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Cadaveric vs. Live-Donor Kidney Transplants: The Interaction of Institutions and Inequality

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CADAVERIC VS. LIVE-DONOR KIDNEY TRANSPLANTS:

THE INTERACTION OF INSTITUTIONS AND INEQUALITY*

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Abstract: "In 1991, the World Health Assembly approved a set of Guiding Principles which emphasize voluntary donation, non-commercialization and a preference for cadavers over living donors" (World Health Organization). We investigate whether factors such as inequality, rule of law and religion have any effect on the ratio of cadaveric transplants to all transplants. Using an unbalanced annual dataset from 64 countries over 1993-2004, we show particularly for developing countries that an improvement in equality and rule of law encourage cadaveric kidney transplants. Religion also plays an important role in that relationship.
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Keywords: Cadaveric and live-donor kidney transplants, rule of law, religious beliefs, inequality

1. Introduction

Although organ transplants are a relatively new phenomenon, it is already saving tens of thousands of lives around the globe. Nevertheless, the extent and rapid pace of the spread of the transplantation technology have intensified several critical concerns. As of the beginning of July 2005, there were 62,433 kidney patients in the United States who are registered on a waiting list for transplant of a cadaver kidney (28,318 of them registered in 2004 alone).[1, 2] The median waiting time is well over 1,000 days. In 2004, 7,060 individuals died while waiting for organ transplant, and 1,664 became too ill to be eligible for transplantation. The number of kidney patients on the transplant waiting list is growing at a rate of about 20% a year mainly because of improvements in surgical technology and transplant immunology that significantly raises the success rates of organ transplantation.

In 2004, there were 9,355 transplants of cadaver kidneys[3] and 6,647 live-donor transplants (the body can continue to function with only one of its two kidneys). This increase in the demand for kidney transplantation has not been met by a corresponding increase in the supply of kidneys that can be transplanted. This issue has gathered significant attention recently, which was also the focus of the National Science Foundation's website on October 5, 2005. Both live-donor and cadaveric transplants face binding constraints. Regarding live-donor transplants, a willing, healthy donor is not always able to donate to his intended patient, because of blood type and/or immunological incompatibilities between them (see Subsection 2.1 below). The latter pertains to matching human leukocyte antigens (HLA) - which are a combination of six proteins - between the donor and the recipient; HLA lie on a person's

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1   The Organ Procurement and Transplantation Network (OPTN), National Data, retrieved July 2, 2005 (http://www.optn.org/data). Unless stated otherwise, the U.S. kidney data reported in this paper are from (OPTN).

2   These numbers distort the gap between organ demand and availability downward since the criteria used to admit patients to waiting lists are stringent in part because of the shortage of transplantable kidneys (Randall, 1991; Barnett et al., 1992).

3   Priority on the cadaver queue is rather complex, as queues are organized first regionally, and consist of multiple queues, on which priority is determined by a scoring rule that assigns points regarding how well matched the available kidney is to each patient, how long the patient has been on the waiting list, and so on.

white blood cells. As the HLA mismatch between the donor and the recipient increases, the likelihood of transplanted organ survival decreases.

Regarding cadaveric transplants, there is also an upper limit on how many cadaveric transplants can take place; it is estimated that the annual number of brain-dead potential organ donors in the U.S. is between around 14,000-15,000 (Sheehy et al., 2003). In addition, even in countries with the legal foundation for removal of organs for transplantation from brain-dead potential organ donors (allowing adults to declare whether they wish to donate their organs upon their death, which is legally binding), physicians and organ procurement organizations still seek the consent of the deceased person's family. In the U.S., less than one-third of the organ procurement organizations indicate that they follow the deceased's wishes regardless of next of kin's preferences. When the remaining organ procurement organizations ask for the next of kin's permission, the consent rate of families is about 55 percent (Sheehy et al. 2003, Siminoff et al., 2001). Despite of various specific mechanisms aiming to increase the consent rate of these families[4] in the U.S., the number of cadaveric donors grows by slightly more than 12 percent because of ignorance about the need for donations or grieving relatives' reluctance (U.S. Department of Health and Human Services, 2002).

Of all countries, only in Iran and the Philippines kidney sales are legal. The Philippines allows residents to sell a kidney to a Filipino if no broker is involved (Jimenez and Bell, 2001). Evidence from both of these countries suggests that brokers continue to take advantage of the poor (who have a weak bargaining power) and there is a lack of decent health care following transplantation. Thus, even with a

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4   Examples of non-controversial proposals are public education and awareness campaigns as well as financial incentives for donor's families. At the 1993 annual meeting of the American Medical Association (AMA), its Council on Ethical and Judicial Affairs produced a report which concluded that "there is enough evidence in favor of employing some form of financial incentive to justify the implementation of a pilot program." One such pilot program exists: Pennsylvania's organ donor law, which has been in effect since 1995, allows its residents renewing their driver's license to donate US$ 1 to a Donor Awareness Trust Fund (Eshleman, 1994). One tenth of this fund is reserved in trust for families of organ donors to recover funeral expenses. It is also documented that families are much more likely to consent to organ donation if they knew that the patient had a donor card (Siminoff et al. 2001).

legal market for kidneys, it is still always poor people who sell their kidneys, and in such countries where the state cannot pay for health services, in reality only the rich 'sick' will benefit from such a system. It is unlikely that poor people will be able to have kidney transplants, including those who sell their kidneys regardless of their health conditions and as a result suffer renal problems later on. In developing countries, the medical institutions for regulation of organ transplantation are often under-funded, dysfunctional or readily compromised by organized criminal networks and by the impunity of surgeons willing to perform kidney transplants asking no questions (Pearson, 2004).

Not surprisingly, the substantial consensus in the medical community worldwide is firmly opposed to allowing even cadaveric organs to be bought and sold (see Subsection 2.2 below). Despite the strong stance of the medical community against commercialization of organ transplants, the shortage in available organs has generated a desperate search for them even in the countries where organ sales are illegal. Many patients now travel national or international routes to secure a transplant, putting aside questions about how the organ was obtained. This very scarcity has provided incentives to physicians, hospital administrators, and government officials in a number of (especially developing) countries to pursue ethically dubious strategies for obtaining organs.

In response, the medical community's anti-commercialization concerns and stance regarding organ transplants are getting stronger.[5] WHO webpage summarizes these concerns and stance of the medical community as follows: "In 1991, the World Health Assembly approved a set of Guiding Principles which emphasize voluntary donation, non-commercialization and a preference for cadavers over living

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5   Given the state of legal kidney markets in Iran and the Philippines and the strong anti-commercialization sentiment of the international bodies, it seems that free-market arguments favoring establishment of a kidney market are not likely to become popular in public policy debates at least in the near future. Mainstream economists too started recognizing this: "well-worn arguments that the market for livers would function more effectively if only it looked more like the market for pork bellies are not going to earn economists a bigger voice at the policy-making table" (Byrne and Thompson, 2001, p. 70). See Subsection 2.2 for more on this topic.

donors[6] and for genetically related over non-related donors. [7] ... 'organ trafficking' (such as that described in the 10 May 2003 Lancet) ... apparently occurs in a number of countries where payment for organs is supposedly outlawed. ... The rising trend has prompted a serious reappraisal of current legislation, while WHO has called for more protection for the most vulnerable people who might be tempted to sell a kidney for as little as US$ 1000 (WHO)."

These principles laid down by the international bodies (the WHO, the WMA, the COE) and others (such as the Transplantation Society) have made their way into national law with most countries having provisions against organ trafficking or sale of organs. Yet despite the existence of laws, enforcement in most countries has been very weak. To remove a kidney for transplantation requires an operation of several hours in a sterile environment (in a few hospitals with specialized equipment),[8] carried out by skilled specialists; these needs will not be met in rural villages or covert settings. Thus, the technical requirements of transplantation, as well as existing national registries of where organs originate and to whom they go make off-the-record surgeries almost impossible. As explained in Subsection "'Lack of Enforcement' and 'High Inequality' Affecting the Cadaveric Ratio," almost invariably the commercial donor is made to pose as a relative. Clearly, this increases the number of live-donor transplants vis-a-vis cadaveric transplants. Thus, the extent of how closely the principles laid down by these international bodies are followed by different countries can be judged by the ratio of cadaveric transplants to all transplants ("cadaveric ratio," CR in short) in these countries since cadaveric transplants (that require

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6   Although live-donor transplants have slightly higher survival rates than cadaveric transplants in developed countries such as the U.S. (see OPTN website), morbidity rates (from infection and hepatitis) are considerably higher in many developing countries which generally use organs from living persons since these transplants risk the lives of both the donor and recipient (see Rothman et al., 1997).

