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Responsiveness to Incentives in Organ Donation Decisions: A Laboratory Experiment

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Abstract

In Thailand, the number of patients who are waiting for an organ transplant has been growing. This study investigates the optimal organ allocation rule considering the risk of organ compatibility between givers and receivers. We run the experiment focusing on three allocation rules: the first come first served, the rebate, and the priority rule. In the first come first served, the longest waiting subject obtains an organ. The rebate rule is that donors receive payment for donating and they are given a priority when they need an organ transplant in the priority rule. We find that the subjects have the strongest response to the priority rule and the compatibility factor played a crucial role when subjects decide to donate.

Keywords

Organ Allocation Rule, Organ Donation, Experimental Economics

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Introduction

The scarcity of organs has been a problem in many countries around the world, including Thailand. According to the 2019 Annual Report of Thai Red Cross Organ Donation Centre, the number of patients who are waiting organs is signifcantly increasing, whereas the numbers of organ receivers and organ donors remain rather steady (see Figure 1)[1]. Approximately 85% of the waiting patients have kidney failure and need kidney dialysis treatments. One factor causing the number of waiting patients to increase is that the dialysis cost is subdized by the social security system (4,500 baht/140 USDper week,). Furthermore, in the case that they have received the organ, the cost of transpantation and cyclosporine, a medicine that the receiver must take for his/her entire life, are fully subsidized. Therefore, the queue waiting for kidney replacement is the longest. The average waiting time for a kidney transplantation is approxitmately 5 years and since 2010 there have been 900 patients who died while waiting. Since the trend of patients waiting is increasing, the scarcity of organs has increased. This scarcity creates greater challenges for the organizations involved with organ donations in Thailand.

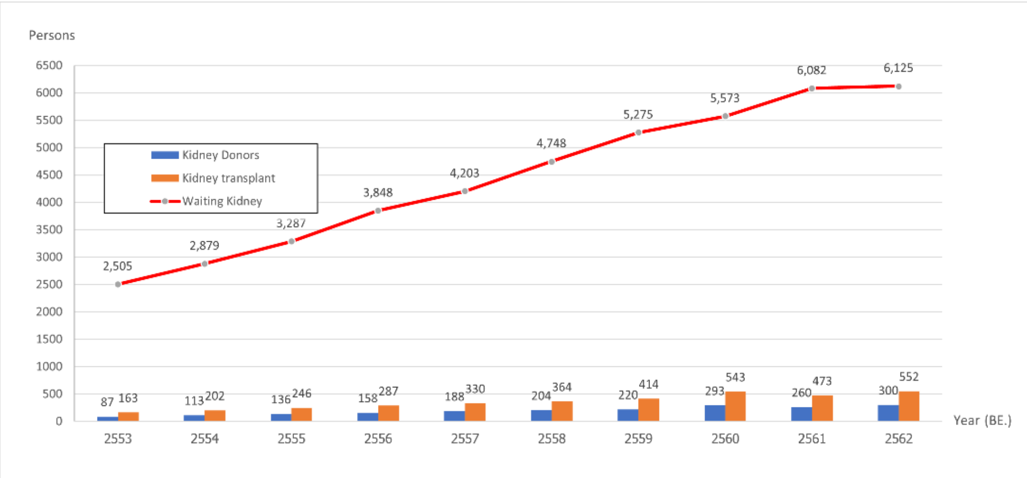

Figure 1 The number of organ donors, organ receivers and waiting patients

Source: The Annual Report of Thai Red Cross Organ Donation Centre (2019).

[1] The difference between donor and registered donor is that the registered donor is a person who intends to be a donor but has not yet provided an organ to others, whereas the donors have already given. The registered donor will possibly be a donor for example if killed in a car accident. See details in Supply of organs, in section 2.

The scarcity of organs is not a unique situation in Thailand. For example, in 2019, there were approximately 100,000 patients on the waiting list for organs in the USA and only 23,359 patients received the operation (The Annual Report of Organ Procurement and Transplantation Network) [2]. In terms of economics, this situation is due to an excess in demand and the most common way to reduce such demand is to to increase the price. Unfortunately, organs cannot be quoted using a regular pricing mechanism. Selling and buying organs is prohibited by law in most countries, and the market is constrained on ethical grounds. Alternatively, the only way to remedy such scarcity is to raise the number of registered donors.

