Research Article

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Is Family-Priority Rule the Right Path? An Experimental Study of the Chinese Organ Allocation System

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Abstract: China is experiencing an organ shortage crisis. We experimentally test the effectiveness of the family-priority allocation rule on organ donation and argue that such incentive would be highly motivating in Chinese family-oriented culture. Results of our experiment show that introducing the family-priority rule can not only increase donor registration but also promote family consent. Such priority rule would be particularly effective to increase deceased organ donation in China, as it will significantly promote donor registration and meanwhile generate a consistent higher family consent rate in a more family-orientated culture.

Keywords: organ donation; family priority; laboratory experiment; health

JEL Classification: C91; I10; I18

1 Introduction

The demand for a life-saving organ transplant has been growing rapidly all over the world during the past decade. However, the failure of producing adequate supply to satisfy the demand for transplantable organs has resulted in major organ shortage

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crisis. China particularly suffers from a major shortage of organ supply. Although about 300,000 patients need transplants each year in China,[1] only 19,454 operations were carried out in 2019.[2] According to the 2021 Newsletter of International Registry on Organ Donation and Transplantation (IRODaT), the deceased organ donor rate is only 4.16 per million population in 2020, compared to the United States, which has the highest deceased organ donor rate of 38.35 per million population.

Low donation rate in China has its historical reason. The development of the organ donation system in China has far lagged behind other major countries. For years, the main source for organ transplantation in China was executed prisoners.[3] A civilian organ donation system only started in China after the World Health Organization Transplantation Senior Management Conference in 2005.[4] In late 2010, a *family-priority* rule was first set out in the "China's Basic Principles of the Distributing and Sharing of Human Organs and the Core Policy", which came into effect in 2018. Such priority rule gives the immediate family members of a deceased donor priority to receive transplantable organs should they ever need transplantation.[5]

The goal of this paper is to analyze the effectiveness of the family-priority based organ allocation mechanisms to incentivize deceased donor organ donations in China. It is worth noting that we focus on promoting deceased donation for several reasons. First, deceased organ donation is largely the main source for organ transplantation. Second, one deceased donor can donate multiple organs and save more lives. Third, many transplants of solid organs, such as heart, pancreas, and intestinal organs, rely exclusively on deceased donation.

We compare the family-priority rule with a self-priority rule, which has been implemented in Singapore (Iyer 1987), in Israel[6] (Lavee et al. 2010), and in Chile

1 http://www.bbc.com/news/world-asia-china-30324440.

2 According to the Report on Organ Transplantation Development in China (2019).

3 Over 90 percent of deceased donors were executed prisoners (Huang et al. 2012) in China before 2015. China has banned harvesting organ from executed prisoners since January 1, 2015.

4 At the World Health Organization Transplantation Senior Management Conference held in July 2005, the Vice Minister of Health of China acknowledged executed prisoners are the source of organs for transplantation in China and stressed the Chinese Government's pledge to strengthen supervision of organ transplantation in the country.

5 The current policy in China grants priority to the family members of the deceased donors in addition to the registered donors.

6 Israel adopts a priority-based allocation system that extends the priority to the family members of the registered donor, whereas in China, priority is granted to the family member of the actual deceased donors. Since the extended family priority in Israel does not rule out the "free-rider" problem, whereby individuals enjoy a higher priority in receiving organ donations without contributing to the organ supply, we combine it into the class of a *self-priority* rule.

(Zuniga-Fajuri 2015).[7] A self-priority rule allocation system gives registered organ donors precedence for transplantable organs when they are in need for one, so that individuals who are registered donors have a higher probability of access to organs should they need an organ transplant. Such priority rule has a positive impact on deceased donor registration (Herr and Normann 2016, 2018; Kessler and Roth 2012; Kim, Li, and Xu 2021; Li 2016; Li, Hawley, and Schnier 2013; Li, Riyanto, and Xu 2023).[8]

Compared with the self-priority rule, we argue that the family-priority rule would increase not only the donor registration but also the family consent, therefore be more effective to increase deceased donor organ donations. Kessler and Roth (2014) argue that a self-priority rule contains a loophole, which allows individuals to register themselves as a donor to receive the priority but never actually donate.[9] These free riders can manipulate the system by waiting to register as a donor until they need an organ. The system allows them to receive priority immediately upon registration without requiring anything in return. In practice, policymakers usually impose a freeze-out period together with the self-priority rule to eliminate the scope of such manipulation. With a freeze-out period, registered donors are not entitled to the top of the waiting list until they have been on the registry for a specific span of time.[10] Donor-priority with a freeze period can improve the aggregate donation rate (Li, Riyanto, and Xu 2022). However, such implementation does not eliminate the loophole. Since it is common practice to ask the deceased's next-of-kin to make the final donation decision, an individual can still register as a donor to receive priority but ask their next of kin to block the donation upon their death.

The family-priority rule can eliminate such "loophole" under the self-priority rule as the incentive is provided after the donation has taken place and the family-priority based incentive would be highly motivating particularly in a family-oriented culture like that of China. As suggested in previous literature, individuals are typically more altruistic towards their family members (Fong and Luttmer 2009; Leider et al. 2009; List and Price 2009). Chinese culture has been influenced by Confucian ideology for generations. Chinese tend to place a strong emphasis on family connections, as most of them believe one has more moral obligations to

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7 The *self-priority* allocation rule in Singapore and Chile is combined with an opt-out registration system, under which the default status is being a registered donor and individuals must self-select out of being an organ donor. The effectiveness of such combined policy has been studied by Li, Hawley, and Schnier (2013).

8 Kim, Li, and Xu (2021) studied the priority allocation rule with extended donor-priority benefits to one's family members. It is essential the same as the Israel system explained above.

9 Kessler and Roth (2014) found the presence of the loophole not only undermines the incentives of the priority rule, but also crowds out altruistic donors.

10 In Israel, priority only rewards registered donors of at least 3 years.

take care of one's family members than others (Fan 2016; Fan and Wang 2019). The family-priority rule gives family members of deceased donors precedence for transplantable organ, which creates incentives to donate by connecting the potential of helping others to the potential of taking care of one's family members.

In addition, China has a high rate of potential family refusals at the consent stage of organ donation and family opposition is the major concern that affect people's willingness to register as an organ donor in China (Pan et al. 2021).[11] The family-priority rule can not only promote family consent in the process of organ procurement by providing direct incentive to family members of deceased donors, but also can improve willingness to register, as individuals believe that the family-priority rule would promote family consent.[12]

We design a laboratory experiment to study how the family-priority rule affects the willingness to register as a donor as well as the decision of family consent. The experimental method is probably the only available tool for this study at this stage as it will be years before we can collect data on actual organ donations in China. Even when we can, the data may present a mixed result of the family-priority policy combined with other policy changes during the same period.[13] Furthermore, many aspects that are hard to be measured in actual organ donations can be manipulated in the lab. For instance, in the lab, we can vary how family members share each other's gain through the experiment to manipulate family connections in different culture meaning.

One significant difference between our work and other experiments in the literature is that we did not model a strong version of donation with which registering as a donor implies being an available donor upon death in the experiment. Our research complements the design of Kessler and Roth (2014) by introducing the concept of a "family", so that the donation decision contains two steps in our setting – *donor registration* by the subjects and *donation consent* by their family members. In our design, a "family" is formed by pairing two random subjects from two different groups. Family members shared each other's costs and earnings occurred in the experiment, resembling family connections in real life.

Results of our experiment show that introducing the family-priority rule can significantly increase the donation rate. The family-priority rule can not only

11 Pan et al. (2021) find around 85 % of the donation-eligible cases in their survey failed due to family objection in China. In contrast, the family refusal rate of Spain is just about 15 % (Hulme et al. 2016).

12 Pan et al. (2021) report 92 % of their survey participants support the idea that the family-priority policy would promote family consent.

13 For instance, the China Organ Donation Administrative Center started an online organ donation registration system on April 2, 2014. This might be another main reason for the increase in donor registration.

increase donor registration but also promote family consent. As expected, the self-priority rule generates a loophole so that subjects can register as organ donors to receive the priority but not actually donate. Such loophole eliminates the incentives created by the priority rule and leads to zero increase in donation. We also find that the efficacy of the family-priority rule varies across different levels of family connections. The family-priority based incentive is relatively stronger in a family-oriented culture setting, like that of China. The impact on donor registration reduces in a loose family connection setting, but the family-priority rule still has a positive impact on family consent, as it provides direct incentive to family members of donors.

We also study the effect of information in our experimental setting. Economists have shown that some individuals are more willing to contribute to a public good when they learn that others also do so (Allcott 2011; Andreoni 1988, 1989; Fischbacher, Gächter, and Fehr 2001; Frey and Meier 2004; Shang and Croson 2008), however, their incentive to contribute can be reduced or even crowded out if they observe free riders (Kessler and Roth 2014; Sun, Lu, and Jin 2016). Organ donation is a decision of contributing to a public good, and whether to make details of the mechanism publicly traceable is an option of policy makers. Results of our experiment show that providing individuals particular additional information about the donation process does not have a significant impact on either donor registration or family consent.

