Eliciting Preferences over Life and Death: Experimental Evidence from Organ Transplantation

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Abstract

Optimal allocation of life-saving medical treatment depends on society's preferences over distributions of survival times. I experimentally elicit preferences over survival time bundles in incentivized, life-or-death decisions by having participants allocate a real organ transplant among cats with kidney failure. Using the allocation choices in the experiment, I estimate participants' indifference curves. Most participants value both total survival time and equality of survival times; few prefer to save the shortest-lived patient at all costs, despite the prevalence of this approach in allocating human transplants in practice. Aversion to monetary inequality strongly predicts aversion to survival inequality.

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1 Introduction

The number of patients in need of an organ transplant in the US far exceeds the supply of deceased donor organs. In 2021, over 11,000 patients died waiting for an organ or became too sick to transplant; only about 41,000 transplants were performed while over 105,000 patients remain on the waitlist (OPTN, 2022). Organ transplantation relies on the availability of donor organs, a scarce medical resource; deciding which patients should receive the limited supply of organ transplants is a key policy issue. Should we prioritize transplant patients according to medical urgency, survival benefit, or time spent on the waitlist? We face similar concerns when allocating other scarce medical resources, such as ventilators, hospital beds, and medical expertise in times of crisis. Optimal allocation fundamentally depends on society's preferences over patients' survival times — that is, preferences over the bundles of survival times that are achievable with the resources available.

In practice, regulatory bodies determine allocation rules for many medical resources, such as human organ transplants. By providing transplants for some patients and not others, these allocation rules imply a set of preferences over bundles of survival times for potential transplant recipients. For example, liver transplants in the US are allocated primarily according to medical urgency, without taking into account expected survival benefit.[1] Since preferences for high-quality organs are largely shared across patients, this system benefits the sickest patients at the expense of healthier patients who may benefit more from high-quality organs (Schaubel et al., 2008; Croome et al., 2012; Bittermann and Goldberg, 2018). This particular allocation system implies that the regulatory body prefers to prevent the immediate death of the sickest patients rather than transplant healthier patients with a greater survival benefit.

Do these allocation rules reflect society's preferences more broadly? Research has shown that opinions of regulators and ethical experts often differ drastically from those of laypeople (Stüber, 2021), are subject to various judg-

[1] In addition to medical urgency as determined by the Model for End-Stage Liver Disease (MELD) score, the liver priority system also favors pediatric patients and those living nearby.

ment biases (Tobia et al., 2013; Schwitzgebel and Cushman, 2015; Horvath and Wiegmann, 2021), and are influenced by policy-irrelevant factors (Washington, 2008). In a series of cross-country surveys, Roth and Wang (2020) show that public opinion is a poor predictor for the regulations in controversial markets such as prostitution, surrogacy, and global kidney exchange. Though the market for organ transplants is administered on behalf of the government and relies on organs donated by the public, the hypothesis that regulatory bodies' rules do not match the social welfare function is supported by the variety of rules implemented for organ allocation. Deceased donor livers, kidneys, lungs, and hearts are each allocated using different rules, and the rules change frequently in response to technological change, regulatory change, and legal challenges. Further, rules vary widely between countries.[2] Which (if any) of these rules reflect society's preferences is largely unknown.

One obstacle in assessing whether these rules accord with society's preferences is measuring individuals' preferences over survival times. How could we elicit such preferences? An ideal experiment would elicit choices between real bundles of survival times, then actually deliver the preferred bundle by manipulating survival times; however, ethical and legal concerns make this incentivized experiment all but impossible. Economists often rely on hypothetical scenarios and unincentivized surveys to study preferences when stakes are high or controversial. However, hypothetical decisions can be unreliable in a variety of settings (see, for example, FeldmanHall et al. (2012); Grewenig et al. (2020); Trautmann and van de Kuilen (2015); Schlag et al. (2015); Vossler et al. (2012)).[3] Without empirical evidence comparing hypothetical and incentivized choices in life-and-death scenarios, we do not have the data to assess whether hypothetical decisionmaking is a reliable measure of underlying pref-

[2]For example, in the US, organ procurement organizations often require patients with alcoholic liver disease to demonstrate six months of sobriety before becoming eligible for a transplant. In the UK, no period of sobriety is required (Neuberger, 2016).

[3]Hypothetical responses are still predictive of incentivized decisionmaking in many contexts. The reliability of hypothetical decisionmaking depends on the experimental context, survey design, and individuals' strategic concerns (Carson and Groves, 2007). In some contexts, incentivized experiments largely confirm the findings of hypothetical surveys (see, for example, Elías et al. (2019) in the context of paid organ donation).

erences.

In this paper, I use a novel experiment to compare choices in life-and-death decisions with and without incentives. I elicit preferences over survival time distributions for patients with organ failure, a life-threatening disease that can be treated with an organ transplant. Legal and ethical constraints prevent allocating a human organ transplant to incentivize participants' decisions.[4] However, humans are not the only species to suffer from organ failure. Indeed, some veterinary transplant centers in the US regularly treat kidney failure in cats with a kidney transplant. To incentivize decisions in the experiment, one randomly selected participant allocates transplant funding for a real feline patient with kidney failure. Veterinary partners identify potential transplant recipients who are unlikely to receive a transplant without financial support, and the participant allocates $12,000 to the Small Animal Medicine and Surgery group at the University of Georgia College of Veterinary Medicine for kidney transplant surgery for the selected patient.[5] Participants also make hypothetical decisions on how they would allocate a transplant among human recipients and among feline recipients. This approach allows me to compare elicited preferences over life-and-death decisions, with and without incentives.[6]

In two experiments — a within-subject experiment with 311 participants and a hybrid between-subject experiment with 988 participants — I elicit preferences for allocating a transplant in two types of questions: *survival price lists*, in which the participant chooses transplant recipients from a series of patient profiles, and *rule-based* allocations, in which participants choose guiding

[4]The National Organ Transplant Act of 1984 regulates the use of human organs, outlawing the sale of organs in exchange for valuable consideration and establishing a legal framework for the allocation of deceased donor organs.

[5]The random dictatorship design avoids strategic incentives for misreporting. See Section 2 for a further discussion of the market for feline kidney transplants and related costs, Section 4.3 for details on the incentive structure, and Appendix A for ethical considerations in the design.

[6]I use the term *incentivized* to mean that participants' reports could impact real organ allocations, even though every decision does not result in a transplant. Previous research has shown that paying out incentives for a subset of decisions or individuals is as effective as paying all decisions (Charness et al., 2016). Other researchers prefer the term *consequential*. As Harrison and List (2004) point out, high-stakes incentives may improve the realism and reliability of an experiment.

principles to select a patient on their behalf. The survival price lists — the primary measure of interest — are designed to identify indifference curves over survival times, and allow participants to express a wide range of preferences. In particular, questions are designed to identify participants' competing desires to increase total survival time in a patient population, and to decrease survival time inequality. While this allows for rich preference elicitation, these questions require exactly one patient to be selected in every comparison — participants cannot express indifferences or signal a desire to randomize between patients, and they cannot opt to withhold the transplant from both patients.

The rule-based allocations help address these constraints and assess participants' attitudes toward commonly used transplant allocation systems. Participants choose between five rules, each targeting a different objective: *(i)* to maximize the minimum survival time (i.e., transplant the sickest patient); *(ii)* to maximize total survival time (i.e., transplant the patient who will receive the largest increase in survival time); *(iii)* to maximize the amount of time the organ is used (i.e., transplant the patient who will live the longest after surgery, regardless of the benefit caused by the transplant); *(iv)* to give all candidates an equal chance (i.e., select a recipient at random); and *(v)* to provide no transplant.[7] Each rule represents a different view of fairness and efficiency, and resembles a possible allocation system. For example, by prioritizing medical urgency, liver transplants in the US extend the minimum survival time in the patient pool. Kidney transplants, on the other hand, give higher priority to patients with a larger estimated survival benefit, suggesting a preference maximizing total survival time. Rule selections allow us to validate — and examine the principles underlying — choices in the survival price lists.[8]

[7]Note that the patient with the longest post-transplant survival time does not necessarily gain the most from transplant. If the patient would survive even in the absence of a transplant, the post-transplant survival time might be long while the benefit from transplant (i.e., the difference between survival with transplant and survival without transplant) might be small. In this case, rules *(ii)* and *(iii)* would recommend different allocations.

[8]Rather than mimic the policy context directly, the experiment seeks to identify the underlying parameters that inform preferences over policies. In the policy setting, organ transplants become available over time, and patients may have multiple opportunities to

The experiment identifies three primary results. First, I find that choices are highly consistent across incentivized and unincentivized conditions, suggesting that hypothetical responses are reliable indicators of preferences in this context. Thus, the findings are not restricted to preferences about feline transplants: instead, the experiment provides novel data supporting the use of hypothetical choices to study the allocation of human transplants.

Second, most participants have a moderate aversion to inequality. I find little support for prioritizing the sickest patients at the expense of patients with greater survival benefit, despite the frequent use of this rule in deceased donor organ markets. Very few participants (3.9% in the incentivized cat treatment) allocate the organ to the patient who would die first without the transplant, regardless of the potential survival gains for the other patient. Most participants (80.4% in the incentivized cat treatment) respond to increases in total survival when the gains are large enough, even if those gains accrue to the longer-lived patient. However, most participants do value both total survival time and equality; on average, participants allocating a real feline transplant are willing to give up 6.1% of total survival time to shift from a very unequal survival distribution (where one patient lives twice as long as the other) to equality.

Third, I find that inequality aversion in the domain of money is a strong predictor of how individuals allocate transplants. I elicit preferences for monetary equality by having participants choose between bundles of payments for other participants, making tradeoffs between equality of payments and total payment amounts. The relationship between equality preferences in payments and survival times suggests that an individual's inequality aversion may express itself similarly across domains.[9]

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receive a transplant; in the experiment, participants make one-time allocation decisions and only one transplant is available. These two problems are closely linked: if the outcomes of policies in the dynamic setting can be predicted, selecting an optimal policy is as simple as choosing between survival bundles. I discuss the mapping of the experiment to the policy setting and other generalizability considerations in Section 4.6.

[9]Perhaps surprisingly, I find that the "trolley problem" — a hypothetical moral dilemma frequently used to identify consequence-driven and rule-driven decisionmakers — is a poor predictor of behavior in this setting. This supports recent evidence that our reliance on the

This paper contributes to three bodies of economic research: first, the design of matching markets for organs; second, the economic understanding of fairness and equality; and third, the role of incentives in experimental design.

This paper provides the first experimental, incentivized evidence of preferences toward different transplant allocations, contributing to a growing literature on market design in the allocation of organ transplants. Over the past decade, the non-profit organization tasked by Congress with managing organ allocation in the US has made several changes to the process for determining waitlist priority for deceased donor organs, and has proposed additional changes for the near future. Many of these changes are promoted on the grounds of fairness and efficiency (UNOS, 2020). Researchers have studied how to increase the supply of donor organs, through organ exchange chains (Roth et al., 2005, 2007), donor compensation (Becker and Elías, 2007; Elías et al., 2019), prioritizing registered donors as recipients (Kessler and Roth, 2012), and increasing the use of suboptimal organs (Held et al., 2016; Tullius and Rabb, 2018). Researchers have also developed tools to study and improve the allocation process (Agarwal et al., 2019). Simulations are used to assess patient outcomes under alternative allocation policies (Scientific Registry of Transplant Recipients, 2015a,b, 2019), and methods recently developed by Agarwal et al. (2021) account for changes in patient behavior under alternative allocation systems, mapping allocation systems to the resulting distribution of transplants. Researchers and transplant network administrators have attempted to survey the community (Tong et al., 2010; Oedingen et al., 2019) and incorporate community preferences into the design of the allocation system (Leard et al., 2021). However, eliciting these preferences in a reliable, incentivized way has proved challenging. This paper seeks to do exactly that: eliciting survival preferences in an incentivized experiment in order to select between alternative allocation policies. My results suggest large potential welfare benefits from incorporating recipients' survival benefit in addition to medical urgency when setting allocation rules, increasing patient survival while aligning the allocation system more closely with public preferences.

trolley problem as a moral classification system may be misguided (Bostyn et al., 2018).

I also contribute to a robust literature on social preferences, measuring distributional preferences over survival times and identifying an aversion to survival inequality. Many economists have studied the role of equality and fairness in driving behavior both in the lab and the field (see, among others, Kahneman et al. (1986); Fehr and Schmidt (1999); Andreoni and Miller (2002); Fisman et al. (2007); Cappelen and Tungodden (2019)). Social preferences predict a wide variety of behavior, including donation outside the lab (de Oliveira et al., 2012), political behavior such as attending protests (Cantoni et al., 2022), and effort in the workplace (DellaVigna et al., 2022). Social preferences help determine optimal policies for taxation and redistribution (Kuziemko et al., 2015; Chen et al., 2017), as well as other societal tradeoffs such as between civil liberties and health (Alsan et al., 2023). While economists have studied how individuals value the distributions of wealth, little is known about how individuals evaluate inequality in non-wealth domains. This paper contributes to our understanding of preferences for equality by identifying distributional preferences over survival times and examining the relationship between preferences across domains.

In addition, this paper contributes a new methodology for incentivizing life-or-death decisions. A large body of literature suggests that incentivizing decisions in experiments yields more reliable results than hypothetical decisions (see, for example, Harrison and Rutström (2008); FeldmanHall et al. (2012); Grewenig et al. (2020); Trautmann and van de Kuilen (2015); Schlag et al. (2015); Carson and Groves (2007); Vossler et al. (2012)). Thus, the ability to incentivize ethical dilemmas in high-stakes environments may improve our understanding of ethical decisionmaking. Studies of consumer ethics have incentivized decisions with the use of animal-based products (Boaitey and Minegishi, 2020; Albrecht et al., 2017). My experimental design takes inspiration from Falk and Szech (2013), in which participants can forego payments to save mice from death. The incentive structure (described in Section 4.3) draws on methodology from Kessler et al. (2019) to provide real-stakes incentives to the evaluation of hypothetical scenarios. My experiment shows no significant differences in responses to incentivized and hypothetical questions, indicating that studying preferences in this context may not require expensive, high-stakes incentive schemes.

Section 2 describes institutional details around feline kidney transplantation in the US. Section 3 introduces a conceptual framework; Section 4 describes the within-subject experimental design; and Section 5 presents the results. Section 6 describes a between-subject experiment addressing issues raised by the within-subject experiment. Section 8 concludes.

2 Institutional Details

A shortage of organs for transplant has forced policymakers into difficult decisions prioritizing some patients over others. The vast majority of human organs for transplant come from deceased donors, which are allocated to patients following waitlist system with priorities.[10] Priority rules differ by organ, but may consider various characteristics of the recipient and the donor-recipient match, such as the recipient's medical necessity, geographic proximity to the donor organ, expected benefit from transplant, and time spent on the waitlist. When an organ becomes available for transplant, it is offered to patients in priority order. With advice from their transplant surgeon, each patient decides whether to accept or refuse the organ. If the patient refuses, the patient remains on the waitlist and the organ is offered to the next-highest-priority recipient.

Feline kidney transplantation is a useful context for studying preferences over organ allocations in part due to key similarities with human liver transplantation. Dialysis is generally not available as a long-term treatment for feline kidney failure, and there is no equivalent of dialysis to replace the function of a failing human liver. As such, transplantation is the only available treatment, and failure to receive a transplant generally leads to death.[11]

[10]Living donors contribute about one third of transplanted kidneys and about 5% of transplanted livers. Heart and lung transplants are performed only with deceased donor organs. Living donor organs are do not follow the same priority waitlist process as deceased donor organs.

[11]Some cases of acute kidney failure in cats can be treated with short-term dialysis which

Kidney disease is one of the most common causes of death in cats (O'Neill et al., 2015), and kidney transplantation is one of the few transplants commonly performed for treatment of animal diseases.[12] Only three veterinary transplant centers in the US — the University of Pennsylvania, the University of Georgia, and the University of Wisconsin — perform feline kidney transplants.

As in humans, many cats do not receive the life-saving transplant they need due to scarcity of resources. However, cat organ transplants are generally limited by cost rather than the availability of organs. The typical costs of feline kidney transplantation surgery range from \$12,000–\$18,000, with additional costs for post-transplant treatment and immunosuppression. Immunosuppressive drugs typically cost \$500–\$1,500 annually (University of Wisconsin–Madison School of Veterinary Medicine, 2012). As described in Section 4, the experimental incentives allocate a \$12,000 payment toward a transplant for one cat. After transplant, the owner of the transplant recipient is responsible for any follow-up treatments and immunosuppressive drugs.

Transplant centers recruit living feline kidney donors from local animal shelters. Cats can survive and live a normal life with one functioning kidney (as can humans). Donors, typically young and healthy, donate one kidney to the recipient. Following surgery, the donor cat is adopted by the recipient's owner and provided with a home. In practice, this means that — unlike with human kidney transplantation — there is no shortage of feline donor kidneys.[13] The transplant thus saves two lives: that of the sick cat, and that of the donor by providing a permanent home (Yeates, 2014).

may allow the kidneys to recover.

[12]Transplants are not commonly used to treat kidney failure in dogs, in part because the genetic diversity in the species increases the risk of rejection. Interestingly, it was dogs who played the pivotal role as test subjects for the pioneer surgeons experimenting in transplantation in the early and mid-20th century (Mezrich, 2019).

[13]See Appendix A for a discussion of ethical considerations in the design of this study.

3 Conceptual Framework

In this section, I introduce a conceptual framework for identifying participants' preferences over organ allocations. An agent is tasked with allocating an organ transplant to one of two patients, A and B. Denote with x_A the survival time of Patient A, and x_B the survival time of Patient B. The agent derives utility $u(x_A, x_B)$ from the patients' survival times.