There are two kinds of organ donors: living and deceased. This research focuses on the deceased donars because one donor is able to help up to eight patients (claimed by Thai Red Cross Organ Donation Centre, https://www.organdonate.in.th/). We believe that an increase in deceased donors can remedy the scarcity of organs more than that in living donors. In the literature, there are three main mechanisms to incentivize people to donate organs, first come first served, the rebate and the priority mechanism. For the first come first served mechanism the longest waiting subject receives an organ first. This rule is currently applied in many countries, including Thailand. In the rebate rule, a donor is awarded by a rebate scheme. In the USA, organ donors can deduct up to $10,000 in taxes.[3] The priority allocation rule is that a donor will benefit from a priority when she needs an organ. For instance, suppose there is one organ available but there are five patients on the waiting list. A patient who has donated previously will receive that organ, regardless of how long she has been waiting. There are a few countries that are applying this rule, such as Singapore, Israel, Chile, USA and China.[4]

Kessler and Roth (2012) concluded that the priority rule effectively induces people to be donors. Successive papers have confirmed that the priority rule is crucial in many environments (for example, Li et.al, 2013, Kessler & Roth, 2014 b). Those papers treat people as homogenous agents in the sense that a donor's organ can be perfectly compatible to any patient. In reality, before transplantation, a doctor matches a donor's organ to the patient who has the closest body compatibility. This means that donors and patients are heterogeneous agents, and organ compatibility is crucial.

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[2] See detail in https://optn.transplant.hrsa.gov/data/view-data-reports/annual-report/

[3] See detail in https://www.alec.org/model-policy/organ-donation-tax-deduction-act/#:~:text=Summary, one%20or%20more%20human%20organs.

[4] In the USA, organ allocation is not monopolized by a central organ donation center as in other countries. There are several organ centers, and each center has their own rules. However, many centers have applied priority rule to members.

This paper asks whether the priority allocation rule is effective when the importance of organ compatibility is taken into consideration. A patient who has previously registered as a donor certainly receives the benefit in a homogenous environment. However, they might not be able to receive an organ in a heterogeneity environment if their body is not compatible to that of an organ's donor. Therefore, the benefit of being a donor decreases when donor and receiver's body are not perfectly compatible.

Since the rebate and priority allocation rules have not yet been applied in Thailand, no primary data is available. Therefore, we formed the experiment to collect the data, in which there are three treatments, first come first served, rebate and priority. We extend Kessler and Roth (2012) by incorporating the risk of organ compatibility between givers and receivers. This means that the patient who is on top of the waiting list might not be able to receive the organ if the organ is not compatible with his/her body.[5] In this experiment, we assigned types to subjects. There are two types of subjects that differ in their flexibility to receive the organ. The first type can receive from any giver; the other type can obtain only from givers of the same type. The results of this study show that the difference in type is considerable for subjects when they decide to donate. In addition, the priority rule is more effective than first come first served which is the status quo in Thailand.

The organization of this paper is as follows. We describe an overview of organ donation in section 2. Section 3 is the literature review, and the experimental design is given in section 4. The results are in section 5 and the conclusion is provided in section 6.

Supply of Organs

The Organ Donation Systems

There are two systems of organ donation, opt in and opt out. In the opt in system, people are non-donors (the default option is non-donors). If they want to be a donor, they can register as a registered donor. By contrast, in the opt out system, people are donors by default. They can abandon this option by registering to be non-donors. Examples of opt in countries are Thailand, Brazil, and Australia; while, examples of opt out countries are Spain, Sweden, Singapore (Shepherd et al., 2014).

Living and Deceased Donors

Donors were divided into two categories, living and deceased donors. A living donor is a donor who donates a part of an organ, such as one kidney, to other people and

[5] In reality, the compatibility is calculated in form of score and the score varies by the degree of alignment between organ and waiting patient in several factors such as waiting time, blood type, HLA mismatch, etc.

continues to live after giving. By law, givers and takers are restricted in that they must be from the same family. Donating among friends and distance relatives is not approved legally. On the other hand, a deceased donor is a brain-dead donor, without injury to the organ in demand. By law, the definition of death is brain dead.[6] After diagnosing that the brain is dead, but the subject still breathes, a doctor will perform a surgery to harvest organs. Because a deceased donor can give more organs than a living donor does, this paper will focus on deceased donors.

According to an interview with a Thai Red Cross Organ Donation Centre officer, most organs are donated by deceased donors but they themselves do not consent. The donors have not registered as a registered donor since they are alive. When the brain of a patient has died, nurses often enquire from the next of kin for consent. They ask if the patient can serve as a deceased donor. If the family consents, the doctors can operate. With the current system, most of the supply of organs depends on officers asking and the kin's consent. Unfortunately, the decision at that very moment is very difficult and most of them wait for a last-minute miracle, after which it can be too late to extract organs. However, we believe that if the next of kin are aware of the intentions of the patient (they want to be a donor and have registered as a donor), it might be easier for the next of kin to give consent. Therefore, increasing the number of registered donors would also increase the supply of organs and reduce waiting times. In October 2020, there were 91,568 registered donors in Thailand, which is approximately 1.2% of the Thai population. The strategy to increase registered donors is a challenge to the Thai Red Cross Organ Donation Center.