1.1 Related Literature

Our paper is heavily related to research on mechanism design in markets with a shortage but facing a ban on monetary incentive due to ethical concerns, though introducing a monetary incentive can significant increase the number of organ donors (Eyting, Hosemann, and Johannesson 2016; Hawley et al. 2018). The idea of family priority is featured in many policy practices and proposals related to kidney exchange. Kidney exchange was first analyzed as a market-design problem by Roth, Sönmez, and Utku Ünver (2004), advocating a mechanism where both compatible and incompatible patient/donor pairs participate in kidney exchange to create suboptimal utilization of living donors, however, in practice there is no incentive for patients with compatible donors to start an exchange. Sönmez, Ünver, and Yenmez (2020) proposed an incentive scheme by providing patients priority in the deceased-donor queue if he needs a repeat transplant in future, after their compatible living donors participate in kidney exchange. Another example is the priority voucher system adopted under the advanced kidney donation program for kidney exchange in the United States. The program provides donors' intended recipients priority in future paired kidney exchange, which incentivizes living donors whose optimal time to donate a kidney occurs long before the intended recipients need a transplant.[14] Veale et al. (2017) report three cases where older living donors of young patients utilized the voucher system to overcome such chronological incompatibility and triggered chains of kidney exchange that helps other pairs receive transplants in the present.

Another example of related area of literature is work on the design of blood markets. Sun, Lu, and Jin (2016) studies the effectiveness of a family replacement program in China in addressing blood shortage. The program is implemented by the hospital during blood shortage period by giving patients the option to persuade their family to donate blood to receive immediate access to blood inventory allocated from the blood bank. To alleviate shortage of convalescent plasma for the treatment of COVID-19, Kominers et al. (2020) develop priority-based incentive schemes by granting plasma donors priority vouchers that can be transferred to patients of their choice.

The rest of the paper proceeds as follows. In Section 2, we present a simple model and theoretical hypotheses. Section 3 outlines our experimental design. Section 4 discusses the results from the experiment and in the final section we conclude our findings with a discussion.

2 Simple Model and Hypotheses

To help interpret the effect of family priority rule and develop a series of behavioral hypotheses in our experiment, we consider a simple model building on the theoretical framework developed by Kessler and Roth (2012).

An agent faces two possible health outcomes: (i) brain death with probability $\beta \in (0, 1)$; or (ii) organ failure with probability $\theta \in (0, 1)$. When the first outcome occurs, γ organs of the deceased can be donated conditional on his donor registration status and family consent. An agent with organ failure need only one organ donated by others to save life. Therefore, the ratio of maximal organ supply to organ demand is $\frac{\gamma\beta}{\theta}$.

In reality, not every registered organ donor is eligible for organ transplantation. In United States for instance, only 3 in 1,000 people die in a way that allows for deceased organ donation (Health Resources & Services Administration). According to the 2021 data of Organ Procurement & Transplantation Network (OPTN),

14 The median lifespan of a living-donor transplant kidney is less than 16 years and 16 percent of living-donor transplants fail within the first 5 years. A young patient with kidney transplant will likely need a kidney again in future. The older family members of the young patients may be willing to donate a kidney when it is in need, however, the window for donation is short for them.

one deceased donor supplied 2.511 organs on average, while the average rate of organ failure was 1,342/100,000 person-years (Pedersen et al. 2019). These numbers translate into 0.6 for the ratio of the maximal organ supply/the organ demand. To model an environment with severe organ shortage like the one in the real world, we assume $\frac{\gamma\beta}{\theta} < 1$.

Before observing health outcomes, agents can register as organ donors, whose organs will be available for donation when they die from brain death. The accomplishment of donation requires family consent. If family members refused to consent, organs of the deceased registered donor will not be donated.

Costs of organ donation is normalized to be $C > 0$ and valuations of receiving organ donations is normalized to be $V > 0$.[15] We assume family members share each other's costs of donation and valuation of receiving organ donations with a ratio $\alpha \in (0, 1)$, to resemble family connections in real world. When organ donations are completed, donors incur a cost αC (for example, the discomfort of thinking about one's own death and the fear that doctors will not try hard to save lives of registered donors) and family members of donors incur a cost $(1 - \alpha)C$ (for example, concerns that their loved ones should have all organs when buried due to cultural beliefs and the fear that their loved ones can be still be recovered from brain death). Valuations of receiving organ donations inform family values and how the family deal with challenges as a unit, which consist of αV for donation recipients and $(1 - \alpha)V$ for recipients' family. The smaller α is, the stronger the family connections are.[16]

We assume a continuum of agents derive direct benefits $b_1 \sim F(b_1)$ from registering as an organ donor (for example, the feeling of altruism or the warm glow of

15 C can be considered as a combination of registration costs and costs in donation stage, which is essential the same as costs for registration in Kessler and Roth (2012). Kessler and Roth utilized a strong version of donation where registering implies donating organs upon death, so registration costs are essentially donation costs in their experiment. In our setting, donation requires both donor registry and family consent and we adopt a strategy method. We therefore combined costs of them to make payment calculation more straightforward for subjects.

16 Ratio α can be treated as how one weights the net gain of his family relative to his own and we try to resemble the intensity of the family connection by varying the ratio α across treatments. For instance, in the treatment of $\alpha = 0.5$, one weights the gain of his family and his own equally, meaning if his family earns \$1, that would be equivalent to earning \$1 himself. In the treatment of $\alpha = 0.25$, one weights the gain of his family three times more relative to his own, meaning if one's family earns \$1, that would be equivalent to earning \$3 himself. This will be the same as if we adopt two different parameters, e.g. α and β, where $\alpha = 1$ and $\beta = 1$ versus $\alpha = 1$ and $\beta = 3$. α and β can be varied across treatments to resemble different levels of family connection. Our parameter selection can be considered as a special case, where $\alpha + \beta = 1$. The reason we chose this special setting is to keep the total welfare of the family controlled across treatments. No matter how α varies, the net gain of the family is the sum of earnings of the family minus the potential donation costs of each family member.

save lives), and direct benefits $b_2 \sim G(b_2)$ from providing family consent to donation (for example, the feeling of altruism from donating their loved ones' organs to save lives and of honoring the wishes of loved ones).

2.1 Control Condition

There is no incentive scheme for donation in the *Control* condition and donated organs are randomly assigned to agents with organ failure. The decision to donate completely relies on altruism and is determined by the tradeoff between costs and direct benefits. Only agents with $b_1 \geq \alpha C$ will register to be a donor and family with $b_2 \geq (1-\alpha)C$ will consent to donate. Therefore, the rate of registration is $1 - F(\alpha C)$ and the rate of family consent is $1 - G(C - \alpha C)$.

2.2 Self-Priority Condition

In the *Self-priority* condition, available organs will be first distributed among registered donors, and a non-donor can only receive an organ if the needs of all registered donors are satisfied. Therefore, agents who are registered organ donors get higher probabilities of receiving donated organs when they encounter organ failure. The probability for a registered donor with organ failure to receive an organ is $p_d = \frac{\gamma\beta}{\theta}$. Again, we assume an environment with severe organ shortage where $\frac{\gamma\beta}{\theta} < 1$, hence there are not enough organs for agents with priority and the probability for a non-donor with organ failure to receive a donated organ is $p_n = 0$.

Equilibrium when agents are indifferent between registering and not registering requires that

$$b_1{}^* = \alpha C - \alpha V\theta\left(p_d - p_n\right) = \alpha C - \alpha V\gamma\beta,$$

and the rate of registration is $1 - F\left(\alpha C - \alpha V\gamma\beta\right)$ and the rate of family consent is $1 - G(C - \alpha C)$.

Hypothesis 1. Introducing the self-priority rule can increase only the registration rate but not the consent rate.

2.3 Family-Priority Condition

The family-priority rule creates incentives for family consent as well as for donor registration through family connections. In the *family-priority* condition, when agents donate their organs, their family members with organ failure will receive priority for available organs. The probability for family members of deceased donors to receive an organ is $p'_d = \frac{\gamma\beta}{\theta}$ and the probability for family members of non-donors to receive a donated organ is $p_n' = 0$. Equilibrium for family consent requires that

$$b_2{}^* = (1-\alpha)C - \alpha V\theta\left(p_d' - p_n'\right) = C - \alpha C - \alpha V\gamma\beta,$$

and the rate of family consent is $1 - G\left(C - \alpha C - \alpha V\gamma\beta\right)$. Equilibrium when agents are indifferent between registering and not registering requires that

$$b_1{}^* = \alpha C - (1-\alpha)V\theta\left(p_d' - p_n'\right) = \alpha C - (1-\alpha)V\gamma\beta,$$

and the rate of registration is $1 - F\left(\alpha C - V\gamma\beta + \alpha V\gamma\beta\right)$.

