Can Markets Save Lives?
An Experimental Investigation of a Futures Market for Organs

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Many people die waiting for organ transplants even though the number of usable organs far exceeds the number needed for transplant. Markets for organs represent one plausible solution, but policymakers are reluctant to establish organ markets despite potential for mutually beneficial exchanges. We employ laboratory methods to study an overlapping-generations game that models the decision to donate, and we ask whether creating a futures market reduces the shortage. We find that the market increases organ supply. However, as critics suggest, we find that market supply derives disproportionately from the poor and that market design is crucial to matching supply to demand.

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Introduction

Advances in medical technology enable human organs to be transplanted from one person to another. Many types of organ transplant are now fairly routine procedures that save thousands of lives each year. However, countries around the world face chronic shortages of organs for transplant. For example, in the United States more than 100,000 people in need of an organ transplant are currently on a waiting list.\(^1\) Deceased donors account for most transplant organs, though in the case of kidneys living donors (usually family members) provide organs to an increasing number of those waiting. However, since data was first collected in 1988, demand for organs has grown far more quickly than donor supply. In fact, in just the last year, over 6000 Americans died while on the waiting list for organ transplants.\(^2\)

Societies are grappling with ways to reduce the shortage of transplantable organs. For example, recent work by Roth, Sunmez, and Unver (2004) highlights the power of matching markets to facilitate live donation by matching multiple donor-recipient pairs to overcome immunological incompatibility. Cynowiec, et al. (2009) conclude that efforts to reduce the shortage of organs will focus heavily on providing incentives for increasing organ supply. In one such effort Kessler and Roth (forthcoming) design an experiment to test whether offering waiting list priority to registered donors will increase the supply of organs. However, as pointed out by Surman, et al (2008) there are insufficient data to provide a solid foundation for new policy. Jasper, et al (2004) and Haddow (2006) report surveys of US medical professionals’ and the Scottish general public’s views on using various monetary and non-monetary incentives to promote donation, respectively, and both find that many people are opposed to incentives even though they believe such mechanisms would be effective. Jasper et al (2004) claim “nothing short of a market test can demonstrate conclusively the impact that incentives would have on the supply of donated organs.”(p. 384)

We rely upon experimental methods to test the impact of creating a futures market for organs. As argued by Smith (1994) controlled laboratory experiments provide a means to

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\(^1\) Statistic from US Dept. of Health and Human Services (http://optn.transplant.hrsa.gov/latestData/rptData.asp)

\(^2\) http://online.wsj.com/article/SB1222948107890913051.html
evaluate policy proposals. Specifically, we model the incentives faced by donors and recipients to explore mechanisms for increasing the supply of organs. We test 1) the lifesaving effectiveness of reducing the opportunity cost (‘repugnance’) of organ transfer, 2) the power of a market solution to an organ shortage, and 3) the distributional impact of these interventions. In the laboratory we control the number of people in need of an organ, the number of potential organ providers, and the wealth of each agent. We begin with a system of “presumed consent” voluntary donation in which agents may opt out of donating or accepting an organ. ³ To model repugnance or an ethical cost of transferring organs, we implement a lottery with a large potential payoff. ⁴ This lottery is available only to those not exchanging organs. By comparing situations with and without this lottery, we can directly evaluate the effects of induced opportunity cost for organ donation or sales. To determine whether access to a market for organs will reduce the excess demand for organs, we replicate the lottery environment with and without a market.

We find that eliminating the lottery increases the number of lives saved by organ donation relative to our baseline, presumed consent condition; on the other hand, the market actually increases the death rate. We identify the causes of death in the baseline treatment as both insufficient demand and insufficient supply. While eliminating the lottery solves both of these problems, the market only increases supply. However, only 11% of those in need of an organ would have been unable to acquire one at some price in the market treatment. Hence, we find more support for the effectiveness of the market solution than indicated by the ‘death rate’ statistics alone. A combination of institutional factors and artificial market thinness caused many of the deaths in the market treatment, highlighting the importance of the specific market

³ Evidence suggests that a presumed-consent system is more effective than an informed-consent or ‘opt-in’ system at inducing cadaveric donation; however, even where presumed-consent has become policy, a shortage remains. See e.g. (Mossalios, et al. 2008). While many countries including the U.S. continue to rely upon an opt-out system, our choice of an opt-out system as a baseline provides a conservative test for the marginal value of creating a futures market in organs.

⁴ Clearly we cannot actually induce the strong moral feelings, desperate needs, and risks associated with organ donation, sales and transplantation in the lab without actually creating a market for organs (something IRB will not allow). The purpose of this induced cost is merely to model the incentives involved in organ transplantation. Roth and Kessler (forthcoming) employ a similar technique. The high potential payoff from the lottery is designed to be appealing, but the low expected payoff means that upon deeper inspection people should find little value in playing the lottery. In this sense, our lottery mimics the moral repugnance associated with organ transfers.
institution when implementing an organ market. Furthermore, as some critics of organ markets have suggested, we find that poor subjects disproportionately undertake organ sales.

We also conducted a post-experiment survey to gauge the views of our respondents regarding organ markets and donations and ask if these attitudes correlate with their observed behavior in the experiment. Overwhelmingly, our respondents were supportive of voluntary organ donation, although Catholic respondents were less supportive. On average respondents were indifferent to compensating donors or their families, but they were strongly opposed to “selling organs.” Reported opinions of organ markets and donations were uncorrelated with donations in the experiment. However, subjects who offered to sell organs in the experiment were more supportive of selling organs with the proceeds going to charity.

Background

Many policy solutions to the organ shortage have been suggested, but none has been so controversial as permitting a (regulated) market for organs. In the 1960s, British newspapers began printing advertisements from live donors attempting to sell their kidneys, suggesting the prospect of an open market in human organs (Dukeminier Jr., 1970). In 1983, a former physician, Dr. H. Barry Jacobs created a brokerage for human kidneys in Virginia, opening the debate in the United States and sparking moral outrage. Within a year, a federal law was passed to ban the sale of human organs and his company was shuttered (S.H.D. 1985).\(^5\) Roth (2007) argues that the “repugnance” of such transactions stems from moral opposition to the objectification of the body, the potential for coercion, and the fear that permitting one sort of problematic transaction will open the door to a host of others. Whether the objection is grounded in an individualized moral code, shared cultural heritage, or religious creed, many people regard the buying and selling of the body as taboo. To uphold a moral code or to maintain purity, people are willing to rule out even the possibility of potentially beneficial transactions (Durkheim 1976, Belk et al. 1989).

\(^5\) India in the 1980s and early 1990s and Iran since 1988 are the only examples of legal organ markets. (Becker and Elias 2007)
Despite others’ strong moral objections, many proponents of organ markets have argued that providing monetary incentives to increase supply of transplant organs would alleviate shortages and supplement supply provided by altruistic donors (Arrow 1972, Perry 1980, S.H.D. 1985, Mahoney 2000, Becker and Elias 2007). Opponents of a market have argued that the commoditization of organs may actually crowd out altruistic motivations and thereby decrease the total quantity supplied (Titmuss 1971, Singer 1973, DeLong et al 1995, Byrne and Thompson 2001). Additionally, opponents argue that the decision to sell an organ for live donation may lead to time-inconsistent decisions and regret (Byrne and Thompson 2001, Satz 2008). Some also highlight the potential negative distributional consequences of organ markets by pointing to the injustice of a system in which sales are undertaken primarily by the poor and desperate (Archard 2002, Borna 1987).\(^6,7\)

Of those opposed to market solutions for the shortage of transplantable organs, many argue that sufficient supply could be obtained through better marketing to the altruism of potential donors and that the organ shortage represents a failure that could be alleviated by simply improving procurement efforts (Prottas 1983, Thorne 1998, Healy 2004). For example, Roth and Kessler (forthcoming) employ laboratory experiments to test an incentive system in which those who agree to be cadaveric donors are given priority in the future if they are in need. Similarly, there is empirical evidence that a policy of “presumed consent” for donation, a legal regime under which people are presumed to be willing to donate organs upon death unless they specify otherwise, increases the available supply of organs. This approach has been successfully adopted in Spain, Portugal and Austria (Abadie and Gay, 2006, Mossialos et al, 2008). In contrast, the United States relies upon an “informed consent” or opt-in system for deceased organ donation which generally leads to lower cadaveric donation rates. However, even if all cadaveric organs were made available for transplant, a shortage would remain, highlighting the potential power of a market solution (Israni et al, 2005, Beard et al, 2006).