Literature Review

The seminal papers in organ allocation are Roth et. al (2004), Roth and Sönmez (2005) and Roth et. al (2005) in which they propose the W-chain algorithm to match patients and donors. The algorithm addresses problems of medical incompatibilities between patients and donors. The merit of their algorithm is that they provide a way to exchange between patient-donor pairs. They also apply this algorithm to hospitals in New England. Since those papers, there has been extensive literature on organ allocation, most of which proposes matching algorithms that improve the W-chain algorithm. However, studies focusing on deceased donors is limited.

Kessler and Roth (2012) is the most influential paper to pose the question on how to increase organ donations from deceased donors. They designed an experiment to compare the allocation rules priority, rebate, discount, and first come first served. In addition, they

[6] The reason is that one of the main functions of the brain is to control breathing and heartbeat. When the brain is dead, breathing and heartbeat automatically stop soon after. By law, brain death diagnosis requires the unanimity of at least two doctors.

investigated the roles of low and high psychological costs. They found that the rule was very important to decisions to donate. In addition, they proposed a simple model to explain donors' behavior, in which they assume cost distribution. Under the usual circumstances, a critical value exists and subjects who have cost over that value will not donate. This current paper is close to Kessler and Roth (2012); however, we focus on the risk of organ compatibility in our experiment.

Li et al. (2013) extended the role of priority to opt in and opt out systems and the result was consistent with Kessler and Roth (2012); however, they found that the most effective rule to induce donation decisions is the priority rule combined with the opt out system. Kessler and Roth (2014 b) investigated the durability of the priority allocation rule. They designed an experiment consistent with the Israeli system and focused on cheating. In 2011, Israel incentivized people by giving priority to donors and the number of registered donors rose from 7.8 to 11.4 donors per million people in the same year (Lavee et al., 2013). However, the priority system in Israel has a unique characteristic. When an individual becomes a registered donor, she must legally inform the family and her clergyman. At the time of death, the doctors cannot operate unless they have the permission from each of these parties. Then it is possible that people treat registering as a strategy. Kessler and Roth (2014 b) investigated what would happen if a registered donor made a deal with their clergyman to not give permission when they died. Their paper found that without cheating the priority treatment induced more donations than first come first served. In contrast, if the subjects knew that it was possible to cheat, they may be inclined to do so, and the real donations would be much less than with the first come first served alternative. This result is consistent with the fairness and retaliation in an ultimatum game. In an ultimatum game, responders tend to reject the offer if they benefit less than 40%. An excellent survey of the fairness and ultimatum game is available in Chapter 2 of Camerer (2011).

Besides the allocation rule, the default option is an important factor when people decide to be donors. From multi-country data, countries that apply the presumed consent (opt out choice) rule have much higher numbers of registered donors than countries that adopt the opt in rule (Shepherd et al., 2014). The difference in registered donors between opt in and opt out rules was confirmed by Johnson and Goldstein (2004). When a subject is asked to be a donor in the opt out environment, they are more likely to donate than when they are in the opt in system. However, there is indifference when subjects are in an opt out or in a neutral environment (they are not informed what system they are engaged with). Kessler and Roth (2014 a) focus on the role of the framing effect in which they ask a "mandated question," the question respondents must answer 'yes' or 'no' (in reality, they check the 'yes' or 'no' box). Asking those questions at the Department of Motor Vehicle (such as in New York or California), they found that people were more likely to check the ‘yes’ box when the ‘no’ box was in the frame.

To our knowledge, there is no existing studies on organ compatibility. Previous studies treat people as having the same body condition. Zenios, Woodle and Ross (2001) remarked that Blood Type O donors might receive less benefits compared to other donors because they can receive only from those with the same blood type. That is the research gap that this paper explored. In the next section, we provide the experimental design embedding the risk of organ compatibility.

Experimental Design

The experimental design was modified from Kessler and Roth (2012). The subjects were assigned into different groups. In each group, there were 12 subjects without reshuffle throughout the experiment. A subject had to decide whether to be a donor for 30 rounds. At the beginning of the experiment, a subject was informed that they had 2 goods, 1 piece of A (representing the brain), and 2 pieces of B (representing the kidneys).[7] Before each round started, a subject decided whether they would register to donate kidneys.[8] After deciding, there were 10 periods in which the probability that the brain was dead was assigned at 10% and the chance of kidney failure was 20%. If the brain had died, that round was terminated. On the other hand, if the kidneys have failed, the subject could wait for 5 periods. During the waiting periods, if the subject received the kidney, they remained alive.[9] Otherwise, the round ended. In the case that the subject received the kidney, that kidney was not available to others.

In cases that a registered donor’s brain had died, their kidneys would be given to 2 subjects. Receiving the kidney depended on both the organ compatibility and the kidney allocation rule. In each group, there were 2 types of subjects with different probability of matching. One type had an organ compatibility of 100% and the another had an organ compatibility of 50% (see details below). This probability assignment was constant throughout the experiment.

