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Do institutions, inequality and cultural differences affect cadaveric versus live-kidney harvesting?

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Abstract

This paper empirically investigates the role of institutions, income inequality, cultural differences and health expenditures on cadaveric versus total kidney transplants scrutinizing information gathered from 63 countries over the period 1998-2002. We show that improvements in income equality and the rule of law encourage cadaveric kidney transplants in low-income countries. We find that cultural differences affect the number of cadaveric kidney transplants both in low- and high-income countries.

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1. Introduction

Improvements in surgical technology and transplant immunology have led to long waiting lists for cadaveric and live kidneys since the latter part of the 1970s. Unfortunately, live kidney donors may not always be able to donate their organ to the intended patient because of blood-type and/or immunological incompatibilities. There is also an upper limit set on the number of cadaveric transplants by the number of brain-dead organ donors.¹ Although, we can only keep the waiting list under control by increasing the use of cadaveric kidneys, it appears that there are a number of reasons why we cannot effectively increase cadaveric kidney donations.

In this paper, we hypothesize that the rule of law, income inequality and cultural differences are some of the important factors that affect cadaveric *versus* live-kidney harvesting. We provide empirical support for our claims by using country-specific information on income inequality, the rule of law, cultural differences (proxied by religious beliefs), and live and cadaveric kidney transplants gathered from 63 countries over the period 1998-2002. In order to gauge the robustness of our findings and to guard against the potential misspecification of our model, we also introduce country-specific measures of medical expenditures in our analysis.

We find that, in low-income countries, improvements in income equality and the rule of law in particular raise the cadaveric to total kidney transplant ratio while they do not have any impact in higher-income countries. We also find that cultural differences have an important impact on the cadaveric to total kidney transplant ratio both in low- and high-income countries. Private health expenditures also play a minor role both in low- and high-income countries. Interestingly GDP does not have any impact on the cadaveric to total kidney transplant ratio. To the best of our knowledge, this is the first empirical paper to date that links health outcomes and cultural beliefs (see Anbarci and Caglayan, 2007, for a theoretical analysis of that link).

The rest of the paper is organized as follows: Section 2 lays out the background information and our hypothesis. Section 3 presents our data and empirical findings. Finally, Section 4 concludes.

2. Background: Institutions, Inequality and Cultural Beliefs

There is no established and effective market system for human body parts other than the unregulated and informal system which is in place in some countries.² In fact, prominent international groups such as the Council of Europe, the Transplantation Society, the World Health Organization, and the World Health Assembly regard the commoditization of body parts as “unacceptable.” Furthermore, the medical community worldwide is firmly against the purchase and sale of organs. However, although these principles set by these international organizations have made their way into national law, the purchase and sale of kidneys still persists. In some countries it is even legal.³

¹ For example, in the U.S., the upper limit for cadaveric kidneys is around 14,000-15,000 (Sheehy et al., 2003).

² Roth, Sonmez and Unver (2005) suggest a centralized clearinghouse to facilitate kidney exchange. Such clearinghouses are most needed in markets that are prone to various market failures.

³ Kidney sales are legal in Iran and the Philippines kidney sales are legal. In Iran the brokers can induce the poor to donate their kidneys in return for amounts of cash as low as \$1000. The Philippines allows residents to sell a kidney to a fellow countryman if no broker is involved (Jimenez and Bell, 2001). Evidence from Iran and the Philippines suggests that it is generally the poor who sell their kidneys.

The use of a live *versus* a cadaveric kidney depends on several factors. Elsewhere (see Anbarci and Caglayan, 2007), using a very simple, standard theoretical model we have highlighted the role that the rule of law, income inequality, and cultural differences play in the use of live *versus* cadaveric kidneys in transplants. Our results were as follows:

1. As income inequality increases, more live kidneys will be used relative to the number of cadaveric kidneys used.
2. As the extent of the rule of law increases or the fraction of people with anti-transplant cultural beliefs increases, fewer live kidneys will be used relative to the number cadaveric kidneys used.
3. As per capita income increases, the number of live kidneys used relative to the number of cadaveric kidneys used may increase, decrease or remain the same; thus, per capita income has no consistent impact on that ratio.
4. As the per capita income increases, the number of live kidneys used relative to the number of cadaveric kidneys used will depend less on the extent of the rule of law and income inequality.

