Importance of allocation mechanisms that don't rely on price adjustment: Rebuilding the concept of markets

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Key points

- Focusing on the visible hand that replaces traditional price mechanisms
- Expanding the use of market design for kidney transplants
- Improving institutional design to eliminate the childcare waiting lists issue

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One of the most prominent ideas in economics is Adam Smith's concept of the "invisible hand." The invisible hand is the magical mechanism for price adjustment that is capable of maximizing the wealth of society if self-interested consumers and companies respond to the prices of goods and services. With advances of research in economics, this idea has been elaborated upon. However, neoliberals have also used this phrase to promote deregulation.

And yet, no one has ever actually seen the invisible hand. In fact, examples of the price mechanism not working can be found everywhere in society.

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Although it may be a slightly extreme example, let us look at the transplant kidney market. This marketplace has a demand side (patients) and a supply side (donors) involving kidneys as the goods being traded.

However, the invisible hand doesn't function to adjust prices in the transplant kidney market. The reason is simple: it is illegal to sell organs. With the exception of illegal black-market transactions or the like, the invisible hand cannot adjust the price of goods that cannot be priced. As the price of a kidney is zero, the number of donors is far smaller than the number of patients, and there is no balance between supply and demand. Consequently, it has become common for nephritic patients to wait years for a donated kidney.

One additional example is still fresh in our minds: the ban on the resale of face masks at high prices during the early phase of the COVID-19 pandemic. There is an ethical imperative not to rely upon price adjustment for the distribution of artificial respirators, vaccines and other medical resources. Outside the medical sector, approved childcare centers can be considered a major battlefield for the childcare waiting lists issue. They also form a marketplace in which the invisible hand does not succeed in adjusting prices because childcare fees are determined from a political perspective.

Some people who trust price mechanisms believe that regulations in these markets should be removed. Although this author does not necessarily dispute every aspect of this school of thought, it seems unlikely that sudden changes in moral values and laws in the near future would result in a world in which organs become widely traded.

Given this reality, modern economists have considered the creation of a marketplace using a "visible hand" mechanism. This area of study is called market design. Marketplaces can be found any place where goods and services are exchanged, including transplant organs and childcare centers, and the exchange of money and the establishment of prices are not the essence of a market.

To explain, let us look again at the transplant kidney example. Humans have two kidneys, and it is believed that having only one kidney does not affect human health. Accordingly, it is possible to transplant kidneys from living donors, and, in principle, the potential supply of kidneys is nearly inexhaustible. In Japan where people have a strong aversion to transplants from people who have suffered brain death, this fact is particularly important.

However, as the price of a kidney is zero, the number of donors is far smaller than the number of patients, and potential donors are normally limited to patients' spouses, family members, etc.

Moreover, the existence of a living donor candidate does not ensure that a transplant can occur. This is because the blood type and other elements must match between the patient and donor. For example, it may be possible to transplant a kidney from a donor with a blood type of O to a patient with a blood type of A, but it not possible to transplant a kidney from a donor with a blood type of A to a patient with a blood type of O, unless the patient is immunosuppressed or there is some other special treatment. Because of this, the demand side (patients) and the supply side (donors) of the goods (kidneys) need to be brought together by a method other than a price mechanism.

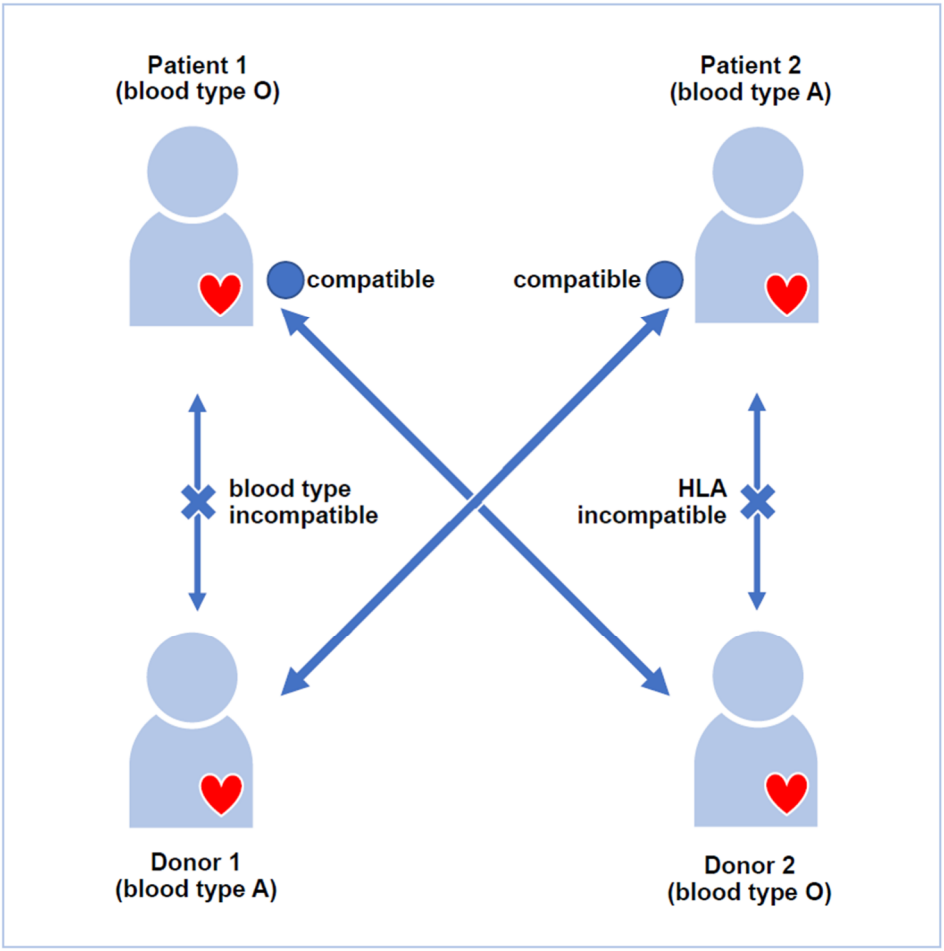
The design of systems for matching kidney donors with patients is an example of a successful social implementation for market design researchers. The fundamental idea is that when the blood groups of a donor and patient are incompatible, incompatible pairs can be matched. For example, one pair including a patient with a blood type of O and a donor with a blood type of A can be matched with another pair consisting of a patient with a blood type of A and a donor with a blood type of O. If the donor and patient are incompatible because of a reason other than blood type (for example, Human Leukocyte Antigen [HLA] antibodies), it may be possible to swap the donors between the two pairs to make both kidneys compatible with the patients in need (see figure). This is similar to goods (kidneys) being exchanged on a marketplace.