Suppose that we know all survival times with certainty. If Patient A receives the transplant, she will survive for a period of x_A^{with}; without the transplant, she will survive for a period of $x_A^{without}$. Thus, with one available transplant, the agent the agent simply compares the utilities $u\left(x_A^{with}, x_B^{without}\right)$ and $u\left(x_A^{without}, x_B^{with}\right)$ and selects the bundle with higher utility.

Since each comparison involves a discrete allocation, we elicit a series of comparisons to map out participants' indifference curves. In particular, we fix three of the four pertinent survival times: x_A^{with}, $x_A^{without}$, and $x_B^{without}$ in each question, and we find the value of x_B^{with} where the participant is indifferent between transplanting Patient A and Patient B. By eliciting survival bundles of equal utility to the agent (and adding parametric assumptions described in Section 5.1), we can identify indifference curve passing through those two points. A schematic of this identification strategy is shown in Figure 1.

This simple model assumes that each agent derives utility from the amount of time that others survive, and ignores potentially complex interactions with other sources of utility, such as the agent's own survival time.[14]

[14] The bundles presented do not include the agent's own survival time. An agent's willingness to give up her own survival for the benefit of others is an interesting line of inquiry, but not as useful for the design of organ allocation systems since most people will not be candidates for organ transplant. There is an analogous distinction in the literature on aversion to inequality of money (see, for instance, Fisman et al. (2007)).

Figure 1: Sample Indifference Curve Estimation

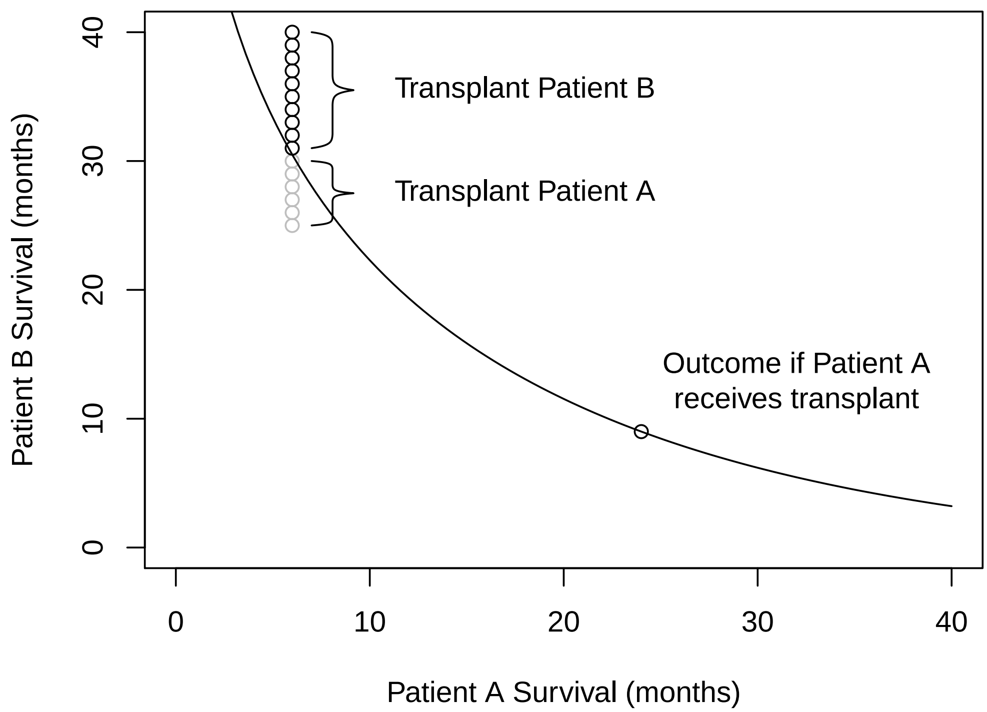


Figure shows the conceptual framework for identifying indifference curves from a series of binary allocation decisions. In this example, Patient A survives for 6 months without transplant and 24 months with transplant; Patient B survives 9 months without transplant. Each decision compares the point $(24, 9)$ — representing the survival times of Patients A and B when the transplant is provided to Patient A — against $(6, x)$, where x varies with possible survival times of Patient B with a transplant. The indifference curve passes through the initial comparison point $(24, 9)$ and the switching point, where the agent switches from transplanting Patient A to transplanting Patient B. Points below the indifference curve (shown in gray) are possible survival bundles if Patient B received the transplant; these points are revealed to be less desirable than transplanting Patient A. The indifference curve shown here assumes constant elasticity of substitution.

4 Within-Subject Experimental Design

I recruit 311 participants on Amazon's Mechanical Turk to complete a 20–30 minute research survey. Participants are paid $5 for completing the survey, and have the opportunity to earn bonus payments based on their decisions and the choices of other participants. In addition, participants are told that their choices may be used to allocate $12,000 toward a kidney transplant for one feline patient with kidney failure.

The structure of the experiment is as follows:

1. Consent
2. Risk & Time Preference Elicitation — 9 multiple price lists
3. Survival Tradeoff Elicitation
   (a) Unincentivized Cat — 4 survival price lists
   (b) Unincentivized Human — 4 survival price lists
   (c) Incentivized Cat — 4 survival price lists
4. Rule-Based Allocations
   (a) Unincentivized Cat Rules
   (b) Unincentivized Human Rules
   (c) Incentivized Cat Rules
5. Monetary Payments to Others
6. Hypothetical Ethical Dilemma
7. Demographics

All participants progress through sections of the experiment in the same order. Since survival is a risky payout over time, I first elicit time and risk preferences through nine multiple price lists (see Appendix Figures B.3 and B.4). Participants then progress to organ allocation decisions, beginning with a series of *survival tradeoff elicitations*.[15] These choices (described in detail in Section 4.1) identify participants' willingness to trade off the short-term survival of the shorter-lived patient for the long-term survival of a longer-lived patient. Next, participants make *rule-based* allocations (described in Section 4.2), where they rank a set of rules for allocating organs. All transplant allocation choices include both incentivized and unincentivized questions (incentives described in Section 4.3). After completing the transplant decisions, participants make a series of incentivized, low-stakes decisions over payments to other study participants (described in Section 4.4). Finally, a brief exit survey collects information on ethical and political views and demographics.

4.1 Survival Tradeoff Elicitations

I elicit participants' willingness to trade off between the survival of shorter-lived and longer-lived patients using four "survival price lists," as in Figure 2.

Each row of the list represents a different pair of patients, and each patient has two projected survival times: survival without transplant and survival with transplant. In each row, the participant selects one patient to receive the transplant. Patient B's post-transplant survival time increases in each row, while all other survival times (Patient A's survival with and without transplant, and Patient B's survival without transplant) remain fixed. As Patient B's post-transplant survival time increases, participants select the point at which they would switch from allocating the transplant to Patient A to allocating the transplant to Patient B. Participants may also select Patient A or Patient B in every row without switching.

The switching point design allows me to elicit preferences over a large number of survival distributions with only a small amount of effort on the part of the participant. However, this also constrains the expression of certain types of preferences. In particular, participants are required to select exactly one recipient in each row, restricting participants' ability to express indifferences

[15] Participants are given a brief description of human and feline organ transplantation in the US. No information is provided about human and feline donors.

between patients, a distaste for transplantation, or complex preferences with multiple switching points.[16] In addition, previous researchers have raised concerns about inconsistent responses in multiple price list-style experiments (see, for example, Csermely and Rabas (2016) and Engel and Kirchkamp (2019)). The rule-based allocations described in the next section address these concerns by providing insight into the principles guiding participants' allocation decisions.

Survival times in the four questions were designed to distinguish between preferences for total survival and survival equality, while remaining within the realistic range of survival times for feline organ transplant candidates. Each allocation rule described below is consistent with a unique set of switching points in the four questions, allowing me to identify the rules that are most consistent with participant behavior. Parameter values in the four survival price lists are shown in Panel A of Appendix Table B.1.[17]

Participants make survival price list selections for hypothetical feline, hypothetical human, and real feline patients. Hypothetical questions precede incentivized questions to limit order effects, since high-stakes questions are more likely to trigger careful consideration.[18] To avoid conflating preferences over survival with preferences over non-survival characteristics (such as age), I limit eligibility to adult patients and provide no additional information about patients beyond survival times. In particular, participants are instructed to assume that all patients are adults (human patients are at least 18 years old, and feline patients are at least 18 months old); that we know survival times with and without the transplant with certainty; that survival times represent periods of good quality of life; and that no patient will have another opportu-

[16]For example, participants with a strong taste for equality may prefer to forego a transplant that increases inequality. Fisman et al. (2007) allow this kind of poorly behaved utility function in monetary payments by permitting free disposal in allocation decisions. The results in Section 5 indicate that this isn't a major issue; very few participants prefer to prevent transplants or to randomize between patients.

[17]As a check on participant comprehension, each question offers a weakly dominated transplant option, sometimes with no survival benefit to the recipient. The weakly dominated options are still consistent with maximizing the use of the transplanted organ; however, the non-dominated option would achieve the same use of the organ in all cases.

[18]Section 6 discusses a between-subject experiment eliminating order effects.

Figure 2: Sample Decision Table

PATIENT A		PATIENT B
NO TRANSPLANT: 6 MONTHS **TRANSPLANT: 24 MONTHS**	OR	**NO TRANSPLANT: 9 MONTHS** TRANSPLANT: 24 MONTHS
NO TRANSPLANT: 6 MONTHS **TRANSPLANT: 24 MONTHS**	OR	**NO TRANSPLANT: 9 MONTHS** TRANSPLANT: 25 MONTHS
NO TRANSPLANT: 6 MONTHS **TRANSPLANT: 24 MONTHS**	OR	**NO TRANSPLANT: 9 MONTHS** TRANSPLANT: 26 MONTHS
NO TRANSPLANT: 6 MONTHS **TRANSPLANT: 24 MONTHS**	OR	**NO TRANSPLANT: 9 MONTHS** TRANSPLANT: 27 MONTHS
NO TRANSPLANT: 6 MONTHS TRANSPLANT: 24 MONTHS	OR	NO TRANSPLANT: 9 MONTHS **TRANSPLANT: 28 MONTHS**
NO TRANSPLANT: 6 MONTHS TRANSPLANT: 24 MONTHS	OR	NO TRANSPLANT: 9 MONTHS **TRANSPLANT: 29 MONTHS**
	...	
NO TRANSPLANT: 6 MONTHS TRANSPLANT: 24 MONTHS	OR	NO TRANSPLANT: 9 MONTHS **TRANSPLANT: 44 MONTHS**
NO TRANSPLANT: 6 MONTHS TRANSPLANT: 24 MONTHS	OR	NO TRANSPLANT: 9 MONTHS **TRANSPLANT: 45 MONTHS**
NO TRANSPLANT: 6 MONTHS TRANSPLANT: 24 MONTHS	OR	NO TRANSPLANT: 9 MONTHS **TRANSPLANT: 46 MONTHS**
NO TRANSPLANT: 6 MONTHS TRANSPLANT: 24 MONTHS	OR	NO TRANSPLANT: 9 MONTHS **TRANSPLANT: 47 MONTHS**
NO TRANSPLANT: 6 MONTHS TRANSPLANT: 24 MONTHS	OR	NO TRANSPLANT: 9 MONTHS **TRANSPLANT: 48 MONTHS**

A sample survival price list with a response selected. Each row represents a pair of patients. Patient A's survival times and Patient B's survival time without transplant remain constant in each row; Patient B's survival time with transplant increases by one month in each row. Highlighted cells indicate the patient who would receive the transplant in that row based on the participant's decisions. Bolded text in each cell indicates the patient's survival time under the selected allocation scheme. Ellipsis indicates omitted rows.

nity for a transplant. These assumptions help to identify preferences over final distributions of survival times rather than other factors such as beliefs, risk preferences, and other patient or owner characteristics. While the market for deceased donor human organs involves uncertainty over the future availability of deceased donor organs, the experiment abstracts away from this uncertainty in order to measure preferences over the final distribution of survival times.[19]

4.2 Rule-Based Transplant Allocations

In *rule-based* questions, participants rank five rules for allocating organs between two patients:

1. **No Transplant:** Perform no transplant
2. **Maximize the Increase in Survival Time:** Consider how much longer each patient will live with the transplant than without the transplant and give the transplant to the patient whose life will be extended more
3. **Maximize Use of the Organ:** Give the transplant to the patient who will live the longest with the transplant
4. **Maximize the Minimum Survival Time:** Give the transplant to the patient who will die first without the transplant
5. **Select Patient at Random:** Give each patient a 50% chance of receiving the transplant

Participants first rank rules in unincentivized questions for feline and human patients, then in an incentivized question for allocating a transplant between two cats. These rules represent simple, commonly used priority rules

[19]Specifically, the experiment does not elicit participants' preferences over allocation *systems*, but over the final distribution of a limited supply of organs. In addition to eliminating uncertainty, this also abstracts away from preferences over the allocation process itself, such as a desire for procedural fairness. See Section 4.6 for a more detailed discussion of the mapping between the experiment and the policy context.

for organ allocations, and are based on previous work identifying factors that drive community preferences for organ transplantation (Tong et al., 2010). For example, deceased donor livers in the US are allocated primarily by the patient's expected survival time without transplant, akin to a rule that maximizes minimum survival time. The allocation of deceased donor kidneys, on the other hand, takes expected survival benefit into account, suggesting a desire to maximize the increase in survival caused by the transplant. Note that with one organ transplant for two patients, maximizing the increase in survival is equivalent to maximizing total survival time. The selected rules can be used for both feline and human patients, allowing us to compare preferences across patient species. Of course, there are many other possible allocation rules; this list was selected to speak to the types of efficiency and fairness often addressed in the economics literature, and to reflect a simplified version of rules currently used for organ allocation.[20] The rules identify participants' main criterion for allocation, and identify participants who object to organ transplantation.[21]

4.3 Incentivizing Organ Transplant Allocations

The core of the experiment lies in incentivizing participant responses in life-and-death decisions. Participants are instructed that one randomly selected participant's responses will be used to allocate money for a real kidney transplant for a cat suffering from kidney failure. After the conclusion of the experiment, $12,000 was paid to the University of Georgia College of Veterinary Medicine for the costs of one transplant surgery under the direction of Dr. Chad Schmiedt of the Small Animal Medicine & Surgery group, who also

[20] We restrict our analysis to rules based on patient survival times. Other rules may take account of additional patient characteristics, such as time spent waiting for a transplant, or even the patient's appearance or the composition of a patient's family. These interesting alternative criteria are beyond the scope of this paper.

[21] Organ donation and transplantation is controversial in some religions and cultures (see, for example, Oliver et al. (2010), Kobus et al. (2016), and Alhawari et al. (2020)). Objections to feline kidney transplantation in particular may relate to the sourcing of donor organs and the inability of the donor to consent to surgery. In order to avoid these complications and to maintain a parallel between feline and human organ transplantation, participants are not informed of the process for obtaining feline donor organs.

recruited and evaluated transplant candidates.

In each incentivized question, participants are reminded of the stakes and instructed in how their decisions might be implemented to allocate an organ transplant. Participants are told that after the experiment, "we will partner with veterinary practices to identify two cats in need of a transplant that are unlikely to receive a transplant without financial support, and we will pay for a transplant for one of them." The allocation could be based on either the rule rankings or the survival price lists. If the rule-based allocations are randomly selected, two of the five allocation rules will be randomly selected, and the transplant allocated according to the higher ranked rule, incentivizing the full ranking of the rules. If the survival price lists are selected, "the cat who most closely matches your choices in this section" will receive a transplant. To implement this, I use each participants' responses to estimate their indifference curves and then use the estimates to select between the two transplant candidates. This follows the incentive structure of Kessler et al. (2019), eliciting preferences over a variety of hypothetical scenarios with the promise that responses will be used in a real-stakes decision.[22] Implementing any particular row of the survival price lists would require finding two transplant candidates fitting the exact survival profiles in the list; instead, we learn participants' preferences and later use the elicited preferences to select between the two eligible transplant candidates. See Appendix Figure B.6 for experimental instructions.

4.4 Payments to Others

To study equality preferences across the domains of survival and money, I ask participants to select between bundles of low-stakes payments for future study participants (maximum \$4.00). If low-stakes payments are sufficient for predicting preferences elicited with a high-stakes organ transplant, we may be

[22]The estimation procedure is described in Section 5.1. In Kessler et al. (2019), real employers evaluated resumes of hypothetical job candidates, and machine learning was used to recommend real job candidates based on each employer's responses. Hypothetical candidate profiles allow the researcher to randomize candidate characteristics, while the real-stakes matching provides incentives for participants to evaluate profiles carefully. The stakes are described to participants as shown in Appendix Figures B.6 and B.7.

able to rely on simpler and cheaper incentives to elicit preferences for equality.

The four payment questions mimic the survival price lists, with one future participant receiving a *high* and another receiving a *low* payment. Payment values are similar to patient survival times in the survival price lists, at a rate of \$0.10 per month.[23] Payment recipients are not given any information about the additional payment (such as which row was selected or whether they were selected as Participant A or Participant B) or the participant who made the selection.

4.5 Risk & Time Preferences

Following Dean and Ortoleva (2019), I ask nine questions to establish each participant's aversion to risk, discount rate in short-term payoffs, and discount rate in long-term payoffs. Question structure follows that of the survival price lists: participants identify a switching point between a risky payment and a certain one, or between a near-term payment and a distant one (see Appendix B for additional details). One row from one question is randomly selected to determine the participant's bonus payment.