7   Matching probability is higher between donor and recipient who are blood relatives.

8   When the Nigeria acquired its first such facility in 2004, it made the news: "Lagos State government has disclosed plans to acquire kidney transplant equipment in addition to the cardiac surgery facilities that are being put to use under the free cardiac surgery programme at the critical care unit of the Lagos State University Teaching Hospital (LASUTH), Ikeja (allAfrica.com)." http://allafrica.com/stories/200411230114.html

brain-dead donors) do not involve commercial transactions, while live-donor transplants do.

There are extreme differences in different countries' cadaveric ratios. On the one hand, in countries such as Ireland, Luxemburg, Belgium, France, Spain, Finland, Estonia, Latvia, Hungary, Poland, Spain, the lowest CR is well above .9. On the other hand, in countries such as Egypt and Bangladesh it is 0 and in countries such as Iran, Pakistan, Jordan, and Georgia, Philippines it is virtually zero. There is no official data for China and India (Rothman et al., 1997). Moldova reported only one kidney transplant in years 2003 and 2004. In South Africa CR increased due to transplant tourism. In developed countries such as US, UK, Australia, Canada, Sweden, Sweden and Switzerland, although CR is still pretty high, it is declining in time nevertheless.[9] It is on the rise in Chile, Uruguay, Venezuela, Hong Kong, Italy, Slovenia and Croatia. Excluding the tiny Bahrain emirate (which had a total of 9 kidney transplants in 2002 and 2003, the only years the country reported kidney transplants data), the highest CR among the Moslem countries are in Malaysia (range: .40-.59) and Saudi Arabia (.19-.56), which are significantly lower than the average of non-Moslem countries.

In this paper, we theoretically and empirically study the effects of inequality and institutions such as rule of law and religion on cadaveric ratio of kidney transplants. All of these factors have important implications for the use and donation of cadaveric kidney to treat end-stage renal disease as indicated above and further discussed in the next section. To that end, prior to embarking on our empirical analysis, we propose a simple theoretical model, which guides us throughout our investigation (we place it in a theoretical appendix since it is very straightforward and standard). It turns out that CR increases when rule of law becomes more prevalent and inequality decreases. In addition, the roles of these variables become more pronounced in lower-income countries. Furthermore, our simple model also points out that religious beliefs can decrease the number of cadaveric kidney transplants. Given our

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9   For instance, in 2004, 58% of kidneys transplanted in the U.S. came from cadaveric donors, down from 80% in 1988 (the first year OPTN reports data about).

simple framework, using an unbalanced annual data gathered from 64 countries covering the period between 1993-2004, we carry out our empirical analysis to find out if the data would be consistent with those predictions. In our empirical investigation, we construct a 5-year and 3-year average of the variables of interest due to the nature of the data. Using this data set, we carry out pooled regressions and cross sectional regression analysis using simple OLS (and instrumental variables) techniques with robust errors. We also gauge the robustness of our findings and guard against potential misspecification of the model by introducing public, private and total health care expenditures into our general framework. Overall, data yield strong support for our model's predictions.

The rest of the paper is organized as follows. Section 2 provides the background information. Section 3 gives information about our data sources and presents our empirical findings, while Section 4 concludes and draws implications for future research.

2. Background

2.1. Kidney 101

A kidney patient is someone who has 'End Stage Renal Disease' (ESRD) - a fatal disease unless treated with dialysis or kidney transplantation. Transplantation is considered the preferred treatment for various reasons. First of all, dialysis treatments are time consuming. More importantly, transplants are more cost effective in the long run. A year of dialysis treatment in the U.S. costs about $45,000. The federal government pays 80% of that sum and private insurance pays part of the remaining 20%. In the first year after a successful surgery, transplantation and medical costs average about $90,000, and cost in each following year (mainly to cover the cost of immunosuppresant medications) average about $15,000 (Shapiro, 2003).

Assuming that the donor and recipient have no immunological incompatibility, type AB patients are the most advantageous ones among all four blood types since all types of kidneys can be transplanted

into them. Type O kidneys are the least advantageous ones since they can be transplanted into any patient but can only receive type O kidneys. Type A or type B kidneys can be transplanted into same type or type AB patients and receive kidneys from their type and type O.

In developed countries such as the U.S., the shortage of kidneys led to intensified efforts to increase the efficiency of kidney transplants: "When kidney and recipient were perfectly matched, 52 percent of the transplants lasted at least 10 years, compared with 32 percent for those who got a mismatched kidney. Each organ bank in the United States generally offers organs first locally, then regionally, then nationally. ... The study in Thursday's New England Journal of Medicine looked at a program set up in 1987 by the United Network for Organ Sharing. It ships kidneys anywhere in the country to people considered perfect matches. ... Since 1987, doctors have gotten better at suppressing organ rejection after transplants [by using cyclosporine], the upper age for kidney donors has risen, and new research has made perfect matches easier to find. But some argued that sending refrigerated kidneys across the country would result in cold damage and that finding a perfect match is not important anymore because of improvements in immune-system suppression (CNN, 2000a)"

In certain parts of the U.S. for instance, live-donor and cadaveric kidney transplants are intricately linked via an indirect exchange: "In New England, Washington, D.C., and elsewhere, would-be donors unable to give a kidney to a loved one instead have given a kidney to a stranger. The loved one, in turn, is rewarded by being moved up on the waiting list for a dead person's kidney" (Wessel, 2004; Wall Street Journal). There is, however, a widespread concern in the transplantation community that such an indirect exchange can harm type O patients with no living donors. First of all, they will lose their priority to type O patients with incompatible donors donating to the cadaveric pool. In addition, very few type O living kidneys will be offered to their pool since a type O donor can directly donate to his intended recipient unless there is an immunological incompatibility.

There have also been notable efforts to increase the efficiency of live-donor kidney transplants as

well. In a few cases, an exchange has been arranged between one incompatible patient-donor pair and another, in which the donor from each pair gives a kidney to the patient from the other pair. Since 2001, there have been six such paired exchanges in New England (Allen, 2004); in addition, in the United States, there have even been two exchanges among three incompatible patient-donor pairs. (Such exchanges do not constitute violations of the 1984 National Organ Transplant Act (NOTA), which prohibits the sale or purchase of human organs.) Roth, Sönmez and Ünver (2004) showed that the benefits of such an exchange could increase live kidney donations between unrelated donors from about 54% to as much as 91% if multiple-pair exchanges are feasible, and to as much as 75% even if only pairwise exchanges feasible. The latter are logistically simpler than exchanges involving more than two pairs (1) for incentive reasons, all transplantations in an exchange need to take place simultaneously (since otherwise a donor may refrain from donating her kidney her intended recipient receives a transplanted kidney), and (2) even a pairwise exchange involves four simultaneous surgical teams, operating rooms, and so on.

2.2. The Stance of Prominent International Bodies and Legislation in Developed Countries

Prominent international bodies such as the Council of Europe, the Transplantation Society, the World Health Organization, and the World Health Assembly regard commodification of body parts as "unacceptable."[10] Italy was the first country to ban it in 1969, and an overwhelming number of countries have followed its lead. In the U.S., this is a felony under the National Organ Transplant Act (NOTA) of 1984, and the Uniform Anatomical Gift Act of 1987; it calls for as much as a $50,000 fine and five years in prison if a person is convicted of buying or selling human organs.