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\(^6\) Hypothetical survey evidence in Halpern et al. (2010) suggests that income is not strongly correlated with willingness to sell or donate live kidneys and that other factors such as own risk of kidney failure, the price offered, and relation to the recipient are dominant. However, as we detail below, our results suggest that when the decisions involve real monetary incentives, wealth may matter.

\(^7\) Harvey (1990) objects not to direct transfers for organs, but to the idea of a middleman profiting from the organ of another individual.
Furthermore, Tetlock et al. (2000), and Tetlock (2003) describe survey evidence that people are willing to make taboo trade-offs despite their strongly-held moral beliefs which indicates that market incentives could overcome moral objections to donation. Hence, we design a stylized experiment that induces both the necessity and opportunity cost of organ transfer in order to test the welfare effects of a market solution to organ shortages.

**Experimental Design**

To explore the impact of a market for organs, we employ a partial 2x2 within-subjects experimental design. The first dimension is the existence of an organ market and the second dimension is the presence of an opportunity cost of not retaining one’s organ. Each group of subjects first participates in a *Baseline* treatment with an induced opportunity cost of donation and a presumed consent (opt-out) organ donation policy, which is meant to represent the current best-case policy situation.\(^8\) The group of subjects then participates in one of the two alternative treatments meant to coincide with potential solutions for increasing the supply of transplanted cadaveric organs. In the *Market* treatment we introduce a futures market that allows people to sell organs; while, in the *NoLotto* treatment we eliminate the opportunity cost of donating the organ (modeled as a lottery available only to those who choose not to accept or donate). Creating a market compensates those who allow their organs to be transplanted, thus increasing the marginal benefit of doing so. On the other hand, removing the lottery represents a reduction in the marginal cost of having one’s organ transplanted. Either treatment is expected to increase the number of organs offered for transplant. In the experiments organs were referred to as assets so as not to bias subject behavior; however, other terms described below such as “Poor,” “Wealthy,” “Young” and “Old” were used to aid subjects in understanding the structure of the experiment as described below.\(^9\)

In each laboratory session there are ten subjects who interact in an overlapping generations framework where people live for two periods. In the first period there are three “Young”

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\(^8\) If a shortage exists under a presumed consent policy, then the case for market incentives is even stronger.  
\(^9\) Experiments commonly use neutral language in regards to the specific attributes of the problem that are of interest to avoid introducing bias. We could have referred to the assets as organs, but we doubt that such a change in language would simulate the true intensity of moral issues at stake, but may have influenced behavior as the value of taking a stance may have outweighed the normal experimental stakes.
people and three “Old” people. The other four people are inactive. In the second period, three of the people who were inactive in the first period become “Young,” the three people who were Young in the first period become Old, and the three people who were Old in the first period become inactive. This process repeats after each period. To avoid issues associated with repeated play games, each Old person must be inactive for one period before returning to the economy, the number of inactive people is larger than the next generation, and there is no way to identify other people across lives. Furthermore, we pay subjects on only one randomly chosen life to minimize the impact of previous experiences on behavior.

Each period that a living person holds a useable asset they receive a specified payment. There are two types of people in each economy. Half of the subjects are “Wealthy” and half are “Poor.” Wealthy people receive a payment of $8 for holding a useable asset when they are Young and $5 for holding a useable asset when they are Old. Poor people receive a payment of $2 for holding a useable asset when they are Young and $5 for holding a useable asset when they are Old. Thus both Wealthy and Poor people have the same value for a useable asset when Old and income levels do not affect the gains from exchange when an asset is donated or traded. The Young can be thought of as workers for whom income variation is due to labor productivity or some other factor exogenous to the experimental environment, whereas Old subjects can be thought of as being retired. Inactive people cannot hold any assets. Each subject remains Poor or Wealthy throughout the entire experimental session; thus generations may differ in the number of Wealthy and Poor people.

There are two types of useable assets: yellow and green. Yellow assets last for one period. Green assets last for two periods before turning yellow and lasting one additional period. After one period yellow assets become red assets, which have a value of $0 to both agent types. In each new generation, two people are born with new green assets and one person is born with a yellow asset. Every active person can observe the color of his or her own current asset.

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10 This approach is commonly used in macroeconomics experiments where the economy outlives individual agents. See e.g. Lim et al. (1994), Marimon and Sunder (1994), and Marimon et al. (1993).

11 While people only die once, repeated rematching of subjects and payment for a single instance are common techniques in experimental economics for exploring one shot games as they enable the researcher to collect data in a more cost effective way.
In periods in which there was no market, Old people who owned a green asset (i.e. an asset that was turning yellow and would last one more period) could choose to either “Donate My Asset” or “Keep my Asset” with the default choice being to donate the asset.\textsuperscript{12} A young person with a yellow asset has a similar choice between “Accept an Asset” or “Keep my Asset.” Given the set up of the experiment, there were always two Old people with green assets and as long as either of them donated the asset and the young person accepted the asset, then in the following period the young person would hold the donated asset and earn $5. The asset would become yellow in the next period when the recipient was Old and thus could not be donated again to the following generation. Note that the decision to donate the asset or not did not affect the payoff to the Old person or the Young person in the period the decision was made. In this sense the agreements are about what will happen to the Old person’s asset in the next period when he or she has died. Hence our market treatment creates a futures market (see Cohen 1989 for an argument in favor of such markets).

In situations where there was a lottery, by selecting to “Keep my Asset” each subject had a chance to win the additional $100 by guessing an integer from 0 to 999. After each period with a lottery, a winning number was drawn from a uniform distribution over the integers [0, 999] and announced to everyone. The payoff was selected to be nominally very large and thus attractive initially, but very unlikely to be obtained, and thus of little expected value when viewed rationally.\textsuperscript{13} In this respect we believe the lottery is a reasonable proxy for moral outrage as many people have a visceral negative reaction to organ transfer, but when pressed, believe that organ donations are socially responsible. If a person chose to donate or accept an asset, they did not play the lottery even if they did not ultimately give or receive an asset, as could occur

\textsuperscript{12} Previous work by Samuelson and Zeckhauser (1988) has indentified a “status quo bias” in which people are likely to maintain the default choice. This has been the impetus for organ donation policies in Europe where a person is by default an organ donor unless they take active steps to not be an organ donor. As mentioned above, Abadie and Gay (2006) provide evidence that this policy increases the supply of transplantable organs. As an experimental design choice, this should strengthen any claim that the market “works” since it is competing against the best “real-world” alternative policy currently employed in any developed country.

\textsuperscript{13} The expected value of this lottery is a dime and a risk-averse individual will value it even less. Previous experimental work has routinely found that people behave as if they are risk averse (see e.g. Holt and Laury 2002; Goeree et al. 2003 and Cox et al 1982). In light of previous dictator game results, one might worry that the expected value of the lottery is too low so that there is no problem of shortage to be solved. As discussed in the results, this is not the case – subjects are reluctant to forego the lottery.
when a potential recipient was willing to accept but no one donated an asset or when a there was no willing recipient for a donation. This positive opportunity cost is meant to model some internal opposition (religious, ethical, disgust, etc.) to separating the organ from its original owner. Hence, both prospective donor and recipient face the same cost. However the lottery’s expected value is deliberately low to emphasize the asymmetry between the costs of cadaveric donation and the benefits to an organ recipient.