[7] We intentionally used the neutral word “goods”, rather than the direct word “brain and kidneys”. The reason was that we wanted to control background knowledge in organ donation of subjects. Otherwise, subject might decide, based on culture, religion, etc.

[8] In the experiment, the registered donor automatically donates when the brain had died without any consent from a third party as the reality. Therefore, we replaced registered donor with donor.

[9] In reality, kidney failure patients can survive for many years by kidney dialysis. However, the patients who receive a kidney from a deceased donor live longer. The average is 10 years after transplantation (Wolfe, 1999).

The subject was still alive if their brain was good, and they had at least one kidney. They received an increment of 20 baht in every round that they lived. The payoff stopped if they died or were waiting in the queue. We randomly chose 4 rounds to average the payoff to subjects when the experiment terminated.

The subject decided to donate before they knew the status of brain and kidneys in that round. In being a donor, subject paid 10 Baht. This monetary cost represents the cost of registration to be a donor. Although registration as a donor currently incurs very low cost because the donor can register online at the official website of the Thai Red Cross Organ Donation Centre, the real cost of organ donation can also be thought of as a psychological cost. There are many reasons that people are afraid to donate organs; for instance, it might hurt, they are afraid that doctors will operate on them too early, they think the doctors might not pay full attention to help them, they wait for a last-minute miracle, they believe that they will be disabled in their future life. Adding a monetary cost was a way to represent those fears in the experiment.

The information that was given to the subjects at the end of each round included the status of their brain and kidneys, the periods that they had been waiting, the results of organ allocation and the payoff. Subjects did not know the number of donors in a given round.

Types of Subjects

In each group, we categorized subjects into 2 types, with 6 subjects of type X and 6 subjects of type Y. For subjects of type X, they could match with any organ regardless of the type of donor. However, subjects of type Y could only be matched with a type Y donor. In other words, the organ compatibilities were 100% and 50% for types X and Y, respectively. One of the actual medical requirements is that the blood types of giver and taker must be the same. This setup represented blood type A (or B) and type AB. For type AB, a waiting patient could receive an organ transplant from any blood type; on the other hand, those who had blood type A (or B) could only receive an organ transplant from someone with the same blood type or type O.