In Sections 2.1-2.3 we will elaborate on these different factors, and in Section 3 we will check the empirical validity of the results obtained by Anbarci and Caglayan (2007).

2.1 Lack of Law Enforcement and Income Inequality

Law enforcement in developing countries has been both weak and misplaced due to the presence of a large gulf between the laws that are in the statute books and their enforcement. For instance, Buscaglia and Stephan (2005) point out the gap between ‘law in the books’ and ‘law in action’. They report evidence that the most unprotected segments of the population consider the main obstacles to access to justice to be the lack of legal information, economic factors, the fear of abuse of authority and corrupt practices. Bardhan (2005) indicates that there is a deficiency in each citizen’s expectations about others’ compliance of the law especially in most developing countries; while the presence of such expectations about others’ compliance forms the foundation of the *rule of law*, any deficiency in it points to a weak sense of the rule of law.

In this sense, the stories originating from various countries describing the abuses to which farmers, the lower class, lower caste populations or prisoners are exposed in order to make them give up their kidneys or other body parts can be seen as a reflection of a lack of the rule of law. However, these stories also point out the presence of an income inequality in the society, as most organ sales in developing countries, whether open or covert, appear to involve voluntary sales of kidneys by poor farmers to wealthier urban residents. In other words, *income inequality* has a magnifying effect which is distinct from the key role of ‘lack of the rule of law’ in raising the commercial live-donor transplants in many developing countries.⁴ However, these issues are not relevant for developing countries alone. Existing

⁴ Income inequality plays different roles in magnifying certain problems in different contexts. In the context of earthquake fatalities, it causes the relatively wealthy to simply self-insure against the disaster while leaving the relatively poor at its mercy (Anbarci et al., 2005). In the context of traffic fatalities, either it allows the relatively wealthy to drive a motorized vehicle while the relatively poor to assume the role of pedestrians or it allows the relatively wealthy to drive a large, safe motorized vehicle while the relatively poor drive small, unsafe cars (Anbarci et al., 2009). Anbarci and Caglayan (2007) find that beyond some cut-off income inequality level, income inequality operates through the simplest channel: the very poor but healthy individuals can no longer resist the price that the very rich kidney patients would be able to afford to pay for the kidneys that these poor but healthy individuals possess. (While Anbarci et al. (2005, 2009) have both theoretical and empirical sections, our analysis here will only be empirical, since Anbarci and Caglayan (2007) have already provided the relevant but very standard theoretical analysis.)

loopholes in the laws of developed countries still permit illegal organizations to trade live human organs.⁵ Also, the life-and-death dilemma creates serious ethical and legal problems for medical staff. For instance many doctors admit that, before going ahead with a kidney transplantation, they cannot check the legality of every detail regarding a live-kidney transplantation arrangement between two people if the circumstances seem reasonable.

2.2 Cultural Differences and Behavior

Although there is little in the literature explaining why various health care systems in the world differ from each other, the literature on the importance of cultural differences in explaining individuals' behaviors (or their perceptions of events) as well as a wide spectrum of economic outcomes may provide some clues in that regard. Various researchers, including Knack and Keefer (1995), Harrison and Huntington (2000), and Spolaore and Wacziarg (2006) have suggested that the development and national economic performance of a country depend on her cultural make up, such as institutional arrangements and religious and political values, which can act as a barrier to the adoption of certain economic practices, institutions or technologies. Health care practitioners are also aware that a knowledge of cultural customs can help avoid misunderstanding and enable practitioners to provide better care (see Galanti, 2000).