4.6 Generalizability: Mapping Experiment to Policy

In this section, we address some key differences between the experiment and the policy setting in order to assess the generalizability of the results. I focus on two key elements of the "SANS" framework of List (2020): the selection of participants, and the naturalness of the setting.[24]

Participants were selected through a voluntary recruitment process on Mechanical Turk which advertised the pay for the task and obtained informed consent for participation in research. Eligibility was restricted to MTurk work-

[23]See Panel B of Appendix Table B.1 for list values, Appendix Figure B.9 for instructions, and Appendix Figure B.10 for a sample question.

[24]The SANS framework also addresses concerns with attrition and scaling. In my experiment, the within-subject design guarantees no differential attrition by treatment. Aside from the sample selection issues described here, scaling presents no additional generalizability concerns.

ers with strong reputations, to reduce noise and ensure strong internal validity. Though MTurk workers differ from the US population at large, research indicates that treatment effects measured on MTurk samples are generally similar to those in nationally representative samples (Mullinix et al., 2015). Further, I find that observable characteristics such as race, gender, and political affiliation do not predict participant responses, suggesting that results from a participant pool chosen to represent the US population based on these characteristics would be similar (see Appendix Table C.2). Thus, the results likely generalize to the US population.

The experiment was designed to ensure a tight link between the experiment and the policy setting. I selected survival times for the experiment to represent realistic outcomes for both feline kidney transplant and human liver transplant patients (see Table B.1).[25] Treatments described both human and feline potential transplant recipients as "patients," and the problem as allocating an "organ transplant" rather than describing the liver or kidney specifically, in order to ease comparison.

A few assumptions are required to map the experimental setting to the policy setting. While the policy problem involves selecting dynamic allocation process in which patients may receive many transplant offers over time, the experiment uses a one-time allocation between two patients. This simplification makes the experiment feasible and easy to explain to participants, but raises concerns about generalizability. However, with three key assumptions, we can infer policy preferences from decisions in the experiment: i) utility is a function only of survival bundles; ii) all survival times are known with certainty (in particular, that the distribution of survival times under each allocation policy is predictable); and iii) agents do not discount payoffs over time. The first and second assumptions ensure that choosing between allocation systems is equivalent to choosing between bundles of survival times directly. The third

[25]While true survival times differ between human and feline transplant recipients, there is significant overlap in the ranges of survival times. Human liver transplants generate average survival benefits ranging from 0.2 years to 7.2 years depending on the illness of the patient (Luo et al., 2018). By contrast, median post-transplant survival time for feline kidney transplant recipients is estimated around 1.7 years (Schmiedt et al., 2008).

assumption makes decisions, and is met if time scales in the dynamic setting are sufficiently short. Meeting these assumptions implies that participants make identical choices in the two settings; preferring one survival bundle over another implies preferring the system that generates that bundle over the system the generates the other.

Even with these considerations, the decisions in this study are not similar to those participants make in day-to-day life, and it is difficult to know whether framing, information interventions, or different contexts (e.g., saving lives with preventive medicine rather than organ transplants) might lead to different decisions.

5 Analysis & Results

The within-subject experimental sample consists of 311 Mechanical Turk workers recruited in October 2020.[26] Table 1 shows summary statistics describing the study sample. Participants range in age from 20 to 73 years old, with a mean of 37.1 years. Participants are more likely to be male (58.6%) than female (41.4%), with most participants identifying as white (76.5%) and smaller groups identifying as Black (10.4%) or Asian (5.8%).[27] Most participants (71.1%) identify as pet owners, with 37.6% of participants owning at least one cat. Participants represent a mix of political positions, with 59.8% identifying as liberal on social issues and 46.3% identifying as liberal on economic issues.

This section describes the results of the experiment. Section 5.1 examines participants' survival tradeoffs and rule-based decisions and estimates participants' preferences for efficiency and equality. Section 5.2 explores allocative preferences across domains of survival and wealth. Finally, Section 5.3 examines the effect of the real transplant incentives on behavior by comparing incentivized and unincentivized decisions.

[26] I restricted participation to US-based workers having completed at least 500 previous tasks with an approval rate of at least 99%. I also conducted two experimental pilots with different sample restrictions.

[27] Two participants did not select either male or female when asked their gender.

Table 1: Summary Statistics

	Mean	Std. Dev.
Age	37.05	10.77
Female	0.41	0.49
Asian	0.06	0.23
Black or African American	0.10	0.30
White	0.77	0.42
Multi-racial or other	0.07	0.26
Hispanic	0.07	0.25
Pet Owner	0.71	0.45
Cat Owner	0.38	0.49
Liberal on Social Issues	0.60	0.49
Liberal on Economic Issues	0.46	0.50
Observations	311	

Table shows the means and standard deviations of experimental participants' demographic and personal characteristics in the within-subject experimental sample.

5.1 Survival Tradeoffs and Rule Selections

5.1.1 Survival Tradeoffs

We first examine switching points in incentivized survival price lists. Only 3.9% of participants consistently transplant the shorter-lived patient, suggesting that few participants prefer to save the shorter-lived patient at all costs. Instead, the vast majority (80.4%) consistently switch from the shorter-lived to the longer-lived patient when the gains to the longer-lived patient are sufficiently high.[28]

Following the framework described in Section 3, I estimate indifference curves by treating each row of a survival price list as a comparison between two survival bundles. Following Fisman et al. (2007), I assume a constant elasticity of substitution (CES) utility function with equal weight on the survival of the two patients:

$$u(x_A, x_B) = \left(\frac{1}{2}x_A^{\rho} + \frac{1}{2}x_B^{\rho}\right)^{\frac{1}{\rho}}$$

The equal weight of each patient's survival time in the utility function amounts to an assumption that the agent's utility follows the anonymity axiom: utility does not depend on which patient is labeled A or B. The CES utility function is flexible enough to capture a wide range of preferences, nesting perfect substitutes and Leontief preferences under different values of ρ. When ρ approaches $-\infty$, the utility function approaches Leontief utility; when ρ approaches 0, the utility function approaches Cobb–Douglas utility; and when $\rho = 1$, the utility function is linear, suggesting the survival times of the two patients are perfect substitutes.[29]

To aid in interpreting the results, I reparameterize ρ and define a *2:1 fairness discount*. The 2:1 fairness discount (or 2:1 FD) measures the share of total payoffs an agent would forego in order to move from an unequal, 2:1

[28] While preferences are generally well behaved, a small share of participants (4.2%) always allocate to the longer-lived patient, including in allocations that added no survival benefit. Recall that two survival price lists include an option that provides no survival benefit to the recipient; 8.7% of participants select at least one of these dominated options.

[29] Appendix Figure C.1 shows a variety of indifference curves described by different values of ρ.

distribution of payoffs (i.e., where one person receives twice as much as the other) to an equal distribution. That is, if an agent is indifferent between an outcome bundle $(66\frac{2}{3}, 33\frac{1}{3})$ and $(45, 45)$, the agent is willing to forego 10 units of the 100 total units in the first bundle to reach an equal distribution; a 2:1 FD of 10%. This measure is a simple transformation of the parameter ρ with CES indifference curves.[30] In the experiment, selecting the shorter-lived patient in every case would imply a 2:1 fairness discount of 12.1%.

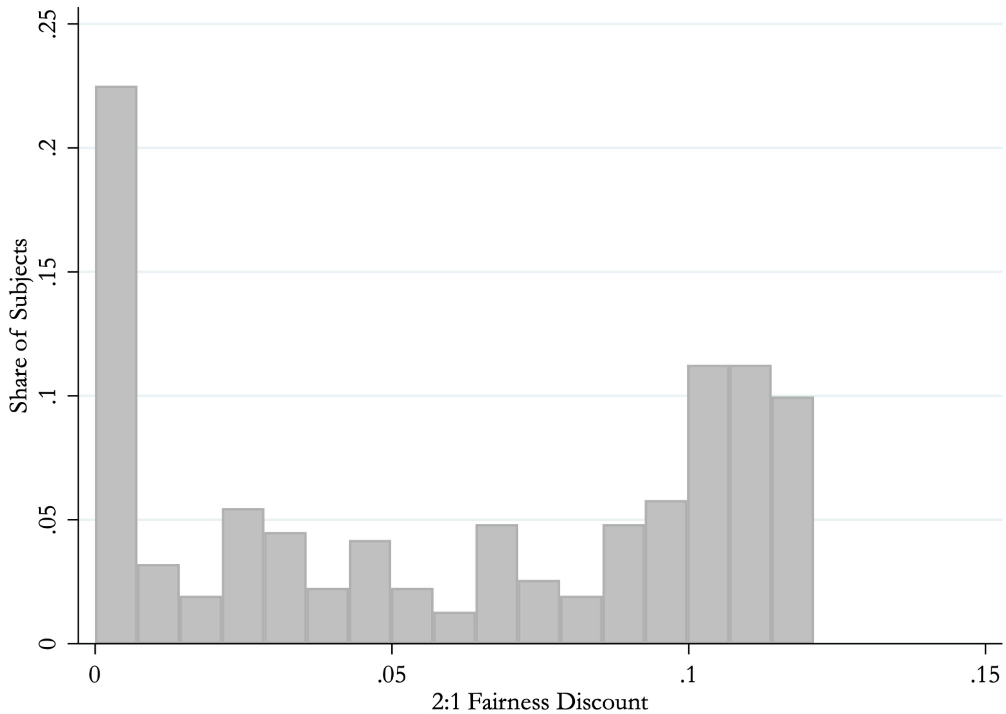
The distribution of participants-level average 2:1 fairness discounts in incentivized transplant allocations is shown in Figure 3.[31] On average, participants are willing to give up 6.1% of total survival time to shift from a 2:1 survival ratio to equality, but most participants fall in the extremes: 23.5% of participants have a strong preference for increasing total survival time, viewing survival times for each patient as near-perfect substitutes (2:1 $FD < 1\%$) and 40.5% have strong preferences for survival time equality (2:1 $FD > 9\%$).

Previous research on preferences toward monetary inequality documents a similar pattern, with widely diverging preferences among participants. Fisman et al. (2007) find that 53% of participants have $\rho > 0.1$ (equivalent to a 2:1 fairness discount less than 5.2%), indicating a preference for increasing total payoffs. In my experiment, 45.6% have these preferences. Participants in my experiment tend toward extreme preferences (either perfect substitute or Leontief preferences) more than in previous research. While Fisman et al.

[30] The fairness discount can be calculated for any payoff ratio; I selected 2:1 for ease of interpretation. To find the fairness discount transformation, note that we are looking for a fraction α that makes the agent indifferent between an uneven split of some amount x and an even split of αx. Let the uneven split be represented by the bundle $(\lambda x, (1-\lambda)x)$ where $\lambda \in [0, 1]$. Setting $u(\lambda x, (1-\lambda)x) = u(\alpha x/2, \alpha x/2)$ and solving for the fairness discount $1-\alpha$ with symmetric CES preferences yields $1-\alpha = 1 - \left((\lambda^\rho + (1-\lambda)^\rho)/2^{1-\rho}\right)^{\frac{1}{\rho}}$. I use a 2:1 fairness discount in these analyses, which sets $\lambda = \frac{1}{3}$.

[31] Participants' 2:1 fairness discounts are calculated based on the average CES curvature parameter ρ in four questions of the same type. Forty-four percent of participants make at least one selection that suggests an outward-bending indifference curve or that matches no symmetric CES indifference curve, corresponding to transplanting the longer-lived patient even when it reduces the total survival time in the system. I interpret these decisions as suggesting a strong preference for efficiency, and therefore assign CES parameter $\rho = 1$ and 2:1 fairness discount of 0. Results are largely robust to alternative aggregation methods; see Appendix Section C.3 for robustness checks and Figure C.8 for the distribution of unadjusted 2:1 fairness discounts.

Figure 3: 2:1 Fairness Discounts in Incentivized Transplant Allocations



Distribution of subject-level averages of 2:1 fairness discount in incentivized cat survival tradeoff elicitation decisions. Averages are taken across all four survival price lists; fairness discount is bounded below at 0. A 2:1 fairness discount of 0 indicates no aversion to inequality; high fairness discounts indicate large aversion to inequality. Mean: 6.1%. Sample: 311 participants in within-subject experiment.

(2007) find that only 4.4% display approximately perfect substitute preferences (ρ between 0.9 and 1, or a 2:1 fairness discount less than 0.6%), 21.5% do in my experiment. Similarly, 10.6% of participants in Fisman et al. (2007), and 22.8% of participants in my experiment, have Leontief preferences ($\rho < -0.9$ or equivalently, a 2:1 fairness discount greater than 10.6%).

5.1.2 Rule-Based Allocations

Almost all participants prefer to transplant some patient; 90.0% of participants rank the no-transplant option last among available rules. Participants prefer to use transplants to maximize the increase in survival (ranked first by 39.9% of participants) and to maximize the use of the organ (ranked first by 35.7% of participants). Maximizing the minimum survival time is the third most popular, ranked first by 11.9% of participants. Random allocation is the least popular way to allocate a transplant, ranked in fourth place by most participants (above no transplant). The CDF of participant rule rankings is shown in Figure 4.

The popularity of maximizing the use of the transplant is surprising from the point of view of survival time efficiency, since it can lead to transplants that provide little survival benefit (i.e., transplanting a patient who would have survived a long time even without a transplant). However, the popularity of the rule suggests a real preference among participants. Whether this is driven by a sense of obligation to the donor, a misapplied heuristic (such as assuming all patients are equally in urgent need of transplant), or the association between a transplant and an increased quality of life is beyond the scope of this experiment.[32]

5.1.3 Relationship Between Survival Tradeoffs and Rules

Participants' choices in survival price lists do not adhere to the five allocation rules. While each rule is associated with switching points in each survival price list question, only 27.0% of participants follow any particular rule in all four decisions, with the largest group of participants (17.7%) choosing switching points that maximize the use of the organ. 5.5% of participants consistently maximize the increase in patient survival time, while 3.9% of participants maximize the minimum survival time. Many participants (36.3%) never select a switching point that is consistent with any rule, while the rest either make

[32] Debates around providing liver transplants to patients with alcoholic liver disease may reflect a similar sentiment. Transplant centers typically restrict transplant to patients with a history of alcohol abuse, in part due to concerns about the misuse of a donated organ.

a subset of decisions consistent with one rule (21.5%) or switch between rules in different questions (15.1%).

While the rules don't fully capture the dynamics of the survival tradeoffs, participants are generally consistent in their preferences for equality or total survival across the two types of questions. Figure 5 shows average 2:1 fairness discounts by participants' top-ranked rule. Fairness discounts are significantly lower among participants who prefer rules favoring the longer-lived patient (*Maximize the Increase in Survival Time* and *Maximize Use of the Organ*) compared to participants who prefer equality-oriented rules (*Maximize the Minimum Survival Time* and *Select Patient at Random*).[33]

5.2 Preferences Across Domains

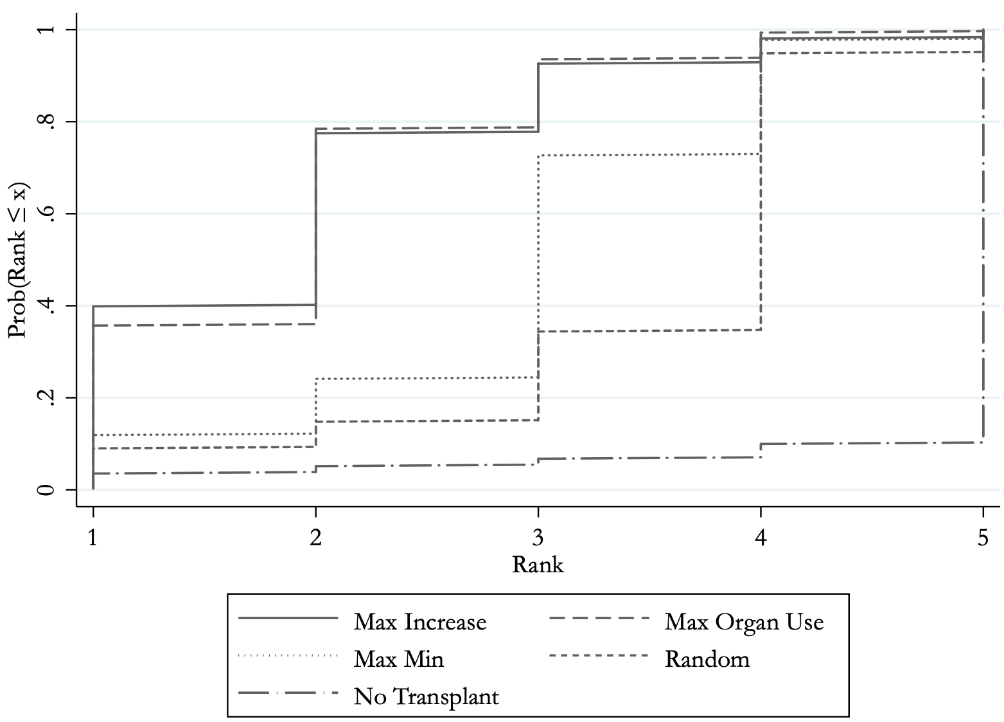
To measure equality preferences over money, we can calculate 2:1 fairness discounts using participants' payment to other survey participants. As in the transplant allocation decisions, participant preferences are approximately bimodal: 32.2% of participants have a 2:1 fairness discount of less than 1%, substituting almost perfectly between payments to low-pay and high-pay participants; 25.7% of participants have a 2:1 fairness discount of at least 9%, suggesting a strong preference for equality.[34]

Aversion to inequality in payments predicts aversion to survival time inequality, suggesting that preferences for redistribution are correlated across domains. Figure 6 shows average 2:1 fairness discounts in transplant decisions for different fairness discounts in monetary payments; regression results are shown in Appendix Table C.3. While these equality preferences are correlated, they are not identical: 11.9% of participants display preferences for total payoffs (2:1 FD less than 1%) in either payments or survival, while holding strong

[33] See Appendix Figure C.3 for the full distribution of 2:1 fairness discounts by participants' top-ranked rules.