When there was an active market for assets, Old people with green assets chose between “Sell my Asset” and “Keep my Asset.” If the subject selected “Sell my Asset” they also had to enter an ask between $0 and $5 in cents. Similarly, Young people with yellow assets chose between “Buy an Asset” and “Keep my Asset” and those who opted to buy an asset had to enter a bid, also between $0 and $5 in cents. If there was no bid or no ask then there was no trade. If the lowest ask was above the bid then there was again no trade. If the bid was above a single ask the price was the average of the bid and ask and the young person bought the asset from the seller offering the lowest ask. If the bid was above two asks then the price was equal to the average of the two asks and the young person bought the asset from the seller with the lowest ask. A person was ineligible for the lottery if they placed a bid or an ask, regardless of whether they were actually involved in a trade. Each period with a market, all of the subjects in the session observed a summary report of any bids, asks, or prices. This was done in part to provide information to market participants and to aid price convergence since the markets are thin and the parties do not have the opportunity to renegotiate.14

After completing the directions, subjects answered a series of comprehension questions, and an experimenter went over the answers and privately corrected any mistakes. Once all of the subjects had answered the questions correctly, the experiment began. After 20 periods (19 complete generations) of the baseline condition had been completed, subjects were given additional instructions for the treatment that would be in place for the last 20 periods of the experiment starting when the 20th generation became Old. In order to limit the potential

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14 Specific institutional features can have a dramatic effect on market performance (see e.g. Friedman 1993 and Coppinger et al. 1980). The purpose of this paper is not to determine the optimal market structure for an organs market, but to see how an active market could increase the supply of transplantable organs. The issue of designing an organ market is a question left for future research.
influence of forward-looking strategic considerations, subjects were not informed of the number of periods in either portion of the experiment nor were subjects initially informed that the experiment would have two parts. Copies of all directions and the comprehension questions are available in the appendix.

After the experiments were completed, subjects answered a web-based survey eliciting their opinions on donating and trading organs and supplied limited demographic information. A copy of the survey is included in the appendix. Once all subjects had completed the survey, one of their experimental “lives” was randomly selected, and the subjects were paid based upon those earnings. Each subject was paid in private and then dismissed from the experiment. The average salient payment was $9.41 and the experiment lasted approximately 45 minutes. Each subject also received a $5 payment for completing the survey and a $7 participation payment. A total of 80 undergraduates from a private university in the United States participated in the experiment. Some subjects had previously participated in other economics experiments, but none had participated in any related studies.

**Hypotheses**

Our first hypothesis concerns the effects of the *Market* and *NoLotto* treatments on the provision of organs to sick individuals relative to the *Baseline*. Since the existence of a market increases the marginal benefit of supplying an asset and the removal of the lottery decreases the marginal cost, *both treatments should increase the provision of organs relative to the Baseline*.

A naïve prediction based upon material self-interest is that the *Baseline* treatment with the lottery will lead to zero donations since subjects must give up a potential gain to provide a benefit to others; however, results from dictator games suggest that people frequently part with money when doing so yields direct benefits to others. Furthermore, as the ratio of other’s gains to own losses grows, so does the amount given (Forsythe, et al. 1994, Andreoni and Miller 2002, and Deck 2009). Based upon that behavioral pattern one would expect some people to accept an expected $0.10 loss to provide a $5.00 gain to the recipient. Anyone willing to forgo $0.10 should also be willing to donate the asset when it is costless to do so. Therefore,
donations should be at least as frequent in the \textit{NoLotto} treatment as in the \textit{Baseline}. When a market is introduced, the supplier is compensated so that the loss cannot exceed $0.10$. Under the assumption that anyone willing to incur a $0.10$ loss would also be willing to incur a smaller loss or even a gain to benefit another person, organ provision should be at least as frequent in \textit{Market} as in \textit{Baseline}.

Our second hypothesis pertains to wealth effects. We create early life income differences across subjects in order to test for evidence of one of the common ethical concerns addressed to those who favor the creation of markets for human organs. It is frequently argued that market exchange in human organs will act as an “undue inducement” encouraging the poor and desperate to disproportionately provide supply in such a market. While this argument is typically made in reference to live organ sales, it is equally applicable to futures transactions for those who are on principle opposed to organ exchanges. By offering cash payments, one might influence those who would otherwise prefer to maintain their principled stance (or in the case of our experiment maintain their chance at the lottery). This conjecture is formalized in the following hypothesis: \textit{In the Market treatment, Poor subjects will be more likely to offer their organs for sale than Rich subjects.}

We do not offer explicit predictions for the number of assets that will be exchanged in any environment in part because a person’s behavior is contingent upon their beliefs about the actions of others. An old person should not forgo $0.10$ to donate an asset if they believe the other potential donor will donate or that the potential recipient has chosen not to accept a donation. A young person should not forgo $0.10$ to accept donations if she believes that neither potential donor is going to donate. In fact, in all three of our treatments everyone selecting “Keep My Asset” is a Nash Equilibrium. We also note that there is no pure strategy equilibrium price in the Market treatment because of the avoidable cost of having to forgo the lottery to enter the market. This intuition for this is straightforward. Since a seller could earn $0.10$ by staying out of the market, any seller must expect to earn at least $0.10$ from placing an
ask. This could not be true at any price below $0.10, but for any price above $0.10 both sellers would have an incentive to undercut their rival.15

Results: Effectiveness of the Treatments

Our data consist of 640 salient organ supply choices and 320 salient organ demand choices from subjects in 8 independent sessions. Half of the observations are from the Baseline condition, while one fourth of the observations are from each of the Market and NoLotto treatments. We present the experimental results as a series of findings. The first finding considers the metric of lives saved.

Finding 1: Only the NoLotto treatment reduces the number of subjects who die young relative to the Baseline. In fact, the percentage of subjects who die young actually increases in the Market treatment.

In the Baseline treatment only 45.6% of sick subjects receive a donated organ indicating that the induced donation cost of $0.10 leads to a large reduction in social welfare. As expected, the NoLotto treatment reduces the death rate and 75% of sick subjects find donors. However, the Market treatment actually increases the death rate as subjects receive organs only 33.8% of the time. This finding is supported statistically by mixed-effects logistic regression where the eight sessions are modeled as random effects (es) to compute treatment effects on the probability of death while controlling for Period.16 Specifically we estimate equation (1) where the binary dependent variable is Deatht, which equals 1 if the sick person did not receive a new asset in period t and is 0 otherwise.

\[
\text{Death}_t = \alpha_0 + \alpha_1\text{NoLotto} + \alpha_2\text{Market} + \alpha_3\text{Period} + \varepsilon + e_t
\]  

NoLotto and Market represent dichotomous dummy variables indicating the absence of the lottery and the presence of the market, respectively. The left column of Table 1 reports the estimation results. Consistent with our hypothesis, the coefficient on NoLotto is negative and significant indicating that removing the lottery increase the number of assets received by those in need. However, while the coefficient on Market is negative, it is insignificant, indicating that

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15 See van Boening and Wilcox (1996) for a discussion of markets with avoidable costs.
the specific market institution did not increase the number of assets that were successfully transferred.

While the NoLotto treatment did not completely eliminate the organ shortage, the response was encouraging. However, the negative effect of opening a market for organs is surprising and warrants further attention. Specifically, to explain the differences between the treatments we compare in greater detail the causes of death across treatments. Deaths may occur because no one is willing to provide an organ, no one is willing to supply an organ, or the terms of the exchange cannot be agreed upon. The third cause cannot occur in the absence of a market as donations effectively set the exchange terms at a price of 0.

We define a demanded organ as an instance in which a sick subject chose “Accept” or “Buy” and define a supplied organ as a choice to “Donate” or “Sell.” Thus there are excess demanded organs when a sick subject chose “Accept” or “Buy”, but no subject chose “Donate” or “Sell.” Similarly, there are excess supplied organs when someone chose to “Donate” or “Sell,” but the potential recipient chose “Keep”. Table 2 provides summary statistics for the three treatments indicating the number of periods in which subjects died young, demanded organs and supplied organs as well as the number of periods with excess organ demand or excess organ supply. The next series of findings consider how the treatments affected the number of organs demanded and supplied.