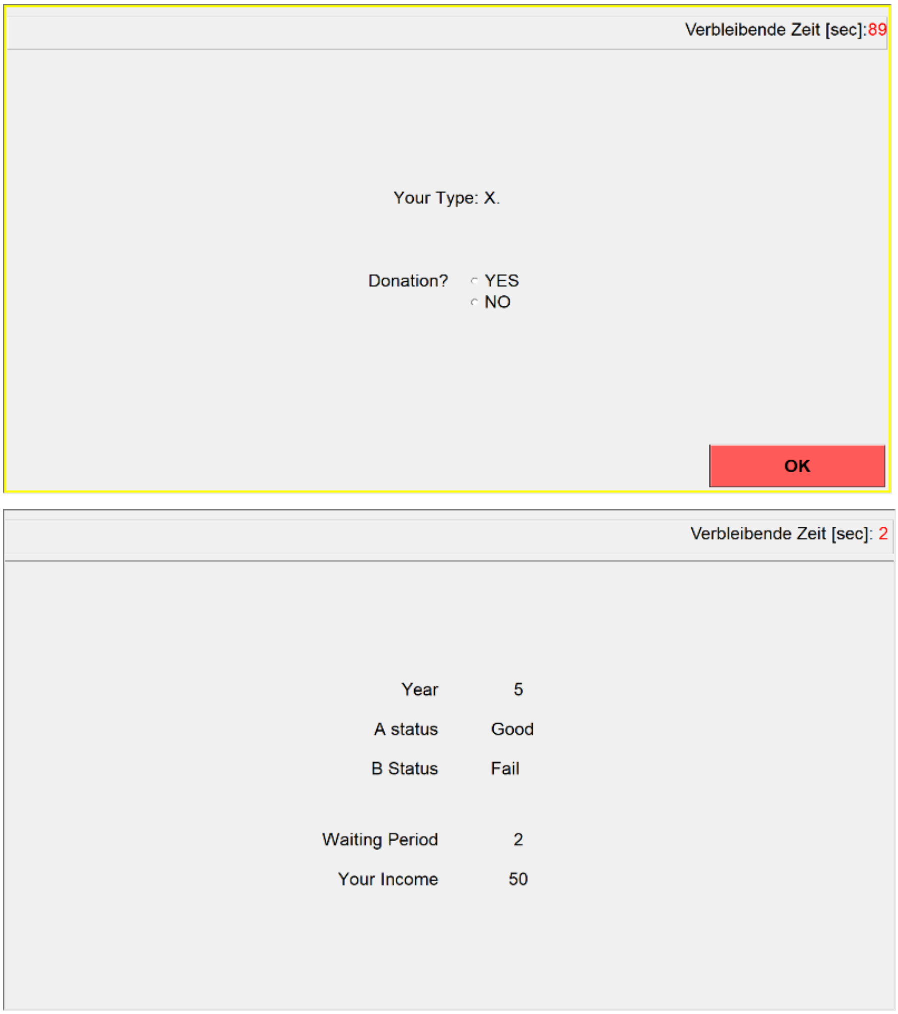

Figure 2 Subjects' screen server

The Organ Allocation Rule

There were 3 treatments in the experiment, first come first served, rebate, and priority treatments. We treated first come first served as the control group because it is the status quo in many countries, including Thailand. Dividing the rounds into rounds 1-15 and rounds 16-30, we rearranged the sequence of treatments to remove the order effect. The number of groups in each sequence of treatment is shown in Table 1.

Table 1 the number of groups

		rounds 16 - 30		
		control	**priority**	**rebate**
rounds 1 – 15	**control**	3	3	3
	priority	3		
	rebate	3		

In the first come first served treatment, the longest waiting subject received the organ, given that their type aligned with the organ donated. In the case that there was more than one subject who had the same waiting period, one subject was randomly chosen.

In the priority treatment, we made two waiting lists, one for donors and another for non-donors. The matching between organs and subjects started from the donor waiting list. The longest waiting subject was matched first and so forth. If the organ remained, or it was not compatible with a subject after exhausting the donor waiting list, then a match was sought with subjects in the non-donors list. It could be the case that a non-donor had been waiting longer than a donor but the donor had the opportunity to receive service earlier. In other words, when donors needed an organ, they were placed in a higher rank (priority) group than the non-donors.

The rebate allocation rule was similar to the first come first served treatment. The donors, however, were rewarded at the end of experiment. Ideally, the rebate should be the benefit of organ donation. Due to the fact that the donors were not able to receive their organ, their benefit was only from other's donation in the sense that the more donors, the more benefit they obtained. Therefore, the amount of rebate (or the benefit from being a donor) was determined by the number of donors. For this reason, subjects did not know the exact amount of the rebate during the experiment. They were informed only that the benefit depended on the number of donors. Otherwise, they would know the number of donors whereas in other treatments subjects did not know this information.

Since the benefits from the priority and the rebate rule are different, we had to assure that both benefits are comparable. The benefit of the priority rule increased when the subjects had lived a long life. The rebate scheme then, was calculated from the average of payoff from 100,000 simulations in priority treatment, when other donors were 0, 1, …, 11, respectively.

Table 2 Rebate scheme

Number of other donors	Rebate	
	Type X	Type Y
0	0	0
1	1.37	0.96
2	2.49	1.8
3	3.21	2.12
4	3.41	2.29
5	3.33	2.24
6	2.95	2.08
7	2.6	1.88
8	1.8	1.46
9	1.4	1.03
10	0.6	0.61
11	0.07	0.05

Type X donors can find a matching organ with certainty while type Y donors could only match with probablity 50%. The benefit of being a donor for type X was higher, regardless of the number of other donors. In addition, the benefit to both types has an inverted U-shape. It rose until 4 other donors (5 subjects in total) and then decreased. The increase in other donations means that organs were less scarce, and the advantage of priority depreciated. Note that the priority benefit was zero when there are no other donations, because the donor could not receive their own organ.

Results

We conducted the experiment at the computer laboratory of the Faculty of Economics, Prince of Songkla University, Thailand during October and November 2019. We recruited 180 subjects by random sampling to participate in the experiment and all were Bachelor's degree students at the university.[10] The average payoff was 286 Baht (inclusive of 180 Baht show-up fee). The subjects were social science (56%), science (30%) and engineering students (14%). Sixty eight per cent of subjects are Buddhists and the others are Muslims. No one was registered donor in real life, but 76% of subjects had donated blood.

The average donation across all treatments was 53%. The average donation of priority and rebate treatments was higher than in first come first served treatment by 16% and

[10] To recruit subjects, we create Facebook page "Experimental Economics, PSU (in Thai)" and requested subjects to fill out time slot they want to attend. The total subjects were 191 but there were 11 students who did not show up in time. They received only show up fee but not participate the experiment.

by 14%, respectively. The percentage of donations was similar between rounds 1-15 and 16-30 (see Table 3).

Table 3 The average percentage of donations.

	round 1-15	round 16-30	Total
control group	49	45	47
priority group	67	59	63
rebate group	59	64	61

As Figure 3 illustrates, first come first served donations were fewer than the other treatments. In rounds 1-15, there were only round 4 and 5 that the donation in control group is close to the other treatments. Similarly, the first come first served and priority group were similar in rounds 23-25. We noticed that the percentage of donations fluctuated around its mean in all treatments, which was different from the pattern of contributions in the public goods literature. Particularly, the contribution rate was high early on and gradually declined (for example, Ledyard, 2020, Isaac & Walker, 1988 and Andreoni, 1988). The reason for the fluctuations around the mean was that the subjects in our experiment were challenged by the uncertainty in organ compatibility and the status of their brain and kidneys. With those unknowns, the benefits from donating were unclear.

