Responsiveness to Incentives in Organ Donation Decisions: A Laboratory Experiment

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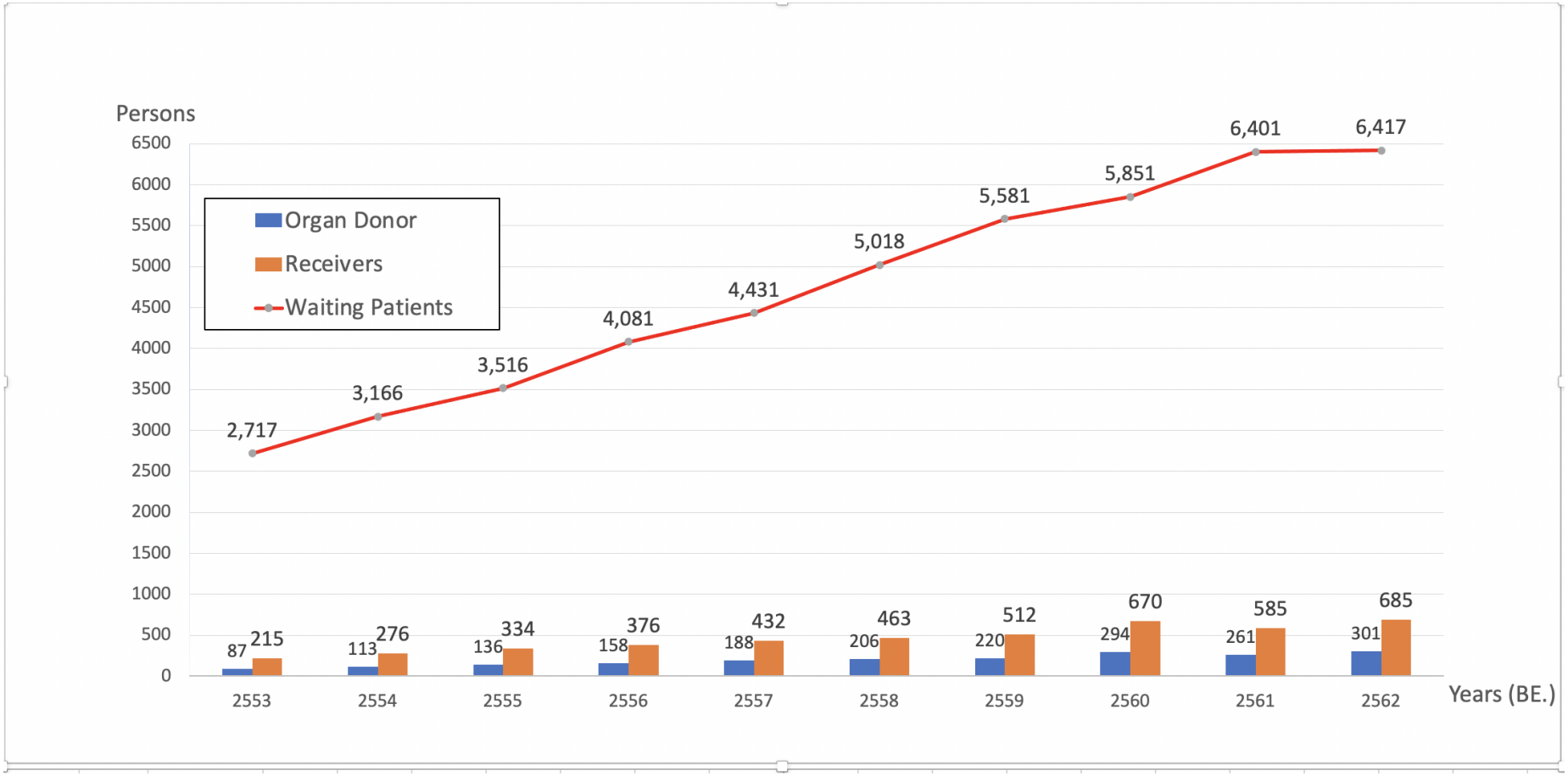
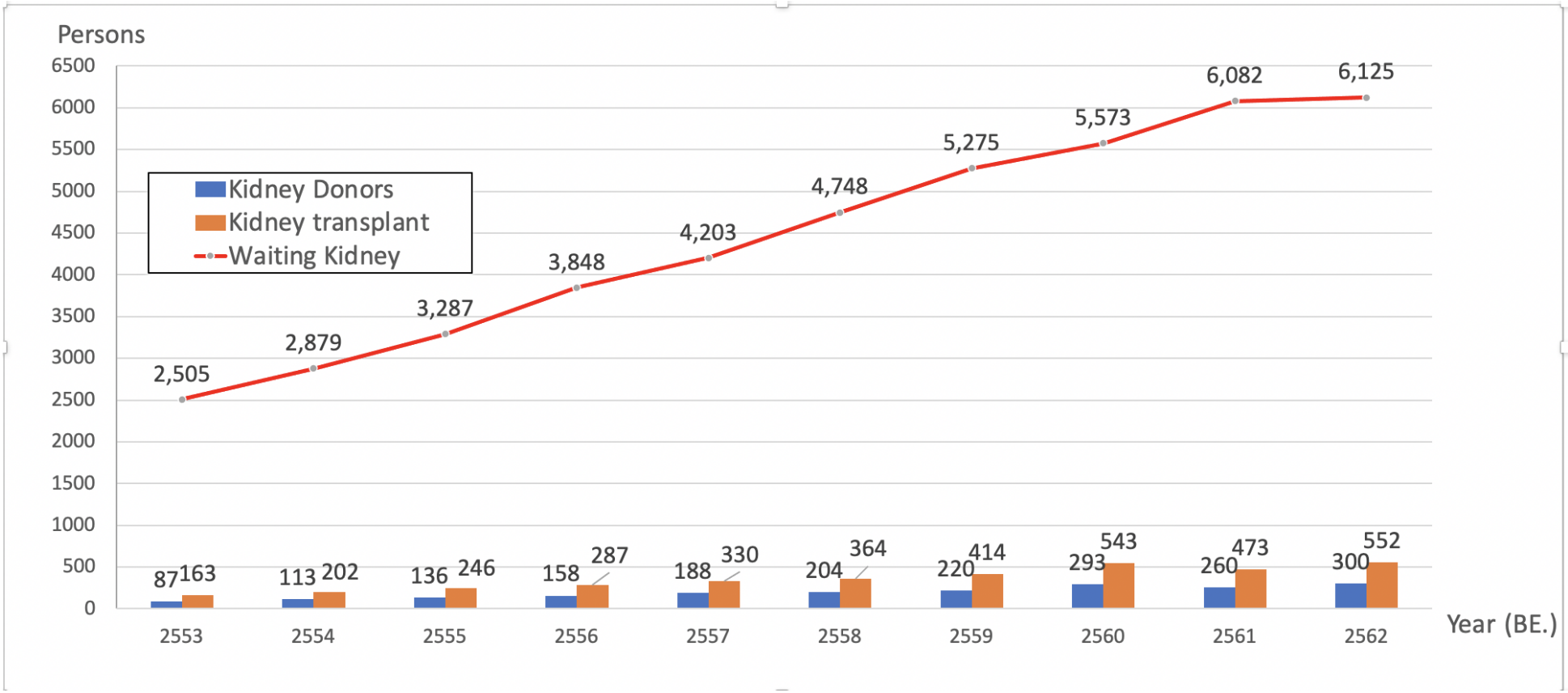
Motivations I.