The World Medical Association issued a statement condemning the purchase and sale of organs in 1985 (and again in 1987, 1994, and 2000). The World Health Organization has found the sale of organs to violate the Universal Declaration of Human Rights as well as its own constitution: "The human

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10 The information provided in this and next paragraph is from Rothman et al. (1997) and Pearson (2004).

body and its parts cannot be the subject of commercial transactions. Accordingly, giving or receiving payment ... for organs should be prohibited." The WHO instructs physicians not to transplant organs "if they have reason to believe that the organs concerned have been the subject of commercial transactions." The Council of Europe in 1987 also declared: "A human organ must not be offered for profit by any organ exchange organisation, organ banking centre or by any other organisation or individual whatsoever." The International Council of the Transplantation Society unequivocally insists: "No transplant surgeon/team shall be involved directly or indirectly in the buying or selling of organs/tissues or in any transplant activity aimed at commercial gain."

There are several reasons behind this strong stance of international bodies that pertain to especially developing countries. For one, rational behavior and frictionless markets are not teeming in many developing countries. As Bardhan (2005) states: "Common observations of myopic, weak-willed, procrastinating and time-inconsistent behaviour fly in the face of the inexorably rational economic man of our textbooks. This may be a special problem in poor countries where public information media are weak, many people are uneducated and superstitious, and there is a surfeit of touts, middlemen and operators trying to manipulate you to make hasty uninformed decisions. The innate psychological characteristics of people may not be different in poor countries, but their circumstances and information sources are often quite different, and capacity for complex calculations is an acquired trait, honed only as transactions become more complex. Also, people often internalise their constraints and by all accounts the constraints are much more severe in the case of poor people. All this may sometimes call for more paternalistic regulations than are admitted in the rational-choice framework of Law and Economics."

Bardhan (2005) also counters the assertion of 'if parties enter into a transaction voluntarily (without any adverse effects on other parties), legal rules should not interfere': "There are many cases, particularly in poor countries where it is possible to show that one party in this transaction would have been actually better off if the law intervened to take out certain options from the choice set." He gives the

examples of "bonded labor' (studied by Genicot, 2002) and 'sexual harassment contract' (studied by Basu, 2000) which can be considered as cases exhibiting 'the paradox of voluntary choice'.[11]

Buscaglia and Stephan (2005) point out that there is a significant gap between 'law in the books' and 'law in action' in most developing countries. Because of this gap, large segments of the population who lack the information or resources to overcome significant substantive and procedural barriers are not able to pursue formal means to remedy their grievances. They report empirical evidence that the most unprotected segments of population consider lack of legal information, economic factors, fear of abuse of authority as well as corrupt practices as main obstacles to access to justice.

In addition, exchange activities and one's relationships - that are mostly autonomous in developed countries are intricately linked in developing countries. Anthropologists (and to some extent, economists) have noted the importance of what Bailey (1971) calls the 'multiplex' nature of long-term relationships in traditional societies, and contrasted this with the relatively short-term exchange relationships observed in modern economies. As Ligon (2005) states: "The watershed between traditional and modern society is exactly [the] distinction between single-interest and multiplex relationships. The hallmark of a modern society is the specialized role and the whole apparatus of its productive prosperity rests upon the division of labor between specialized roles. Thus, to take examples from Bardhan and Rudra (1981, 1983) and Bell (1988), in a 'traditional' society one's banker may also be one's landlord (or perhaps the landlord's brother), and labor undertaken on growing crops on the landlord's land may influence not only the expected yield, but also the terms of a loan taken years earlier."

Even in the developed countries it is recognized that, if a market for kidneys is to be established, it

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11   "The strategic interaction between the landlord and the local credit institutions can constrain the poor peasant to 'choose' a bonded labour contract, whereas if bonded labour were banned it would have resulted in welfare-enhancing credit opportunities for the peasant. Basu (2000) models a somewhat similar case of a woman choosing a 'sexual harassment contract' where she would have otherwise been better off if such contracts were disallowed. Similar cases can be argued for legally taking out the option for a poor worker to work in unsafe or hazardous conditions. These are all cases for interventionist regulations in the context of extremely unequal but 'voluntary' contracts."

needs to be far different than markets for other goods. As Roth, Sonmez and Unver (2005) state: "Kidney exchange, in the context of the legal/social/ethical prohibitions on the buying and selling of organs, gives us a chance to look closely at the exchange of indivisible goods, without a medium of exchange, in an environment in which the structure of efficient exchange can be analyzed." They suggest a centralized clearinghouse to establish a sufficiently thick market so that double and triple coincidences of wants - regarding incompatible patient-donor pairs exchanging donor kidneys with other such pairs - can be identified and carried out.[12] "All of these markets [that can benefit greatly from clearinghouses], like kidney exchange, are matching markets, in the sense that it matters who transacts with whom (in contrast to anonymous commodity markets). And the fact that some of these markets can do much of their work without money at all supports the view that many matching markets in which money is freely available nevertheless do not clear by price adjustments alone. (Departments of economics don't hire professors by announcing a price and seeing who comes...)."

2.3. 'Lack of Enforcement' and 'High Inequality' Affecting the Cadaveric Ratio

News stories, emanating especially from India, describe the abuses to which lower class and lower caste populations are exposed where live donors sell their kidneys through brokers for as low as $600. The Indian government tried to stop illegal organ transplants with a 1994 law that criminalizes organ sales but allows for "unrelated kidney sales," a loophole that has led to corruption. "Now you have a number of unrelated people actually selling organs with 'approval' of the hospital authorization committees which allow them recognizing their emotional closeness," Dr. Sandeep Guleria, a professor at the All India

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12   As Roth et al. explain, clearinghouses are most needed in markets that are prone to failures with respect to the thickness of the market or that have incentive problems that make the participants reluctant to provide information needed for efficient allocation. "For example, clearinghouses recently designed for other markets in which monetary transfers are considered inappropriate have involved the allocation of public school places in New York City (where the clearinghouse solved a congestion problem), and in Boston, where the existing allocation system had an incentive problem. ... Clearinghouses are also used in markets in which monetary wages are entirely appropriate, such as the labor markets for new doctors ... and for medical specialists of various sorts. ... And there has been recent attention to how decentralized markets deal well or badly with some of the same problems that clearinghouses can be used to solve (in e.g. the markets for college admissions and financial aid, law clerks, psychologists, gastroenterologists, collectables, etc.)."

Institute of Medical Sciences (AIIMS), told Reuters Health (Kumar, 2001). In South Africa, the Human Tissue Act of 1983 states that no one can receive payment for the transfer of any tissue - including flesh, bone, organ, or body fluid. Violators, however, are subject to a maximum fine of only $300 *or* imprisonment of no more than one year (Frenkel, 2004).

In India, brokers bring together potential donors and recipients, arrange payments, take large commissions, and sometimes bilk the poor of the sums due them. In the state of Punjab, intensive media investigations, such as by the magazine Frontline, uncovered widespread corruption from doctors to high ranking police officers. In parts of Northern India, which is a major center for organ trade, local government colludes with traffickers. A number of high-ranking police officers have been implicated in threatening, intimidating and assaulting donor-sellers who came forward to file complaints (Swami, 2003). Also, it is common that moneylenders force debt-ridden people into selling organs. In some cases they have the backing of local political leaders. Organ 'donors' are recruited by 'agents' to sell a spare organ in order to cancel crippling debts, to pay for a necessary operation, or to cover large family expenses. Enforcement has been weak and misplaced.[13] In India, while some doctors have been charged, no doctor to date has been convicted of organ trafficking. Recipients of trafficked organs also do not fall under the criminal law and remain largely invisible (Pearson, 2004).