Finding 2: Deaths in the Baseline result from both insufficient supply and demand.

In column 1 of Table 2, note that of the 160 Baseline treatment periods, the sick subject demanded an organ (i.e. choose “Accept”) in only 115 instances, or 72% of the time. Hence, of 87 Baseline deaths, 45, or 52%, were caused directly by a sick agent refusing to accept an organ. We find this behavior somewhat surprising, but it could be rationalized depending on the subject’s value for the lottery and expectations that an organ will be supplied. On the supply side, at least one healthy, old agent chose to “Donate” an organ in 95/160 periods (56% of the time). Given the low expected value of the lottery, this result is also somewhat surprising in light of the aforementioned evidence of pro-social behavior in dictator games. However, for our purposes it is enough to note the existence of a shortage under these conditions. Both
insufficient demand and insufficient supply contributed to premature deaths, and we ask which, if either, of these failures the treatments successfully addressed.

**Finding 3:** The NoLotto treatment increases demanded organs relative to the Baseline, but the Market treatment does not.

In the Baseline treatment, sick subjects demand an organ in 71.9% of periods, and in the NoLotto treatment, demand increases to 87.5% of all periods. However, in the Market treatment, sick subjects submit bids in only 68.8% of periods. Thus, it is clear that the NoLotto treatment increases demand for organs relative to the Baseline, but the Market treatment does not. This conclusion is supported parametrically with a logistic regression. As before, the sessions are modeled as random effects and our fixed effects compute the impact of the treatments, controlling for Period. The dependent variable for the model is $Demand_t$, which takes a value of 1 if the potential organ recipient chose “Accept” or “Buy” in period $t$ and is 0 otherwise. The model is given by equation (2) and the results are reported in the center column of Table 1.

$$Demand_t = \beta_0 + \beta_1\text{NoLotto} + \beta_2\text{Market} + \beta_3\text{Period} + \varepsilon + \epsilon_t \quad (2)$$

As before, NoLotto and Market represent dichotomous dummy variables indicating the absence of the lottery and the presence of the market, respectively. A positive and significant coefficient on NoLotto indicates that removing the lottery increases the willingness of sick subjects to accept organs. This change could be because sick agents value the lottery (with expected value of $0.10) at more than $5.00, or it could be that the sick believe that others are more willing to donate in the absence of a lottery. While the coefficient on Market is positive, the effect is insignificant, suggesting that this market institution does not encourage those in need of an organ to seek one. One explanation is that these subjects place a high value on the lottery, or alternatively, that the sick person does not believe that prospective sellers are willing to trade at an acceptable price. We return to these issues in detail below.

**Finding 4:** Both the NoLotto and Market treatments increase the supply of organs relative to the Baseline. In fact, the total quantity supplied is nominally (though not statistically) greater in the Market treatment than in the NoLotto treatment.
In the *Baseline* treatment, organs are supplied 59.4% of the time, but in the *NoLotto* and *Market* treatments, at least one organ is supplied 86.3% and 88.8% of the time. Clearly, both treatments increase supply relative to the *Baseline*. Again, a mixed-effects logistic regression with random effects for session is used to identify treatment effects, controlling for *Period*, with dichotomous dummy variables for the treatments. The dependent variable in equation (3) is *Supply*, which takes the value 1 if there was at least one supplied organ in period t and is 0 otherwise.

\[
Supply_t = \gamma_0 + \gamma_1\text{NoLotto} + \gamma_2\text{Market} + \gamma_3\text{Period} + \varepsilon + \epsilon_t
\]

The estimation results are reported in the right-hand column of Table 1. Positive and significant coefficients on both treatment variables indicate that the removal of the lottery and the introduction of the market both increase the supply of healthy organs for transplant. Marginal effects indicate that the *NoLotto* treatment increases the probability that an organ is supplied in a period by 34% relative to the *Baseline*; while, the *Market* increases the probability by 38%.

Thus our evidence suggests that eliminating the costs of donation as in the *NoLotto* treatment reduces deaths from organ shortage because it increases both demand and supply; while, the *Market* treatment, on the other hand, fails to reduce deaths because it has a positive impact only on supply. It is worth noting that we see no evidence that creating a market crowds out altruistic motives.

Although the *NoLotto* treatment saves lives in our experimental environment, we must reiterate that our induced cost is no more than a stylized representation of powerful cultural and psychological factors that influence individuals’ decisions to donate — religion, values, norms, etc. For example, Parisi and Katz (1986) find that religious opposition to body mutilation is often reflected in negative attitudes towards cadaveric donation, and survey evidence from our subjects indicates that religiosity is correlated with opposition to live donation. Such factors can be modeled and induced as monetary cost, and in our experiment it is trivial to eliminate this cost and observe the beneficial effects. However, in practice, the culture and psychology that determine an individual’s willingness to donate are not easily altered. The purpose of this treatment is to show that the presence and absence of such costs matters, even
when represented in abstract form. From a practical perspective, our focus is on the Market treatment. Here the increased supply of organs is encouraging for proponents of a market solution, but the failure of the institution to actually save lives in this environment merits further examination.

Thus we return to Table 2 and analyze the causes of death in the Market treatment in greater detail. The most salient fact is that deaths were largely not caused by lack of supply. There were only 9 instances (11\% of periods) in which no organ was offered for transplant in the Market treatment, and in 7 of those cases sick agents expressed demand but were unable to purchase a healthy organ on the market.\textsuperscript{17} Of the 53 deaths in the Market treatment, 25 (47\%) resulted from insufficient demand. As shown in Table 2, there was excess supply in 23 of these 25 cases, so all but 2 of these deaths were feasibly avoidable if the sick agent had chosen to purchase an organ and an agreeable price had been found. However, of the remaining 28 deaths, 21 occurred with both a buyer and a seller in the market. These 21 subjects died because they attempted to trade but did not submit mutually agreeable prices.

These unconsummated trades highlight the importance of institutional design. Recall that after each period, all subjects observed any bids and asks in the market as well as the transaction price if a trade occurred. Hence, some of the 25 cases in which sick agents chose to play the lottery may have resulted from expectations derived from their own or others’ prior failed attempts to purchase in the market.\textsuperscript{18} An institution that was more successful at finding mutually agreeable prices would likely have induced even more potential recipients to seek out an organ and also encouraged more potential sellers to enter the market. Previous experimental research has shown that markets with a repeated bargaining process or direct communication lead to more mutually beneficial trades (see e.g Valley et al. 2002 and Ketcham et al. 1984). Thus, if after the initial bid and asks failed to yield a mutually agreeable price, we permitted subjects to submit updated offers, or if we allowed them to communicate with one another directly, many of the Market treatment deaths might have been avoided.

\textsuperscript{17} This compares favorably to the 65 cases (41\%) of zero supply in the Baseline treatment, resulting in 42 deaths from excess demand.

\textsuperscript{18} However, we note that the coefficient on Period is insignificant in all of our regressions indicating that such effects, if present, are not systematically increasing or decreasing with experience.
A related issue is the structure of supply and demand in our markets, which involve only a single buyer and two sellers. The real-world ratio of healthy to sick organs is much higher than 2:1, so the probability of finding a willing seller would likely be significantly higher than we induce in this environment. Furthermore, the small number of subjects on either side of the market may have contributed to the failure of our institution. Previous experimental work has also shown that thicker markets tend to converge to competitive equilibria more quickly and more reliably than those with only a few sellers (see e.g. Smith and Williams 1990). Thus, in terms of both market structure and the chosen exchange institution, our design was biased against the market’s success in saving lives. Yet even so, the presence of a market substantially increased organ supply. Given the accumulated knowledge of economics, it would be relatively straightforward to design a market to facilitate exchanges between the numbers of buyers and sellers that would enter a real-world organ market, even with differentiated products to account for donor-recipient compatibility.\(^\text{19}\) However, other objections to organ sales remain among those who grant that a market would induce supply, and hence we return to our second hypothesis above, pertaining to the distributional effects of a market for organs.