Figure 1: Organ donors, receivers and waiting patients



Motivations II.

Figure 2: Kidney donors, receivers and waiting patients



Research question.

- How to fill the gap between demand (waiting patients) and supply (organ donors)?
- Unfortunately, the price mechanism cannot be applied because of moral and law.
- We focus on the role of organ allocation rules
  - first come, first served rule: current status quo.
  - rebate rule: receive cash benefit such as tax deduction.
  - priority rule: donors have priority, when they need organs.

The organ donation system.

- Opt-in and Opt-out (presumed consent)

Table 1: The examples of opt-in and opt-out countries

Opt-in	Opt-out
Australia	Argentina
Brazil	Austria
German	Belgium
Japan	Italy
Thailand	Spain
England	Sweden
USA.	Singapore

Living and deceased donors.

- Living donor
  - a donor who donates a part of organ and still live after giving.
- Deceased donor
  - a brain death donor who has died before donating.
  - By law, the definition of death is brain death.
- Because deceased donor can give more organs than living donor does, this paper will focus on deceased donor.

Supply of organ in practice.

- In October 2020, there are 91,568 registered donors. It is approximately 1.2 % of Thai population. In reality, the donors do not register as a registered donor.
- Most of the supply of organs depends on officers' asking and next of kin's consenting. At the time of death, nurses enquire from the next of kin to consent the patient in becoming a deceased donor.
- Therefore, raising the number of registered donors is a way to increase supply of organ and reduce waiting time.

Literature reviews I.

- Mechanism design and allocation rule.
  - The seminal papers in organ allocation are Roth et. al (2004) and Roth et. al (2005*a* and 2005*b*) in which they propose and characterize the *"W-chain algorithm"* in matching patients and donors.
  - Kessler and Roth (2012) find that the rule is very important when subjects decide to donate. Furthermore, they propose a simple model to explain donors' behavior, which is influenced by donation cost.
  - This paper is close to Kessler and Roth (2012); however, we focus on the risk of organ compatibility in our experiment.

Literature reviews II.

- Allocation rule.
  - Li et. al (2013) extend the role of priority to opt in and opt out system and the result is consistent with Kessler and Roth (2012); however, they find that the most effective rule to induce subject is the priority rule combined with the opt out system.
  - Kessler and Roth (2014*b*) ask what if there is loophole in the system. If subjects know that it is possible to cheat, subjects incline to do so and the real donation is much lower than first come, first served treatment.

Literature reviews III.

- Default option.
  - Shepherd et. al (2014) and Johnson and Goldstein (2004) show that when a subject is asked to be a donor in the opt out environment, they are more likely to donate more than when they are in the opt in system.
  - Kessler and Roth (2014*a*) propose the "mandated question" to increase the donation rate. People are more likely to check 'yes' box when there is 'no' box in frame.

Setup I.

- 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 an experiment, a subject was informed that she had 2 goods, 1 piece of A (represent the brain), and 2 pieces of B (represent the kidneys).
- Before each round started, subjects decided whether she would register to donate kidneys. After deciding, there were 10 periods in which
  - the probability of brain death was 10%
  - the chance of kidney failure was 20%.

Setup II.

- If the brain had died, that round was terminated.
- If the kidneys had failed, the subject could wait for 5 periods.
  - If she receives the kidney, she remained alive.
  - Otherwise, she died and the round ended.

Setup III.

- Receiving the kidney depended on both the organ compatibility and the kidney allocation rule.
- The subject is still alive if her brain is good and she has at least one piece of kidney.
- She receives an increment of 20 Baht in every round that she lives. The payoff stopped if she died or were in waiting periods.
- In being a donor, subject paid 10 Baht. This monetary cost represents the cost of registration and psychological cost.

Type of subjects.

- In each group, we categorized subjects into 2 types,
  - For subjects of type X, they could match with any organ regardless of type of donor. (100% compatibility)
  - However, subjects of type Y could only be matched with type Y donor. (50% compatibility)

Allocation rule I.

- First come, first served treatment: the longest waiting subject received the organ, given that her type aligned with the organ donated.
- Priority treatment: we made 2 waiting lists, one for donors and another for non-donors. The matching started from the donor waiting list and then non-donor list.
- Rebate treatment: the donors are rewarded at the end of experiment.

Allocation rule II.