Hypothesis 2. The family-priority rule can promote both donor registration and family consent.

Comparison of registration rate between the self-priority rule and the family-priority rule depends on the ratio α.

Hypothesis 3. Assume $\alpha = 1 - \alpha$ (so that $\alpha = 0.5$), the family-priority rule can generate the same registration rate as the self-priority rule.

2.4 The Effect of Family Connections

Family members shared each other's net gains in each round with a ratio α to resemble family connections. The effectiveness of the family-priority rule can be affected by the level of α. We choose four different settings for α, where $\alpha = 1, 0.75, 0.5$, and 0.25, respectively. $\alpha = 1$ represents an extreme case where family connection is zero. There is no incentive for registration under the family-priority rule (similar like the *Control* condition), as agents do not benefit from the priority received by their family members. The rate of registration will be $1 - F(C)$. However, the incentive for family consent would be the highest, as family members can receive the priority without any cost.

Hypothesis 4. As α decreases, the registration rate under the family-priority rule increases, whereas the rate of family consent decreases.

3 Experimental Design

We adopted the design of Kessler and Roth (2014) as the basic experimental structure. Each subject played a virtual human with one A organ and two B organs in the experiment. Each round of the experiment, each subject was endowed with 8 Chinese Yuan (approximately 1.3 US Dollars) and received a health outcome of either A-organ failure or B-organ failure. If a subject had A-organ failure, he could not earn any more money in that round but could donate his B organs to subjects in need. If a subject had B-organ failure, both of his B organs failed, and he could receive one B organ donated by another subject. He could earn additional 8 Chinese Yuan if he received a donation in that round.

We modified the design by introducing the concept of family in our experiment. Each session of the experiment contains 16 subjects. Subjects were randomly divided into two fixed groups of 8 players. Subjects were told that 2 of 8 subjects in each fixed group would be randomly selected to have A-organ failure in each round and the remaining 6 would have B-organ failure. This ratio creates an organ shortage scenario, where the organ demand outweighs the maximal organ supply. It is consistent with the setting in Kessler and Roth (2012, 2014) and Li, Hawley, and Schnier (2013), which largely mimics the facts observed from the organ donation and transplantation statistics in most countries.

Each subject was randomly matched with one subject from another group to form a "family" and the family match stay fixed through the experiment. Family members shared each other's net gains in each round with a certain ratio to resemble connections between family members in real world. Each subject earnings = $\alpha \cdot \textit{own net gain} + (1 - \alpha) \cdot \textit{family member's net gain}$, where $0 \leq \alpha \leq 1$. There are four different settings for α, where $\alpha = 1, 0.75, 0.5$, and 0.25, respectively.

At the beginning of each round, before observing his health outcome, each subject was asked to decide whether he wanted to register as an organ donor – the **donor registration**. Subjects were told that organs can only be donated to subjects within the same group. If he chose not to register as an organ donor, his B organs would not be donated when he had A-organ failure. If he registered as a donor, his B organs would be available to other subjects in his own group when his family consents to donation. If his family refused to consent, his B organs would not be donated even if he was a registered donor.

After making the registration decision, each subject was also asked to decide whether they would give consent to donate organs of his family when they become available in the experiment – the **family consent**. If his family did not register as a donor, the subject did not need to take any action. If his family registered as an organ donor, the subject was asked to decide whether to donate B organs of his family when they became available. Subjects were told that donating B organs would create a cost of 4 Chinese Yuan for each donor but would generate a total earning of 16 Chinese Yuan for the recipients.

After finishing all the decisions, each subject observed his health outcome. If he had A-organ failure, he also observed his registration status and whether his family agreed to consent for donation. If he had B-organ failure, he received information including his rank on the waiting list, the number of available B organs in his group, and whether he received a B organ in that round. Subjects also observed all the above information for his family.

At the end of each round, each subject received a summary of that round, including donation costs and additional earnings for him and his family respectively, total earnings for the family in that round, and his own earnings in that round. There were 15 rounds in each session of the experiment. At the beginning of each session, subjects were informed that four rounds would be randomly selected for payment at the end of the experiment.

Three different allocation conditions were implemented in the experiment, including the *Control* condition, the *Self-priority* condition, and the *Family-priority* condition. In the *Control* condition, subjects were told that all donated B organs would be randomly allocated to subjects with B-organ failure within the same group of the donors. In the *Self-priority* condition, all donated organs were allocated based on subjects' donor registration. Before making the registration decision, subjects were told that those who chose to register as an organ donor would be given priority to receive a B organ when they ended up needing one. Any donated B organs would be first distributed randomly among subjects with priority in each group. Only when all subjects with priority had received a B organ, remaining available B organs would then be randomly assigned to subjects without priority within the group.

In the *Family-priority* condition, donated organs were allocated based on donation status of the family member. Before observing health status, each subject was informed that if he donated his B organs upon an A-organ failure, his family would receive priority for a B organ when in need of one. Any available B organs in a group would be first distributed randomly among those with priority. Only when all subjects with priority had received a B organ, remaining available B organs would then be randomly allocated to subjects without priority within the group.

We also varied the amount of information provided to subjects. Two types of information setting contain a *standard* setting and an *information* setting. In the *standard* setting, each subject only observed whether he and his family had B-organ failure, the number of available B organs in both groups, and whether he and his family received a B organ in each round. In the *information* setting, each subject additionally received information including how many subjects registered as organ donor, how many family members agreed to consent in each group, and how many subjects received priority but did not donate (only in *Self-priority* condition).

There were 45 sessions of the experiment and the selection of which session to conduct among the 45 sessions was randomly determined prior to subjects entering the experiment laboratory. The number of sessions played for each treatment

Table 1: Number of sessions and subjects in each treatment.

	Control	Self-priority	Family-priority
Standard setting ($\alpha = 0.5$)	5 sessions (80 subjects)	5 sessions (80 subjects)	5 sessions (80 subjects)
Information setting ($\alpha = 0.5$)	5 sessions (80 subjects)	5 sessions (80 subjects)	5 sessions (80 subjects)
Standard setting ($\alpha = 1$)	No sessions		5 sessions (80 subjects)
Standard setting ($\alpha = 0.75$)			5 sessions (80 subjects)
Standard setting ($\alpha = 0.25$)			5 sessions (80 subjects)

is displayed in Table 1. At the end of each session, subjects were presented with a brief questionnaire on their demographic characteristics and their involvement with organ donation in their own lives. They received payment after they completed the questionnaire.

4 Results

The experiment was performed at the Center for Economic Behavior and Decision-making (CEBD) of Zhejiang University of Finance and Economics in China.[17] The first set of the experiment, including 30 sessions, was conducted in June 2020. The second set that contains the remaining 15 sessions was conducted in June 2022. Subjects were recruited from the college student body through a recruiting program on WeChat that randomly invites registered subjects to participate in the experiment. A total of 720 subjects participated in the experiment and Table 2 shows the demographic characteristics of the participants. The average payment of the experiment is 47.24 Chinese Yuan.

To measure the relative effectiveness of different allocation rules, we first assume that $\alpha = 0.5$. Table 3 presents the descriptive statistics for all sessions with $\alpha = 0.5$. There are 1,200 observations at the subject-round level for each treatment of the experiment. Combining data from both information conditions, the registration rate across all subjects is 60.9 % in the *Control* condition, 92 % in the

17 The experiment was conducted using the experimental software z-Tree 3.3.6 (Fischbacher 2007).

Table 2: Demographic characteristics.

	***N* = 720**	**Constitute ratio (%)**
Sex		
Male	249	34.58
Female	471	65.42
Age		
<18	2	0.28
18–21	541	75.14
>21	177	24.58
Know how to register as organ donor		
Yes	142	19.72
No	578	80.28
Donated blood before		
Yes	220	30.56
No	500	69.44

Self-priority condition, and 74.6 % in the *Family-priority* condition. The descriptive statistics clearly indicate that higher registration rates arise when the priority rule, either the *self-priority* or the *family-priority*, is utilized. This finding is consistent with that of Kessler and Roth (2012) and Li, Hawley, and Schnier (2013). The registration rate in *self-priority* condition is also higher than in the *family-priority* condition, regardless of the information setting. The average consent rates are 37 %, 37.2 % and 55.3 % for the *Control*, *Self-priority*, and *Family-priority* conditions respectively. Clearly, higher consent rates were achieved only in the *family-priority* condition. Though there is no significant difference between consent rates in *Control* condition and in *Self-priority* condition, the lower ratio of consent/registration in *Self-priority* condition implies higher rate of refusals at the family consent stage. Table 4 reports the number of actual donors generated in each treatment of the experiment.[18] As shown in Table 4, the family-priority rule generated more donors, but the self-priority rule did not.