**Results: Distributional Consequences**

Critics of market solutions to the organ shortage argue that the creation of a market for organs is unethical in part because the decision to sell one’s organ will be undertaken primarily by the poor and desperate (e.g. Satz 2008, Archard 2002, Borna 1987). To test this hypothesis we induced persistent income differences across subjects, and we ask whether poor subjects are disproportionately likely to sell their organs.

*Finding 5: Poor subjects are more likely than rich subjects to offer their organs for sale.*

Table 3 provides summary statistics on our subjects’ rate of organ provision and acceptance by treatment and induced wealth level. In the *NoLotto* treatment the increase in the percentage

---

\(^{19}\) The reader should bear in mind that our goal is not to identify the optimal institution for an organ market, but rather to demonstrate that such markets can be studied in the laboratory. Determining the optimal market structure should be the goal of future work. Our design provides conservative evidence that a market’s ability to increase organ supply. In terms of the impact of such a market on aggregate social welfare, we find relatively strong support for the pro-market arguments made by Arrow (1972), Perry (1980), S.H.D. (1985), Mahoney (2000), and Becker and Elias (2007).
of people willing to supply organs is similar for Wealthy and Poor subjects. However, in the *Market* treatment, the increase in willingness to supply is much greater for the Poor (27%) than for the Wealthy (10%). Finding 5 is supported by mixed-effects logistic regression with random effects computed for subjects \(e_i\) where the dependent variable is \(Supply_{i,t}\), which equals 1 if subject \(i\) was willing to supply an organ in period \(t\) and is 0 otherwise. The model is shown in equation (4) where the treatment dummies are as before and \(Poor_i\) is a dichotomous dummy variable indicating whether subject \(i\) is poor.

\[
Supply_{i,t} = \delta_0 + \delta_1 \text{NoLotto} + \delta_2 \text{Market} + \delta_3 \text{Poor}_i + \delta_4 \text{Period} + \delta_5 \text{NoLotto} \times \text{Poor}_i + \delta_6 \text{Market} \times \text{Poor}_i + \varepsilon + e_i
\]

Table 4 contains estimated coefficients and marginal effects for the estimation. The positive and significant coefficient on the interaction term \(\text{Market} \times \text{Poor}_i\) indicates that poor subjects are more likely than wealthy subjects to offer their organs in the market, and the marginal effect indicates that poor subjects are 22% more likely to sell their organs than rich subjects. Insignificant coefficients on \(\text{Poor}_i\) and \(\text{NoLotto} \times \text{Poor}_i\) indicate that there are no distributional effects in the other treatments. In our experimental environment where induced wealth differences are necessarily small, we nevertheless observe that relative wealth alters the probability of selling one’s organ. If this wealth effect operates at the scale of our experiment, then it is likely to be all the more important in a real-world market for organs. Thus in implementing a market for organs, regulators should take care to ensure that decisions to sell are not made under financial duress or without sufficient forethought.

**Survey Results**

The survey asked opinions of various organ-related activities using several scales (see Appendix C).\(^{20}\) The scales included morality, preferred legality, upsetting-ness, offensiveness, rationality, compassionateness, and sanity. The Cronbach alpha was high for each activity indicating that these scales were capturing a consistent measure of the respondents’ attitudes towards the given behavior. Table 5 gives the average attitude towards each action. These scores are

---

\(^{20}\) In contrast to the salient experiment where we minimized the presence of context to avoid unduly influencing behavior, the survey was explicitly about human organs so as to provide a direct measure of the subject’s attitudes. This is the reason the survey was always administered at the end of the session.
bounded between 1 and 5 with a lower number indicating a more favorable outlook. The table also shows how personal attributes and behavior correlate with the survey responses. Fifty four percent of the respondents were male. Twenty-one percent of the respondents were Catholic, while 28% reported being Protestant and 19% reported being affiliated with another organized religion. Forty four percent of the respondents rarely went to religious services, while 26% went at least once a month.

From Table 5, it is clear that the respondents had positive attitudes towards donating organs (Behaviors 1 and 4), but opposed selling organs (Behaviors 7-10) or taking them without permission (Behaviors 2 and 5). However, the responses were more neutral towards the notion of ‘compensating’ organ providers (Behaviors 3 and 6). This suggests a disconnect between views on profit seeking in a market and the idea of compensating desirable behavior. Not surprisingly, people who report being listed as an organ donor had more favorable opinions of organ donation at death and while alive ($\rho = -0.22$ and $\rho = -0.24$, respectively), but were not significantly more likely to have a favorable outlook on people receiving money for providing organs. Catholics have a less favorable opinion of donating organs at the time of death and for compensation of such donations ($\rho = 0.23$ and $\rho = 0.25$, respectively). Somewhat surprisingly, those who report any religious affiliation are more opposed to live kidney donations ($\rho = 0.24$), but perhaps unsurprisingly are more supportive of the proceeds of a live donation going to charity ($\rho = -0.21$). We also note that we find no significant gender differences. Attitudes towards organ donation and organ markets had no correlation with behavior in the Baseline environment. However, for those who were in the market treatment, the willingness to sell one’s organ was correlated with greater support for living people to donate organs and sell organs if the proceeds go to charity ($\rho = -0.30$ and $\rho = -0.27$, respectively). It was also correlated with a greater tolerance for taking organs without explicit consent ($\rho = -0.30$ and $\rho = -0.27$, respectively).

**Conclusions**

We design a laboratory experiment with overlapping generations in which to analyze the effects of various mechanisms on organ donation. We find that both the introduction of a
market and the elimination of the opportunity costs of organ donation increase the supply of usable organs relative to a baseline of presumed consent donation. While our NoLotto treatment yielded a significant reduction in the death rate, we note that cultural and psychological concerns about transactions in human organs cannot easily be removed. This treatment rather serves to demonstrate that these concerns, modeled here as a relatively small avoidable cost, can have a powerful impact organ supply and demand. Thus, based on the evidence of increased supply in our Market treatment, we argue that a suitably designed market institution would likely provide a powerful means of reducing unnecessary deaths from the current organ shortage. Indeed, because of the institutional and structural features of our simple market institution, the power of the market is understated by our design.

A market solution that incentivizes individuals to make taboo tradeoffs would provide an obvious social benefit, in terms of human lives, but ethical concerns about violation of the body remain and are augmented by additional concerns about coercion and equity. A social planner could produce the same benefits as a market by forcibly taking organs from the healthy or recently deceased and giving them to the sick, but many proponents of the market would likely argue that the difference between these two examples is in the voluntary nature of market exchange. While this principle is clear enough, as Satz (2008) notes, the meaning of “voluntary” is brought into question if the probability of donating is contingent on factors other than risk preferences and the intensity of one’s ethical views on organ transactions. If, for example the incentives affect individuals facing various economic circumstances differently, as is suggested by the fact that poor subjects in our experiment are more likely to sell their organs, then the existence of a market may constitute an “undue inducement” to poor individuals.21

Furthermore, a market with unequal distributional consequences could lead to perceptions that rich individuals are essentially harvesting organs from the poor. In our environment, we note no difference in the survival probability of rich and poor agents because no agent is unable to afford an organ if he or she attempts to purchase one. In the real world, however, the market price of organs could potentially price certain classes of individuals out of the market, further

21 Karelis (2007) rationalizes the risk-seeking behavior of poor individuals by arguing that the marginal utility of income is actually increasing below some minimum level.
exacerbating ethical concerns. Finally, it is also clear from survey evidence that people fear that a market for organs may increase the willingness of doctors to declare one patient dead in order to provide organs to many others (Parisi and Katz 1986). While we do not address this possibility, all of the aforementioned potential costs represent legitimate concerns that require further analysis before we would recommend the creation of a market.