Kidney exchanges such as this are not considered organ trade according to the laws of many countries. It is believed that this system does not pose an ethical problem because there is no exchange of money. An alternative barter marketplace has been established, so to speak, among kidney donors without setting prices. However, it is not possible for the invisible hand to work without the establishment of prices. Following this principle, researchers have designed algorithms to act as a visible hand for kidney exchange.

First, a database of donor/patient pairs is created. Next, algorithms are used to identify methods for maximizing the number of donor exchanges to enable as many patients as possible to receive a kidney. Then, the transplants occur following the identified solution. This framework has been used in many countries around the world since the beginning of the 21st century, with doctors, economists, computer scientists and others participating. Because of The Japan Society for Transplantation's negative view of

this system, it has not been implemented in Japan. However, this author believes that the system deserves to be reviewed in Japan, in light of its implementation progressing steadily in societies around the world.

In some situations, swapping the donors of two incompatible pairs will make it possible for both kidneys to be compatible.



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The visible hand of Market Design can also be applied to the childcare waiting list issue. Many childcare centers in Japan are approved childcare centers and the fees they are able to charge are set low by local governments. Accordingly, there is supply/demand imbalance, which would not occur in a normal marketplace, causing some children to wait for admission.

The invisible hand is not free to work when childcare fees are determined from a political perspective, and local governments determine children's admission to childcare centers using an algorithm. Specifically, applicants submit a ranked list of their preferred childcare centers to the relevant local authority. The local authority considers various factors, such as the applicant being a single parent, or the availability of the child's grandparents to aid in childcare, and prioritizes and determines which children can be admitted to which childcare centers, taking the applicants preferences into account. This is an example of how the visible hand of local governments works.

However, there are pros and cons to this human-designed visible hand. There is room for improvement in the current system. Firstly, almost every local government performs the process for determining admission to childcare centers manually. As the process is basically a pre-established algorithm, it can be performed by computers.

Second, the work of determining admissions is based on preset enrollment limits for each age group at each childcare center. Even popular childcare centers in areas with fierce competition may have many applicants in the 0-2 age group, but less applicants in the 3-5 age group. This creates the possibility that the staff and space assigned to the 3-5 age group may not be utilized effectively.

A collaborative study conducted by Kamada Yuichiro, an associate professor at the University of California, Berkeley and this author proposes a measure to eliminate this inefficiency. Rather than rigidly determine the limits for each age group in advance, these limits can be flexibly defined based on the submitted preferences. According to data from Yamagata City in Yamagata Prefecture and Bunkyo Ward in Tokyo, our proposal contributed to a significant decrease in the number of children waiting for admission.

Modern economics, and market design in particular, have begun to improve society using a visible hand beyond the bounds of the traditional economics. The University of Tokyo recently established a Market Design Center. It plans to make policy recommendations regarding the issues of securing medical care in remote areas, distributing medical resources in response to the COVID-19 pandemic, and auction system design, among others. Market design will play an important role in the modern world, which places greater significance on marketplaces that depart from the forms of traditional marketplaces relying on the invisible hand.

Translated by The Japan Journal, Ltd. The article first appeared in the "*Keizai kyoshitsu*" column of the *Nikkei* newspaper on October 29, 2020 under the title, "*Kakaku chosei ni tayoranu hasso ni omomi: Shijo-zo no saikochiku* (Rebuilding the image of markets)." *The Nikkei*, October 29, 2020. (Courtesy of the author).

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Kojima received his B.A. at the University of Tokyo and Ph.D. at Harvard University, both in economics. After spending one year at Yale University's Cowles Foundation as a postdoc, he taught at the Economics Department at Stanford as assistant, associate, and then full professor. He joined the University of Tokyo as a professor in the fall of 2020, where he is also a founding director of the University of Tokyo Market Design Center (UTMD). His research interest is in game theory, matching theory, and market design. Among his best known research is a new proposal for matching doctors to hospitals in a balanced manner across regions in Japan, as well as a proposal for matching children to nursery schools in Japan.