Figure 1 shows subjects' decisions in each round of the experiment for each treatment. Panel A and C show the percentage of subjects who were registered organ donors in each round for the *standard* setting and the *information* setting, respectively. Panel B and D present the percentage of family members who

18 We adopted a strategy method – each subject first decided whether to register as a donor and then whether to donate his paired family's organs when available before knowing his health outcome. Reported donors are subjects who chose to register and received family consent in each round.

Table 3: Descriptive statistics for sessions with $\alpha = 0.5$.

Variable	Obs	Mean	Std. dev.
	Control treatment		
Registration rate	2,400	0.609	0.49
Consent rate	2,400	0.37	0.48
Standard setting			
Registration rate	1,200	0.589	0.49
Consent rate	1,200	0.379	0.48
Information setting			
Registration rate	1,200	0.629	0.48
Consent rate	1,200	0.36	0.48
	Self-priority treatment		
Registration rate	2,400	0.92	0.27
Consent rate	2,400	0.372	0.48
Standard setting			
Registration rate	1,200	0.913	0.28
Consent rate	1,200	0.373	0.48
Information setting			
Registration rate	1,200	0.928	0.26
Consent rate	1,200	0.37	0.48
	Family-priority treatment		
Registration rate	2,400	0.746	0.44
Consent rate	2,400	0.553	0.50
Standard setting			
Registration rate	1,200	0.74	0.44
Consent rate	1,200	0.571	0.50
Information setting			
Registration rate	1,200	0.753	0.43
Consent rate	1,200	0.534	0.50

consented for donation in each round for the *standard* setting and the *information* setting, respectively. We conducted a series of Wilcoxon rank-sum tests to compare registration rates and donation rates across treatments. Table 5 illustrates the results from these tests.

We conducted a series of probit regressions to investigate the marginal effect of different mechanisms on subjects' decisions. Table 6 presents regression results with two dependent variables: donor registration and family consent. The independent variables in regressions (1) and (4) include the two treatment dummy variables

Table 4: Number of generated donors for sessions with $\alpha = 0.5$.

Treatment	Obs	Number of donors	Percentage of donors
		Control treatment	
Total	2,400	887	36.96
Standard setting	1,200	455	37.92
Information setting	1,200	432	36.00
		Self-priority treatment	
Total	2,400	892	37.17
Standard setting	1,200	448	37.33
Information setting	1,200	444	37.00
		Family-priority treatment	
Total	2,400	1,326	55.25
Standard setting	1,200	685	57.08
Information setting	1,200	641	53.42

Self-priority and *Family-priority*.[19] Regressions (2) and (5) control for the effect of information. The dummy variable *Info* equals to 1 if subjects received additional information and it is interacted with the two primary treatment dummies. Regressions (3) and (6) include demographic control variables *Male*, *Age*, *Know how to register, and Blood donation*. The latter two being dummy variables indicating that whether the subject knows how to register as an organ donor, and whether the subject has donated blood, respectively.

Result 1: *Compared with the Control condition, subjects are more likely to register as a donor in the Self-priority condition. However, the consent rate does not increase accordingly as family members are more likely to refuse to donate in the Self-priority condition.*

As shown in Figure 1, the *Control* condition lies beneath the *Self-priority* condition in both Panel A and C, suggesting that introducing the *Self-priority* rule has a significant positive impact on the donor registration rate. The positive and statistically significant coefficient on the *Self-priority* dummy variable in regression (1) of Table 6 indicates that subjects are about 28 percentage points more likely to register as a donor in the *Self-priority* condition than in the *Control* condition across

19 The reference group is subject's decision in the *Control* treatment.

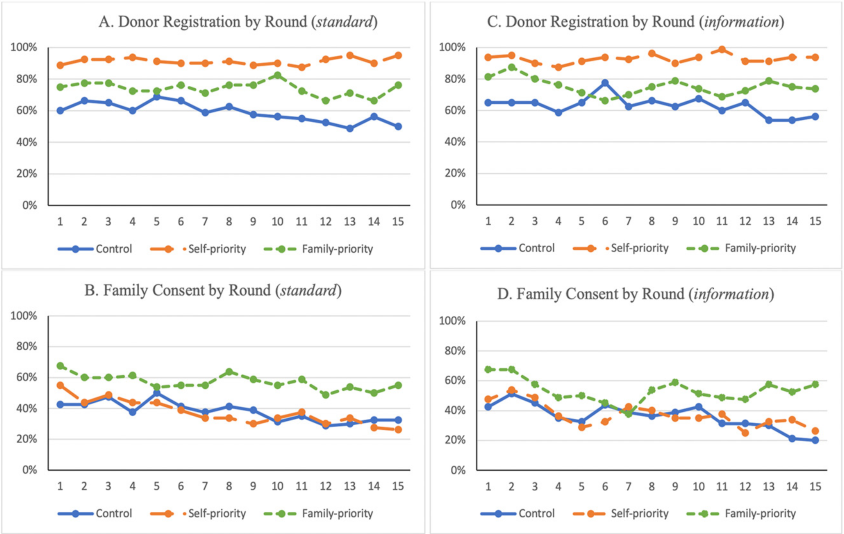

Figure 1: Registration rate and consent rate in each treatment reported by round ($\alpha = 0.5$).

all rounds. This represents almost a 50 % increase in the registration rate over the rate observed in the *Control* condition. Furthermore, this finding is robust to the additional controls used in the other econometric specifications in regressions (2) and (3). This is consistent with the finding in Kessler and Roth (2012) and Li, Hawley, and Schnier (2013).

Since the priority was granted before family consent was made in the *Self-priority* condition, it is possible for subjects to take advantage of the priority rule without donating their organs – the loophole. Table shows that coefficients on the *Self-priority* dummy variable in regression (4) through (6) are not statistically significant, suggesting incentive created by the self-priority rule is eliminated. As shown in Figure 1, the difference between *Control* and *Self-priority* in Panel B and D is not noticeable across all rounds, indicating the self-priority rule did not significantly promote family consent. Results from Wilcoxon Rank-Sum test in Table 5 also confirm this finding.

Result 2: *Compared with the Control condition, introducing the family-priority rule can significantly increase the donation rate, as it has a significant positive impact on both donor registration and family consent.*

Table 5: Wilcoxon rank-sum tests ($\alpha = 0.5$).

Donor registration				Family consent			
Treatment		Treatment	Test statistic	Treatment		Treatment	Test statistic
Control	versus	*Self-priority*	−18.307***	*Control*	versus	*Self-priority*	0.295
Control	versus	*Family-priority*	−7.824***	*Control*	versus	*Family-priority*	−9.400***
Self-priority	versus	*Family-priority*	11.150***	*Self-priority*	versus	*Family-priority*	−9.689***
Control with info	versus	*Self-priority with info*	−17.651***	*Control with info*	versus	*Self-priority with info*	−0.509
Control with info	versus	*Family-priority with info*	−6.536***	*Control with info*	versus	*Family-priority with info*	−8.579***
Self-priority with info	versus	*Family-priority with info*	11.758***	*Self-priority with info*	versus	*Family-priority with info*	−8.078***

Note: ***Significant at 1 percent level.

Table 6: Probit regressions on decisions to be a donor in the experiment ($\alpha = 0.5$).

	Probit estimation					
	Donor registration (0 or 1)			Family consent (0 or 1)		
	(1)	(2)	(3)	(4)	(5)	(6)
Self-priority	0.280***	0.280***	0.280***	0.00217	−0.00603	−0.00212
	(0.0207)	(0.0292)	(0.0293)	(0.0343)	(0.0496)	(0.0501)
Family-priority	0.107***	0.116***	0.118***	0.183***	0.191***	0.193***
	(0.0233)	(0.0330)	(0.0329)	(0.0317)	(0.0461)	(0.0459)
Info		0.0306	0.0281		−0.0199	−0.0174
		(0.0369)	(0.0367)		(0.0474)	(0.0476)
Self-priority × *Info*		0.000860	0.00441		0.0165	0.0143
		(0.0565)	(0.0568)		(0.0688)	(0.0693)
Family-priority × *Info*		−0.0195	−0.0153		−0.0164	−0.0155
		(0.0532)	(0.0522)		(0.0638)	(0.0639)
Male			0.0627***			0.0623**
			(0.0226)			(0.0292)
Age			0.00872			0.00211
			(0.00877)			(0.0109)
Know how to register			0.00127			0.0645*
			(0.0313)			(0.0380)
Blood donation			0.0109			0.00878
			(0.0251)			(0.0298)
Observations	7,200	7,200	7,200	7,200	7,200	7,200

Note: All variables are expressed as marginal values. Clustered errors by individual. Standard errors are in parentheses. ***Significant at 1 percent level, **significant at the 5 percent level, *significant at the 10 percent level. Independent variables: *Self-priority*, *Family-priority*, and *Info* are dummy variables representing the treatment; *Donor in real life* is a dummy variable equal to 1 if subjects are registered organ donors in real life; *Know how to register* is a dummy variable equal to 1 if subjects reported that they know the approaches to register as an organ donor; *Blood donation* is a dummy variable indicating whether or not subjects donated blood in real life.