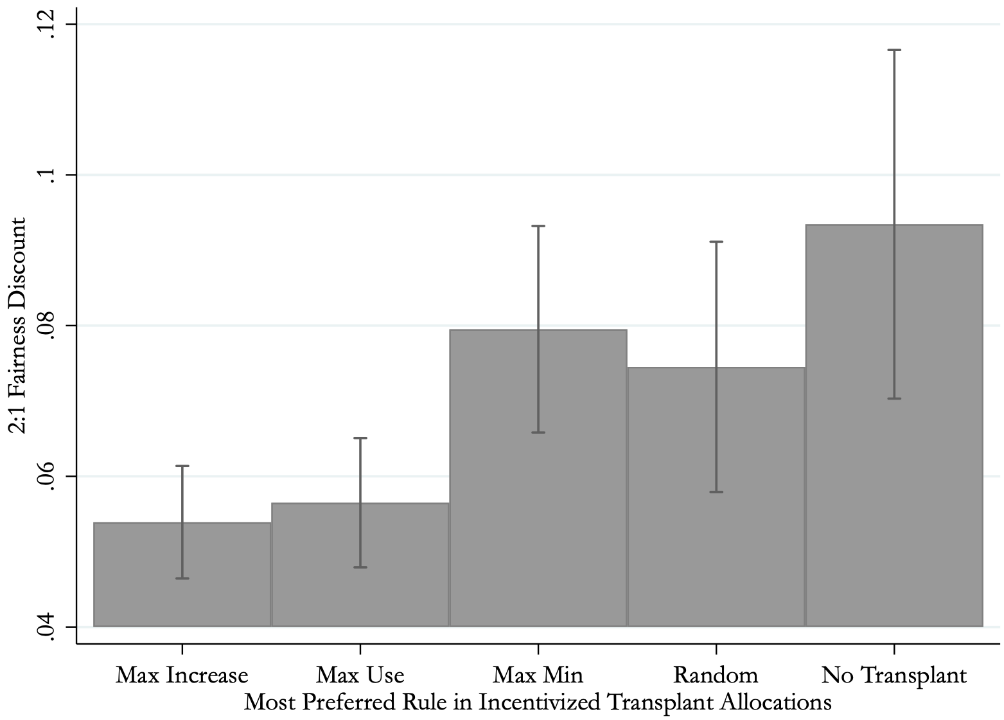
[34] The distribution of 2:1 fairness discounts is shown in Appendix Figure C.5. Fifty-seven percent of participants make at least one selection that suggests an outward-bending indifference curve. This corresponds to giving the high payment to the wealthier participant, even when it reduces the total amount of payments. As in transplant allocations, I interpret these decisions as suggesting a strong preference for efficiency, and therefore assign CES parameter $\rho = 1$ and 2:1 fairness discount of 0.

Figure 4: CDF of Ranking for Incentivized Cat Transplant Rules



Cumulative distribution function (CDF) of participant rankings of incentivized cat transplant allocation rules. The five rules include *Maximize the Increase in Survival Time* (Max Increase), *Maximize Use of the Organ* (Max Organ Use), *Maximize the Minimum Survival Time* (Max Min), *Select Patient at Random* (Random), and *Perform No Transplant* (No Transplant). Sample: 311 participants in within-subject experiment.

Figure 5: Average 2:1 Fairness Discount by Top-Ranked Rule



Bar heights indicate the average 2:1 fairness discount in incentivized cat survival price lists for participants ranking each rule as most preferred in incentivized cat rule rankings. Higher fairness discounts indicate larger aversion to inequality. The five rules include *Maximize the Increase in Survival Time* (Max Increase — $n = 124$), *Maximize Use of the Organ* (Max Use — $n = 111$), *Maximize the Minimum Survival Time* (Max Min — $n = 37$), *Select Patient at Random* (Random — $n = 28$), and *Perform No Transplant* (No Transplant — $n = 11$). Spikes represent 95% confidence intervals. Sample: 311 participants in within-subject experiment.

preferences for equality (2:1 FD greater than 9%) in the other dimension.

Since survival is a risky benefit realized over time, one might expect risk preferences and temporal discounting to predict preferences over survival times. Indeed, participants who display a higher preference for short-term payments also show a preference for saving the lives of shorter-lived patients in the short term; participants who demonstrate present bias (a disproportionate preference for immediate payments over future payments) display an even stronger preference for saving shorter-lived patients (see Appendix Table C.1 for regression results). Demographics, political leaning, pet ownership, and behavior in the trolley problem are not predictive of survival time inequality aversion (see Appendix Table C.2).

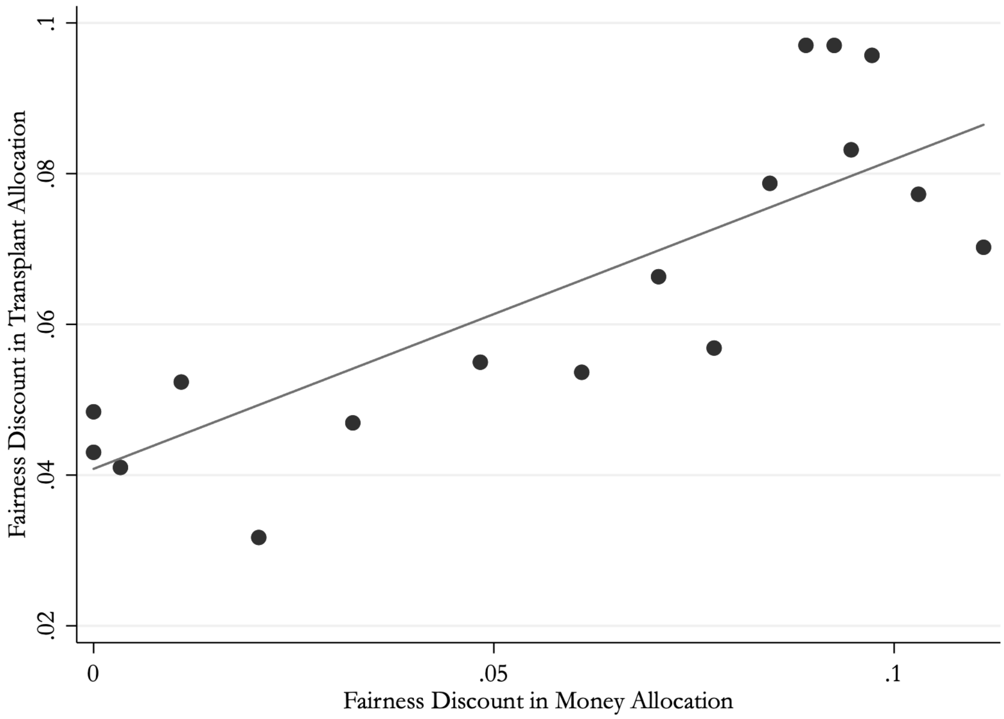
5.3 The Effect of Incentives

Are hypothetical responses reliable in this context? Recall that participants respond to the same questions under unincentivized and incentivized conditions, allowing us to examine the effect of incentives by comparing responses under the two conditions.

In the aggregate, rule rankings and survival tradeoffs are nearly identical across conditions (see Figure 7 for the CDFs of rule rankings, and Appendix Figure C.4 for the distribution of 2:1 fairness discounts in the three treatment conditions). However, many individual participants do change their reported preferences: 46% of participants rank rules differently under incentivized and unincentivized conditions. This result — consistency across treatments in the aggregate, coupled with high churn across treatments at the individual level — suggests noisy decisionmaking may be driving individual-level variation. We explore this hypothesis in the between-subject experiment described in the next section.[35]

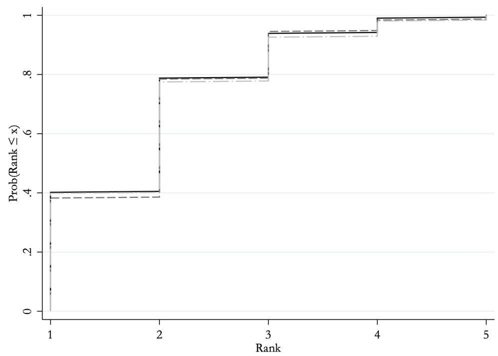
[35] Differences in rankings do not seem to be driven by indifference between any two particular rules. While only 8.4% of participants report different rankings for *Perform No Transplant*, the remaining rules are all ranked differently by a substantial share of participants (*Maximize the Increase in Survival Time* — 30.5%; *Maximize Use of the Organ* — 29.3%; *Maximize the Minimum Survival Time* — 28.9%; *Select Patient at Random* — 26.7%).

Figure 6: 2:1 Fairness Discounts in Payment and Transplant Allocation

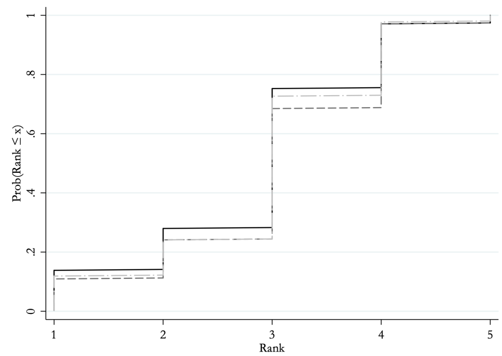


Binned scatter plot of participant-level averages of 2:1 fairness discount in payment allocation questions and incentivized cat transplant allocation questions. Higher fairness discounts indicate a larger aversion to inequality. Regression results in Appendix Table C.3 show that a 10 percentage point increase in payment fairness discount is associated with 4.1 percentage point increase in survival time fairness discount (p-value < 0.001; $R^2 = 0.143$; correlation = 38.8%). Sample: 311 participants in within-subject experiment.

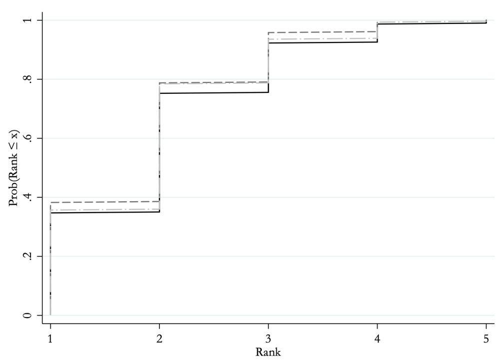
Figure 7: Distribution of Rule Rankings Across Treatment Conditions



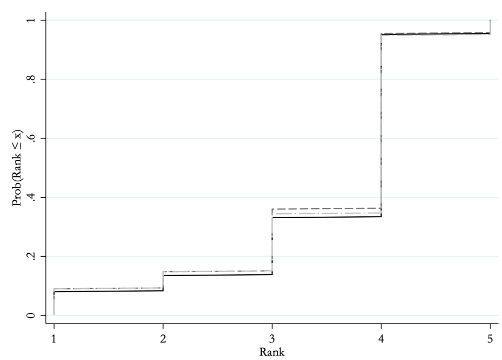
(a) Maximize Increase in Survival Time



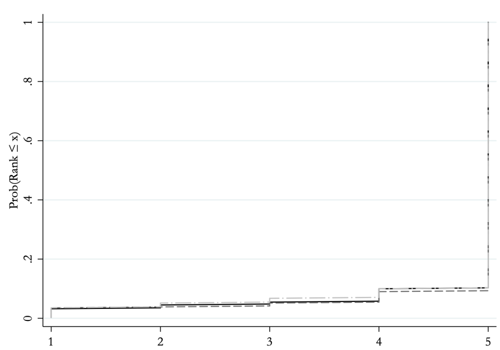
(b) Maximize Minimum Survival Time



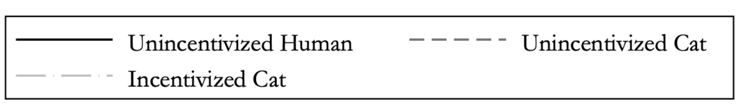
(c) Maximize Use of the Organ



(d) Select Patient at Random



(e) Perform No Transplant



CDFs of rule rankings under *Incentivized Cat*, *Unincentivized Cat*, and *Unincentivized Human* conditions. Each figure shows the distribution of rankings for one of the five allocation rules: *Maximize the Increase in Survival Time*, *Maximize the Minimum Survival Time*, *Maximize Use of the Organ*, *Select Patient at Random*, and *Perform No Transplant*. Sample: 311 participants in within-subject experiment.

6 Between-Subject Experiment

In the aggregate, the results of the within-subject experiment are strikingly similar under hypothetical and incentivized conditions, and in transplants for humans and cats. One may be concerned that correlations between treatment conditions are overstated due to participants' desire to be consistent in their decisions. To what extent are these results driven by the within-subject design?

The experimental results also highlight a large share of participants who change responses between the unincentivized and incentivized conditions. Random decisionmaking could generate similar results: individual-level variation across treatments, but small differences on average between treatments. To what extent do these results represent substantive differences in preferences, and how much could be explained by simple noise in the decision process? To answer these questions, I conducted a replication experiment with a hybrid between/within-subject design, allowing me to rule out cognitive dissonance as the main driver of similarities across treatments, and to estimate the role of noise in participants' decisions.

6.1 Between-Subject Design

Participants in the second experiment were randomized into one of three treatments: *Incentivized Cat*, *Unincentivized Cat*, or *Unincentivized Human*. In each treatment, participants made choices of only one type: participants in the *Incentivized Cat* treatment made choices only for the real cat transplant, while participants in the unincentivized were asked only about hypothetical transplants.[36] Decisions in the incentivized treatment had a probability of being used to allocate a real feline transplant, as in the main experiment. The questions were identical to those in the main experiment, and included both survival price lists and rule selection. This design alleviates concerns that cognitive dissonance drives similar responses across treatments. Instead, comparing responses in incentivized and unincentivized conditions identifies

[36] A single transplant was used to incentivize decisions in both the within-subject and between-subject experiments.

the effect of providing life-and-death stakes, while comparing unincentivized responses between *Unincentivized Human* and *Unincentivized Cat* treatments demonstrates how preferences differ across the species of the transplant recipient.

To address noise in the decision process, I repeat each question twice in a given treatment. This within-subject element of the experiment allows me to measure pure decision noise: how often do participants change their selections when faced with the same question? Changing responses in repeated questions would suggest inconsistent preferences or indifferences; consistent responses would suggest that patient species and question stakes drive differences between treatments.

6.2 Results

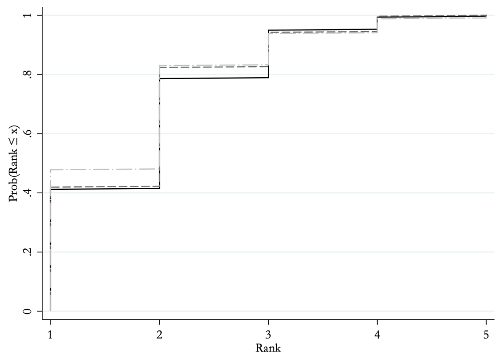
The sample in the second experiment includes 988 new participants from Mechanical Turk (after discarding 12 ineligible or incomplete responses), randomized to one of three treatments. Appendix Table C.4 shows summary statistics of demographics information for each treatment group, demonstrating that characteristics are balanced across treatments.

As in the first experiment, participants show remarkably consistent preferences across treatments. Shares of participants selecting each rule are almost identical across treatments, and they closely match selections in the within-subject experiment (CDFs of rule rankings are shown in Figure 8). Maximizing the increase in survival time and maximizing the use of the organ remain the most popular rules in all treatments, with maximizing the minimum survival most often ranked third. The least popular options in all treatments are randomizing between recipients and performing no transplant.[37]

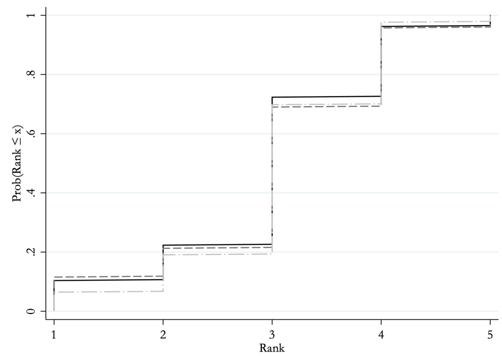
In the within-subject experiment, participants display a surprising degree of variation in their responses across treatments. In the between-subject exper-

[37]Since participants rank rules twice in repeated questions, I use each participant's initial rule ranking in this analysis. Appendix Figure C.7 shows that these results are robust to analyzing participants' second rule ranking in repeated questions. Survival price list choices are also similar across incentivized and hypothetical treatments, as shown in Appendix Figure C.6 and described in Appendix C.2.

