

## 【Grant-in-Aid for Scientific Research (S)】

### Broad Section A



#### Title of Project : Advancing Social Science through Market Design and its Practical Implementation

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Keyword : Market Design, Matching Theory, Auction Theory, The University of Tokyo Market Design Center (UTMD)

#### 【Purpose and Background of the Research】

Recent developments in the economics of market design proposing ways in which institutions can effectively allocate scarce resources to the right place are attracting broad attention and promoting further methodological progress. Nonetheless, applications to real-world problems are still limited. The aim of this project is to advance understanding of how to put the ‘right person in the right place’ in the real world. Based on the latest academic achievements, we propose unprecedented designs of institutions and protocols for the efficient allocation of human resources and goods. Further, we implement them in the real world and solve pressing problems in Japanese society, such as the childcare waitlist problem. The design, implementation, and evaluation of institutions for efficient resource allocation requires the collective knowledge of fields beyond economics, including algorithms, artificial intelligence, and data science. Our team is composed of outstanding specialists in these fields and we bring their distinct approaches together to tackle real-world problems. The University of Tokyo Market Design Center (UTMD)—headed up by the project’s principal investigator, the world-leading specialist in market design and a former professor at Stanford University—acts as the project’s hub and applies market design principles in the real world. Moreover, feedback from these practical implementations drives further advancements.

#### 【Research Methods】

Employing recent academic achievements, we design implementation protocols and put them into practice in the real world through UTMD. We focus on matching theory and auction theory in particular. Based on this body of theory, we tackle serious, front-line, real-world problems such as the uneven distribution of doctors, the childcare waitlist problem, and contract fulfillment through blockchain technology (“digital court”). Accumulating feedback from these real-world implementations, we re-examine the roles of markets and organizations, or institutions in a broader sense, which leads to a profound comprehension of resource allocation problems that are commonly inherent in a variety of social problems. This yields considerable direct benefits to society through further practical implementations. Also, UTMD coordinates with other organizations to expand the field of activities to areas that are not considered to be the primary realm of market design but which can be expected to offer sizable synergies.

#### 【Expected Research Achievements and Scientific Significance】

We expect to realize considerable synergies among the following three groups undertaking the project: UTMD, which explores the needs of society for innovative market designs to alleviate misallocation of resources, the theory-oriented team lead by the principal investigator, which proposes optimal institutional designs that address those needs, and the implementation-oriented team consisting of specialists in algorithms, artificial intelligence, and data science, which handles the real-world implementation of the proposed designs. The project is unique in that it retains the following three capabilities at a high level to perform fully successful market design and its implementation: the capability to explore social needs with respect to market design, the theoretical capability to create optimal designs that can withstand the demands of society, and the computational science capabilities needed to implement highly elaborate designs. The project contributes to a wide range of social problems irrespective of time span or urgency. Such examples include nursing and education, which constitute the essential framework for sustaining the growth of Japanese society, labor markets and financial markets, which are fundamental institutions for the economy, and public policies to achieve optimal resource allocations in times of urgency such as natural disasters or pandemics.

By facilitating the swift implementation of innovative market designs that meet societal demands, we expect this project to serve as a next-generation archetype for the social sciences.

#### 【Publications Relevant to the Project】

- Kojima, Fuhito and Kamada, Yuichiro, “Fair Matching under Constraints: Theory and Applications.” accepted for publication, *Review of Economic Studies*.
- Kojima, Fuhito, Ning Sun, and Ning Neil Yu. "Job matching under constraints." *American Economic Review* 110.9 (2020): 2935-47.
- Kojima, Fuhito, Akihisa Tamura, and Makoto Yokoo. "Designing matching mechanisms under constraints: An approach from discrete convex analysis." *Journal of Economic Theory* 176 (2018): 803-833.

#### 【Homepage Address and Other Contact Information】

The University of Tokyo Market Design Center (UTMD)

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