Figure 1 illustrates that the *Family-priority* condition has higher average registration rates and consent rates than the *Control* condition. Results from Wilcoxon Rank-Sum test also rejects the null hypothesis that registration rates and consent rates from the *Control* condition and the *Family-priority* condition are identical.

The probit results also support the finding that registration is higher in the *Family-priority* condition. Positive coefficients on *Family-priority* in regressions (1) through (3) indicate that the registration rate increases by between 10.7 % and 11.8 % compared with the *Control* condition, depending on the regression assumptions. Results in probit regressions (4) through (6) also indicate that the *Family-priority* rule has a positive impact on family consent. Compared with the *Control* condition, subjects in the *Family-priority* condition are 18.3 %–19.3 % more likely to consent for donation depending on the model. The Family-priority rule provides incentives not only for the donor registration but also for the family consent.

Result 3: *The self-priority rule generates more registration but less family consent than the family-priority rule* ($\alpha = 0.5$).

The only difference between the *Self-priority* condition and the *Family-priority* condition is how was the priority granted. According to the theoretical prediction, when $\alpha = 0.5$ that family members equally share costs and earnings occurred in each round of the experiment, incentives for registration provided by the two mechanisms should be the same. However, Figure 1 shows that the *Self-priority* condition generates a higher registration rate but a lower consent rate than the *Family-priority* condition, regardless of the information setting. Wilcoxon rank-sum tests results in Table 5 also clarify this treatment effect. Probit regression results also confirm this observation. Comparisons of the treatment coefficients in regressions (1) through (3) are statistically significant (Wald test, $p = 0.0000$).

This finding implies that subjects in the *Self-priority* condition registered as donors may only for the benefit of the priority but did not intend to donate. The self-priority rule introduces a loophole to the allocation system, with which subjects can receive the priority without paying for the cost of donation. The additional registration seems to be driven by subjects who do not intent to help others. We confirm this behavior by testing how one's registration decision is affected by donation in the previous round. If a subject register only for the priority, he would be less likely to register if he observes that his organs were donated in the previous round. Table 7 presents these results based on all data, data from the *standard* setting only, and data from the *information* setting only, respectively. We find a significant negative interaction term between *Donated Last Round* and *Self-priority*. This implies when organs were donated in the previous round, subjects are less likely to register in the *Self-priority* condition than in the *Control* condition. This can be a way for subjects to "signal" their family members that they do not actually want to donate.

Result 4: *There is no behavioral difference across different information settings.*

Table 6 also reports results controlling for the effect of information. In regressions (2) and (5), coefficients on the dummy variable *Info* are not statistically significant, indicating that neither donor registration not family consent varied significantly across different information settings in the *Control* condition. Coefficients on *Info* interacted with the two primary treatment dummies also indicate that information does not have a significant effect on the registration rate ($p = 0.4625$ for

Table 7: OLS regressions on registration decision in the experiment.

	Donor registration (0 or 1)		
	All data	**Standard setting**	**Information setting**
Donated last round	0.303***	0.321***	0.287***
	(0.0304)	(0.0432)	(0.0426)
Self-priority	0.416***	0.433***	0.400***
	(0.0314)	(0.0467)	(0.0419)
Family-priority	0.125***	0.120**	0.128**
	(0.0407)	(0.0590)	(0.0557)
Self-priority × Donated last round	−0.274***	−0.279***	−0.270***
	(0.0340)	(0.0496)	(0.0463)
Family-priority × Donated last round	−0.0770*	−0.0516	−0.101*
	(0.0429)	(0.0617)	(0.0594)
Round dummy	Yes	Yes	Yes
Observations	6,720	3,360	3,360
R-squared	0.154	0.172	0.14

Note: Clustered errors by individual. Standard errors are in parentheses. ***Significant at 1 percent level, **significant at the 5 percent level, *significant at the 10 percent level. All regressions exclude round 1. Donated Last Round is a dummy indicates "next of kin" agreed to donate in the previous round.

Self-priority; $p = 0.7490$ for *Family-priority*) and the consent rate ($p = 0.944$ for *Self-priority*; $p = 0.3983$ for *Family-priority*) with the priority rule.

4.1 Family Connections

In our experiment, family members shared each other's net gains in each round with a ratio α to resemble family connections. The smaller α is, the stronger the family connections are. There are four different settings for α, where $\alpha = 1, 0.75, 0.5$, and 0.25, respectively.

Result 5: *The family-priority rule will significantly promote donor registration and meanwhile generate a consistent higher family consent rate when α is low.*

Table 8 presents the descriptive statistics for all sessions under the *Family-priority* condition with the standard information setting. The registration rate is 58.3 % when $\alpha = 1$, 54.8 % when $\alpha = 0.75$, 74 % when $\alpha = 0.5$, and 74.7 % when $\alpha = 0.25$, respectively. As predicted, the registration rate with $\alpha = 1$ is close to the rate of 58.9 % in the *Control* condition (with *standard* information setting) and α decreases, the registration rate increases as α decreases. Results from Pribit regressions in Table 9 also confirm this finding. Subjects with $\alpha = 0.5$ and $\alpha = 0.25$

Table 8: Descriptive statistics for all family-priority sessions.

Variable	Obs	Mean	Std. dev.
$\alpha = 1$			
Registration rate	1,200	0.583	0.493
Consent rate	1,200	0.528	0.499
$\alpha = 0.75$			
Registration rate	1,200	0.548	0.498
Consent rate	1,200	0.463	0.499
$\alpha = 0.5$			
Registration rate	1,200	0.74	0.44
Consent rate	1,200	0.570	0.50
$\alpha = 0.25$			
Registration rate	1,200	0.747	0.435
Consent rate	1,200	0.523	0.499

Note: All sessions are in the *standard i*nformation setting.

Table 9: Probit regressions on decisions to be a donor in the experiment.

	Probit estimation			
	Donor registration (0 or 1)		Family consent (0 or 1)	
	(1)	(2)	(3)	(4)
$\alpha = 0.75$	−0.0329	−0.0427	−0.0650	−0.0722
	(0.0479)	(0.0475)	(0.0475)	(0.0476)
$\alpha = 0.5$	0.150***	0.153***	0.0427	0.0428
	(0.0419)	(0.0415)	(0.0484)	(0.0492)
$\alpha = 0.25$	0.157***	0.172***	−0.00584	0.00517
	(0.0425)	(0.0421)	(0.0469)	(0.0474)
Male		0.0434		0.0154
		(0.0357)		(0.0351)
Age		−0.00817		−0.00769
		(0.0126)		(0.0132)
Know how to register		0.0388		0.0370
		(0.0370)		(0.0397)
Blood donation		0.0798**		0.0568
		(0.0364)		(0.0354)
Observations	4,800	4,800	4,800	4,800

Note: All variables are expressed as marginal values. Clustered errors by individual. Standard errors are in parentheses. ***Significant at 1 percent level, **significant at the 5 percent level. Subjects in sessions with $\alpha = 1$ serve as the reference group.

are about 17.2 % and 13.6 % more likely to register as a donor than those with $\alpha = 1$, implying the family-priority rule is particularly effective to improve donor registration in culture with strong family connections.

The incentive for family consent would be the highest when $\alpha = 1$, as family members can receive the priority without any cost. The average consent rates are 52.8 %, 46.3 %, 57.1 %, and 52.3 % for the setting of $\alpha = 1, 0.75, 0.5$, and 0.25, respectively, showing a slight decreasing pattern as α decreases. Coefficients on treatment variables in regression (3) and (4) are also negative, except for $\alpha = 0.5$ in Table 9. However, none of these coefficients are statistically significant, indicating that the family-priority rule can generate consistent higher consent rates across different level of culture settings.

5 Discussion

Humans are wired to care for their close relatives, and family members often share deep psychological connections. These family ties create a strong foundation for caring about the welfare of their family members. Identifying such family tie in the field is challenging, as it is more likely to be psychological. In the lab, however, monetary values can be imposed and manipulated to model the family connection to some level of approximation. We did not use real "family" in the experiment (subjects were randomly matched strangers). As the welfare for virtual life in our experiment is measure in monetary value (e.g. being healthy in each round is equivalent to earning 8 yuan), sharing imposed costs and earnings between paired subjects resembles family members caring about the well-being of each other through family ties. Our laboratory design may be abstracted away from complex sentiments associated with family connections; however, it provides a controlled environment allowing us to study the relative comparisons across different incentive structures. We also take advantage of the opportunity to manipulate intensity of family ties in the experiment by varying the ratio of sharing to better understand the impact family-priority rule under different connection settings.