Table 2: The number of groups in each treatment.

round 1 – 15	rounds 16 – 30			
		control	priority	rebate
	control	3	3	3
	priority	3	–	–
	rebate	3	–	–

- To assure that the benefit of rebate exactly equal to the benefit from priority, the rebate scheme was calculated from the average of payoff from $100,000$ simulations in priority treatment, when other donors were $0, 1, \ldots, 11$, respective

Table 3: Rebate scheme

Number of other donors	Rebate	
	Type X	Type Y
0	0	0
1	1.37	0.96
2	2.49	1.3
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

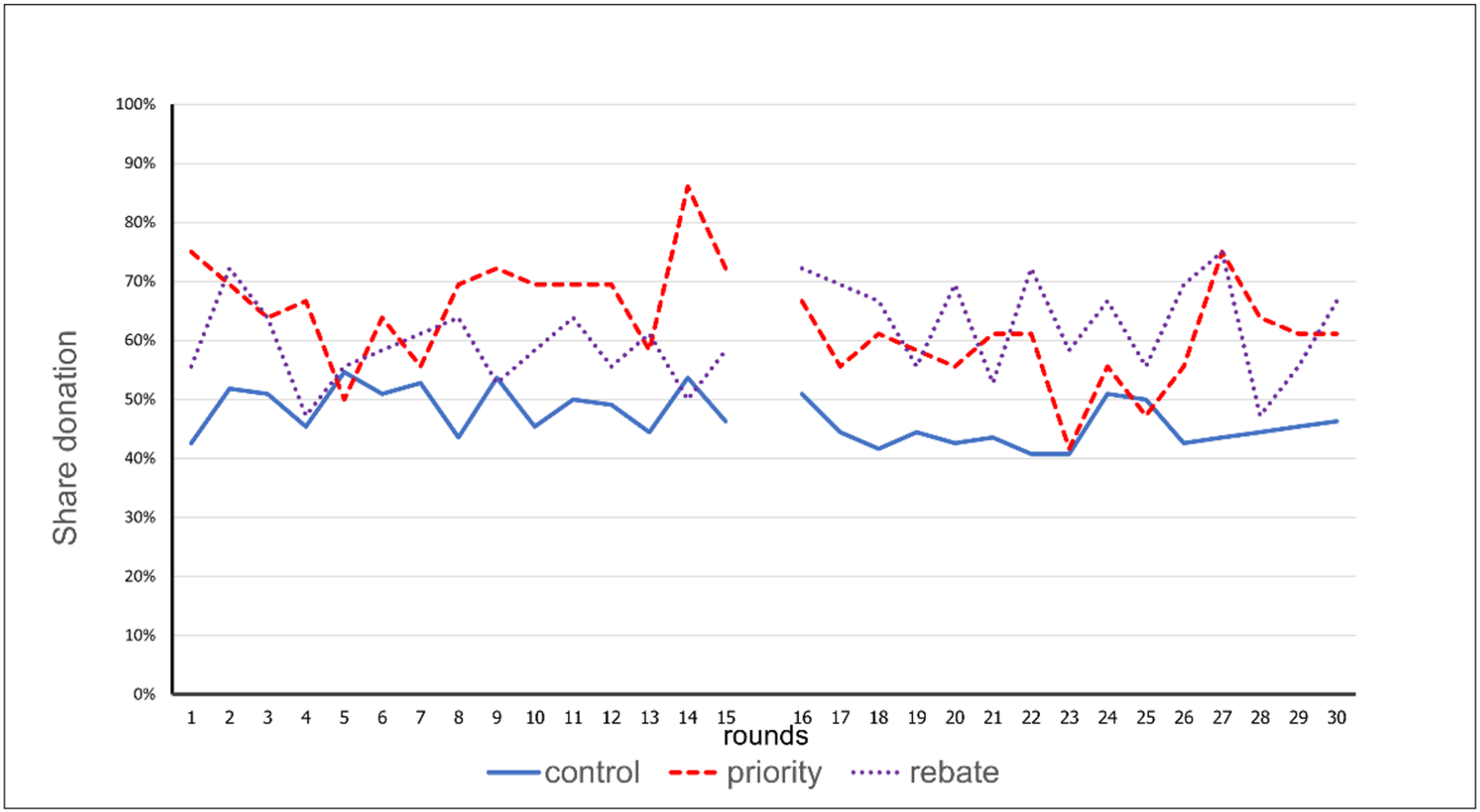
Basic results.