"Some of these outlaw transplant operations are cloak and dagger, others operate in the gray nether world of loopholes and soft corruptions of waiting lists for tightly regulated and rationed organs,"

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13 As Reuters (1996) reported, some leaders such as the Colombian President Ernesto Samper ordered the creation of a new police unit on Friday to crack down on traffickers in human body parts. In some other cases, the leaders either complained about lack of resources: In 2000, CNN reported that a grandmother in Russia tried to sell her five-year-old grandson for his organs; Vaknin (2002) reported that, when confronted by the European Union on this issue, Russia responded that it lacks the resources required to monitor organ donations. In other cases, they asked for international help: In 2004, LifeSiteNews.com reported that five missionary nuns working in Mozambique have revealed a gruesome network trafficking in human organs that involves kidnap and murder of child victims and the complicity of police. Shortly after, the same source reported that one of the Brazilian nuns responsible for exposing a human organ trafficking ring in Mozambique has been murdered. Agence France-Presse later reported that Mozambique President Joaquim Chissano told reporters during a visit to Portugal that they "have asked for help from international organisations which we belong to."

states University of California medical anthropologist (and the founder of "Organ Watch") Nancy Scheper-Hughes, who has tracked organ profiteers in eight countries over five years (Kates, 2002, reported for New York Daily News). When faced with an investigation, "the accused always made the donor pose as a relative of the recipient and had documents ready to support their case. In some cases the donor also stayed with the recipient to get used to the family to prevent suspicion" (Delhi Police forces quoted by Delhi NewsLine, 2004).[14] "Out of all the renal transplants done in India currently, only 30% are from relatives whereas 64% are from unrelated 'donors. Only a miniscule 6% transplants come from donors classified as brain dead" (an Indian doctor quoted by Kumar (2001) from Reuters News Agency).

All of these characteristics point to very weak institutions which are manifested especially by the extent of lack of rule of law. As Bardhan (2005) states: "When the state is captured by a narrow clique, or when the state is weak so that there is an "oligopoly" of coercion and authority ... shared by various protection rackets and corrupt officials (police, judges, bureaucrats), there is usually a big gulf between laws that are in the statute books and their enforcement, and, most importantly, a deficiency in every citizen's expectations about others' compliance, which form the foundation of the rule of law."

India, however, is not alone in this lucrative industry. The use of organs from executed prisoners is systematic in China. However, most organ sales, according to the Chinese media, appear to involve voluntary sales of kidneys by poor farmers to wealthier urban residents. A report in October 2000 in the Yangcheng Evening News said that middlemen had posted advertisements on China's auction Web sites (Pomfret, 2001, reported for Washington Post). Thus, it is straightforward to detect the magnifying role of inequality apart from the key role 'lack of rule of law' plays in increasing the commercial live-donor transplants in many developing countries.

As mentioned before, legal loopholes enable organ sales to flourish in many countries. Such

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14   As one Rio doctor explained: "I don't want to know what kinds of private exchanges have taken place between my [kidney] patients and their [living] donors. But obviously you do have to suspect something when the patient is a wealthy Rio socialite and her 'donor' is a poor, barefoot 'cousin' from the country."

loopholes exist even in highly developed countries such as the United States. "An international transplant mafia based in the former Soviet Union is capitalizing on America's organ-shortage crisis by smuggling live donors into the country to sell their lungs and kidneys, the Daily News has learned. Illicit organ donors from Moldova, the poorest country in the former Soviet Union, enter the United States - mostly at Kennedy Airport - on false student or tourist visas. They are whisked to hospitals where their organs are removed and sold, government sources said. ... the FBI and the State Department's visa fraud section is closing in on the gang ringleaders, whose operatives match desperately impoverished donors to equally desperate patients. ... the Moldovans have duped doctors into believing they are giving their organs altruistically to family members. But, the source said, 'There are clearly some doctors who knew what the entire deal is about' and profit from it. ... 'We had to pretend we knew this person, that he was an old friend who was doing this,' [one] relative [said]. ... The life-and-death dilemma creates serious ethical and legal problems for patients and doctors. 'At some point, you cannot turn over every rock looking for trouble,' said Dr. Ian Tellis, a renal transplant surgeon at Montefiore Medical Center in the Bronx. 'We are obligated not to facilitate something terrible, but if the circumstances seem reasonable we go ahead'" (Kates, 2002).[15]

Inequality and with weak institutions can decrease cadaveric donations through another channel

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15   The kidney sellers do not know or understand what the agreement is they are signing until it is too late. This precludes them from taking any further action against the broker, doctor or the clinic, especially when they donate their kidney in a foreign country. Larry Rohter, in his New York Times (2004) report, tracks the sale of a kidney involving an international plot. "When Alberty José da Silva heard he could make money, lots of money, by selling his kidney, it seemed to him the opportunity of a lifetime. For a desperately ill 48-year-old woman in Brooklyn whose doctors had told her to get a kidney any way she could, it was. ... her husband had relatives in Israel who had heard of a syndicate that brokered transplants, and reached out to them. The woman and her husband said that relatives and the brokers reassured them that an operation abroad would be perfectly legal. ... 'It was only when I got to South Africa and was told to sign a document saying that the recipient of my kidney was my cousin that I realized that something was wrong,' Mr. da Silva said. 'But by then it was too late to turn back.'"
        International transplant tourism is very active. Apart from many Americans, Canadians and Western Europeans, residents of other countries too travel international routes to obtain a kidney. Residents of Israel, who used to travel to Turkey or Eastern Europe, now travel to South Africa to obtain a kidney from mostly poor Eastern European and Brazilian donors. Residents of some Asian countries (e.g., Malaysia, Singapore) frequently travel to India. Residents of Taiwan, Hong Kong, Korea, and Singapore go to mainland China.

as well. To see that note that, not only to have a live-donor transplant, but also to gain access to the waiting list for organs, a patient must demonstrate the ability to pay transplant-associated costs, which are rather high. Many insurance companies and government programs do not cover these costs fully; this situation is worse for less-than-wealthy individuals in countries with weaker institutions which also manifest themselves in rather low levels of collective action. Since cadaveric transplantation mainly depends on public altruism to make organs available, in an unequal society with weak institutions it may not be a reassuring public policy to ask everyone to donate but to give organs only to those who can afford to pay.

Finally, another channel through which Rule of Law can be influential is as follows: Apart from its enforcement aspects (general enforcement as well as property-rights enforcement), as Bardhan (2005) notes, rule of law also includes various democratic rights of political participation, association, mobilisation, and expression of 'voice.' Bardhan states that "an analysis of cross-country variations in human development indicators (which includes education or health variables like mass literacy or life expectation) shows that an institutional variable measuring 'voice' or participation rights is just as important as that measuring security of property rights as an explanatory variable - see Bardhan (in press, chapter 1). In other words, the part of 'rule of law' that refers to democratic participation rights explains a significant amount of variations in human development indices across countries."

2.4. Religious Beliefs Affecting the Cadaveric Ratio

The gap between demand and supply is even more acute in countries with religious considerations inhibiting organ donation. In the Middle East, religious precepts discourage, if not prohibit, cadaveric organ donation. Islamic teachings strongly emphasize the need to maintain the integrity of the body at burial (the body is considered the cover that needs to protect the invaluable soul); although many religious leaders have approved organ donation as a gift of life, others continue objecting it. For that reason, residents of Gulf States (e.g., Kuwait, Saudi Arabia, Bahrain, Oman, United Arab Emirates)

frequently travel to lndia to obtain a kidney or obtain it from the foreign guest workers in their countries (Rothman et al., 1997).

Israelis, on the other hand, reject the principle of brain death (equating it with murder), thereby making organ retrieval almost impossible. "Paying for an organ has become so routine in Israel that there have been instances in which a patient has elected not to accept the offer of a kidney donation from a well-matched relative. 'Why risk harm to a family member?' one patient told me. Instead, these patients have decided that purchasing a kidney from someone they've never met -- in almost all cases someone who is impoverished and living in a foreign land -- is a far more palatable option" (Finkel, 2001; New York Times).[16]

3. Empirical Findings

The empirical predictions we have follow from the simple and standard theoretical model we have in the theoretical appendix.