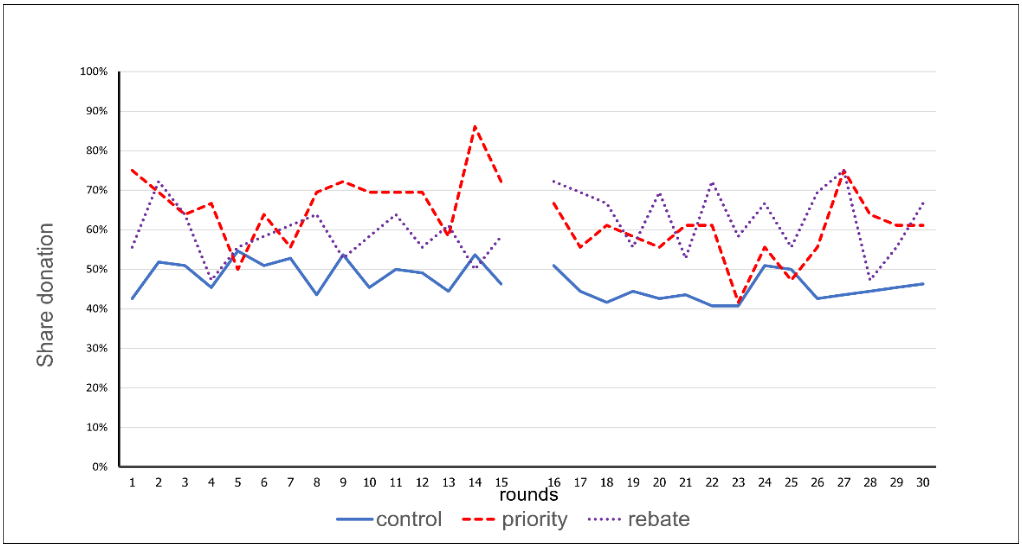

Figure 3 Donation round by round

Applying the Wilcoxon rank-sum test, we found that the medians statistically differ between the control and treatment groups. In addition, the medians of rebate and priority differ statistically in both rounds 1-15 and in rounds 16-30 (see Table 4).

Table 4 Wilcoxon rank-sum test

	rounds 1-15	**rounds 16-30**	**rounds 1-30**
control vs. rebate	11.99***	22.185***	24.52***
control vs. priority	21.16***	16.066***	25.85***
rebate vs. priority	10.29***	-5.607***	3.44***

*****indicates 1% significance level, ** indicates 5% significance level, * indicates 10% significance level.

In addition, we confirmed the non-parametric statistics by performing a regression analysis. We applied the following pooled OLS regression in which *i* and *j* denotes subjects and rounds. The panel model is:

$$y_{it} = \boldsymbol{x}_{it}\boldsymbol{\beta} + c_i + u_{it}$$

where c_i is individual heterogeneity. We chose pooled OLS rather than fixed or random effect because all independent variables ($\boldsymbol{x}_{it}$) were dummy variables which were purely exogeneous. In addition, we excluded the subjects' backgrounds, which were key factors in individual heterogeneity; for example, we used neutral words "goods A" and "goods B", instead of "brain" and "kidneys". In other words, we had $E(\boldsymbol{x'}_{it}u_{it}) = 0$ and $E(\boldsymbol{x'}_{it}c_i) = 0$ by experimental design. We therefore treated $v_{it} = c_i + u_{it}$ as an error term and the estimated value of pooled OLS regression was consistent.[11] Since c_i was constant over time and the error term v_{it} had serial correlation problem, we applied a robust variance matrix in all models when calculating a standard error.[12]

[11] See detail in Wooldridge (2010) pp. 256-257.

[12] See detail in Wooldridge (2010) pp. 171-176.

Table 5 Marginal effects in Probit model.

	Regression 1	Regression 2	Regression 3	Regression 4
priority	0.158 (0.027)***	0.181 (0.038)***	0.227 (0.045)***	
rebate	0.138 (0.028)***	0.093 (0.046)**	0.08 (0.048)*	0.027 (0.051)
second half		-0.041 (0.03)	-0.041 (0.03)	-0.087 (0.029)***
second half*priority		-0.049 (0.065)	-0.049 (0.065)	
second half* rebate		0.091 (0.074)	0.090 (0.073)	0.132 (0.071)*
type			0.086 (0.038)**	0.057 (0.035)
type*priority			-0.103 (0.053)*	
type*rebate			0.028 (0.056)	0.042 (0.058)
earning last round				0.021 (0.000)**
received an organ last round				0.039 (0.018)**
N	5400	5400	5400	5,220
Wald Chi 2	49.93	52.68	65.61	42.17
Pseudo R2	0.016	0.019	0.023	0.0173

Note: The coeficient is marginal effect of probit model and parenthesis is in standard error. This estimate is calculated by cluster by id. *****indicates 1% significant level, ** indicates 5% significant level, *indicates 10% significant level.