Great care indeed should be taken before making inference from laboratory experiments to field environments. However, the difficulties of conducting donor-based research outside of the lab makes the experimental method an additional avenue of such research in which many field complexities are relaxed. It is sensible to look to these simple experiments to generate hypotheses about organ donation policies, which may prove insightful in formulating public policy. Our results provide support for the conjecture that the family-priority rule can increase organ donation. Results of our experiment show that introducing the family-priority rule can not only increase donor registration but also promote family consent.

We find the family-priority based incentive fit to the family-oriented culture of China. The registration rate under the family-priority rule increases as the family connections get stronger, whereas family consents do not change significantly across different culture settings. This suggests that, for the culture meaning with strong family connections like that of China, it would be effective to implement the family-priority rule, which will significantly promote donor registration, and meanwhile generate a consistent higher consent rate than the self-priority rule. The magnitude of such impact may not entirely drive the results observed in the experiment, as family ties are driven by the combination of evolutionary, social and cultural factors. In fact, this may be studied by an experiment in a different culture setting where the family fabric is less strong (e.g. countries in Scandinavia).

Although majority people believe that family-priority rule can improve family consent for organ donation, only a few are aware of this policy.[20] In addition, majority of the population in China, including the young generation, are not familiar with the current donation system. For instance, among our experimental participants (college students), only 19.72 % reported knowing how to register as an organ donor in China. It seems that family-priority incentive may be sufficient to inspire family consent and improve donation, but what is more important is to strength policies that can disseminate the registration system and the family-priority rule. It may be a feasible move to collaborate with online platform, such as WeChat, to popularize donation registration.

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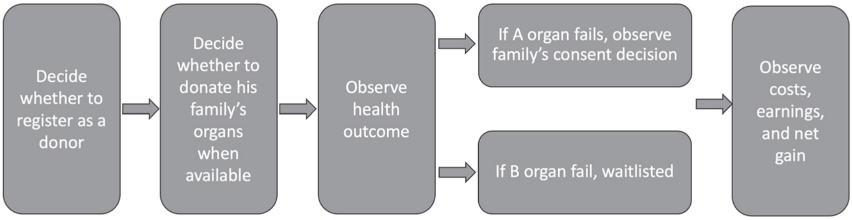
Appendix

A The Timeline of Each Round of the Experiment

Each session, subjects were randomly and equally divided into two groups and were randomly paired across groups to form “families”. Each round of the experiment was conducted as follows:

20 Pan et al. (2021) find 61.4 % of the participants in the current study said that this would significantly promote the requirement for family consent, but 83.4 % reported that they are not aware of any family policies regarding organ donation.



B Instructions for Each Treatment of the Experiment

The experiment was conducted in China, and the original instructions were presented in Chinese. We provide all instructions used in the experiment with English translation in this section.

Instruction 1 – Control

1. 本场实验共有16 名实验参与者。16 名参与者会被随机的分成一号组和二号组, 每组各有8名。

   There are 16 participants in the experiment today. All participants have been randomly assigned to either Group 1 or Group 2. Each group contains 8 participants.
2. 你已被随机分配到一(二)号组。你的实验组及同组成员在本场实验中保持不变。

   You have been randomly assigned to Group 1 (2). Members of your group stay unchanged through the experiment.
3. 你已和对方组1 名参与者随机配对组成一个家庭。你们互为对方的家属, 并且该家属关系在本场实验中保持不变。

   You have been matched with one participant from Group 2 (1) to form a family. Your family member stays unchanged through the experiment.
4. 本场实验包括15 轮次。每一轮实验起始, 每名参与者将是一个拥有1 个 A 器官和2个 B 器官的虚拟人, 并获得起始收益￥8。

   There are 15 rounds in the experiment. At the beginning of each round, each participant is assigned a virtual life with one A organ and two B organs, and also endowed with 8 yuan.
5. 每一轮实验中, 每个实验组都将有2名参与者失去 A 器官和6 名参与者失去 B 器官(同时失去两个 B 器官)。失去 A 器官的参与者将不能在本轮中获得额外收益; 失去 B 器官的参与者可等待接受同组参与者捐献的一个 B 器官。获得捐赠的实验参与者, 可在本轮获得额外收益￥8。

   Every round, two participants will be randomly assigned with A-organ failure, while the remaining six will have B-organ failure. Participant with A-organ failure can not earn any additional money in that round but can donate his B organs to group members. Participants with B-organ failure can receive one B organ donated by a group member to earn additionally 8 yuan.

6. 每一轮实验起始, 每位实验参与者将选择是否同意注册为器官捐献者。如果参与者不同意注册, 在失去 A 器官时其 B 器官将不会被捐献; 如果参与者同意注册, 将由其家属决定是否完成捐献; 如果家属不同意完成捐献, 该参与者在失去 A 器官时其 B 器官将不会被捐献; 如果家属同意完成捐献, 该参与者在失去 A 器官时, 其两个 B 器官将分别被捐献给同组的两名参与者。

   At the beginning of each round, each participant will be asked to decide whether he want to register as an organ donor. If he chooses not to register as an organ donor, his B organs will not be donated when he has A-organ failure. If he decided to register, it will be up to the decision of his family whether his B organs will be donated when he has A-organ failure. His B organs will only be available to his group members when his family consents to donation.

7. B 器官将在同组需要接受捐献的参与者间进行分配, 分配排序则随机生成。

   Available B organs will be randomly allocated to group members with need.

8. 完成捐献 B 器官将会为器官捐献者产生￥4 的捐献成本, 但捐献两个 B 器官可分别挽救2名同组实验参与者, 并为他们创造总共￥16 的额外收益。

   Donating B organs creates a cost of 4 yuan for each donor but generates a total earning of 16 yuan for the organ recipients.

9. 每一轮实验将以家庭为单位计算净收益, 你与家属将平均分配家庭净收益。每轮家庭净收益将是你与家属本轮所有收益之和减除你与家属在本轮中各自支付的捐献成本。

   Each round, family members equally shared each other's net gain. Each participant's net gain is the sum of earnings minus the potential cost of donation.

10. 所有轮次结束后, 你将从中随机抽取4 个轮次。你本场实验的最终收入等于4 轮随机抽取轮次收益的总和加出场费￥10。

    At the end of the experiment, four rounds will be randomly selected for payment. Therefore, you should make your decision in each round independently of your choice in other rounds. Your payment will be the sum of earnings from the four randomly selected rounds plus a show-up fee of 10 yuan.

Instruction 2 – Self-Priority

1. 本场实验共有16 名实验参与者。16 名参与者会被随机的分成一号组和二号组, 每组各有8名。

There are 16 participants in the experiment today. All participants have been randomly assigned to either Group 1 or Group 2. Each group contains 8 participants.

2. 你已被随机分配到一(二)号组。你的实验组及同组成员在本场实验中保持不变。

   You have been randomly assigned to Group 1 (2). Members of your group stay unchanged through the experiment.

3. 你已和对方组1 名参与者随机配对组成一个家庭。你们互为对方的家属, 并且该家属关系在本场实验中保持不变。

   You have been matched with one participant from Group 2 (1) to form a family. Your family member stays unchanged through the experiment.

4. 本场实验包括15 轮次。每一轮实验起始, 每名参与者将是一个拥有1 个 A 器官和2个 B 器官的虚拟人, 并获得起始收益￥8。

   There are 15 rounds in the experiment. At the beginning of each round, each participant is assigned a virtual life with one A organ and two B organs, and also endowed with 8 yuan.

5. 每一轮实验中, 每个实验组都将有2名参与者失去 A 器官和6 名参与者失去 B 器官(同时失去两个 B 器官)。失去 A 器官的参与者将不能在本轮中获得额外收益; 失去 B 器官的参与者可等待接受同组参与者捐献的一个 B 器官。获得捐赠的实验参与者, 可在本轮获得额外收益￥8。

   Every round, two participants will be randomly assigned with A-organ failure, while the remaining six will have B-organ failure. Participant with A-organ failure cannot earn any additional money in that round but can donate his B organs to group members. Participants with B-organ failure can receive one B organ donated by a group member to earn additionally 8 yuan.

6. 每一轮实验起始, 每位实验参与者将选择是否同意注册为器官捐献者。如果参与者不同意注册, 在失去 A 器官时其 B 器官将不会被捐献; 如果参与者同意注册, 将由其家属决定是否完成捐献; 如果家属不同意完成捐献, 该参与者在失去 A 器官时其 B 器官将不会被捐献; 如果家属同意完成捐献, 该参与者在失去 A 器官时, 其两个 B 器官将分别被捐献给同组的两名参与者。

   At the beginning of each round, each participant will be asked to decide whether he want to register as an organ donor. If he chooses not to register as an organ donor, his B organs will not be donated when he has A-organ failure. If he decided to register, it will be up to the decision of his family whether his B organs will be donated when he has A-organ failure. His B organs will only be available to his group members when his family consents to donation.