- We recruited 180 subjects to participate in the experiment and all are Bachelor degree students of Prince of Songkla University.

Table 4: The average percentage of donation.

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

Figure 3: Donation round by round.



Pooled OLS

- Although the data is panel data, we apply pooled OLS regression.
- The panel model is

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

- By experimental design, we exclude subjects' background which is a key factor of individual heterogeneity. Then,

$$E(x'_{it}u_{it}) = 0$$
$$E(x'_{it}c_i = 0$$

- We therefore treat $v_{it} = c_i + u_{it}$ as an error term and the estimated value of pooled OLS regression is consistent.

Figure 4: Marginal effect of Probit model.

	regression 1	regression 2	regression 3	regression 4
priority	0.158	0.158	0.227	
	(0.027)***	(0.038)***	(0.045)***	
rebate	0.138	0.093	0.08	0.027
	(0.028)***	(0.046)**	(0.048)*	(0.051)
second half		-0.041	-0.041	-0.087
		(0.03)	(0.03)	(0.029)***
second half*priority		-0.049	-0.049	
		(0.065)	(0.065)	
second half* rebate		0.091	0.090	0.132
		(0.074)	(0.073)	(0.071)*
type			0.086	0.057
			(0.038)**	(0.035)

Figure 5: Marginal effect of Probit model (cont.)

	regression 1	regression 2	regression 3	regression 4
type*priority			-0.103	
			(0.053)*	
type*rebate			0.028	0.042
			(0.056)	(0.058)
earning last round				0.021
				(0.000)**
received an organ				0.039
last round				0.018)**
N	5400	5400	5400	5,220
Wald Chi 2	49.93	52.68	65.61	42.17
Psuedo R2	0.016	0.019	0.023	0.0173

Regression 1

- Registering organ donation is a public goods in first come, first served rule. By contrast, registering is club goods in priority allocation rule
- Furthermore, we find that the difference in probability of donation between priority and rebate rule is significant statistically. Our interpretation is that donors have more information about others' donation in priority rule than in rebate rule.
- This result implies that a subject donates when she knows that other subjects donate. It is consistent to the "conditional cooperation"

Regression 2

- Regression 2 additionally controls the effect of rounds $1-15$ and $16-30$.
- However, all coefficients are not significant. It means that sequence of playing does not affect donation probability.
- This result is not consistent to the literature such as Kesler and Roth (2012), Li et.al (2013)

Regression 3

- In regression 3, subjects who have 100% organ compatibility are 8.6% more likely to donate than subjects who have 50% compatibility.

- However, the coefficient of interaction term between type and priority is negative significantly. It turns out that subjects who have 100% compatibility donate lower in priority rule.

Regression 4

- In regression 4, we add earning last round and received an organ last round variables.
- The coefficient of *earning last round* and *received an organ last round* variable is positive and significant.
- This result confirms *"conditional cooperation"* behavior of donors.

Conclusion

- Our results show that the organ allocation rule plays a key role when subjects decide to donate organs.

- However, organ compatibility factors such as blood type is crucial. Subjects who can easily match to organs are more likely to donate. This result implies that the success of priority rule depends on the size of organ pool.

Alternative policy.

- Default option.
  - Johnson and Goldstein (2003) find that European countries that have opt-out systems have vastly higher donor registration rates than the European countries that have opt-in systems.
  - However, only Spain has a higher per capita organ recovery rate than the U.S.. High recovery rate is due to a more efficient organization of transplant services (Deffains and Ythier 2010)