3.1. Data

To carry out our analysis we extract data from several sources. The data on kidney transplants are

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[16]   "'I can get you a kidney immediately,' said the broker whom Moshe Tati called. ... Then he quoted a price: $145,000, cash, paid in advance. This would cover everything, the broker said -- all hospital fees, the payment to the seller, accommodations for accompanying family members and a chartered, round-trip flight to the country where the surgery would take place. The trip would last about five days, he said, and the destination would be kept secret until the time they left. The broker promised that one of the top transplant surgeons in Israel would be flying with them to perform the operation. The broker instructed Moshe to undergo blood and tissue exams so that a match with a kidney seller could be arranged. 'I can guarantee you a living donor,' the broker said, 'a young, strong man. This won't be a cadaver organ.' Desire for a living donor is another reason why dialysis patients often prefer to purchase a kidney and circumvent national programs, where legally transplanted organs are almost always from cadavers. An Israeli kidney buyer named Avriham, who used the same broker as Moshe Tati and traveled to Eastern Europe, described this notion in his own terms: 'Why should I wait years just to have a kidney from someone who was in a car accident, pinned in his car for hours, then in miserable condition in the I.C.U. for days, and only then, after all that trauma, have part of him put inside me? That organ is not going to be any good! Or, worse, I could get the organ of an elderly person, a person who died of a stroke or an aneurysm -- that kidney is all used up! It's better to take a kidney from a healthy young man who can also benefit from the money. Where I went, families were so poor they didn't even have bread to eat. The money I gave was a gift equal to the gift I received. I insisted on seeing my donor. He was young and very healthy, very strong. It was perfect, just what I was hoping for. A dream kidney'" (Finkel, 2001).

obtained from the International Registry Organ Donation Transplantation database which provides information on cadaveric and live kidney transplants carried out in 64 countries over the period between 1993-2004.[17] This data set contains information on kidney transplants from developed and developing countries with different religious beliefs. In our data set there are 11 countries (Turkey, Bahrain, Pakistan, Saudi Arabia, Malaysia, Lebanon, Jordan, Kuwait, Iran, Egypt, Bangladesh) with Islam as the prominent religious belief and one country (Israel) with Judaism and Islam as the prominent religious beliefs where use of cadaveric organs is not as acceptable in the remaining countries in the data set. In our analysis we introduce a dummy variable for these countries to capture the effects of their belief systems. We provide detailed statistics for each country in our data set in Appendix A including information on kidney transplants and GDP per capita and the state of (in)equality and rule of law indices. We extract PPP adjusted GDP calculated at 1995 prices in US dollars from world development indicators and population data from US census bureau IBD database (www.census.gov/ipc/www/idbconf.html). Information on income inequality (Gini) is obtained from World Income Inequality Database (www.wider.unu.edu/wiid/wiid.html). Data on rule of law (ROL) is constructed merging the indices provided by Knack and Keefer(1995) and Kraay, Kaufmann and Mastruzzi (2005), which is accessible through the world bank's web site under Governance, Macroeconomics and Growth.

The full sample, which is an unbalanced panel data from 64 countries, provides us with 510 observations over the 1993-2004 period. As depicted in Table 1a, the average number of live transplants that is carried out in a year is approximately 221 cases and that of cadaveric transplants is 510 cases. If one were to concentrate on the B countries; i.e. countries where belief system generally disapprove the use of organ transplants, one can observe that the average number of annual average live transplants shot up to 362 cases and that of cadaveric kidney transplants drop to a dismal 49 cases a year. If we look at the remaining countries, on average cadaveric kidney transplants dominates that of live transplants by 583 to

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199 cases.

Table 1b provides basic statistics on the remaining variables of interest. Compared to data presented in Table 1a, we have fewer observations due to missing information on several country specific years. The table provides information on average inequality (Gini) index, GDP per capita and rule of law (ROL) index. The average Gini index is 37 for the sample that excludes B countries and 41 for the B countries, indicating that on average inequality is higher in B countries. When we compare average per capita income levels, average per capita income in B countries is lower than that of the group that exclude these countries. Finally, a similar pattern is observed for ROL index; we observe a lower score for B countries than that of others implying for a lesser presence of rule of law in these countries.

In the following subsections, we present our empirical results. In each case, we first estimate the model using the pooled sample, and then carry out our estimations using averages of 5-year and 3-year data. After we present our main results, we provide a set of additional regression results which incorporate health care expenditures in our regressions, including total, public and private health care expenditures extracted from *World Development Indicators*, to gauge the robustness of our findings and guard against potential misspecification of the model. In all models, we report robust standard errors.

3.2. Main Results

Given that our main variables of interest do not change significantly over time, in particular GDP per capita, the ROL and Gini coefficients, we first construct 5-year averages of our variables for the periods 1994-1998 and 1999-2003. Next, we compute 3-year averages of the data using the periods 1995-1997, 1998-2000 and 2001-2003 and repeat the analysis as described below to see if results would differ from the first set.[18] Note that we do not use data from 2004 for only a handful of countries contribute information

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18 We also construct two secondary sets of data where we take 5-year and 3-year averages with different starting years (the 5-year data starts as of 1993 and the 3-year data starts as of 1994) and carry out the analysis that we lay out below with those sets of data to verify our findings. Results from these alternative data sets are qualitatively similar to those we report here and available upon request from the authors.

on kidney transplants for that year. The model that we investigate has the following form:

$$CR = \alpha_0 + \alpha_1 \text{ Belief} + \beta_1 \text{ GDP}_t + \beta_t \text{ Gini}_t + \beta_3 \text{ ROL}_t + \varepsilon_t, \qquad (1)$$

where CR denotes the cadaveric to total kidney transplants ratio, Belief is a dummy which takes 1 if countries are Turkey, Bahrain, Pakistan, Saudi Arabia, Malaysia, Lebanon, Jordan, Kuwait, Iran, Egypt, Bangladesh or Israel where the belief system traditionally does not approve the use of cadaveric organ transplants.[19] The remaining three variables capture the impact of GDP per capita, the Gini and ROL indices on CR.

Table 2a reports our regression results when we construct the data by taking 5-year averages of the variables of interest. This method yields two 5-year averages covering the years between 1994-1998 and 1999-2003. The first column depicts the results when we employ pooled data, which provides up to 2 data points for each country. A quick look at the results reveals that mean GDP per capita does not play a significant role in the relationship. However, the Gini coefficient is negative and significant at the 5% level implying that as inequality declines, the use of cadaveric kidney transplants increases. ROL takes a positive sign and it is significant at the 1% level meaning that an improvement in the rule of law will encourage the use of cadaveric transplants. What is also quite interesting is that, the coefficient of Belief is negative and significant at the 1% level capturing the fact that cadaveric kidney transplants are not acceptable in these countries in comparison to the other countries we have in our data set. These results are in line with the predictions of the theoretical model that we present in the appendix.

In the remaining columns of Table 2a, we report our results after splitting the data into low-income and high-income country categories where the thresholds for these definitions are the 40th percentile of GDP per capita evaluated each year; thus a particular country may appear in different categories over time. We introduce separate Gini and ROL indices for poor (Gini40 and ROL40) and

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19   Due to space considerations, we do not present results for the case when we excluded Israel from the set of countries above. The results are qualitatively similar to those we present here and available from the authors upon request.

wealthy (Gini60 and ROL60) countries, i.e., countries that are below and above 40th percentile of GDP, respectively, into our regressions.[20] In other words, we allow the slope coefficients for Gini and ROL indices to differ in line with the wealth of the group of countries we form. Also, although we have initially allowed GDP to take different values in conjunction with the wealth of the countries, we report coefficient of GDP since the coefficients of GDP40 and GDP60 were not significant. (In fact, the coefficient of GDP is never significant throughout the analysis.)

Turning back to column 2 of Table 2a, notice that Gini40 and ROL40 are the two variables that take on a significant coefficient at the one percent level along with Belief. It appears that improvements in equality in low income countries as well as improvements in rule of law lead to higher use of cadaveric kidney transplants. Similar as in column 1, Belief takes a negative sign capturing the fact that cadaveric kidney transplants in those countries are not approved in relation to the rest of the countries we have in the data set. The next two columns (columns 3 and 4) report our results when we ran separate regressions for each 5-year period average separately; one set of results with the end year as of 1998 and the other with that of 2003. Since the results given in these columns are qualitatively the same as in column two, we refrain from further comment due to space constraints. Overall, results depicted in Table 2a verify the predictions of our theoretical model.

We carry out the same exercise after we produce three 3-year period-averages covering the years between 1995-1997, 1998-2000 and 2001-2003. The coefficients and their significance levels in each column as we report in Table 2b are very similar to those reported in Table 2a. GDP does not play a significant role in explaining cadaveric kidney transplants whereas the Gini, ROL and Belief do. Furthermore the same is true for low-income countries as reported earlier; Gini40 and ROL40 are both significant. This set of results confirms our findings and implies that the results depicted in Table2a are

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20   We also split the data at the median. However chose to continue with those reported here for the lower 40 percentile countries are more homogeneous in comparison to those countries that fell into below the median GDP group. These results are available from the authors.

robust to the choice of 5-year or 3-year data averaging process.