7. 等待接受 B 器官的排序由你的器官捐献者注册状态确定。如果你选择同意注册为器官捐献者(无论你的家属是否最终同意完成捐献),你将在需要接受 B 器官捐献时获得等待排序的优先权, 即你将优先于其他未注册器官捐献者获得 B 器官, 同等优先级别下等待排序则随机生成。

If you choose to register as a donor, you will receive priority for one B organ when in need of one, no matter whether your family agrees to donate or not. Any available B organs will be first distributed randomly among group members with priority. Only when all members with priority have received one B organ, remaining available B organs will then be randomly allocated to those without priority in the group.

8. 完成捐献 B 器官将会为器官捐献者产生￥4 的捐献成本, 但捐献两个 B 器官可分别挽救2名同组实验参与者, 并为他们创造总共￥16 的额外收益。

   Donating B organs creates a cost of 4 yuan for each donor but generates a total earning of 16 yuan for the organ recipients.

9. 每一轮实验将以家庭为单位计算净收益, 你与家属将平均分配家庭净收益。每轮家庭净收益将是你与家属本轮所有收益之和减除你与家属在本轮中各自支付的捐献成本。

   Each round, family members equally shared each other's net gain. Each participant's net gain is the sum of earnings minus the potential cost of donation.

10. 所有轮次结束后, 你将从中随机抽取4 个轮次。你本场实验的最终收入等于4 轮随机抽取轮次收益的总和加出场费￥10。

   At the end of the experiment, four rounds will be randomly selected for payment. Therefore, you should make your decision in each round independently of your choice in other rounds. Your payment will be the sum of earnings from the four randomly selected rounds plus a show-up fee of 10 yuan.

Instruction 3 – Family-Priority ($\alpha = 0.5$)

1. 本场实验共有16 名实验参与者。16 名参与者会被随机的分成一号组和二号组, 每组各有8名。

   There are 16 participants in the experiment today. All participants have been randomly assigned to either Group 1 or Group 2. Each group contains 8 participants.

2. 你已被随机分配到一(二)号组。你的实验组及同组成员在本场实验中保持不变。

   You have been randomly assigned to Group 1 (2). Members of your group stay unchanged through the experiment.

3. 你已和对方组1 名参与者随机配对组成一个家庭。你们互为对方的家属, 并且该家属关系在本场实验中保持不变。

   You have been matched with one participant from Group 2 (1) to form a family. Your family member stays unchanged through the experiment.

4. 本场实验包括15 轮次。每一轮实验起始, 每名参与者将是一个拥有1 个 A 器官和2个 B 器官的虚拟人, 并获得起始收益￥8。

   There are 15 rounds in the experiment. At the beginning of each round, each participant is assigned a virtual life with one A organ and two B organs, and also endowed with 8 yuan.
5. 每一轮实验中, 每个实验组都将有2名参与者失去 A 器官和6 名参与者失去 B 器官(同时失去两个 B 器官)。失去 A 器官的参与者将不能在本轮中获得额外收益; 失去 B 器官的参与者可等待接受同组参与者捐献的一个 B 器官。获得捐赠的实验参与者, 可在本轮获得额外收益￥8。

   Every round, two participants will be randomly assigned with A-organ failure, while the remaining six will have B-organ failure. Participant with A-organ failure can not earn any additional money in that round but can donate his B organs to group members. Participants with B-organ failure can receive one B organ donated by a group member to earn additionally 8 yuan.
6. 每一轮实验起始, 每位实验参与者将选择是否同意注册为器官捐献者。如果参与者不同意注册, 在失去 A 器官时其 B 器官将不会被捐献; 如果参与者同意注册, 将由其家属决定是否完成捐献; 如果家属不同意完成捐献, 该参与者在失去 A 器官时其 B 器官将不会被捐献; 如果家属同意完成捐献, 该参与者在失去 A 器官时, 其两个 B 器官将分别被捐献给同组的两名参与者。

   At the beginning of each round, each participant will be asked to decide whether he want to register as an organ donor. If he chooses not to register as an organ donor, his B organs will not be donated when he has A-organ failure. If he decided to register, it will be up to the decision of his family whether his B organs will be donated when he has A-organ failure. His B organs will only be available to his group members when his family consents to donation.
7. 如果你选择同意注册为器官捐献者并最终由家属完成捐献, 你的家属将在需要接受 B 器官捐献时获得等待排序的优先权, 即你的家属将优先于其他未注册器官捐献者获得 B 器官, 同等优先级别下等待排序则随机生成。

   If you and your family both agree to donate, your family member will receive priority for one B organ when in need of one. Any available B organs will be first distributed randomly among group members with priority. Only when all members with priority have received one B organ, remaining available B organs will then be randomly allocated to those without priority in the group.
8. 完成捐献 B 器官将会为器官捐献者产生￥4 的捐献成本, 但捐献两个 B 器官可分别挽救2名同组实验参与者, 并为他们创造总共￥16 的额外收益。

   Donating B organs creates a cost of 4 yuan for each donor but generates a total earning of 16 yuan for the organ recipients.

9. 每一轮实验将以家庭为单位计算净收益, 你与家属将平均分配家庭净收益。每轮家庭净收益将是你与家属本轮所有收益之和减除你与家属在本轮中各自支付的捐献成本。

   Each round, family members equally shared each other's net gain. Each participant's net gain is the sum of earnings minus the potential cost of donation.

10. 所有轮次结束后, 你将从中随机抽取4 个轮次。你本场实验的最终收入等于4 轮随机抽取轮次收益的总和加出场费￥10。

    At the end of the experiment, four rounds will be randomly selected for payment. Therefore, you should make your decision in each round independently of your choice in other rounds. Your payment will be the sum of earnings from the four randomly selected rounds plus a show-up fee of 10 yuan.

Instruction 4 – Family-Priority ($\alpha = 1$)

1. 本场实验共有16 名实验参与者。16 名参与者会被随机的分成一号组和二号组, 每组各有8名。

   There are 16 participants in the experiment today. All participants have been randomly assigned to either Group 1 or Group 2. Each group contains 8 participants.

2. 你已被随机分配到一(二)号组。你的实验组及同组成员在本场实验中保持不变。

   You have been randomly assigned to Group 1 (2). Members of your group stay unchanged through the experiment.

3. 你已和对方组1名参与者随机配对组成一个家庭。你们互为对方的家属, 并且该家属关系在本场实验中保持不变。

   You have been matched with one participant from Group 2 (1) to form a family. Your family member stays unchanged through the experiment.

4. 本场实验包括15 轮次。每一轮实验起始, 每名参与者将是一个拥有1个 A 器官和2个 B 器官的虚拟人, 并获得起始收益￥8。

   There are 15 rounds in the experiment. At the beginning of each round, each participant is assigned a virtual life with one A organ and two B organs, and also endowed with 8 yuan.

5. 每一轮实验中, 每个实验组都将有2名参与者失去 A 器官和6 名参与者失去 B 器官(同时失去两个 B 器官)。失去 A 器官的参与者将不能在本轮中获得额外收益; 失去 B 器官的参与者可等待接受同组参与者捐献的一个 B 器官。获得捐赠的实验参与者, 可在本轮获得额外收益￥8。

   Every round, two participants will be randomly assigned with A-organ failure, while the remaining six will have B-organ failure. Participant with

A-organ failure can not earn any additional money in that round but can donate his B organs to group members. Participants with B-organ failure can receive one B organ donated by a group member to earn additionally 8 yuan.

6. 每一轮实验起始, 每位实验参与者将选择是否同意注册为器官捐献者。如果参与者不同意注册, 在失去 A 器官时其 B 器官将不会被捐献; 如果参与者同意注册, 将由其家属决定是否完成捐献; 如果家属不同意完成捐献, 该参与者在失去 A 器官时其 B 器官将不会被捐献; 如果家属同意完成捐献, 该参与者在失去 A 器官时, 其两个 B 器官将分别被捐献给同组的两名参与者。

   At the beginning of each round, each participant will be asked to decide whether he want to register as an organ donor. If he chooses not to register as an organ donor, his B organs will not be donated when he has A-organ failure. If he decided to register, it will be up to the decision of his family whether his B organs will be donated when he has A-organ failure. His B organs will only be available to his group members when his family consents to donation.

7. 如果你选择同意注册为器官捐献者并最终由家属完成捐献, 你的家属将在需要接受 B 器官捐献时获得等待排序的优先权, 即你的家属将优先于其他未注册器官捐献者获得 B 器官, 同等优先级别下等待排序则随机生成。

   If you and your family both agree to donate, your family member will receive priority for one B organ when in need of one. Any available B organs will be first distributed randomly among group members with priority. Only when all members with priority have received one B organ, remaining available B organs will then be randomly allocated to those without priority in the group.

8. 完成捐献 B 器官将会为器官捐献者产生￥4 的捐献成本, 但捐献两个 B 器官可分别挽救2名同组实验参与者, 并为他们创造总共￥16 的额外收益。

   Donating B organs creates a cost of 4 yuan for each donor but generates a total earning of 16 yuan for the organ recipients.