Table 5 demonstrates between-subject effects by estimating 4 probit models.[13] The dependent variable in all models was donations, which was 1 if a subject donates. In regression 1, the coefficients of marginal effect of *rebate* and *priority* variables were positive

[13] In addition, we ran Logit model and Linear Probability model (LPM) and results are close to probit model (see detail in Appendix). However, some observations in LPM return the probability greater than 1 $(\hat{y}_{it} > 1)$.

and statistically significant. The priority and rebate allocation rules outperform the first come first served in the sense that subjects in those rules were more likely to donate about 13.8-15.8, compared with subjects in the first come first served rule. This result was consistent with the significance of Wilcoxon rank sum test. The statistics were 25.85 (p-value = 0.000) and 24.52 (p-value = 0.000) for priority and rebate treatments, respectively.

Although organ receiving is private goods, registering organ donation is public goods in first come first served rule. It is non-rival because everyone benefits from registering and it is non-excludable because those who have been waiting longest can be matched to a donor and become organ recipients. By contrast, it is still non-rival in priority rule but non-donors are excluded from the organ pool, especially when an organ is scarce. In other words, registering is club goods in priority allocation rule. That is the reason why there are more donors in priority rule than under the first come first served rule.

In addition, we found that the difference in probability of donation between priority and rebate rules was statistically significant. With the significance level of 1%, the chi-square statistic was 49.93 (p-value = 0.000). This result was from the difference in information structure. In the priority rule, if a donor does not receive an organ, it is more likely that no one donated in that round. If someone donates, they will have a high likelihood of receiving an organ because of the priority. This fact could be inferred from the number of other donations in each round. By contrast, not receiving an organ is vaguer in rebate treatment. It might be because no one donated or because someone else took the organ. Donors learned about other donations when they received their rebate at the end of experiment. Therefore, donors had more information about other donations in priority rule than in rebate rule. This result implies that a subject donates when they know that other subjects donate. It is consistent with "conditional cooperation," which was first introduced by Fischbacher et al. (2001).

Regression 2 additionally controlled the effects of rounds 1-15 and 16-30. The *second half* variable wa 1 if observations were from rounds 16-30. In addition, we added interaction effects between the effect of round and organ allocation rule. However, all coefficients were not significant. This meant that the sequence of playing did not affect donation probability. This result was not consistent with prior literature such as Kesler and Roth (2012), or Li et al. (2013)

In regression 3, we investigated the effects of organ compatibility. The *type* was a binary variable and was 1 if observations were from subjects who could match any type of donor. The coefficient of *type* variable was positive and statistically significant. Subjects who had 100% organ compatibility were 8.6% more likely to donate than subjects who had 50% compatibility. However, the coefficient of interaction term between type and priority was negative and significant. It turns out that subjects who had 100% compatibility donated less in priority rule.

Regression 4 investigated the effects of the benefit in the last round on donation probability. We added *earning-last-round* and *received-an-organ last round* variables. However, we removed variables which involved priority rule because subjects might decide to donate, based on the benefit they received from the last round. If those variables were left in the model, there might be a collinearity problem. The coefficient of *earning last round* was positive and significant. A subject increased donation probability when they received more payoff in the last round. Similarly, the coefficient of *received-an-organ-last-round* variable was positive and significant. Receiving an organ in the last round increased the donation probability by about 4%. This result confirms "conditional cooperation" behavior of donors.

Conclusion

This study investigated the effects of organ allocation rules, aiming to increase organ donations. We find that the decision to donate is subject to the allocation rule. The probability of donation in rebate and priority rules is clearly higher than in the first come first served rule (status-quo). Furthermore, organ compatibility factors such as blood type are crucial. Subjects who can easily match donated organs are more likely to donate. This result indicates the limitation of the priority allocation rule. People might not want to register as a deceased donor because the benefit is vague, and the number of donors does not increase.

Although the rebate rule can increase the donation rate, it is difficult in practice. Giving money to donors is close to selling and buying organs, which is constrained by law and moral reasons. Roth (2007) calls this trade a repugnant market. Tax deductions are alternative forms of a rebate scheme and are currently applied to living donors in some cities of the USA, such as in New England. However, tax deductions cannot directly apply to deceased donors.