What we desire is a mechanism that increases the provision of organs by incentivizing donation while also minimizing the ethical costs. Coffman (2009) shows that ethically questionable actions are deemed less worthy of punishment when undertaken by a third-party agent. Hence, an alternative approach is a monopsonist who compensates voluntary donors at a fixed price for donating an organ. Introducing a third party to the transaction (e.g. an insurance company or government agency) and eliminating the direct sale of organs could allay ethical concerns and promote donation by ensuring that risky donation is appropriately compensated.22 Jasper et al (2004), Haddow (2006), and Halpern, et al. (2010) analyzed attitudes towards similar proposals with surveys of medical professionals and the general public, with mixed results, but little data exists on which to base a policy prescription. Future experiments can provide data on the incentive properties of these mechanisms. Furthermore, since our environment concerns deceased donations and futures markets we hope future work will utilize experiments incorporating live donation and spot markets for organs.

References


22 Satz (2008) points out that unless prices are set appropriately, such a policy could lead to shortages as well.


Table 1: Treatment Effects on Deaths, Demand and Supply

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Death equation (1)</th>
<th>Demand equation (2)</th>
<th>Supply equation (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant Estimate</td>
<td>-0.03 (0.30)</td>
<td>1.11 (0.30)**</td>
<td>0.65 (0.29)*</td>
</tr>
<tr>
<td>NoLotto Estimate</td>
<td>-1.61 (0.53)**</td>
<td>1.32 (0.60)*</td>
<td>1.89 (0.62)**</td>
</tr>
<tr>
<td>Market Estimate</td>
<td>-0.01 (0.51)</td>
<td>0.19 (0.55)</td>
<td>2.36 (0.64)**</td>
</tr>
<tr>
<td>Period Estimate</td>
<td>0.02 (0.02)</td>
<td>-0.02 (0.02)</td>
<td>-0.02 (0.02)</td>
</tr>
</tbody>
</table>

Marginal Effect

Logistic regression, standard errors in parentheses, clustered by Session.

** p< 0.01
* p< 0.05
+ p< 0.1

Table 2: Summary Data by Treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Baseline</th>
<th>NoLotto</th>
<th>Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sessions</td>
<td>8</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Periods</td>
<td>160</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Died Young</td>
<td>87 (54%)</td>
<td>20 (25%)</td>
<td>53 (66%)</td>
</tr>
<tr>
<td>Periods Demanded</td>
<td>115 (72%)</td>
<td>70 (88%)</td>
<td>55 (69%)</td>
</tr>
<tr>
<td>Periods Supplied</td>
<td>95 (56%)</td>
<td>69 (86%)</td>
<td>71 (89%)</td>
</tr>
<tr>
<td>Periods with Excess Demand</td>
<td>42 (26%)</td>
<td>10 (13%)</td>
<td>7 (09%)</td>
</tr>
<tr>
<td>Periods with Excess Supply</td>
<td>30 (19%)</td>
<td>9 (11%)</td>
<td>23(29%)</td>
</tr>
</tbody>
</table>

Percentage in parentheses.
### Table 3: Donation and Acceptance Statistics

<table>
<thead>
<tr>
<th></th>
<th>No Lotto Treatment</th>
<th></th>
<th>Market Treatment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lotto</td>
<td>No Lotto</td>
<td>Change</td>
<td>Lotto</td>
</tr>
<tr>
<td>Rich Accept</td>
<td>31</td>
<td>29</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>Rich Sick</td>
<td>38</td>
<td>32</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>% Rich Accept</td>
<td>81.6%</td>
<td>90.6%</td>
<td>0.090</td>
<td>63.9%</td>
</tr>
<tr>
<td>Poor Accept</td>
<td>32</td>
<td>41</td>
<td></td>
<td>29</td>
</tr>
<tr>
<td>Poor Sick</td>
<td>42</td>
<td>48</td>
<td></td>
<td>44</td>
</tr>
<tr>
<td>% Poor Accept</td>
<td>76.2%</td>
<td>85.4%</td>
<td>0.092</td>
<td>65.9%</td>
</tr>
<tr>
<td>Rich Donate</td>
<td>32</td>
<td>62</td>
<td></td>
<td>34</td>
</tr>
<tr>
<td>Rich Old and Healthy</td>
<td>80</td>
<td>89</td>
<td></td>
<td>84</td>
</tr>
<tr>
<td>% Rich Donate</td>
<td>40.0%</td>
<td>69.7%</td>
<td>0.297</td>
<td>40.5%</td>
</tr>
<tr>
<td>Poor Donate</td>
<td>30</td>
<td>42</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>Poor Old and Healthy</td>
<td>80</td>
<td>71</td>
<td></td>
<td>76</td>
</tr>
<tr>
<td>% Poor Donate</td>
<td>37.5%</td>
<td>59.2%</td>
<td>0.217</td>
<td>36.8%</td>
</tr>
</tbody>
</table>

Average Rich Bid: 298.6
Average Poor Bid: 236.3
Average Rich Ask: 259.4
Average Poor Ask: 284.5

### Table 4: The Effects of Poverty on Donation

| Dependent Variable | Supply$_{i,t}$
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>equation (4)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>Estimate</td>
</tr>
<tr>
<td></td>
<td>Estimate</td>
</tr>
<tr>
<td>NoLotto</td>
<td>Marginal Effect</td>
</tr>
<tr>
<td>Market</td>
<td>Estimate</td>
</tr>
<tr>
<td></td>
<td>Marginal Effect</td>
</tr>
<tr>
<td>Poor$_i$</td>
<td>Estimate</td>
</tr>
<tr>
<td></td>
<td>Marginal Effect</td>
</tr>
<tr>
<td>Period</td>
<td>Estimate</td>
</tr>
<tr>
<td></td>
<td>Marginal Effect</td>
</tr>
<tr>
<td>NoLotto*Poor$_i$</td>
<td>Estimate</td>
</tr>
<tr>
<td></td>
<td>Marginal Effect</td>
</tr>
<tr>
<td>Market*Poor$_i$</td>
<td>Estimate</td>
</tr>
<tr>
<td></td>
<td>Marginal Effect</td>
</tr>
</tbody>
</table>

Mixed-effects logistic regression, SE in parentheses.

** p< 0.01
* p< 0.05
<table>
<thead>
<tr>
<th>Behavior</th>
<th>Average Attitude</th>
<th>Cronbach's Alpha</th>
<th>Correlation with Attitude for Given Behavior</th>
<th>Listed as Donor</th>
<th>Percent Donated Periods 1-20</th>
<th>Percent Offer to Sell in Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Donating a Kidney at the Time of Death</td>
<td>1.63</td>
<td>0.79</td>
<td>0.17</td>
<td>-0.10</td>
<td>0.23</td>
<td>0.08</td>
</tr>
<tr>
<td>2. Taking a Kidney at the Time of Death without Explicit Permission</td>
<td>3.56</td>
<td>0.91</td>
<td>0.20</td>
<td>-0.08</td>
<td>0.19</td>
<td>0.08</td>
</tr>
<tr>
<td>3. Paying the Family at the Time of Death in Return for a Kidney</td>
<td>2.70</td>
<td>0.88</td>
<td>-0.17</td>
<td>-0.03</td>
<td>0.25</td>
<td>-0.17</td>
</tr>
<tr>
<td>4. Donating a Kidney while Alive</td>
<td>2.09</td>
<td>0.88</td>
<td>-0.20</td>
<td>0.24</td>
<td>0.03</td>
<td>-0.16</td>
</tr>
<tr>
<td>5. Taking a Kidney from a Living Person without Explicit Permission</td>
<td>4.44</td>
<td>0.83</td>
<td>0.15</td>
<td>-0.11</td>
<td>-0.01</td>
<td>0.12</td>
</tr>
<tr>
<td>6. Paying a Living Person in Return for a Kidney</td>
<td>3.06</td>
<td>0.91</td>
<td>-0.18</td>
<td>-0.05</td>
<td>0.00</td>
<td>-0.12</td>
</tr>
<tr>
<td>7. Selling a Dead Person's Kidney on eBay</td>
<td>4.40</td>
<td>0.9</td>
<td>0.05</td>
<td>-0.20</td>
<td>0.09</td>
<td>-0.01</td>
</tr>
<tr>
<td>8. Selling a Dead Person's Kidney and Giving the Earnings to Charity</td>
<td>3.84</td>
<td>0.92</td>
<td>0.03</td>
<td>-0.18</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>9. Selling a Living Person's Kidney on eBay</td>
<td>4.36</td>
<td>0.9</td>
<td>-0.02</td>
<td>-0.12</td>
<td>0.02</td>
<td>-0.02</td>
</tr>
<tr>
<td>10. Selling a Living Person's Kidney on eBay and Giving the Money to Charity</td>
<td>3.59</td>
<td>0.92</td>
<td>0.07</td>
<td>-0.21</td>
<td>-0.07</td>
<td>0.07</td>
</tr>
</tbody>
</table>
Appendix A: Experiment Instructions

This is an experiment on economic decision-making. You will be paid in cash at the end of the experiment based upon your decisions and the decisions of others, so it is important that you understand the directions completely. All payoffs are in cents, so 100 = $1. If you have a question at any point, please raise your hand and someone will come to you. Otherwise, you should not communicate with anyone else during the experiment.