3.2.1. Results with the Inclusion of Health Care Expenditures

Having presented our main results, one may be curious if these results are biased due to some missing variables, which might be important in explaining the number of kidney transplants carried out in a country. To that end, we specifically incorporate private, public and total health care expenditures as a percentage of GDP to our basic set up to gauge the robustness of our results. Unfortunately, the data for these variables are not available for all the years we are interested in. However, we were able to extract data for 5 years between 1998-2002 allowing us to construct a 5-year as well as a 3-year average and carry out a similar analysis we have presented above, in fact using a slightly different timing. The fact that we are using a different timing, our findings would provide additional evidence that results presented in Tables 2a and 2b are not dependent on the time frame we implemented.

To be consistent with our earlier tables, we present 5-year and 3-year averages in Tables 3a and 3b. In both sets of tables, we can observe that average health care expenditures do not seem to play an important role in determining cadaveric to total kidney transplants ratio. Coefficients associated with Gini40, ROL40 are significant, negative and positive, respectively, as well as that of Belief, which is negative and significant as before, providing additional evidence that inequality, rule of law and belief structure are important determinants of cadaveric kidney transplants over live transplants. These, overall, provide evidence that our results are robust to the inclusion of public, private and total health care expenditures.

4. Concluding Remarks

Organ transplants save thousands of lives each year and have been a miracle of modern medicine. The main advantage of such an intrusive procedure is that the patient can live a more natural life after the surgery with the help of immunosuppressants. In particular, although a patient with end stage renal

disease   can be treated through other renal replacement therapies, kidney transplant is the preferred treatment method for both cost effectiveness and the quality of life that the patient enjoys afterwards. Nevertheless, the extent and rapid pace of the spread of this treatment method have intensified several critical concerns. One such concern stems from the source of kidney that will be transplanted. The organ will be either cropped from a kidney donor or cadaver. Regarding cadaveric transplants, there is an upper limit on how many cadaveric transplants can take place. In addition, when the next of kin's permission is asked, the consent rate of families is about 55 percent.   Regarding live-donor transplants, matching probability is higher between donor and recipient who are blood relatives. Clearly, there is a limit on the number of blood relatives who can donate kidneys without immunological incompatibilities. Especially, in a number of developing countries, this very scarcity has provided incentives to physicians, hospital administrators, and government officials to pursue ethically dubious strategies for obtaining organs.

In this paper, we ask whether factors such as inequality and institutions such as rule of law and religion have any effect on the ratio of cadaveric transplants to all transplants. In other words, does an improvement in equality and in rule of law increase the use of cadaveric kidney transplants. To that end we use a simple theoretical model in the Theoretical Appendix which implies that CR will increase as income level increases and as rule of law becomes more prevalent and inequality decreases.   The theoretical model also points out that beliefs are important in use of cadaveric kidney transplants. We test these predictions using an unbalanced annual data gathered from 64 countries covering the period between 1993-2004. Our empirical work, which utilizes 5-year and 3-year averages of the variables of interest yield strong support for our model's predictions.

Overall, not discounting other potential policy changes that can be implemented, our findings suggest that the use of cadaveric kidney transplants can increase by implementing policies which improve the rule of law, income levels and equality especially in developing countries.

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Table 1a: Basic descriptive statistics on kidney transplants

	Full Sample		Full Sample less B		B countries	
	Live Transp.	Cadaveric Transp	Live Transp.	Cadaveric Transp	Live Transp.	Cadaveric Transp
N	510	510	440	440	70	70
mean	221	510	199	583	362	49
std dev	712	1276	735	1360	531	51
min	0	0	0	0	0	0
max	6464	8938	6464	8938	2271	189

Notes: B countries are Turkey, Bahrain, Pakistan, Saudi Arabia, Malaysia, Lebanon, Jordan, Kuwait, Iran, Egypt, Bangladesh and Israel.

Table 1b: Basic descriptive statistics

	Full Sample			Full Sample less B			B countries		
	Ave. Gini	Ave. GDP	Ave. ROL	Ave. Gini	Ave. GDP	Ave. ROL	Ave. Gini	Ave. GDP	Ave. ROL
N	460	474	493	434	420	439	37	65	65
mean	37	15862	4	37	16443	5	41	10294	4
std dev	9	8754	1	9	8890	1	4	5917	1
min	23	1209	2	23	1209	2	31	1525	2
max	59	41214	6	59	41214	6	47	18782	5

Notes: B countries are Turkey, Bahrain, Pakistan, Saudi Arabia, Malaysia, Lebanon, Jordan, Kuwait, Iran, Egypt, Bangladesh and Israel.

Table 2a.   Main results using 5-year averages

	Full Sample	Full Sample	First 5-year averages ending 1998	Second 5-year averages ending 2003
Mgdp	-0.004 [0.005]	-0.005 [0.006]	0.001 [0.009]	-0.015 [0.009]
Mgini	-0.008 [0.003]**	-	-	-
Mgini40	-	-0.012 [0.004]***	-0.016 [0.005]***	-0.012 [0.006]**
Mgini60	-	0.003 [0.004]	-0.004 [0.005]	0.010 [0.006]
Mrol	0.095 [0.036]***	-	-	-
Mrol40	-	0.147 [0.043]***	0.057 [0.067]	0.292 [0.085]***
Mrol60	-	0.026 [0.036]	-0.028 [0.053]	0.094 [0.076]
Belief	-0.410 [0.093]***	-0.423 [0.088]***	-0.409 [0.176]**	-0.411 [0.094]***
R-squared	0.42	0.49	0.40	0.60
N	91	91	41	50

Notes: * significant at 10%; ** significant at 5%; *** significant at 1% . Robust standard errors in parenthesis.

Table 2b. Main results using 3-year averages

	Full Sample	Full Sample	First 3-year averages ending 1997	Second 3-year averages ending 2000	Third 3-year averages ending 2003
Mgdp	-0.003 [0.004]	-0.001 [0.005]	0.002 [0.011]	0.001 [0.006]	-0.016 [0.010]
Mgini	-0.008 [0.003]***	-	-	-	-
Mgini40	-	-0.012 [0.003]***	-0.013 [0.007]*	-0.015 [0.006]**	-0.010 [0.006]*
Mgini60	-	-0.000 [0.003]	-0.003 [0.004]	-0.007 [0.005]	0.010 [0.006]
Mrol	0.080 [0.026]***	-	-	-	-
Mrol40	-	0.125 [0.032]***	0.102 [0.049]**	0.104 [0.120]	0.287 [0.085]***
Mrol60	-	0.016 [0.028]	0.008 [0.047]	0.010 [0.065]	0.107 [0.079]
Belief	-0.470 [0.080]***	-0.463 [0.082]***	-0.626 [0.154]***	-0.373 [0.147]**	-0.423 [0.110]***
R2	0.42	0.46	0.53	0.36	0.58
N	132	132	37	45	50

* significant at 10%; ** significant at 5%; *** significant at 1% . Robust standard errors in brackets. Constant is not reported.

Table 3a.   Robustness tests using 5-year averages

5-year averages ending 2002	Basic regression results	Average public health care expenditures	Average private health care expenditures	Average total health care expenditures
Mgdp	0.001 [0.006]	-.000 [0.008]	0.000 [0.006]	0.000 [0.007]
Mgini40	-0.015 [0.005]***	-.0135 [.005]**	-0.0124 [0.006]*	-.0145 [0.006]**
Mgini60	-0.003 [0.006]	0.004 [0.007]	0.007 [0.008]	0.0039 [0.008]
Mrol40	0.187 [0.079]**	0.184 [0.080]**	0.209 [0.0817]**	0.202 [0.081]**
Mrol60	-0.013 [0.062]	-0.010 [0.072]	-0.005 [0.062]	-0.0018 [0.0667]
Belief	-.493 [0.108]***	-.465 [.121]***	-0.488 [0.104]***	-0.504 [0.117]***
5 year Mean Health care	-	0.014 [0.026]	-0.033 [0.0266]	-0.008 [0.023]
R-squared	0.50	0.50	0.51	0.50
N	54	51	51	51

Notes: * significant at 10%; ** significant at 5%; *** significant at 1% . Robust standard errors in parenthesis.