9. 实验参与者每轮的净收益=其在本轮所有收益之和减除其本轮支付的捐献成本。

   Each participant's net gain in each round is the sum of his earnings in that round minus the potential cost of donation.

10. 所有轮次结束后, 你将从中随机抽取4 个轮次。你本场实验的最终收入等于4 轮随机抽取轮次收益的总和加出场费￥10。

    At the end of the experiment, four rounds will be randomly selected for payment. Therefore, you should make your decision in each round independently of your choice in other rounds. Your payment will be the sum of earnings from the four randomly selected rounds plus a show-up fee of 10 yuan.

Instruction 5 – Family-Priority ($\alpha = 0.25$)

1. 本场实验共有16 名实验参与者。16 名参与者会被随机的分成一号组和二号组, 每组各有8名。

   There are 16 participants in the experiment today. All participants have been randomly assigned to either Group 1 or Group 2. Each group contains 8 participants.
2. 你已被随机分配到一(二)号组。你的实验组及同组成员在本场实验中保持不变。

   You have been randomly assigned to Group 1 (2). Members of your group stay unchanged through the experiment.
3. 你已和对方组1名参与者随机配对组成一个家庭。你们互为对方的家属, 并且该家属关系在本场实验中保持不变。

   You have been matched with one participant from Group 2 (1) to form a family. Your family member stays unchanged through the experiment.
4. 本场实验包括15 轮次。每一轮实验起始, 每名参与者将是一个拥有1个 A 器官和2个 B 器官的虚拟人, 并获得起始收益￥8。

   There are 15 rounds in the experiment. At the beginning of each round, each participant is assigned a virtual life with one A organ and two B organs, and also endowed with 8 yuan.
5. 每一轮实验中, 每个实验组都将有2名参与者失去 A 器官和6 名参与者失去 B 器官(同时失去两个 B 器官)。失去 A 器官的参与者将不能在本轮中获得额外收益; 失去 B 器官的参与者可等待接受同组参与者捐献的一个 B 器官。获得捐赠的实验参与者, 可在本轮获得额外收益￥8。

   Every round, two participants will be randomly assigned with A-organ failure, while the remaining six will have B-organ failure. Participant with A-organ failure can not earn any additional money in that round but can donate his B organs to group members. Participants with B-organ failure can receive one B organ donated by a group member to earn additionally 8 yuan.
6. 每一轮实验起始, 每位实验参与者将选择是否同意注册为器官捐献者。如果参与者不同意注册, 在失去 A 器官时其 B 器官将不会被捐献; 如果参与者同意注册, 将由其家属决定是否完成捐献; 如果家属不同意完成捐献, 该参与者在失去 A 器官时其 B 器官将不会被捐献; 如果家属同意完成捐献, 该参与者在失去 A 器官时, 其两个 B 器官将分别被捐献给同组的两名参与者。

   At the beginning of each round, each participant will be asked to decide whether he want to register as an organ donor. If he chooses not to register as an organ donor, his B organs will not be donated when he has A-organ failure. If he decided to register, it will be up to the decision of his family whether his

B organs will be donated when he has A-organ failure. His B organs will only be available to his group members when his family consents to donation.

7. 如果你选择同意注册为器官捐献者并最终由家属完成捐献, 你的家属将在需要接受 B 器官捐献时获得等待排序的优先权, 即你的家属将优先于其他未注册器官捐献者获得 B 器官, 同等优先级别下等待排序则随机生成。

   If you and your family both agree to donate, your family member will receive priority for one B organ when in need of one. Any available B organs will be first distributed randomly among group members with priority. Only when all members with priority have received one B organ, remaining available B organs will then be randomly allocated to those without priority in the group.

8. 完成捐献 B 器官将会为器官捐献者产生￥4 的捐献成本, 但捐献两个 B 器官可分别挽救2名同组实验参与者, 并为他们创造总共￥16 的额外收益。

   Donating B organs creates a cost of 4 yuan for each donor but generates a total earning of 16 yuan for the organ recipients.

9. 实验参与者每轮的净收益=1/4*(其在本轮所有收益之和减除其本轮支付的捐献成本)+3/4*(其家属在本轮所有收益之和减除其家属本轮支付的捐献成本)。

   Each round, each participant's net gain is 1/4 (the sum of his earnings minus the potential cost of donation) + 1/4 (the sum of his family's earnings minus the potential cost of donation).

10. 所有轮次结束后, 你将从中随机抽取4 个轮次。你本场实验的最终收入等于4 轮随机抽取轮次收益的总和加出场费￥10。

    At the end of the experiment, four rounds will be randomly selected for payment. Therefore, you should make your decision in each round independently of your choice in other rounds. Your payment will be the sum of earnings from the four randomly selected rounds plus a show-up fee of 10 yuan.

Instruction 6 – Family-Priority ($\alpha = 0.75$)

1. 本场实验共有16 名实验参与者。16 名参与者会被随机的分成一号组和二号组, 每组各有8名。

   There are 16 participants in the experiment today. All participants have been randomly assigned to either Group 1 or Group 2. Each group contains 8 participants.

2. 你已被随机分配到一(二)号组。你的实验组及同组成员在本场实验中保持不变。

   You have been randomly assigned to Group 1 (2). Members of your group stay unchanged through the experiment.

3. 你已和对方组1名参与者随机配对组成一个家庭。你们互为对方的家属, 并且该家属关系在本场实验中保持不变。

   You have been matched with one participant from Group 2 (1) to form a family. Your family member stays unchanged through the experiment.

4. 本场实验包括15 轮次。每一轮实验起始, 每名参与者将是一个拥有1个 A 器官和2个 B 器官的虚拟人, 并获得起始收益￥8。

   There are 15 rounds in the experiment. At the beginning of each round, each participant is assigned a virtual life with one A organ and two B organs, and also endowed with 8 yuan.

5. 每一轮实验中, 每个实验组都将有2名参与者失去 A 器官和6 名参与者失去 B 器官(同时失去两个 B 器官)。失去 A 器官的参与者将不能在本轮中获得额外收益; 失去 B 器官的参与者可等待接受同组参与者捐献的一个 B 器官。获得捐赠的实验参与者, 可在本轮获得额外收益￥8。

   Every round, two participants will be randomly assigned with A-organ failure, while the remaining six will have B-organ failure. Participant with A-organ failure can not earn any additional money in that round but can donate his B organs to group members. Participants with B-organ failure can receive one B organ donated by a group member to earn additionally 8 yuan.

6. 每一轮实验起始, 每位实验参与者将选择是否同意注册为器官捐献者。如果参与者不同意注册, 在失去 A 器官时其 B 器官将不会被捐献; 如果参与者同意注册, 将由其家属决定是否完成捐献; 如果家属不同意完成捐献, 该参与者在失去 A 器官时其 B 器官将不会被捐献; 如果家属同意完成捐献, 该参与者在失去 A 器官时, 其两个 B 器官将分别被捐献给同组的两名参与者。

   At the beginning of each round, each participant will be asked to decide whether he want to register as an organ donor. If he chooses not to register as an organ donor, his B organs will not be donated when he has A-organ failure. If he decided to register, it will be up to the decision of his family whether his B organs will be donated when he has A-organ failure. His B organs will only be available to his group members when his family consents to donation.

7. 如果你选择同意注册为器官捐献者并最终由家属完成捐献, 你的家属将在需要接受 B 器官捐献时获得等待排序的优先权, 即你的家属将优先于其他未注册器官捐献者获得 B 器官, 同等优先级别下等待排序则随机生成。

   If you and your family both agree to donate, your family member will receive priority for one B organ when in need of one. Any available B organs will be first distributed randomly among group members with priority. Only when all members with priority have received one B organ, remaining available B organs will then be randomly allocated to those without priority in the group.

8. 完成捐献 B 器官将会为器官捐献者产生￥4 的捐献成本, 但捐献两个 B 器官可分别挽救2名同组实验参与者, 并为他们创造总共￥16 的额外收益。

Donating B organs creates a cost of 4 yuan for each donor but generates a total earning of 16 yuan for the organ recipients.

9. 实验参与者每轮的净收益=3/4*(其在本轮所有收益之和减除其本轮支付的捐献成本)+1/4*(其家属在本轮所有收益之和减除其家属本轮支付的捐献成本)。

   Each round, each participant's net gain is 1/4 (the sum of his earnings minus the potential cost of donation) + 3/4 (the sum of his family's earnings minus the potential cost of donation).

10. 所有轮次结束后, 你将从中随机抽取4 个轮次。你本场实验的最终收入等于4 轮随机抽取轮次收益的总和加出场费￥10。

    At the end of the experiment, four rounds will be randomly selected for payment. Therefore, you should make your decision in each round independently of your choice in other rounds. Your payment will be the sum of earnings from the four randomly selected rounds plus a show-up fee of 10 yuan.

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