This experiment is broken into a series of periods. In any period there are 3 young, 3 old and 4 inactive people. In the next period the young become old, the old become inactive, and 3 of the inactive people become young. Which inactive people become young is randomly determined, but everyone must be inactive for at least one period after being old and before becoming young again. Notice that there are more inactive people than young people so some people will be inactive for multiple periods.

Young and old people earn money by holding assets (shown on the screen as colored balls). There are three kinds of assets. Red assets last for 1 period and are worth 0 to everyone. Yellow Assets last for 1 period before becoming Red assets. Green assets last for 2 periods, before becoming Yellow assets in the 3rd period. Each period, two young people start with a Green asset and 1 young person starts with a Yellow Asset. This is determined randomly. Notice that a Green asset lasts longer than its initial owner can use it because people earn money while they are young or old, but not while they are inactive.

In the experiment there are wealthy and poor people. Your type is determined randomly and it will not change during the entire experiment.

1) Wealthy people earn 800 from holding a Yellow or Green asset while young.
2) Poor people earn 200 from holding a Yellow or Green asset while young.

Green and Yellow assets are always worth 500 to an old person, regardless of whether the person is Wealthy or Poor. Young people never have Red assets and no one can hold more than one asset.

Here are screen images for

a Young Poor Person with a Green Asset & an Old Wealthy Person with a Yellow Asset

Period earnings are shown in the table at the bottom right of the screen (earnings are updated after the period ends). Green rows indicate active periods. Since people cycle through being young, then old, then inactive, active periods come in pairs. After the entire experiment is completed, one pair of active periods will be randomly selected to determine your payoff.
You cannot earn money with an asset when you are inactive; nor can you keep it until you become young again. If you are old and have a Green asset, you can “Keep My Asset” or you can “Donate My Asset.” Donating the asset means that a young person with a yellow asset this period can use your asset next period. Regardless of whether or not an old person donates her asset, she earns 500 in the period in which she was old. The donation occurs in the next period when the old person becomes inactive. The default is to “Donate My Asset.” If you want, you can make the donation by pressing “Confirm Choice.” If you want to “Keep My Asset” you must first click on this option and then click “Confirm Choice”.

If (and only if) an old person chooses “Keep My Asset” she has the opportunity to guess a random number between 0 and 999, inclusive, to earn 10,000 (that is US$100). You enter a guess by typing it in the box below “Keep My Asset.” After each period, everyone in the experiment will be informed of the winning number.

A young person with a yellow asset has to choose between “Accept New Asset” (the default option) or “Keep My Asset.” Accepting an asset means that if an old person donates an asset then the young person could use it to earn money in the next period after becoming old. A young person who instead opts to “Keep my Asset” will be able to guess a number between 0 and 999, inclusive, to win 10,000. Either choice must be confirmed by pressing the “Confirm Choice” button.

A young person with a green asset will not make a decision (as he automatically keeps his asset), nor will an old person with a yellow or red asset (as this asset has no value in the next period). Inactive people also have no decision to make.

In the following examples (poor) Person A is old in period 6 and (wealthy) Person B is young in period 6.

<table>
<thead>
<tr>
<th>Period</th>
<th>A is Poor</th>
<th>B is Wealthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Young 200</td>
<td>Inactive 0</td>
</tr>
<tr>
<td>6</td>
<td>Old 500</td>
<td>Young 800</td>
</tr>
<tr>
<td>7</td>
<td>Inactive 0</td>
<td>Old 500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>A is Poor</th>
<th>B is Wealthy</th>
</tr>
</thead>
<tbody>
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<td>5</td>
<td>Young 200</td>
<td>Inactive 0</td>
</tr>
<tr>
<td>6</td>
<td>Old 500</td>
<td>Young 800</td>
</tr>
<tr>
<td>7</td>
<td>Inactive 0</td>
<td>Old 500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>A is Poor</th>
<th>B is Wealthy</th>
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<tr>
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<td>Inactive 0</td>
</tr>
<tr>
<td>6</td>
<td>Old 500</td>
<td>Young 800</td>
</tr>
<tr>
<td>7</td>
<td>Inactive 0</td>
<td>Old 500</td>
</tr>
</tbody>
</table>

Once you have completed the directions and all of your questions are answered, please press the “Enter ID” button and enter your experiment ID. After you have done this, you will be given a brief quiz, which will not affect your payoff in any way. The quiz is intended to make sure everyone understands how the experiment works and how payoffs are determined. The experiment will begin after everyone has completed the handout and had their responses checked by an experimenter.
**No Lotto Treatment**

The next set of periods is similar to those you have already completed. The only difference is that there is no longer an opportunity to guess a number and earn 10,000 if you choose to “Keep My Asset.”

In the following examples (poor) Person A is old in period 6 and (wealthy) Person B is young in period 6.

Example 1: In Period 6, Person A chooses to “Donate My Asset” and Person B chooses to “Accept New Asset.”

Here Person B receives the asset donated by Person A.

<table>
<thead>
<tr>
<th>Period</th>
<th>A is Poor</th>
<th>B is Wealthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Young 200</td>
<td>Inactive 0</td>
</tr>
<tr>
<td>6</td>
<td>Old 500</td>
<td>Young 800</td>
</tr>
<tr>
<td>7</td>
<td>Inactive 0</td>
<td>Old 500</td>
</tr>
</tbody>
</table>

Example 2: In Period 6, Person A chooses to “Donate My Asset” and Person B chooses to “Keep My Asset.”

Here Person B does not receive the asset.

<table>
<thead>
<tr>
<th>Period</th>
<th>A is Poor</th>
<th>B is Wealthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Young 200</td>
<td>Inactive 0</td>
</tr>
<tr>
<td>6</td>
<td>Old 500</td>
<td>Young 800</td>
</tr>
<tr>
<td>7</td>
<td>Inactive 0</td>
<td>Old 0</td>
</tr>
</tbody>
</table>

Once you have completed the directions and all of your questions are answered, please wait quietly. The experiment will resume once everyone has completed these directions. Keep in mind that one pair of active periods from the entire experiment will be randomly selected to determine your payoff.

**Market/Lotto Treatment**

The next set of periods is similar to those you have already completed. The only difference is that instead of assets being donated, you may now buy and sell assets. An old person with a green asset can now choose to “Keep My Asset” or “Sell My Asset.” Similarly, a young person with a yellow asset can choose to “Keep My Asset” or “Buy An Asset.” Anyone who chooses “Keep My Asset” will still have a chance to earn 10,000 by guessing a number from 0 to 999, inclusive.

Old people with a green asset can make an offer to sell by typing it into the box below “Sell My Asset.” Young people with a yellow asset can make an offer to buy by typing it into the box below “Buy An Asset.” Offers to buy and sell must be integer amounts between 0 and 500 (the value to the young person of the asset when he becomes old). You must press “Confirm Choice” after making your decision. One of several things will happen in the market.