Table 3b. Robustness tests using 3-year averages

3-year averages ending 2002	Basic regression results	Average public health care expenditures	Average private health care expenditures	Average total health care expenditures
Mgdp	0.002 [0.006]	0.001 [0.007]	0.001 [0.005]	0.0014 [0.006]
Mgini40	-0.014 [0.006]**	-0.013 [0.005]**	-0.011 [0.006]*	-0.014 [0.006]**
Mgini60	0.0035 [0.006]	0.0042 [0.007]	0.008 [0.008]	0.0045 [0.008]
Mrol40	0.180 [0.078]**	0.176 [0.078]**	0.203 [0.079]**	0.197 [0.078]**
Mrol60	-0.015 [0.061]	-0.015 [0.070]	-0.011 [0.060]	-0.005 [0.064]
Belief	-0.483 [0.108]***	-0.45 [0.119]***	-0.478 [0.1024]***	-0.499 [0.117]***
3-year Mean Health care	-	0.014 [0.0256]	-0.0407 [0.026]	-0.011 [0.0227]
R2	.50	0.50	052	0.50
N	54	50	50	50

* significant at 10%; ** significant at 5%; *** significant at 1% . Robust standard errors in brackets. Constant is not reported.

Appendix A

Country	Years	Ave. Cadaveric	Ave. Live	Ave. Gini	Ave. GDP	Ave. ROL
Argentina	1995 - 2004	399	132	46	10489	4
Australia	1993 - 2004	348	156	43	22958	6
Austria	1993 - 2003	336	29	31	23790	6
Bahrain	2002 - 2003	4	1	NA	16160	4
Bangladesh	2002 - 2003	0	44	39	1525	2
Belgium	1993 - 2002	383	16	30	22601	5
Brazil	1998 - 2003	1126	1534	59	6532	3
Canada	1993 - 2003	678	315	32	23595	6
Chile	1993 - 2003	155	33	58	7984	5
Costa Rica	1998 - 2003	31	65	48	8192	4
Croatia	1993 - 2003	45	8	30	7863	3
Cuba	1995 - 2003	129	19	27	NA	3
Cyprus	2001 - 2004	9	35	NA	16224	4
Czech Republic	1993 - 2004	351	19	27	12485	5
Denmark	1993 - 2004	126	44	37	25059	6
Egypt	2002 - 2003	0	425	38	3082	3
Estonia	2002 - 2003	40	2	39	11220	4
Finland	1993 - 2004	169	5	27	21080	6
France	1993 - 2003	1777	80	33	21958	5
Georgia	1995 - 2004	0	5	50	1895	2
Germany	1993 - 2003	1830	266	33	22883	5
Greece	1993 - 2004	75	75	33	14395	5
Hong Kong	1995 - 2004	48	19	46	22710	5
Hungary	1993 - 2004	258	6	30	10507	5
Iran	1993 - 2003	38	1140	43	5120	4
Ireland	1993 - 2003	122	1	36	23374	5
Israel	1995 - 2003	87	57	37	18782	5
Italy	1993 - 2003	1163	108	36	21958	5
Japan	2001 - 2003	136	635	23	24065	5
Jordan	2002 - 2003	1	167	NA	3648	3
Kuwait	1993 - 2004	13	34	NA	17219	5
Latvia	2000 - 2003	56	0	33	7839	3
Lebanon	2002 - 2004	11	74	NA	5205	3
Lithuania	2002 - 2004	223	8	35	9028	4
Luxembourg	1993 - 2002	8	0	29	41214	6
Malaysia	2000 - 2004	25	26	47	8762	4
Malta	2002 - 2003	12	2	NA	15910	4
Mexico	2002 - 2004	305	1180	54	7827	3
Moldova	1996 - 2004	5	1	43	1209	3
Netherlands	1993 - 2003	392	124	31	23419	6
New Zealand	2002 - 2004	64	47	36	NA	5
Norway	1993 - 2004	124	80	29	30244	6
Pakistan	2002 - 2004	1	1938	31	1627	2
Panama	1995 - 2003	8	12	57	5455	3
Peru	1998 - 2002	95	6	49	4338	2
Philippines	2001 - 2003	6	115	45	3571	2
Poland	1993 - 2003	600	18	33	8189	5

Portugal	1993 - 2003	346	10	36	14325	5
Romania	2000 - 2004	23	134	34	5692	3
Saudi Arabia	1993 - 2004	90	185	NA	10584	4
Singapore	2000 - 2002	40	40	48	20978	5
Slovak Republic	1994 - 2004	82	8	25	10036	3
Slovenia	1993 - 2003	30	1	29	13820	4
South Africa	1995 - 2003	269	53	56	8616	3
Spain	1993 - 2003	1840	27	33	17177	5
Sweden	1993 - 2004	206	110	27	20924	6
Switzerland	1993 - 2003	175	63	33	25395	6
Taiwan	1993 - 2000	110	13	32	NA	5
Turkey	1997 - 2003	123	315	44	5768	3
UK	1993 - 2003	1416	259	38	21271	5
USA	1993 - 2003	8429	4412	46	29709	5
Ukraine	2002 - 2003	41	25	36	4573	2
Uruguay	1998 - 2003	55	6	44	7823	4
Venezuela	1995 - 2004	83	72	46	5361	3

The Theoretical Appendix

The cost of a kidney transplant is $C > 0$ to each individual who needs a kidney transplant. Let $b > 0$ denote the presence of religious beliefs unsympathetic to organ donation, which decrease an individual's willingness to donate their kidney under any kind of arrangement (cadaveric, non-commercial and commercial live-donation). Suppose the fraction of individuals with such beliefs is $f_r \in [0,1]$. Let a potential donor's (i.e., a healthy person's) preferences be such that, if needed, he donates one of his kidney's to a blood relative if $a_d - k_d - b_d \geq 0$ and does not donate otherwise. $a_d > 0$ is the altruist utility an individual obtains from donating a kidney to a relative; a_d is uniformly distributed in the interval $[0,A]$ where the maximum value of a_i is $A > k_d$. k_d is the disutility to the donor of having to go through a donation surgery; for simplicity, k_d is assumed to be the same across all potential donors. b_d, which is the religious disutility of donating a kidney, which is assumed to zero for non-believers; for believers, b_d is positive and, for simplicity, it is the same for all believers in a society. Let $e_d \in (0,1)$ be the eligible fraction of non-commercial live-donors in a society; again, for anyone in e_d, $a_d - k_d - b_d \geq 0$ holds. Clearly, in a society, given the citizens' altruism levels, e_d will decrease in k_d and the fraction f_r as well as b_d.

Let a patient's utility function be $V_p = v_p(y_i) + k_p$. $v_p(y_i)$ is the utility of income, $y_p > 0$, of the individual; for every individual i (i = p, d) in our model the first derivative of $v_i'(y_i)$ is positive and the second derivative $v_i''(y_i)$ is negative. $k_p > 0$ is the value of having a healthy kidney for a patient (net of the disutility of transplant surgery); for simplicity, k_p is the same across all patients. Suppose $k_p \geq v_p(y_i) - v_p(y_i - C)$, then the patient will seek a kidney transplant, and will not otherwise (we do not assume any additional disutility of having to go through a kidney transplant for a patient since he already incurs a comparable disutility from dialysis treatment). The above utility function of a patient implies the following straightforward result:

Proposition 0: Suppose there is no market for kidneys. Keeping inequality constant, changes in per capita income will not affect the cadaveric ratio.

Let $s \in (0,1)$ be the fraction of e_d who are patient p's blood relatives. Let $q^* \in (0,1)$ be the probability that a blood relative of the patient is a good match for a patient. Then $q^* \cdot s \cdot e_d$ is the overall fraction of people who are eligible non-commercial live-donors for an average person to obtain a kidney from.