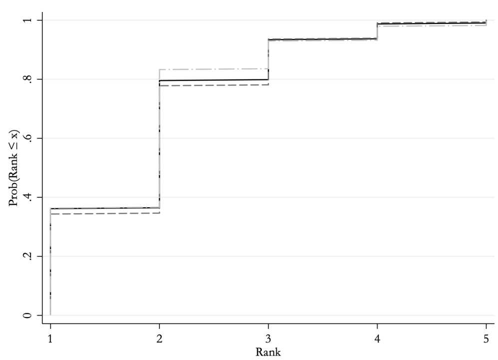
Figure 8: Rule Rankings Across Treatment Conditions, Between Subjects



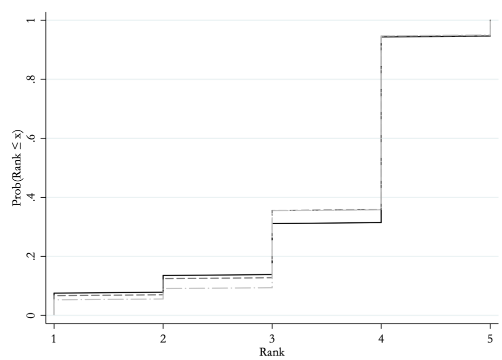
(a) Maximize Increase in Survival Time



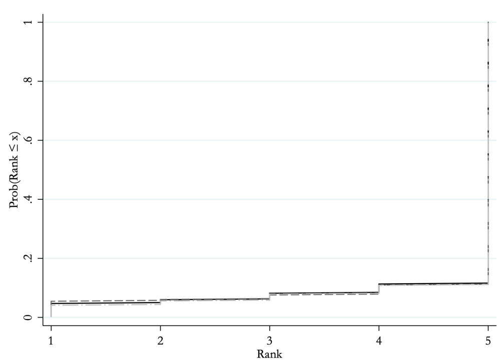
(b) Maximize Minimum Survival Time



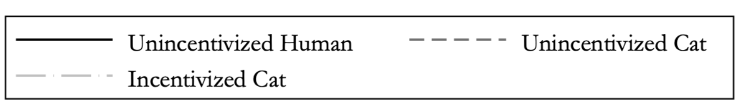
(c) Maximize Use of the Organ



(d) Select Patient at Random



(e) Perform No Transplant



CDFs of first-decision rule rankings under *Incentivized Cat*, *Unincentivized Cat*, and *Unincentivized Human* conditions in the between-subject replication experiment. Each figure shows the distribution of rankings for one of the five allocation rules (*Maximize the Increase in Survival Time*, *Maximize the Minimum Survival Time*, *Maximize Use of the Organ*, *Select Patient at Random*, and *Perform No Transplant*) based on the first set of rankings submitted by each participant. Sample: 988 participants in replication experiment.

iment, 41–44% of participants in each treatment change their rule rankings in repeated questioning (compared to 46% changing responses across treatments in the main experiment). Inconsistency rates are similar across treatments, both in rule rankings and survival price lists.[38]

To summarize, consistency across treatments in the first experiment is not driven by the within-subject design; participants display the same distributional preferences for survival times of humans and cats, and under incentivized and unincentivized conditions, in the between-subject experiment. However, decisionmaking is noisy: participants change responses frequently in repeated questions. Decision noise could account for essentially all individual-level differences across treatments observed in the within-subject experiment.

7 Discussion

There are clear differences between the policy setting and the experimental setting. Three primary differences merit discussion. First, the experiment allocates an organ transplant between feline, rather than human patients. Second, while the experiment involves the static allocation of a single organ transplant, the policy problem involves the allocation of organs in a dynamic process, where patients who remain on the waitlist may receive an organ later. Finally, participants in the experiment only select survival bundles for others, while individuals may be either donors or recipients in the policy context. In this section, I address each of these issues to identify the mapping between the experiment and the policy context.

[38] Incentives cause no significant difference in the share of participants who change responses in repeated survival price lists (78.7% in unincentivized questions versus 79.5% in incentivized questions; p-value=0.81) or the magnitude of the changes (p-value=0.67). See Appendix Table C.5 for various measures of decision inconsistency in the replication experiment.

Why should preferences over feline survival reflect preferences for human survival?

We do not assume that individuals' preferences over feline survival bundles are the same as preferences over human survival times. Instead, the experiment elicits survival time preferences separately for human patients and for feline patients, in order to understand how these preferences might differ.

Survival times used in the experiment were designed to be realistic for both human and feline patients, allowing an easier comparison across the alloctaions for human and feline patients. Researchers estimate that the average survival benefit per solid-organ transplant in the US between 1987 and 2012 was about 4.3 life-years (Rana et al., 2015). Estimated survival benefits for liver transplants in particular depend on the severity of the patient's liver disease, and range from 0.2 years to 7.2 years (Luo et al., 2018). Median post-transplant survival time for feline kidney transplant recipients is estimated around 1.7 years (Schmiedt et al., 2008). The survival times in the experiment (see Table B.1) are within the realistic ranges for both feline and human patients, making comparison between participants' choices more straightforward.

The transplant waitlist allows patients to receive multiple transplant offers over time. How is this dynamic reflected in a static experiment?

While participants in the experiment make one-time allocation decisions, their preferences in these decisions should reflect their preferences in the dynamic policy setting under three assumptions:

1. Utility is a function only of survival bundles. In particular, utility does not on the allocation system directly; individuals are indifferent between any allocation procedures that generate the same bundle of survival times.

2. Survival bundles are known with certainty. In the one-shot setting, this requires predicting patient survival times accurately with and without

transplant. In the dynamic setting, this assumption is met if it is possible to calculate the distribution of survival times that would result from any allocation scheme.

3. Agents do not discount payoffs over time. This assumption is met if time scales in the dynamic setting are sufficiently short.[39]

Together, these assumptions imply that an individual preferring a survival bundle in the one-shot setting would prefer any allocation system resulting in that bundle in the dynamic setting. That is, the two settings provide equivalent information. The second assumption is particularly strong, since current technology does not perfectly predict either survival times or the outcomes of different allocation mechanisms. However, our understanding of how allocation systems lead to continues to improve as researchers develop simulation models (Scientific Registry of Transplant Recipients, 2019, 2015b,a) and economic models (Agarwal et al., 2021) to predict the outcomes of alternative policies.

Some participants may need a transplant themselves someday. How does that affect policy preferences and behavior in the experiment?

Organ transplantation directly affects only a small share of the US population. Bambha et al. (2020) estimate that about 1% of the US population needs a deceased-donor solid organ transplant at some point in their lives; the lifetime probability of becoming a donor is even lower at around 0.2%.[40] It seems reasonable that individuals' preferences over allocations to others (i.e., those preferences elicited in the experiment) are the primary driver of their policy preferences. Moreover, healthy individuals are behind a veil of ignorance: it

[39] This assumption is not required to infer dynamic preferences from the one-shot game. Instead, it is sufficient for the observer to know the discount rate and adjust inferences accordingly.

[40] A larger share of people register as organ donors. However, only a small fraction of registered donors actually donate an organ due to contravening factors such as the manner of death and the quality of the donor's organs.

would be difficult to assess which policies would be personally beneficial. Indeed, the results show no aggregate differences in the preferences of individuals involved in the transplant system (see Appendix Table C.2).

The preferences of individuals currently on the transplant waitlist likely reflect a strong preference for their own survival. It would be natural to assume lexicographic preferences, prioritizing one's own survival over any benefits to others. Thus, this paper does not focus on the preferences of those currently in need; instead, I focus on patients' preferences over others' survival, conditional on one's own survival time.

8 Conclusion

The allocation of scarce, life-saving medical treatments like organ transplants requires difficult decisions determining who lives and who dies. While panels of medical experts often choose between possible bundles of survival times by setting allocation rules, how well their decisions reflect society's preferences has been largely ignored in research. In this paper, I introduce an experimental methodology for identifying preferences over survival distributions with real life-or-death incentives. Participants select one feline patient to receive a real kidney transplant by making a series of decisions that map out indifference curves between survival bundles, and by ranking allocation rules trading off between total survival time and equality.

The results indicate a gap between public preferences and the practice of organ transplant allocation in the US. Most experimental participants respond to increases in total survival, providing the transplant to the patient with the largest gain in survival time, even if those gains accrue to the longer-lived patient. About 80% of participants prefer to transplant a longer-lived patient when the gains from transplant are sufficiently high; a plurality of participants (40%) prefers a rule that maximizes the increase in survival time over all other available rules. Only a small share (3.9%) of participants prefer to give the transplant to the shorter-lived patient at the expense of longer-lived patient in every case; 12% of participants choose this as their most preferred rule. These results suggests that Rawlsian equality aimed at helping the worst-off patient may not be a good model of society's preferences over survival. In the US, priority on the liver transplant waitlist is based primarily on medical urgency, and ignores the potential benefit from transplant; this approach does not seem to align well with society's preferences for increasing total patient survival.

Lexicographic preferences over post-transplant time are common, with a large share of participants choosing to maximize the amount of time the transplanted organ is used. Thirty-seven percent of participants rank this as their most preferred rule, and many participants behave consistently with this preference when deciding between individual patients. By ignoring without-transplant survival time, this rule does not conform to our usual notions of equality or efficiency, but suggests individuals get utility out of the appropriate use of a valuable organ donation, aside from the survival time that the transplant generates. Ongoing controversies in organ transplantation, such as whether to provide transplants to patients suffering from alcoholic liver disease, may reflect the view that the "appropriate" use of an organ is as important as the increase in survival time that the transplant makes possible.

While fairness and equality have been studied in both the lab and the field, most economic treatments of these issues are limited to the monetary domain. This experiment contributes to the economic literature on equality by comparing preferences for inequality across the domains of money and survival. I find that preferences toward the distribution of wealth are closely correlated with preferences toward the distribution of survival. Participants vary greatly in how they choose to allocate money and organ transplants, but decisions in one domain predict decisions in the other.

The crux of the experiment — using a novel incentive structure in life or death decisions to elicit preferences and disentangle mechanisms in a tightly controlled laboratory experiment — could be used in other settings as well. The success of feline transplantation makes it a particularly good setting for economists to learn about organ allocation preferences, but other health behaviors, such as decisions whether or not to pursue medical treatment, obstacles to vaccination, and adherence to health regimens, might also benefit from a similar design.

The similarity of preferences measured under hypothetical and incentivized conditions suggests that future research may rely on hypothetical survey data to map out survival preferences with respect to characteristics such as age, family status, and moral worthiness that were explicitly excluded from my experiment. A similar approach could be used to study preferences over the procedural characteristics (rather than the outcomes) of various allocation rules. This paper demonstrates an approach to using incentivized experiments to improve allocations constrained by challenging ethical tradeoffs.

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For Online Publication

Appendices for "Eliciting Preferences over Life and Death: Experimental Evidence from Organ Transplantation"

Colin D. Sullivan

Three appendices describe the ethical considerations of the experiment (Appendix A), the experimental design and survey materials (Appendix B), and additional results (Appendix C).

A Ethical Considerations

This appendix addresses ethical considerations in the design of this experiment, using a question-and-answer format.

Does this research cause the death of a cat?

No, this experiment does not cause the death of a cat. Instead, the experiment provides funding for a life-saving organ transplant to one cat. One subject in the experiment is selected at random, and his or her choices are used to determine which of two candidate cats will receive a transplant.

Why are you withholding treatment for one of the cats? Is that ethical?

It is important to emphasize that nothing in this experiment prevents any cats from getting a transplant. While I provide funding for only one transplant, the owner of the other cat may still pursue a transplant.

Even so, it may seem unfair that one cat receives a transplant while the other (most likely) does not. There are both financial and methodological reasons for this necessary part of the experiment. The financial reason is that my research budget is limited, and I can only afford one transplant. It would be impossible for me to provide medical care to every cat, but at least one cat benefits from a necessary medical procedure as a result of the experiment. While this increases inequality among cats, it does so by extending one cat's life, not by harming any cat.

Methodologically, the experiment relies on the fact that resources are scarce. If transplants were provided for every cat in need, there would be no incentives for subjects to report their preferences truthfully, since their reports could have no effect on the final allocation. That is, the design of this experiment takes advantage of a limited budget to ensure that even while we can't provide treatment to every sick patient, we can learn something useful about allocating limited resources.[41]

The financial and methodological reasons for providing only on transplant both reflect the fact that scarcity is reality in allocating medical treatments. Medications, hospital beds, medical devices such as ventilators, and the expertise of doctors are all available in limited supply. This experiment is designed to study this empirical reality, and to help us understand how to allocate these scarce goods.

A cat cannot consent to participate in an economics experiment. How can you recruit subjects without their consent?

Cats are not subjects in this experiment. Instead, the subjects are the human workers on Mechanical Turk, who participate in the experiment after providing informed consent. The kidney transplant is the incentive for the human subjects to consider their decisions carefully.

Cats cannot consent to be living organ donors. Is it ethical to take organs from donor cats?

The donor cat is recruited from an animal shelter and adopted by the transplant recipient's owner after the procedure. The concern is that donor cats are unable to agree to this arrangement, and are being exploited for their organs.

This is a valid concern: it's true that cats cannot consent explicitly to this procedure. However, the donor cats would otherwise die in the shelter.[42] While the transplant does not benefit the donor directly, the arrangement extends the donor's life and improves the donor's quality of life by providing a home with a caring owner. For these reasons, transplant surgeons presume consent from the donor cat.

This is common practice in feline transplantation, and is not unique to this experiment.

[41] In theory, the methodology does not require exactly one transplant for two cats; it simply requires that there be fewer transplants than cats. With a larger budget, we could provide more than one transplant, but at least one cat would still not receive a transplant.

[42] So-called "no-kill shelters" are relatively rare in the US, and even in these shelters up to 10% of animals may be euthanized.

While I believe reasonable people could disagree on this issue, this approach has been approved by the regulatory agencies, veterinary surgeons, and by the consensus of veterinary ethicists, so I follow their lead in my experimental design.

Is this animal medical testing?

No, this is not animal medical testing. Animal medical testing refers to carrying out experimental medical procedures on animals in order to test the efficacy of the treatment. Kidney transplantation is not experimental; it is a well established treatment for kidney disease in cats. Moreover, the goal of the transplant is not for research on the efficacy of transplantation as a treatment. Instead, the transplant is intended to treat the recipient's kidney failure.[43] The experimental outcome of interest is not the survival of the two cats, but how the subjects of the experiment allocate scarce resources.

Could donating money for transplant lead to a transplant with follow-up treatment that the owner can't afford, resulting in a lower quality of life for the cat?

As part of the experiment, I contribute $12,000 toward a transplant, making it possible to save the life of a cat who would otherwise die. This donation will ease the financial burden of transplant without eliminating it completely; pursuing a kidney transplant will still require significant financial resources from the owner. The annual cost of immunosuppressant drugs is about $500–$1500, depending on the specific drug regimen followed. This cost is significantly less than the cost of the transplant itself (if we estimate that the average life expectancy of a cat after transplant is about three years), and does not require a large upfront payment. We anticipate that there are many owners with the ability to care for a second cat and the means to pay for follow-up treatment, but who would otherwise choose not to pay the large lump-sum cost of the surgery itself. Of course, the owner will also be free to refuse the surgery (and the financial donation) if they deem it is not in the best interest of the cat.

We rely on the primary care veterinarians and the veterinary transplant center to screen potential transplant recipients. These centers have screening mechanisms in place to determine whether the surgery would be ethical as well as practical for the owner and the patient, and they would not perform a surgery that they deem inappropriate.

Of course, the well-being of the donor cat should also be taken into consideration. If the

[43] Note in particular that although one cat receives a medical treatment and the other does not, this is not a randomized control medical trial. The treatment status of the two cats is not random; it is determined by the choice of the subjects of the experiment.

transplant does not occur, the donor cat is likely to be killed in a shelter.[44]

Owners who pursue transplant for their cats are clearly dedicated to the health and well-being of their pets. Many consider these animals to be part of their family. The screening procedures already in place and the owner's significant financial investment ensure that the owners are invested in providing a high quality of life for the cats. If the IRB is concerned about the welfare of the cats, donating money for a transplant will result in improved quality of life for both cats. Providing one cat with medical treatment and another with a loving home, rather than letting both die, seems like an ethical choice.

Is there any precedent for this type of experiment?

This style of experiment is not common in the economics literature, but there is some precedent for using animal lives to study subject preferences over life and death. In one related study, Falk and Szech (2013) ask subjects to pay to save the lives of lab mice who would otherwise be euthanized. A branch of economics literature has looked at consumers' willingness to pay for the welfare of animals. Most of these studies focus on living conditions for farm animals and elicit willingness to pay through hypothetical or real valuations for animal products with different characteristics (for an overview, see Boaitey and Minegishi (2020)). These products are generally already commercially available, so even the real choice experiments do not directly affect the welfare of animals except through their demand for animal products.

To my knowledge, this is the first study to use animal organ transplants to study human preferences toward survival. A more detailed review of the economic literature is provided in Section 1 in the main body of the paper.

Are there any concerns for the well being of the human subjects in this study?

Human subjects are asked to answer a series of questions at a computer terminal. To protect subjects from psychological stress, I ensure that subjects are well informed about the stakes of the study in general and the stakes of each question. Subjects are able to end their participation in the study at any point.

[44]Even in "no-kill" shelters, up to 10% of animals are euthanized.

The burden of decision shouldn't fall on one subject alone. Why do you randomly select one subject and implement her choices, rather than aggregating all subjects' choices?

Aggregating subjects' preferences — for example, by asking subjects to vote on each potential transplant recipient, and providing a transplant to the candidate with the most votes — may undermine the incentives of the study. Implementing the choices of one randomly selected subject (commonly called a Random Dictatorship) is a standard approach in economics and preserves incentives for subjects to consider the question carefully and respond with their true preferences.

Did an Institutional Review Board (IRB) approve this study?

Yes, this study received "Expedited" review and was approved by the Stanford University IRB.

B Experimental Design Appendix

This appendix provides details on the design of the experiment. After accepting the Human Intelligence Task (HIT) on Amazon's Mechanical Turk, workers interested in participating in the study were directed to the primary and secondary consent forms (Figures B.1 and B.2). The secondary consent form was required to alert subjects to the high stakes of the organ transplantation decisions.

B.1 Time & Risk Elicitation

After acknowledging the consent forms, subjects begin the experiment by making nine decision designed to elicit their preferences over temporal discounting and risk. Subjects respond to six questions in which I elicit indifferences between payments in different time periods. Each question elicits a value x at which the subject is indifferent between payment \$$y$ in s weeks and payment \$$x$ in t weeks. The values $\{t, y, s\}$ in each question follow those used by (Dean and Ortoleva, 2019). Three questions with parameter values $\{5, 6, 6\}$, $\{6, 8, 7\}$ and $\{5, 10, 7\}$ are used to elicit future discounting, and three questions with parameter values $\{0, 6, 1\}$, $\{0, 8, 1\}$ and $\{0, 10, 2\}$ elicit present discounting. Indifferences are elicited using multiple price lists, as shown in Figure B.3.