1. If no one selects “Sell My Asset” or no one selects “Buy An Asset” then there will be no trade and no price in the market.
2. If the offer to buy is below all offers to sell, then again there will be no trade and no market price.
3. If the offer to buy is greater than only one of the offers to sell then the price is the average of the offer to buy and the lowest offer to sell. The young buyer pays the price to the old person with the lowest offer to sell in exchange for use of the asset in the next period.

4. If the offer to buy is greater than both offers to sell then the price is the average of the two offers to sell. The young buyer pays this price to the old person who made the lowest offer in exchange for use of the asset in the next period.

After each period, everyone in the experiment will be informed of the market price, if it exists, as well as all offers to buy or sell. However, no one will know who made which offer.

The following are three examples of what could occur. In the examples (poor) Person A is old in period 6, (wealthy) Person B is young in period 6, and (wealthy) Person C is old in period 6.

Example 1: In Period 6, Person A chooses to “Sell My Asset” with an offer to sell of 300, Person B chooses to “Buy An Asset” with an offer to buy of 400, and Person C chooses to “Keep My Asset.”

Here we have the offer to buy of 400 > the offer to sell of 300 so the price is 350 (the average of 400 and 300) and Person B buys the asset from Person A. Only Person C has the chance to earn 10,000 since C chose “Keep My Asset.”

<table>
<thead>
<tr>
<th>Period</th>
<th>A (Seller) is Poor</th>
<th>B (Buyer) is Wealthy</th>
<th>C is Wealthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Young</td>
<td>Inactive</td>
<td>Young</td>
</tr>
<tr>
<td>6</td>
<td>Old + Price</td>
<td>Young - Price</td>
<td>Old + chance at 10,000</td>
</tr>
<tr>
<td></td>
<td>500 + 350 = 850</td>
<td>800 - 350 = 450</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Inactive</td>
<td>Old</td>
<td>Inactive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>500</td>
<td></td>
</tr>
</tbody>
</table>

Example 2: In Period 6, Person A chooses to “Sell My Asset” with an offer to sell of 300, Person B chooses to “Buy An Asset” with an offer to buy of 200, and Person C chooses to “Keep My Asset.”

Here we have the offer to buy of 200 < the offer to sell of 300 so there is no price and Person B does not buy the asset from Person A. Only Person C has the chance to earn 10,000 because C chose “Keep My Asset.”

<table>
<thead>
<tr>
<th>Period</th>
<th>A is Poor</th>
<th>B is Wealthy</th>
<th>C is Wealthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Young</td>
<td>Inactive</td>
<td>Young</td>
</tr>
<tr>
<td>6</td>
<td>Old</td>
<td>Young</td>
<td>Old</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>800</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+ chance at 10,000</td>
</tr>
<tr>
<td>7</td>
<td>Inactive</td>
<td>Old</td>
<td>Inactive</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Example 3: In Period 6, Person A chooses to “Sell My Asset” with an offer to sell of 300, Person B chooses to “Buy An Asset” with an offer to buy of 400, and Person C chooses to “Sell My Asset” with an offer to sell of $350.
In this case we have the offer to buy of 400 > both offers to sell of 350 and 300. The price is 325 (the average of 300 and 350) and Person B buys the asset from Person A. No one has the chance to earn 10,000 because no one chose “Keep My Asset.”

<table>
<thead>
<tr>
<th>Period</th>
<th>A (seller) is Poor</th>
<th>B (buyer) is Wealthy</th>
<th>C is Wealthy</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Young 200</td>
<td>Inactive 0</td>
<td>Young 800</td>
</tr>
<tr>
<td>6</td>
<td>Old + Price 500 + 325 = 825</td>
<td>Young - Price 800 - 325 = 475</td>
<td>Old 500</td>
</tr>
<tr>
<td>7</td>
<td>Inactive 0</td>
<td>Old 500</td>
<td>Inactive 0</td>
</tr>
</tbody>
</table>

Once you have completed the directions and all of your questions are answered, please wait quietly. The experiment will resume once everyone has completed these directions. Keep in mind that one pair of active periods from the entire experiment will be randomly selected to determine your payoff.
Appendix B: Quiz Questions

1. A green asset lasts for how many periods?
   a. 1 Period
   b. 2 Periods, then it becomes a yellow asset for 1 more period
   c. 3 Periods

2. How much does an active agent with a red asset earn in a period?
   a. 0
   b. 200
   c. 500

3. How many periods will an agent be inactive after being old?
   a. 1
   b. 2
   c. Unknown, but at least 1

4. Agents may hold more than one asset at a time.
   a. True
   b. False

5. Only an old agent with a green asset and a young agent with a yellow asset may choose to “Keep My Asset”.
   a. True
   b. False

6. If an old agent with a green asset chooses to “Donate My Asset“, then that agent will be able to guess a number between 0 and 999 in hopes of earning $100.
   a. True
   b. False

7. If a young agent with a yellow asset chooses to “Keep My Asset”, that agent will be unable to receive a donated asset.
   a. True
   b. False
NoLotto Alternate Questions
6. Old agents with yellow assets may choose to “Donate My Asset” to young agents with yellow assets.
   a. True
   b. False

7. If a young agent with a yellow asset chooses to “Keep My Asset”, that agent will be unable to receive a donated asset.
   a. True
   b. False

Market Alternate Questions
6. Only an old agent with a green asset may choose to “Sell My Asset”.
   a. True
   b. False

7. If an old agent with a green asset chooses to “Sell My Asset”, then that agent will be able to guess a number between 0 and 999 in hopes of earning $100.
   a. True
   b. False
Appendix C: Survey Questions

1) What is your gender?  Male  Female

2) How do you describe your religious affiliation?
   Atheist  Agnostic  Baptist  Buddhist  Catholic  Jewish  Methodist  Muslim  Other Organized Religion  Other Protestant

3) How often do you attend religious services?  Never  Rarely  Monthly  Weekly  More than Once a Week

4) Is there anyone in your family or anyone of your close friends who received or donated an organ? Y/N

5) Are you currently listed as an organ donor? Y/N

6) Rate the following behaviors on the scales below:

   - Donating a Kidney at the Time of Death
   - Taking a Kidney at the Time of Death without Explicit Permission
   - Paying the Family at the Time of Death in Return for a Kidney
   - Donating a Kidney while Alive
   - Taking a Kidney from a Living Person without Explicit Permission
   - Paying a Living Person in Return for a Kidney
   - Selling a Dead Person's Kidney on eBay
   - Selling a Dead Person's Kidney and Giving the Earnings to Charity
   - Selling a Living Person's Kidney on eBay
   - Selling a Living Person's Kidney on eBay and Giving the Money to Charity

Scales:

<table>
<thead>
<tr>
<th>Highly Moral</th>
<th>Somewhat Moral</th>
<th>Unsure</th>
<th>Somewhat Immoral</th>
<th>Highly Immoral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should Be Banned</td>
<td>Banned with Minor Exceptions</td>
<td>Permitted with Major Restrictions</td>
<td>Permitted with Minor Restrictions</td>
<td>Should Be Permitted</td>
</tr>
<tr>
<td>Extremely Upsetting</td>
<td>Very Upsetting</td>
<td>Moderately Upsetting</td>
<td>Not Very Upsetting</td>
<td>Not Upsetting at All</td>
</tr>
<tr>
<td>Not at All Offensive</td>
<td>Not Very Offensive</td>
<td>Moderately Offensive</td>
<td>Very Offensive</td>
<td>Extremely Offensive</td>
</tr>
<tr>
<td>Very Irrational</td>
<td>Somewhat Irrational</td>
<td>Neutral</td>
<td>Somewhat Rational</td>
<td>Very Rational</td>
</tr>
<tr>
<td>Very Compassionate</td>
<td>Somewhat Compassionate</td>
<td>Neutral</td>
<td>Somewhat Cruel</td>
<td>Very Cruel</td>
</tr>
<tr>
<td>Completely Crazy</td>
<td>Somewhat Crazy</td>
<td>Neutral</td>
<td>Somewhat Sane</td>
<td>Completely Sane</td>
</tr>
</tbody>
</table>