Let a person's communal altruism be $\alpha_c > 0$ which, together with $b_c > 0$ and with inequality level g (to be

27

defined below formally) determines one's (and/or of the next of kin's) willingness to have a cadaveric donation; α_c is distributed uniformly in the interval $[0,\Lambda]$ where $0 < \Lambda < A$. Thus, a person (or his next of kin) will be willing to make a cadaveric donation if $\alpha_c - b_c - v_c(g) \geq 0$, where $v_c(g) > 0$ measures an individual's disutility of making a cadaveric donation given the level of inequality g; its first derivative $v_c'(g)$ is positive and second derivative $v_c''(g)$ is non-negative. Let $e_c > 0$ be eligible fraction of cadaveric donors in a society; again, for anyone in e_c, we have $\alpha_c - k_d - b_c > 0$. Let $p_{bd} \in (0,1)$ be the probability of one becoming brain dead. Let $q \in (0,1)$ be the probability that a cadaveric kidney is a good match for a patient, where $q < q^*$. Then $q \cdot p_{bd} \cdot e_c$ is the overall fraction of people who are eligible cadaveric donors for an average person to obtain a kidney from.

As mentioned above, in many countries, buying or selling of kidneys is not prohibited by law or, if laws exist against commercialization of kidney transplants, such laws are not fully enforced. In such countries, there will be a market for kidneys. For simplicity, we assume that in a society there is a uniform distribution of N agents with incomes in the interval $[y_L, y_H]$, where N converges to infinity and $y_L < C$ and $y_H > C$ denote the lowest and highest income levels respectively; thus, per capita income $\underline{y} = (y_L + y_H)/2$. Let $g > 1$ denote the income inequality in a society in terms of y_L and y_H such that $g = y_H/y_L$. That is, as g tends to one, there is no income-inequality and as g increases the income inequality increases. In a society, g can increase while $\underline{y}$ stays the same via a "mean-preserving spread." Thus, with y_L' and y_H' such that $y_H' - y_H = y_L - y_L'$, a "mean-preserving spread" will take place.

Let a seller's utility function be $V_s = v_s(y_i) - k_s$, where k_s is the disutility of a commercial donor (i.e., a "seller") of having to go through a donation surgery; for simplicity, $k_s = k_d$. Let $e_s > 0$ be eligible fraction of sellers in a society; thus, for anyone in e_s, $v_s(y_s + P) - v_s(y_s) \geq k_s$ holds (for now, we will consider the case $b_s = 0$), where P is the market price for a kidney. Similarly, let $e_b > 0$ be eligible fraction of buyers in a society; thus, for anyone in e_b, $v_b(y_b) - v_b(y_b - C - P) \leq k_b$ holds (observe that, trivially, individuals with $y_i < C$ are not eligible to be in e_b; they can only be in e_s).

Recall that cadaveric ratio denotes the ratio of the cadaver kidney transplants to live donor kidney transplants. We obtain the following result since inequality affects a cadaveric donor's donation decision negatively while it does not affect a live non-commercial donor's donation decision.

Proposition 1: Suppose there is no market for kidneys. The cadaveric ratio decreases in inequality but is

not affected by the changes in anti-transplant religious beliefs.

In a kidney market, note that the above assumptions make sure that a kidney is a good and that the demand for kidneys has an income elasticity of greater than one. Suppose for the marginal buyer in the benchmark case (i.e., with the initial inequality, no anti-transplant religious beliefs, and no enforcement of rule of law) we initially have $v_b(y_b) - v_b(y_b - C - P) = k_b$. With the mean-preserving spread (i.e., with a higher inequality level than the initial one), the initial marginal buyer will now have an income $y_b' > y_b$, and thus now $v_b(y_b') - v_b(y_b' - C - P) < k_b$ will hold. Similarly, the initial marginal seller will now have an income $y_s' < y_s$, and thus now $v_s(y_s' + P) - v_s(y_s') > k_s$ holds. Thus, due to concavity of $v_b(y_b)$, someone with a lower income will be the new marginal buyer and someone with higher income will be new marginal seller. Thus, both e_b and e_s will expand. Then we get the following result:

Proposition 2: As inequality increases, more kidneys will be sold and purchased.

Suppose with a higher extent of rule of law, punishment of people who buy and sell kidneys is more effectively enforced; that is, each individual who is involved in kidney sale or purchase gets punished with a penalty, J, which possibly entails a jail term; thus, J reduces one's welfare (in countries where a kidney market is legal, J = 0). This penalty is enforced with probability one in countries with perfect adherence to rule of law and with zero probability in countries with no adherence to rule of law. Thus, this adherence probability, $r \in [0,1]$, also stands for the extent of rule of law. For the initial marginal buyer (of the benchmark case), now $v_b(y_b) - v_b(y_b - C - P) > k_b - rJ$ will hold. Similarly, for the initial marginal seller now $v_s(y_s + P) - v_s(y_s) - rJ < k_s$ will hold. Due to the concavity of $v_b(y_b)$, someone with a higher income will be the new marginal buyer. By the same argument, someone with a lower income will be the new marginal seller. Thus, both e_b and e_s will shrink. Similarly, with $b_s > 0$ for the $f_r > 0$ fraction of the society, using the same argument, e_s will shrink. Then we get the following result:

Proposition 3: As the extent of rule of law increases or the fraction people with anti-transplant religious beliefs increase, fewer kidneys will be sold and purchased.

With higher income, $v_s(y_s + P) - v_s(y_s) < k_s$ and $v_b(y_b) - v_b(y_b - C - P) < k_b$ will hold. Clearly, with a sufficiently higher price P' > P, the initial marginal buyer can still remain the marginal buyer; i.e., $v_b(y_b) - v_b(y_b - C - P') = k_b$. But with P', we may still have $v_s(y_s + P') - v_s(y_s) < k_s$, or have $v_s(y_s + P') - v_s(y_s) = k_s$ or even have $v_s(y_s +$

P') - $v_s(y_s) > k_s$. So, anything can happen to the number of kidneys sold and purchased once $\underline{y}$ increases. Thus, we have

Proposition 4: As per capita income increases, the number of kidneys sold and purchased may increase, decrease or remain the same.

Recalling that an increase in the number of kidneys sold and purchased increases the cadaveric ratio, note that Proposition 0-3 lead to the following summary:

Corollary 1: In the presence of a kidney market, the cadaveric ratio will increase, as the extent of rule of law increases (r), and inequality (g), anti-donation religious beliefs (b_i) and the fraction of such religious people decrease (f_r). The effect of per capita income on the cadaveric ratio is ambiguous.

Next we will show that, combined with a higher income level, the impact of a higher inequality or a greater extent of rule of law will be lower than when they are combined with a lower income level. With higher income (without any change in inequality), $v_s(y_s' + P) - v_s(y_s^*) < k_s$ and $v_b(y_b^*) - v_b(y_b^* - C - P) < k_b$ will hold. With higher inequality (without a change in per capita income), $v_s(y_s' + P) - v_s(y_s') > k_s$ and $v_b(y_b') - v_b(y_b' - C - P) < k_b$ will hold. Choose a per capita income increase and an inequality increase such that y_s remains the same. That way, the marginal seller will remain the same. Thus, e_s will not change and e_b will increase. Hence, the effect of an increase in inequality will be less in the presence of a higher per capita income.

Again, with higher income only, $v_s(y_s' + P) - v_s(y_s') < k_s$ and $v_b(y_b') - v_b(y_b' - C - P) < k_b$ will hold. With a greater extent of rule of law only, $v_s(y_s + P) - v_s(y_s) - rJ < k_s$ and $v_b(y_b) - v_b(y_b - C - P) > k_b - rJ$ will hold. Choose an increase in the per capita income and the extent of rule of law such that $v_b(y_b') - v_b(y_b' - C - P) = k_b - rJ$. Then the marginal buyer will remain the same. Thus, e_b will not change and e_s will decrease. Hence, the effect of an increase in the extent of rule of law will be less in the presence of a higher per capita income.

*Proposition 4***: As per capita income increases, the cadaveric ratio will depend less on the extent of rule of law and inequality.