Risk preferences are also elicited following (Dean and Ortoleva, 2019). Subjects select certainty equivalents of three 50/50 lotteries using multiple price lists: \$6 and \$0, \$8 and \$2, and \$10 and \$0. A sample multiple price list is shown in Figure B.4.

B.2 Transplant Allocation

After the initial elicitation of time and risk preferences, subjects make a series of decisions on allocating organ transplants. This segment of the experiment begins with a brief introduction to the issue of organ transplantation in humans and felines (Figure B.5). Subjects make two types of transplant allocation decisions (survival price lists and rule-based) under three different conditions (hypothetical feline patients, hypothetical human patients, or real feline patients). Subjects complete survival price lists before rule-based allocatios. Within each condition, subjects respond to four questions varying in the survival time of each patient. Section-level instructions and question-specific instructions are shown below for the survival tradeoff elicitation for real feline patients (Figures B.6 and B.7).

Subject next make rule-based allocation decisions by ranking the five available rules in preference order. A sample rule-based question is shown in Figure B.8.

B.3 Payments to Others

Subjects make four decisions allocating funds between two other participants in the study. One of the four questions is randomly selected for implementation. Payment amounts follow the survival times in the survival price lists, with one month of survival translating to $0.10. Instructions are shown in Figure B.9, and a sample question is shown in Figure B.10.

B.4 Ethical Scenario

In a final hypothetical question, subjects are asked to consider an ethical dilemma in a hypothetical scenario. The question (derived from Elías et al. (2019)) is shown in Figure B.11. This scenario is intended to distinguish between subjects with deontological preferences — that is, a set of values or a code of conduct based around an action rather than its consequences — and those with consequentialist (utilitarian) preferences.

Table B.1: Price List Parameters

Panel A: Transplant Allocation

Question	Patient A Survival	*Patient B Survival*		
		Without Transplant	Min. with Transplant	Max. with Transplant
1	Without Transplant: 1 month With Transplant: 6 months	2 months	6 months	36 months
2	Without Transplant: 1 month With Transplant: 2 months	2 months	2 months	24 months
3	Without Transplant: 4 months With Transplant: 5 months	5 months	5 months	24 months
4	Without Transplant: 6 months With Transplant: 24 months	9 months	24 months	48 months

Panel B: Payments to Others

Question	Participant A Payment	*Participant B Payment*		
		Low	Min. with High	Max. with High
1	Low: $0.10 High: $0.60	$0.20	$0.60	$1.20
2	Low: $0.10 High: $0.20	$0.20	$0.20	$1.00
3	Low: $0.40 High: $0.50	$0.50	$0.50	$1.50
4	Low: $0.60 High: $2.40	$0.90	$2.40	$4.00

Table shows the parameters of the survival tradeoff elicitation transplant and monetary allocation questions presented to each subject. In each question, the subject chooses to allocate a valuable item to one of two potential recipients in a series of comparisons. In transplant questions, the subject allocates an organ transplant to Patient A or Patient B, while Patient B's survival without transplant, and Patient A's survival with and without transplant remain constant in each comparison, and Patient B's survival with transplant varies between the minimum and maximum given in columns 4 and 5. In monetary questions, the subject allocates a high value payment to either Participant A or B. Participant B's *low* payment, and Participant A's *high* and *low* payments remain constant in each comparison, while Participant B's *high* payment varies between the minimum and maximum given in columns 4 and 5.

Figure B.1: Primary Consent Form

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This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate. Please save or print this page for your records.

Your participation is voluntary. Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate.

This study does not involve deception. All choices and bonus payments will be implemented in the manner described in the study.

Description: The survey you are participating in today is part of a research study on decision-making in the context of organ transplantation. The research study is designed to analyze individual preferences over priorities for organ transplants. You will be asked to read several pages of instructions. Then you will be asked to make several choices (by using a computer terminal) that will determine the precise amount you will be paid. After these choices, you may be asked to answer several survey questions.

Risks and Benefits: There are no anticipated risks involved in this study. We cannot and do not guarantee or promise that you will receive any benefits from this study. However, your participation may allocate funding that will assist other individuals and organizations. In addition, your participation may benefit society by improving our understanding of behavior and preferences toward organ allocation.

Duration: Your participation in this survey will take approximately 20 minutes.

Payments: You will receive on average $20 per hour as payment for your participation, based on the actions that you select. All subjects will be paid. The minimum payment is the $5 show-up fee. You will receive payment after responses have been validated (within 48 hours); the exact amount and timing of bonus payments will depend on your responses to the survey.

Subjects' Rights: If you have read this form and have decided to participate in this project, please understand your participation is voluntary and you have the right to discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled. The alternative is not to participate. You have the right to refuse to answer particular questions. The results of this research study may be presented at scientific or professional meetings or published in scientific journals. Your individual privacy will be maintained in all reports and published data resulting from the study.

Contacts and Questions: For questions, concerns, or complaints about the study you may contact Dr. Colin Sullivan (cdsulliv@stanford.edu) in the Stanford University Department of Economics. Independent Contact: If you are not satisfied with how this study is being conducted, or if you have any concerns, complaints, or general questions about the research or your rights as a participant, please contact the Stanford Institutional Review Board (IRB) to speak to someone independent of the research team at (650)-723-2480 or toll free at 1-866-680-2906. You can also write to the Stanford IRB, Stanford University, Stanford, CA 94305-5401.

If you agree to participate in this study, please continue. If you do not wish to participate, please close this window and your session will end.

Primary consent form displayed to all subjects before beginning the experiment.

Figure B.2: Additional Consent Form for Organ Transplant Decisions

Stanford

The responses to some questions in this survey will be used to allocate one kidney transplant to a cat in need. After all respondents have completed the survey, one respondent will be selected at random, and the transplant will be allocated based on the answers selected in the survey.

Statement of Understanding

I understand that if my survey is randomly selected, my survey responses and mine alone will determine how an organ transplant is allocated. I understand that if I choose not to participate, I can exit my browser to end my session at any time.

○ Yes, I understand and I wish to participate.

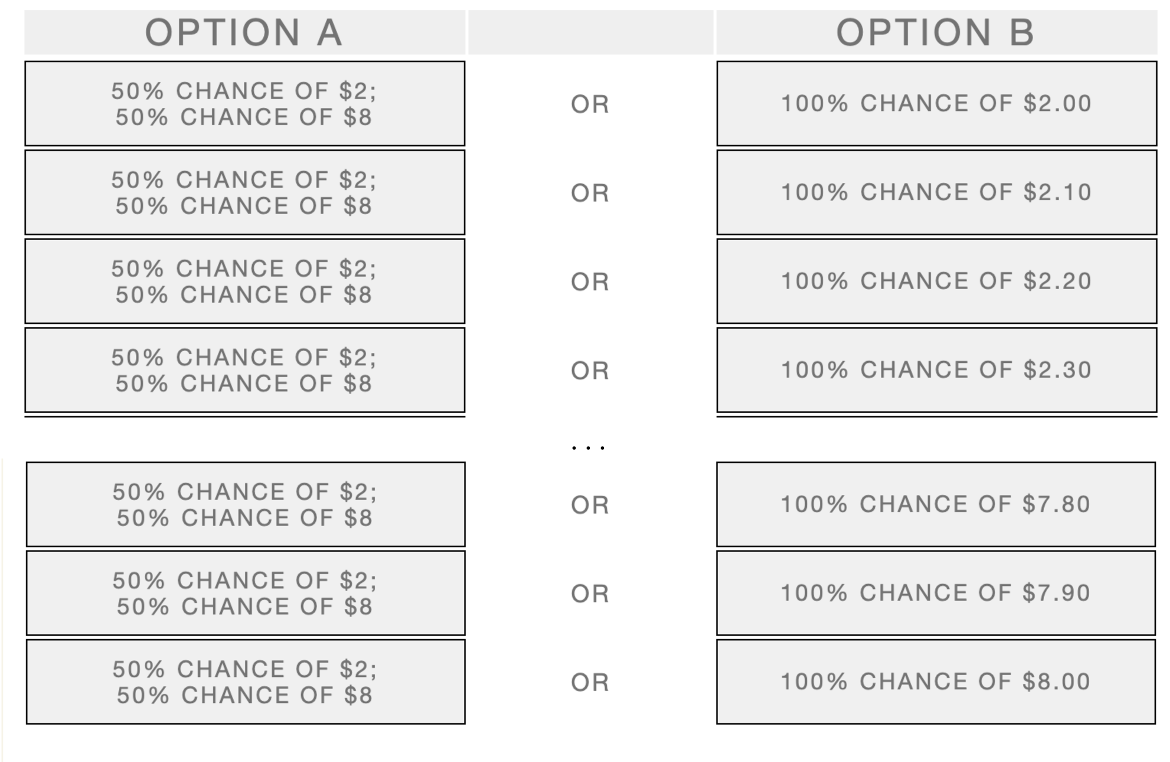
Secondary consent form, informing subjects of the non-monetary incentives of the study.

Figure B.3: Sample Time Preference Question

OPTION A		OPTION B
$8 IN 7 WEEKS	OR	$0.00 IN 6 WEEKS
$8 IN 7 WEEKS	OR	$0.10 IN 6 WEEKS
$8 IN 7 WEEKS	OR	$0.20 IN 6 WEEKS
$8 IN 7 WEEKS	OR	$0.30 IN 6 WEEKS
$8 IN 7 WEEKS	OR	$0.40 IN 6 WEEKS
$8 IN 7 WEEKS	OR	$0.50 IN 6 WEEKS
	...	
$8 IN 7 WEEKS	OR	$7.70 IN 6 WEEKS
$8 IN 7 WEEKS	OR	$7.80 IN 6 WEEKS
$8 IN 7 WEEKS	OR	$7.90 IN 6 WEEKS
$8 IN 7 WEEKS	OR	$8.00 IN 6 WEEKS

Screenshot of a sample question eliciting preferences over payments made at different times. Ellipsis indicates additional omitted rows. Subjects select a switching point between the long-term payment on the left and the short term payment on the right by clicking a cell. The selected option in each row changes color to make the selections clear.

Figure B.4: Sample Risk Preference Question



Screenshot of a sample question eliciting preferences over risky payments. Ellipsis indicates additional omitted rows. Subjects select a switching point between the 50/50 gamble on the left and the certain payment on the right by clicking on a cell. The selected option in each row changes color to make the selections clear.

Figure B.5: Introduction to Organ Transplantation

Organ Transplantation in the United States

Currently, over 100,000 human patients are waiting for an organ transplant in the US, and more than 6,200 people die each year while waiting for a transplant. Surgeons can save lives by transplanting kidneys, livers, heart, and lungs into sick patients.

Organ failure can affect cats the same way it affects humans. Three veterinary transplant centers in the US provide live-saving kidney transplants for sick cats.

This survey will ask your opinions about allocating organ transplants for humans and for cats.

You may see similar questions multiple times. Please read the instructions in each section carefully and answer each question as best you can.

Subjects view a short description of human and feline organ transplantation in the US before making allocation decisions.

Figure B.6: Survival Tradeoff Elicitation Section Instructions

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In this section, you will be asked four questions. Each question will ask you how you would allocate a single organ transplant between two feline patients in need of a transplant.

When making your choices, you can assume that:

- All patients are adults (at least 18 months old).
- We know exactly how long each patient will survive.
- Patients have a good quality of life whenever they are alive.
- Patients will not have another opportunity for a transplant if they do not receive one based on your choice.

Your responses in this section may be used to allocate a real transplant to one of two cats in need of a transplant.

If this section is randomly selected, we will partner with veterinary practices to identify two cats in need of a transplant that are unlikely to receive a transplant without financial support, and we will pay for a transplant for one of them.

You cannot influence which cats are selected as candidates for the transplant, but if this section is randomly selected, your answers and yours alone will determine which of the two cats receives the transplant.

We will rely on the judgment of a veterinary expert to determine the life expectancy of the two cats with and without the transplant. The cat who most closely matches your choices in this section will receive the transplant.

Instructions shown before subjects respond to four incentivized cat survival price lists. The goal of the instructions is to inform subjects about the stakes of the questions and avoid strategic behavior by encouraging truthful responses.

Figure B.7: Survival Price List Instructions

Stanford

Real Cat Transplant

Stakes: This section may be randomly selected. If randomly selected, **your responses will determine which of two cats in need of a transplant receives the transplant.**

How your response may be used: We will identify two cats in need of a transplant, and we will allocate a transplant to the cat who most closely matches your choices in this section based on estimates of life expectancy with and without a transplant.

Task: Each row below represents a different pair of potential transplant recipients. Indicate which patient you would prefer to receive the transplant in each row by clicking on the row where you would like to switch from choosing Patient A on the left to choosing Patient B on the right. Recall that both Patient A and Patient B are **cats**.

Before each survival price list, subjects are reminded of the stakes, the possible implementation of their choice, and the instructions for the task. The figure shows a screenshot of the instructions preceding a survival price list in the incentivized cat condition.

Figure B.8: Rule-Based Transplant Allocation Question

Task: Please click and drag to rank the following rules for allocating transplants in order from most preferred (1) to least preferred (5). Which of these rules should be used to allocate one available transplant between two **cats**?

1. Perform no transplant
2. Consider how much longer each patient will live with the transplant than without the transplant and give the transplant to the patient whose life will be extended more
3. Give the transplant to the patient who will live the longest with the transplant
4. Give the transplant to the patient who will die first without the transplant
5. Give each patient a 50% chance of receiving the transplant

In rule-based questions, subjects are asked to rank five rules that could determine how to allocate a single organ transplant between two candidates. Subjects are also reminded of the stakes and implementation method before each question.

Figure B.9: Instructions for Payments to Others

Stanford

In this section, you will be asked four questions. Each question will ask you how you would allocate extra payments to two future participants in this study.

One participant will receive a *Low* payment, and the other will receive a *High* payment. The *Low* and *High* payments are different for each participant.

Within each question, Participant B's *High* payment increases in each row. The other three payments stay the same.

One question in this section will be randomly selected to determine extra payments to two participants in this study; all questions are equally likely to be selected.

Instructions for allocating funds to other study participants. Before each question, subjects are reminded of the stakes, possible implementation, and instructions to complete the task.

Figure B.10: Sample Payment Allocation Table

PARTICIPANT A		PARTICIPANT B
LOW: $0.60 HIGH: $2.40	OR	LOW: $0.90 HIGH: $2.40
LOW: $0.60 HIGH: $2.40	OR	LOW: $0.90 HIGH: $2.50
LOW: $0.60 HIGH: $2.40	OR	LOW: $0.90 HIGH: $2.60
LOW: $0.60 HIGH: $2.40	OR	LOW: $0.90 HIGH: $2.70
LOW: $0.60 HIGH: $2.40	OR	LOW: $0.90 HIGH: $2.80
LOW: $0.60 HIGH: $2.40	OR	LOW: $0.90 HIGH: $2.90
LOW: $0.60 HIGH: $2.40	OR	LOW: $0.90 HIGH: $3.00

A sample *payment allocation* question with no response selected. Participant A's payments and Participant B's *low* payment remain constant in each row; Participant B's *high* increases by $0.10 in each row. Upon selection, one cell is highlighted in each row to indicate the participant receiving the *high* payment, and text in each cell becomes boldfaced to indicate whether the participant is receiving the *high* or *low* payment.

Figure B.11: Hypothetical Ethical Scenario

Stanford

Now we want to ask a different type of question that helps us better understand how you think about decisions involving life and death. Please consider the following hypothetical scenario:

Casey is a crewperson on a marine-research submarine traveling underneath a large iceberg. An onboard explosion has damaged the ship, collapsing the only access corridor between the upper and lower parts of the ship. The upper section, where Casey and most of the crew are located, does not have enough oxygen for all of them to survive until the submarine has reached the surface. There is enough oxygen in the lower section, where the only remaining crewmember is unconscious.

There is an emergency access hatch between the upper and lower sections. If released, it will allow oxygen to reach Casey and the others, but the hatch will fall to the deck and crush the unconcious crewmember below. If Casey does not release the hatch, the unconscious crewmember will recover and survive, but Casey and the rest of the crew will all certainly die.

Is it appropriate for Casey to release the hatch and crush the crewmember below to save himself and the other crewmembers?

Source

Yes	No
○	○

Subjects react to an ethical scenario based on the common "trolley problem." This formulation of the scenario is based on that used in Elías et al. (2019). There are no payments or incentives involved in this question.

C Results Appendix

This appendix provides supplementary results from the within-subject experiment (Section C.1) and between-subject experiment (Section C.2), as well as robustness checks on the main results (Section C.3).

C.1 Supplementary Results in Within-Subject Experiment

Figure C.1 demonstrates a range of indifference curves available under the assumption of constant elasticity of substitution with equal weight on the survival times of the two patients. Figure C.2 shows the distribution of individual-level parameter ρ, describing the curvature of the indifference curve; the 2:1 fairness discount described in the main results is a reparameterization of ρ. Figure C.3 shows the distribution of 2:1 fairness discounts separately by the subjects' most preferred rule: subjects who select the rule maximizing the minimum survival time also display higher 2:1 fairness discount, while subjects who select the rule maximizing the increase in survival time show low 2:1 fairness discounts in the survival price lists. The distributions of 2:1 fairness discounts shown in Figure C.4 demonstrates that allocations are almost identical across patient species and between incentivized and unincentivized conditions.