Changing the first come first served rule to the priority rule faces multiple challenges. First, Thailand currently lacks explicit organ legislation. There is only regulation of The Medical Council, which guides doctors in the process of death announcement, preparing the bodyfor transplantation and matching the organ and patient. To apply the priority allocation rule, we need the law as a ground to support a priority waiting list, list of registered donors, doctors, and priority patients. Second, as our result points out, the benefit of registered donors is not equal for everyone, and it affects the decision to be donors. The question is how to convince people to register. A complementary mechanism is needed to support people who have a special case and might not receive the benefits of priority. Third, many people misunderstand the definition of death, which is the condition of brain death. They perceive that the transplantation is performed when they are alive and that they can die because of transplantation when the fact is they must already be dead. In addition, some people confuse between organ donation and body donation. Donated bodies are exclusively used to study anatomy. Finally, people are scared when thinking about death which causes them to postpone signing up to become a registered donor. Although organ donation is merit in Buddhism, they believe that it will cause disability in their next life. We talked to Muslims in Southern Thailand and found that they were unclear whether organ donation is prohibited in their religion.

The priority allocation rule is currently applied in some countries such as Israel, Singapore, Chile, China and the USA. In particular, American hospitals collaborate via the National Kidney Registry (NKR) to exchange kidneys among members and living donors. NKR follows the matching algorithm of Roth et. al (2004), Roth and Sönmez (2005) and Roth et. al (2005) to match a donor's organ with patients who registers to the center. Ghanbariamin and Chung (2020) found that in the NKR center, the registered patients who had priority spent less time for kidney transplantation than the non-registered patients. Although this center is applied for only living donors, we believe that the same scheme can be applied to deceased donors. In addition, Israel and China provide a voucher priority that a registered donors can choose to redeem or pass the priority to their child.

Another policy option to raise organ donations is to change the default option from opt-in to opt-out. For example, Singapore assigns citizens to be donors by default, but they can register to be non-donors. In countries that apply the opt-out option, the donation rate is much higher than with opt-in option. This is because most people tend not to like change, including changing the default option. Although changing the default option can increase the number of donors, it is also not straightforward to implement. Since changing directly affects the status of everyone, it is important to reach consensus from all parties.

Since this paper uses students as subjects, external validity is a concern. Also, we ran the experiment in a lab which controlled information that subjects received during the experiment. The advantage of controlling all subjects was the ability to monitor the information they received and remove religious and cultural biases. This might not be true when people decide in real life. Future research should conduct a similar study in the field and compare the result. Comparing the outcome between lab and field would give a broader perspective which could inform future policy recommendations.

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Appendix

Table 6 Marginal effects in Logit model.

	Regression 1	Regression 2	Regression 3	Regression 4
priority	0.157 (0.027)***	0.181 (0.038)***	0.225 (0.044)***	
rebate	0.137 (0.028)***	0.093 (.045)**	0.078 (0.048)	0.0257 (0.051)
second half		-0.041 (0.03)	-0.041 (0.03)	-0.053 (0.025)**
second half*priority		-0.05 (0.07)	-0.049 (0.065)	
second half* rebate		0.091 (0.074)	0.091 (0.072)	0.102 (0.069)
Type			0.085 (0.038)**	0.056 (0.035)
type*priority			-0.101 (0.053)*	
type*rebate			0.030 (0.056)	0.044 (0.058)
earning last round				0.001 (0.000)*
received an organ last round				0.044 (0.018)**
N	5400	5400	5400	5220
Wald Chi 2	49.6	52.09	64.48	34.02
Psuedo R2	0.016	0.019	0.024	0.013

Note. The coeficient is marginal effect of probit model and parenthesis is in standard error. This estimate is calculated by cluster by id. *****indicates 1% significance level, ** indicates 5% significance level, *indicates 10% significance level.

Table 7 Linear Probability model.

	Regression 1	Regression 2	Regression 3	Regression 4
priority	0.161 (0.028)***	0.184 (0.039)***	0.236 (0.049)***	
rebate	0.141 (0.029)***	0.095 (0.047)**	0.082 (0.049)*	0.028 (0.051)
second half		-0.042 (0.03)	-0.042 (0.03)	-0.054 (0.025)**
second half*priority		-0.045 (0.064)	-0.045 (0.064)	
second half* rebate		0.092 (0.076)	0.092 (0.074)	0.101 (0.07)
type			0.088 (0.039)**	0.057 (0.035)
type*priority			-0.104 (0.054)*	
type*rebate			0.025 (0.056)	0.039 (0.057)
earning last round				0.032 (0.000)*
received an organ last round				0.044 (0.018)**
constant	0.469 (0.02)***	0.49 (0.0217)***	0.446 (0.028)***	0.487 (0.027)***
N	5,400	5,400	5,400	5,220
R2	0.022	0.025	0.033	0.0178

Note. The coeficient is marginal effect of probit model and parenthesis is in standard error. This estimate is calculated by cluster by id. ***indicates 1% significance level, ** indicates 5% significance level, *indicates 10% significance level.