ目は、研究成果を国内外の様々なセミナーや会議で発表したことである。発表中には、世界的に有名な研究者から意見を得ることができ、研究成果の改善に繋がった。またこういった交流により、本プロジェクトの重要性を広めることが出来た。本プロジェクトで得られた研究成果は、国際的学界において広く認知されたと考える。

研究成果の学術的意義や社会的意義

(1) My work is published in peer-reviewed international top journal;(2) My works are published in the influential working paper series;(3) My seminar and conference presentations obtain wide recognitions of international academia;(4) Our auction is to be patented in the near future

研究成果の概要(英文)：This project is aimed at providing a systematical analysis of the efficient and incentive-compatible auction theory beyond quasi-linearity. During the two-year research period, the project went on well and I obtained several research achievements. The first achievement is that I completed three research papers, which turned to be the main research outputs of this project. In particular, I published one paper in the peer-reviewed international top economic journal. I also published another two papers as working papers. The second research achievement is that I presented my research results in a variety of important domestic and international seminars and conferences. In my talks, I intersected with international famous researchers and collected comments from them to improve my results. Such communications also helped advice the importance of this project. I believed that results generated by this projects have obtained wide recognitions of international academia.

研究分野：理論経済学

キーワード：Auction Non-quasi-linearity Efficiency Strategy-proofness

1 . 研究開始当初の背景

In last few decades, governments in many countries conduct auctions to efficiently allocate various public assets such as spectrum licenses and vehicle licenses, etc. Some auctions even have great impacts on the national economy. For example, the U.K. spectrum auction generated enormous government revenue (2.5 percent of GNP) by selling four spectrum licenses among five private firms. These extremely large amounts of winning bids also have great impacts on bidders' budgets and cash balances. However, most of existing literature on auction theory assumes the quasi-linearity of bidders' preferences, which means that winning bids are negligible compared with bidders' budgets.

Efficiency (EFF), as announced goals of many government auctions, requires that the bidding items be given to those who value them the most. However, in many cases, preferences are only known by bidders themselves. Bidders may strategically report their preferences to maximize their self-interest, resulting in inefficient allocations. Hence it is crucial for the auction to be incentive-compatible (IC), i.e., bidders cannot gain from misreporting their preferences.

Therefore, developing EFF and IC auction theory beyond quasi-linearity is of great importance to both theory and practical implication.

2 . 研究の目的

This project is aimed at providing a systematic analysis of designing efficient and incentive-compatible auctions beyond quasi-linearity. I try to first design Eff and IC auctions beyond quasi-linearity, and then make some preparations for conducting experiments to examine theoretical results.

3 . 研究の方法

The analytical framework of this project is the multi-item auction model with unit-demand bidders for non-quasi-linear preferences:

- (i) Several items are sold to bidders,
- (ii) Each bidder receives at most one item.
- (iii) Bidders have non-quasilinear preferences over the pairs (object, payment).

It is worth noting that the non-quasilinear preferences accommodate the income effects, and even the continuous market frictions, which just captures the essential features of the scenarios we want to model. The above framework is a most important model in auction theory.

The main research tools come from game theory, in particular, the game of imperfect

information and the game of incomplete information. Moreover, the discrete mathematics, combinatorics optimization, and algorithmic graph theory are also used in this project.

4 . 研究成果

The main research outputs of this project are three research papers. One is published in the peer-reviewed international top journal and the other two are published in the influential working paper series.

The logic of three papers is as follows: The first paper provides the theoretical foundation of designing EFF and IC auction beyond quasi-linearity. It is shown that the minimum price rule has such desirable properties. However, the minimum price rule is a mapping, not an auction process. Thus, what we need to do is to design an auction that always selects the same allocation as the minimum price rule. Then the auction also achieves EFF and IC.

The second paper just provides the auction process that always finds a minimum price equilibrium in a finite number of steps and only requires the agents to reveal finite dimensional information in finitely many times. Moreover, we even find that the auction process can be used to estimate the utility functions in the housing market research.

The third paper further introduces the financial constraints to the analytical framework proposed above. We find that in such a case, there is no competitive equilibrium and there is no possibility to design EFF and IC auctions. Instead, we just focus on the EFF issues and provide a weakened equilibrium concept to conduct the competitive analysis. Moreover, we show that our proposed equilibrium satisfies EFF.

In addition, I presented the above results in a variety of domestic and international seminars and conferences. I also made good preparations for conducting the experiments to test the auctions proposed in the second paper.

I believe that the results generated by this projects have obtained wide recognitions of international academia

5 . 主な発表論文等

〔雑誌論文〕(計 1 件)

1. Zhou Yu, Serizawa Shigehiro, 2018. Strategy-Proofness and Efficiency for Non-Quasi-linear and Common-Tiered-Object Preferences: Characterization of Minimum Price Rule. Referred, *Games and Economic Behavior* 109, 327-363. 【Refereed】

〔学会発表〕(計 7 件)

1. Zhou Yu, *Minimum Price Equilibrium in the Assignment Market*, WINPEC-CPPE Microeconomics Workshop, Waseda University, Japan, 2018.10
2. Zhou Yu, *Minimum Price Walrasian Equilibrium for General Preferences: Serial Vickrey Algorithms*, 14th Meeting of the Society for Social Choice and Welfare, Seoul, Korea, 2018.06
3. Zhou Yu, *Minimum Price Walrasian Equilibrium for General Preferences: Serial Vickrey Algorithms*, Microeconomics seminar, Shanghai University of Finance and Economics, Shanghai, China, 2018.05
4. Zhou Yu, *Minimum Price Walrasian Equilibrium for General Preferences: Serial Vickrey Algorithms*, GSBE-ETBC seminar, Maastricht University, Netherlands, 2018.01
5. Zhou Yu, *Minimum Price Walrasian Equilibrium for General Preferences: Serial Vickrey Algorithms*, Hitotsubashi-Osaka Economic Theory Workshop, Hitotsubashi University, Japan, 2017.12
6. Zhou Yu, *Minimum Price Walrasian Equilibrium for General Preferences: Serial Vickrey Algorithms*, Spain-Japan Meeting on Economic Theory, Sevilla, Spain, 2017.10
7. Zhou Yu, *Minimum Price Walrasian Equilibrium for General Preferences: Serial Vickrey Algorithms*, Conference on Economic Design, York, 2017.06;

〔図書〕(計 0 件)

〔産業財産権〕
出願状況(計 0 件)

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〔その他〕
ホームページ等

Working papers（計2件）

1. Zhou Yu, Serizawa Shigehiro., 2019. Minimum Price Equilibrium in the Assignment Market. *ISER Discussion Paper*, No.1047. 【Non refereed】
2. Herings P.Jean-Jacques, Zhou Yu, 2019. Competitive Equilibria in Matching Models with Financial Constraints. *GSBE Research Memorandum 19/007*, Maastricht University. 【Non refereed】

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