Table C.1 shows the relationship between survival equality tradeoffs and risk and time preferences, regressing 2:1 fairness discounts in incentivized survival price lists on risk aversion, discount rate, and present bias. On the other hand, Table C.2 shows that demographics and other personal characteristics do not predict fairness discounts.

Figure C.5 shows the distribution of 2:1 fairness discount in monetary payments. Table C.3 shows the relationship between 2:1 fairness discounts in survival times and monetary payments, indicating that a 10 percentage point increase in 2:1 FD in payments is associated with a 4.1 percentage point increase in 2:1 FD in survival times.

C.2 Between-Subject Results

This section describes supplementary results from the between-subject experiment. Table C.4 shows summary statistics for the experimental sample, demonstrating balance of observable characteristics across treatment groups. The distribution of 2:1 fairness discounts estimated from incentivized survival price lists is very similar to that estimated from unincentivized desicions (see Figure C.6). Figure C.7 plots the CDFs of rule rankings across treatments for subjects' second responses in repeated questions, demonstrating that the similarity of rankings across species and incentive conditions is consistent in repeated questions. Various measures of decision noise in repeated questions are shown in Table C.5.

Table C.1: 2:1 Fairness Discounts and Preferences over Risk and Time

	2:1 Fairness Discount in Incentivized Survival Decisions
Risk Aversion	-0.021**
	(0.007)
Temporal Discount Rate	0.003*
	(0.001)
Present Bias	0.015**
	(0.005)
Constant	0.057***
	(0.004)
Observations	311
Adjusted R^2	0.053

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table shows OLS regression of 2:1 fairness discounts estimated from transplant decisions on parameter estimates for risk aversion and temporal discounting estimated from incentivized bonus payment decisions. *Risk Aversion* is the individual-level average degree of risk aversion displayed over three different questions comparing lotteries against certain payments; *Temporal Discount Rate* is the individual-level average discount rate calculated from six questions, including three questions about discount from the present versus the future, and three questions about comparing the value of payments at different future dates, with higher values of Temporal Discount Rate indicating more weight on short-term payoffs relative to long-term payoffs; *Present Bias* is an indicator variable for whether the discount rate displayed in questions involving immediate payouts is higher than the rate in the questions comparing payments at different future dates. Robust standard errors are reported in parentheses. R^2 is indicated. Sample: 311 subjects in within-subject experiment.

Table C.2: 2:1 Fairness Discount and Subject Demographics

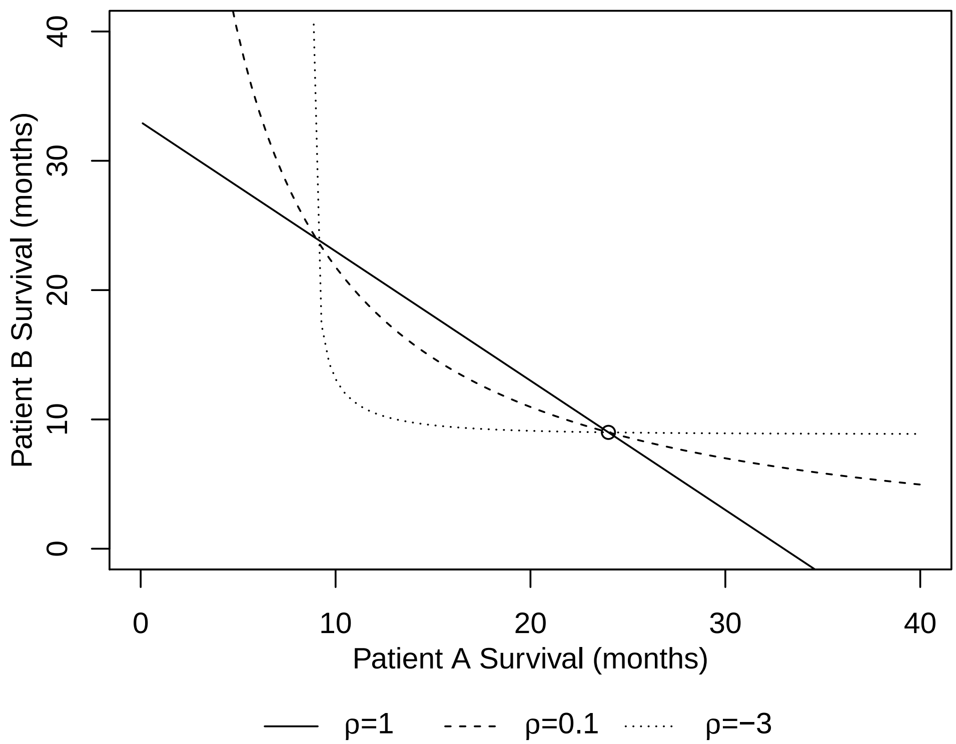
	2:1 Fairness Discount in Incentivized Survival Decisions
Female	-0.001
	(0.005)
Age	-0.000
	(0.000)
Asian	-0.015
	(0.011)
Black or African American	-0.002
	(0.009)
Multi-racial or other	-0.004
	(0.009)
Cat Owner	0.003
	(0.005)
Liberal on Economic Issues	0.002
	(0.007)
Liberal on Social Issues	0.000
	(0.007)
Trolley Problem Consequentialist	-0.005
	(0.007)
Constant	0.087***
	(0.016)
Observations	311
R^2	0.020

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table shows OLS regression of 2:1 fairness discount estimated from incentivized transplant decisions on subject characteristics. Robust standard errors are reported in parentheses. R^2 is indicated. Sample includes 311 experimental subjects in within-subject experiment.

Figure C.1: CES Indifference Curves



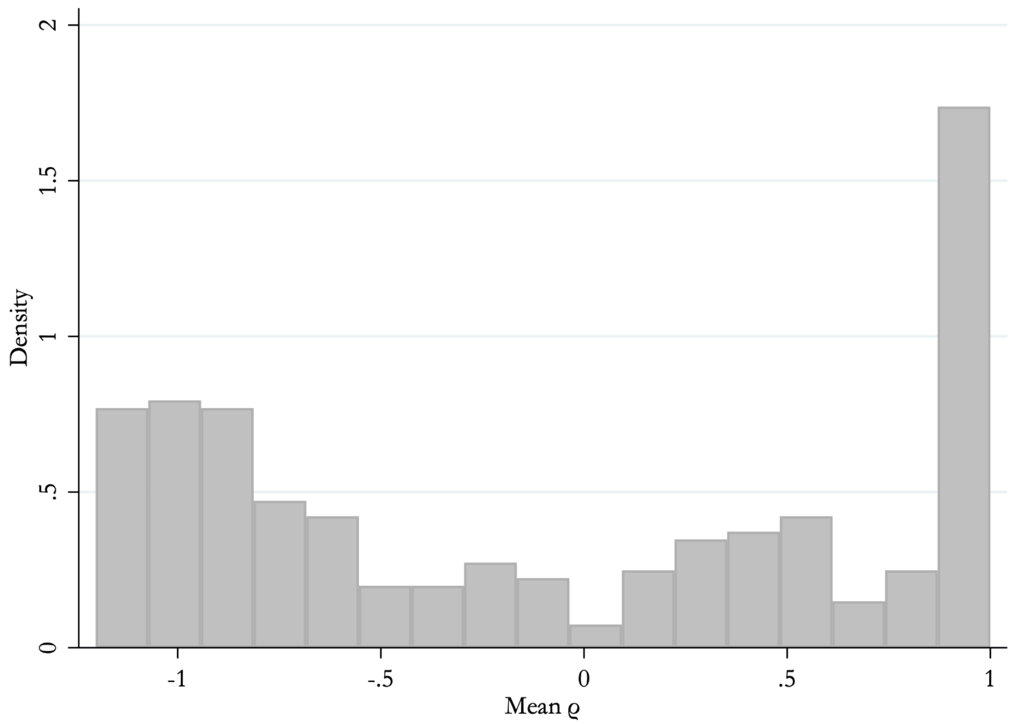
Sample indifference curves possible with constant elasticity of substitution and equal weight on the survival times of the two patients. As in the example in Figure 1, Patient A lives for 24 months with a transplant, and Patient B lives for nine months without a transplant. The point representing this survival bundle is plotted at (24, 9). The figure shows three possible indifference curves passing through this point, representing $\rho \in \{-3, 0.1, 1\}$.

C.3 Robustness Checks

Results are largely robust to alternative aggregation methods and sample restrictions. Figure C.8 shows 2:1 fairness discounts in incentivized survival tradeoff elicitations with no adjustments for outward-bending utility functions. Negative fairness discounts indicate that a subject has outward-bending indifference curves, preferring an increase in survival to the longer-lived patient over an increase of the same size to the shorter-lived patient.

Limiting the sample to subjects who passed all comprehension tests with no errors leads to small changes in the main results. About a quarter of subjects (25.1%) fail at least one comprehension check on the first try. Subjects who make a mistake in the comprehension

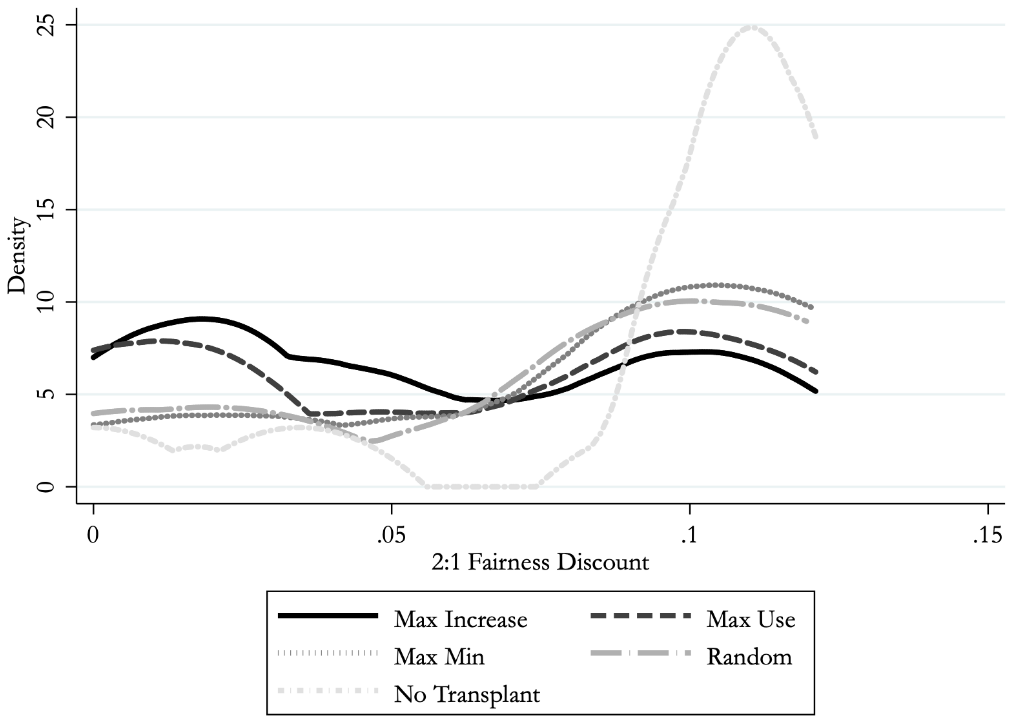
Figure C.2: Distribution of ρ in Incentivized Transplant Allocations



Distribution of subject-level averages of CES indifference curve parameter ρ in incentivized survival price lists. Averages are taken across all four survival price lists. ρ cannot exceed one by design. $\rho = 1$ represents perfect substitution between the two patients; $\rho \to -\infty$ represents Leontief preferences. Sample: 311 subjects in within-subject experiment.

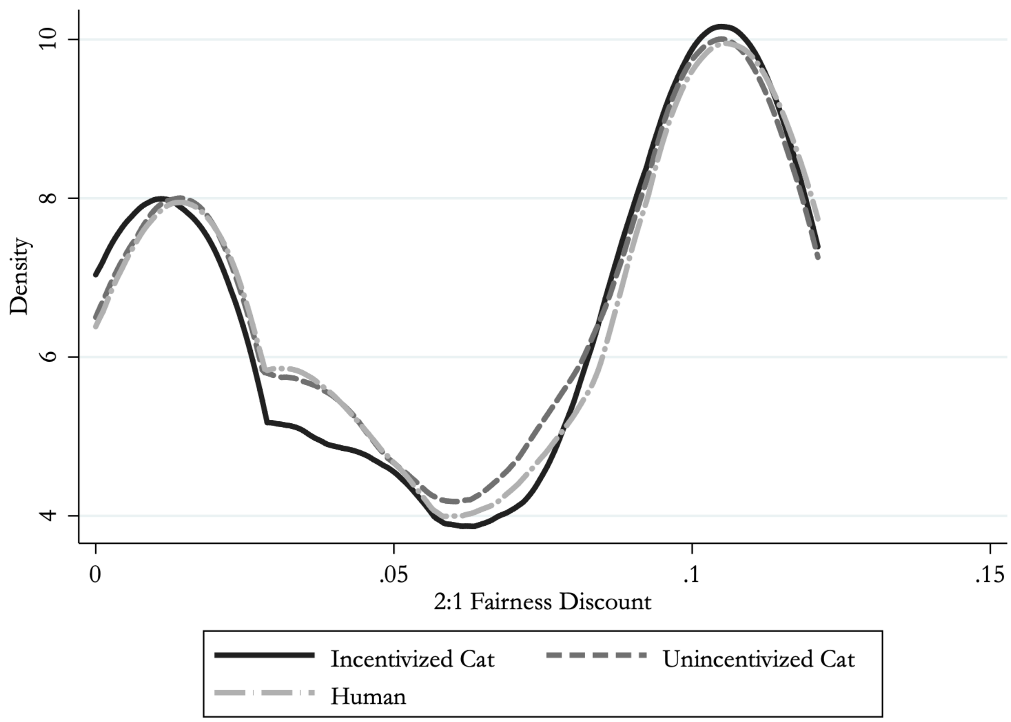
checks are more equality-seeking in their allocations, with an average 2:1 fairness discount of 7.7% compared to 5.6% among subjects with no mistakes (p-value < 0.01; see Figure C.9). This difference appears to be driven by meaningful differences in preferences, rather than confusion: subjects who failed at least one comprehension check are more likely to pick maximizing the minimum survival time as their top-choice rule than other subjects (21.7% versus 8.5%, p-value < 0.01), and less likely to choose the rule maximizing the increase in survival times (24.4% versus 45.1% ,p-value < 0.01). However, this group has a relatively small effect on the overall results, and removing subjects who fail a comprehension check doesn't change the ranking of rules (see Figure C.10).

Figure C.3: Distribution of 2:1 Fairness Discounts by Top-Ranked Rule



Kernel density plot of estimated 2:1 fairness discounts by subject's top-ranked allocation rule in incentivized cat condition. The five rules include *Maximize the Increase in Survival Time* (Max Increase), *Maximize Use of the Organ* (Max Use), *Maximize the Minimum Survival Time* (Max Min), *Select Patient Randomly* (Random), and *Perform No Transplant* (No Transplant). Sample: 311 subjects in within-subject experiment.

Figure C.4: Distribution of 2:1 Fairness Discount by Treatment Condition



Distribution of subject-level average 2:1 fairness discounts by treatment condition in within-subject experiment. Fairness discounts are calculated as the average across four questions in a treatment condition. Sample: 311 subjects in within-subject experiment.

Table C.3: 2:1 Fairness Discount in Payment and Transplant Allocation Decisions

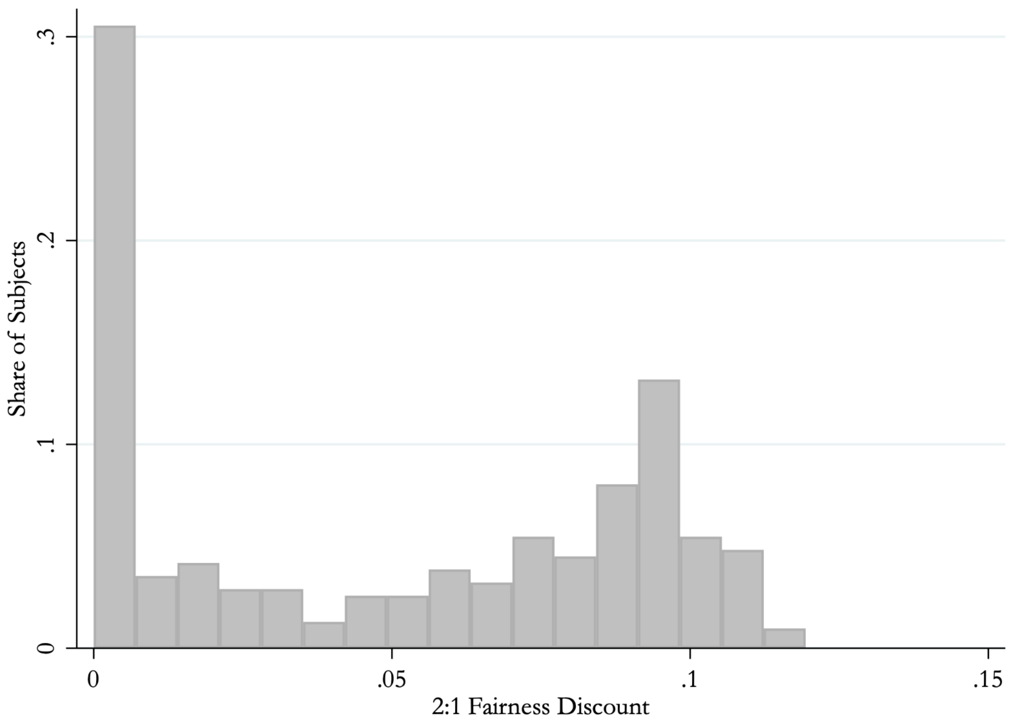
	2:1 Fairness Discount in Incentivized Survival Decisions
2:1 Fairness Discount in Money	0.411***
	(0.059)
Constant	0.041***
	(0.004)
Observations	311
R^2	0.143

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table shows OLS regression of subjects' average 2:1 fairness discounts estimated from transplant decisions on 2:1 fairness discounts estimated from payment allocation decisions. Robust standard errors are reported in parentheses. Adjusted R^2 is indicated. Sample: 311 subjects in within-subject experiment.

Figure C.5: Distribution of 2:1 Fairness Discount in Payment Allocation



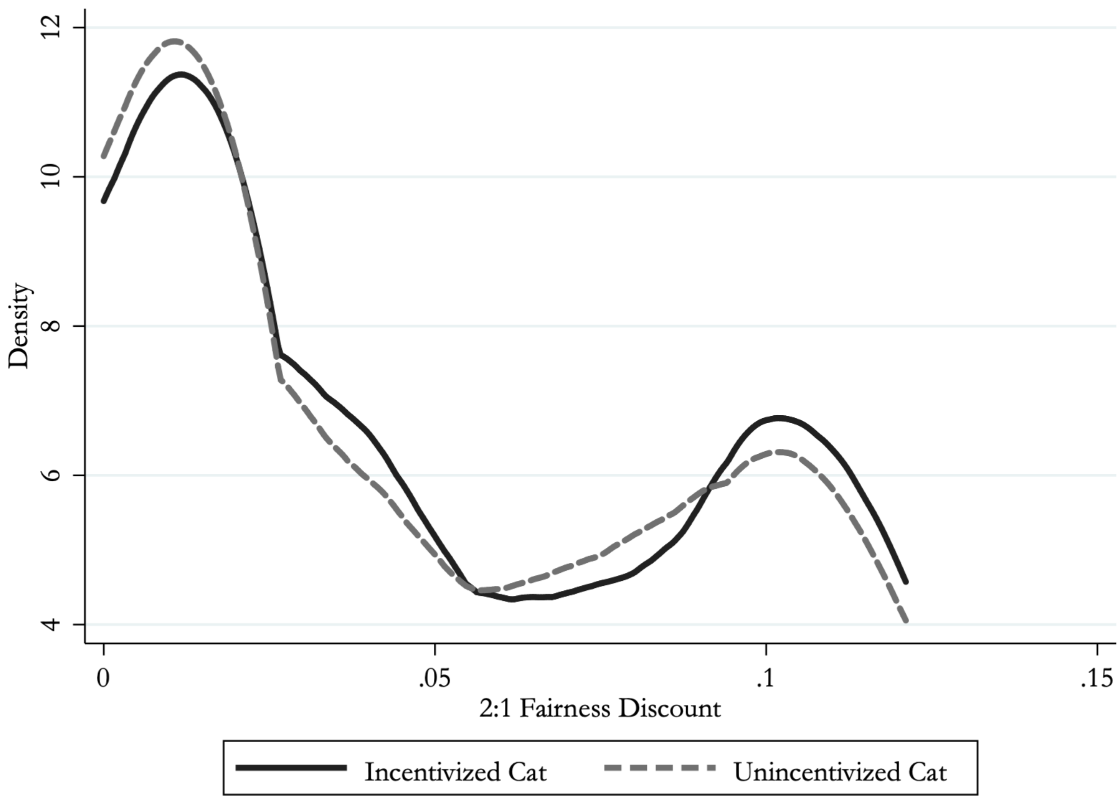
Distribution of subject-level averages of 2:1 fairness discounts in allocating payments to other experimental subjects. Fairness discounts are calculated as the average across four multiple price lists. Fairness discounts are bounded below at zero to avoid outward-bending indifference curves. Mean 2:1 FD: 4.9%. Sample: 311 subjects in within-subject experiment.

Table C.4: Between-Subject Sample Summary Statistics

	Full Sample	Hypothetical Cat	Incentivized Cat	Hypothetical Human
Age	41.44	41.64	41.52	41.13
	(12.67)	(12.58)	(12.31)	(13.16)
Female	0.48	0.51	0.47	0.47
	(0.50)	(0.50)	(0.50)	(0.50)
Asian	0.06	0.06	0.06	0.07
	(0.24)	(0.24)	(0.24)	(0.26)
Black or African American	0.06	0.07	0.05	0.08
	(0.25)	(0.25)	(0.22)	(0.26)
White	0.82	0.82	0.81	0.81
	(0.39)	(0.38)	(0.39)	(0.39)
Multi-racial or other	0.06	0.05	0.08	0.04
	(0.23)	(0.22)	(0.27)	(0.20)
Hispanic	0.08	0.06	0.10	0.07
	(0.27)	(0.24)	(0.30)	(0.26)
Pet Owner	0.75	0.75	0.75	0.74
	(0.43)	(0.43)	(0.43)	(0.44)
Cat Owner	0.39	0.36	0.41	0.41
	(0.49)	(0.48)	(0.49)	(0.49)
Liberal on Social Issues	0.52	0.53	0.54	0.49
	(0.50)	(0.50)	(0.50)	(0.50)
Liberal on Economic Issues	0.39	0.42	0.39	0.37
	(0.49)	(0.49)	(0.49)	(0.48)
Observations	988	329	341	318

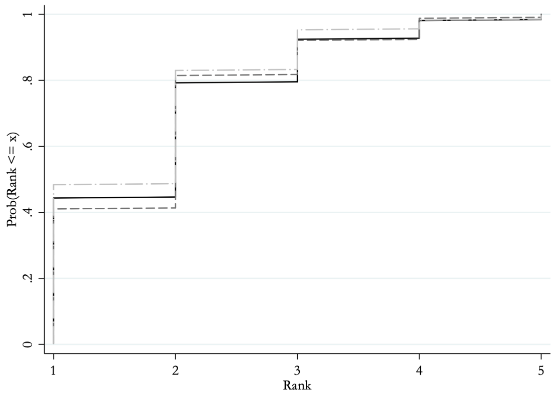
Table shows the means and standard deviations of experimental subjects' demographic and personal characteristics in the between-subject sample. Standard deviations are shown in parentheses.

Figure C.6: Distribution of 2:1 Fairness Discount by Between-Subject Treatment

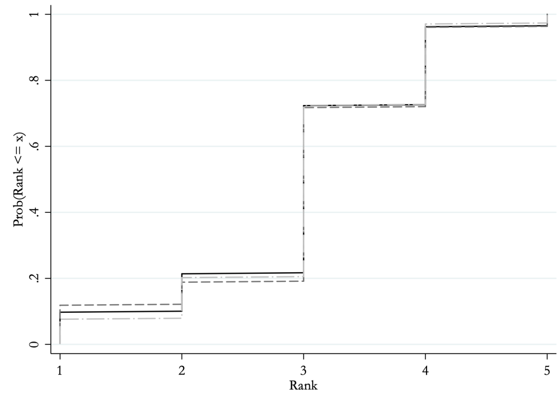


Distribution of subject-level average 2:1 fairness discounts by treatment condition in between-subject experiment. Fairness discounts are calculated as the average across four questions in a treatment condition. Mean 2:1 fairness discounts are 4.8% in the incentivized treatment, and 4.6% in the unincentivized treatment; a t-test fails to reject the null hypothesis that mean fairness discounts in the two treatment conditions are equal (p-value: 0.63). Sample: 670 experimental subjects in the between-subject experiment (341 in the incentivized condition, 329 in the unincentivized condition).

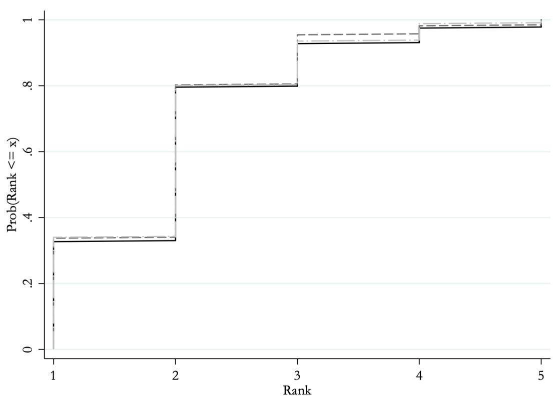
Figure C.7: Repeated Rule Rankings Across Treatment Conditions



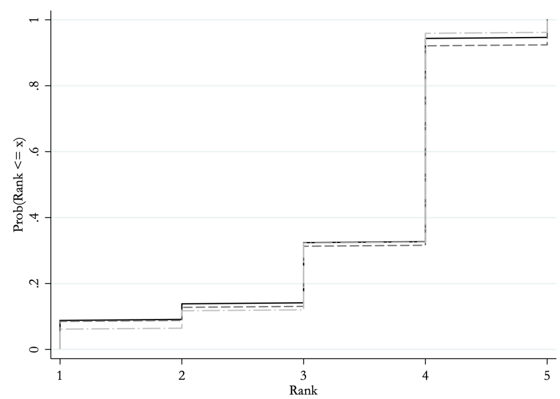
(a) Maximize Increase in Survival Time



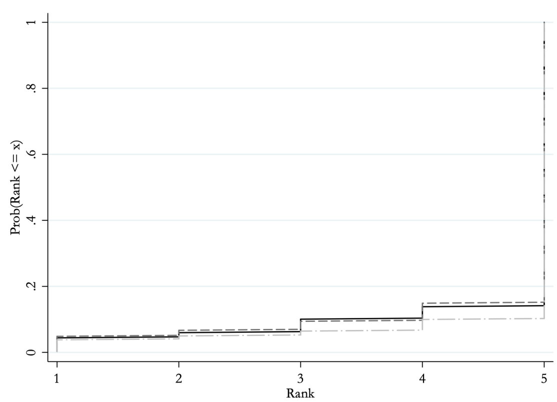
(b) Maximize Minimum Survival Time



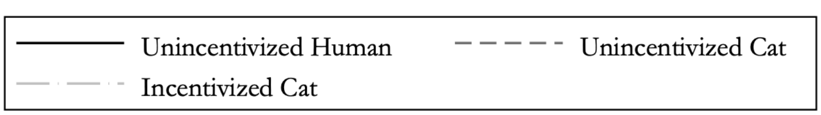
(c) Maximize Use of the Organ



(d) Select Patient at Random



(e) Perform No Transplant



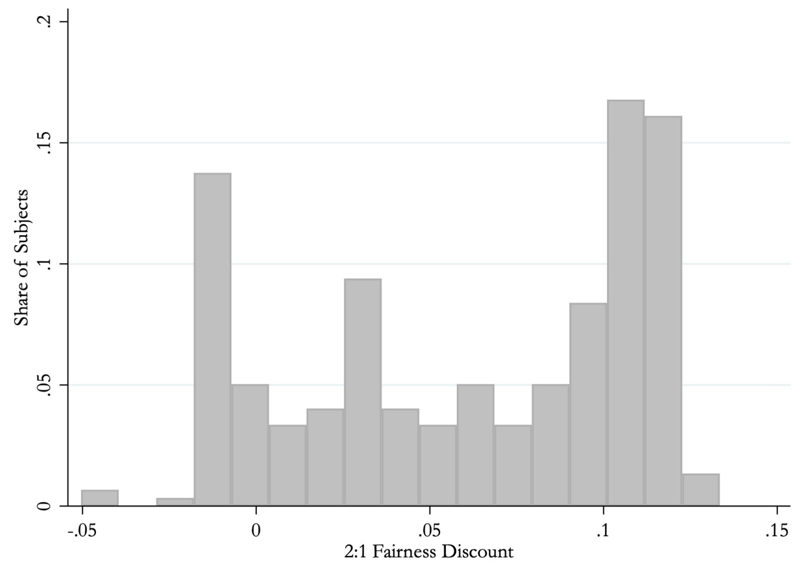
CDFs of second-decision rule rankings under *Incentivized Cat*, *Unincentivized Cat*, and *Unincentivized Human* conditions in the between-subject experiment. Each figure shows the distribution of rankings for one of the five allocation rules (*Maximize the Increase in Survival Time*, *Maximize the Minimum Survival Time*, *Maximize Use of the Organ*, *Select Patient at Random*, and *Perform No Transplant*) based on the second set of rankings submitted by each subject. Sample: 988 subjects in between-subject experiment.

Table C.5: Decision Noise in Rule-Based Allocation Decisions

	Hypothetical Cat	Incentivized Cat	Hypothetical Human
Inconsistent Ranking of Any Rule	0.43	0.42	0.42
	(0.03)	(0.03)	(0.03)
Inconsistent Ranking of Top-Ranked Rule	0.26	0.24	0.25
	(0.02)	(0.02)	(0.02)
Inconsistent Ranking of Second-Ranked Rule	0.29	0.27	0.31
	(0.03)	(0.02)	(0.03)
Inconsistent Ranking of Third-Ranked Rule	0.31	0.28	0.29
	(0.03)	(0.02)	(0.03)
Inconsistent Ranking of Fourth-Ranked Rule	0.24	0.24	0.22
	(0.02)	(0.02)	(0.02)
Inconsistent Ranking of Fifth-Ranked Rule	0.11	0.10	0.10
	(0.02)	(0.02)	(0.02)
Number of Inconsistencies Among Inconsistent Subjects	2.81	2.72	2.84
	(0.06)	(0.05)	(0.06)
Observations	329	341	318

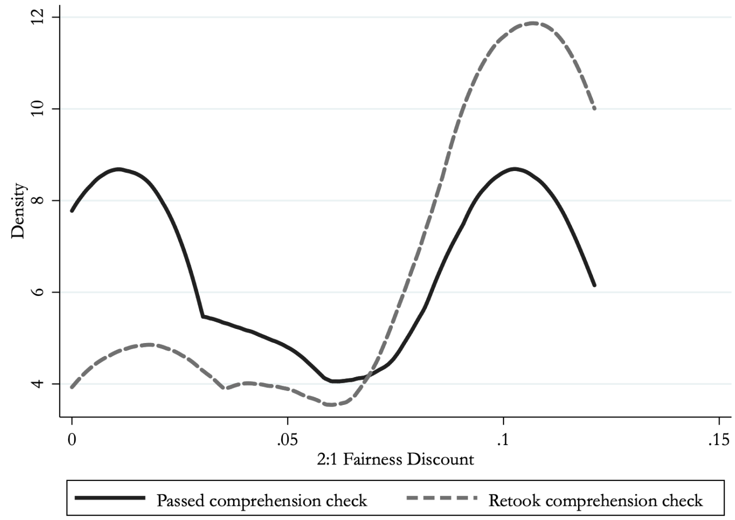
Table shows rates of inconsistent rule rankings across treatments in the between-subject experiment. Standard errors are shown in parentheses. *Inconsistent Ranking* measures whether a subject submitted a different rank order of the available rules in repeated questions. *Number of Inconsistencies Among Inconsistent Subjects* measures how many rules change position among inconsistent rankings; note that for any inconsistent ranking, at least two rules much change position. Sample: 988 subjects in between-subject experiment.

Figure C.8: Distribution of 2:1 Fairness Discounts, Unadjusted



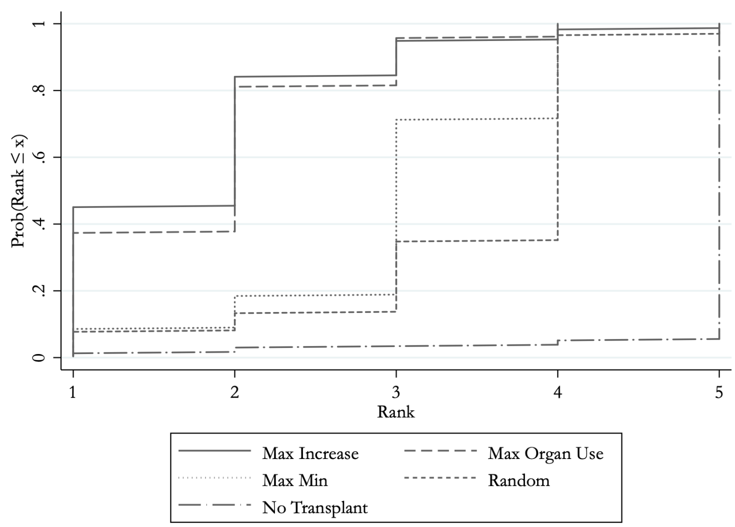
Distribution of subject-level average 2:1 fairness discounts, with no adjustments for outward-bending indifference. Fairness discounts are calculated as the average across four questions in a treatment condition; responses that are incompatible with any equally weighted CES utility function are treated as missing. Mean 2:1 FD: 6.2%. Share of subjects with 2:1 $FD < 0$: 16.8%. Sample: 298 experimental subjects in within-subject experiment with at least one CES-compatible response in an incentivized survival price list.

Figure C.9: Distribution of 2:1 Fairness Discounts by Instruction Comprehension



Distribution of subject-level average 2:1 fairness discounts in incentivized cat survival price lists by performance on comprehension checks. Fairness discounts are calculated as the average across four questions in a treatment condition. Sample: 311 experimental subjects in within-subject experiment (78 who respond incorrectly to at least one comprehension check, 233 who respond correctly in every comprehension check).

Figure C.10: Incentivized Rule Rankings (Passed Comprehension Check)



Cumulative distribution function (CDF) of subject rankings of incentivized cat transplant allocation rules among subjects who successfully passed all comprehension checks on the first try. The five rules include *Maximize the Increase in Survival Time* (Max Increase), *Maximize Use of the Organ* (Max Organ Use), *Maximize the Minimum Survival Time* (Max Min), *Select Patient at Random* (Random), and *Perform No Transplant* (No Transplant). Sample: 233 subjects in within-subject experiment with correct initial responses in every comprehension check.