Although it is not easy to discern behavioural patterns of individuals regarding organ donation, we choose to use religion as a proxy for cultural differences across nations.⁶ Our reason for this is the observation that in many countries, individuals' shared beliefs, values, customs, and behaviors are strongly influenced by religion. In particular, we want to determine whether there are any differences in terms of kidney donations between countries where the main religious belief is Christianity,⁷ Islam or an Eastern religion.⁸ Looking at the sample statistics (see Table 1), one can easily see that there are extreme differences between these groups in the use of cadaveric *versus* live kidneys. Hence, the *prima facie* evidence supports the influence of cultural attitudes.

3. Data and Empirics

We extract data on cadaveric and live kidney transplants from the International Registry Organ Donation Transplantation database for 63 countries over the period 1998-2002.⁹ We split the data based on the countries' main religious beliefs, as a proxy for cultural differences. The data include the following countries where Islam is the dominant religion: Bahrain, Bangladesh, Egypt, Iran, Jordan, Kuwait, Lebanon, Malaysia, Pakistan, Saudi Arabia and Turkey. The data also include Hong Kong, Japan, and Singapore as the sample for Eastern religions, while Christianity is the dominant religion for the remaining countries.¹⁰ For each country, we obtain PPP adjusted GDP (calculated at 1995 prices in US dollars) data

⁵ For example, Kates (2002) reports the existence of an international transplant mafia that smuggles live donors into the US to sell their kidneys and livers.

⁶ We should note that although there may be some religious precepts regarding the use of cadaveric kidney transplants, we mainly use religious beliefs as an indicator for capturing cultural differences.

⁷ We avoid any finer classification of Christianity.

⁸ Eastern religions include Buddhism, Shinto, Confucianism and Taoism which constitute the dominant religions in Hong Kong, Japan and Singapore.

⁹ See www.tpm.org/registry/reg_mondo.asp.

¹⁰ Christian countries: Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malaysia, Malta, Mexico, Moldova, Netherlands, New Zealand, Norway, Panama, Peru, Philippines, Poland, Portugal, Romania, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, UK, USA, Ukraine, Uruguay, and Venezuela.

from the World Development Indicators and population data from the US Census Bureau IBD database. Information on Income Inequality (Gini) is obtained from the World Income Inequality Database. Data on Rule of Law (ROL) are constructed by merging the indices provided by Knack and Keefer (1995) and Kaufmann, Kraay and Mastruzzi (2005), which are accessible through the World Bank databases.

Table 1 provides the basic statistical information for our data. Panel A displays the average number of live and cadaveric transplants for both the full sample and the two categories where we split the sample based on religion, as a proxy for cultural differences. When we look at the full sample statistics we see that the average number of live transplants is approximately 245, and that of cadaveric transplants is 494. If we were to concentrate on the countries, where the dominant religion is Islam, the annual average number of live transplants shoots up to 362 cases, while that of cadaveric kidney transplants drops to 57. If we look at the countries where the dominant religion is an Eastern religion, then the numbers are 140 and 64 respectively. If we look at the remaining – i.e., Christian countries, cadaveric kidney transplants dominate those of live-transplants by 589 to 230 cases, on average. Although there are noticeable differences between Christian and Eastern-religion countries, the most striking difference is between Christian and Muslim countries: in Christian countries cadaveric-kidney transplants dominate live-kidney transplants in an order of more than 5-2, while in Muslim countries live-kidney transplants dominate cadaveric-kidney transplants in an order of more than 6-1.

Panel B provides basic statistics on the average values for the Gini, Rule of Law and per capita GDP indices for the full sample and the two categories as before. The mean Gini index is 41 for the Eastern-religion countries, almost 41 for Muslim countries and almost 38 for Christian countries, indicating that income inequality is higher on average for the non-Christian countries. We further show that the per capita GDP is lower and the Rule of Law is weaker in the Muslim countries than in the remaining countries (note that the per capita GDP is higher and the Rule of Law is stronger in Christian countries than in Muslim countries).

3.1 Empirical Analysis

In our analysis, because the per capita Gini and ROL indices do not vary much over time, we use 5-year averages of our variables to explore the impact of cultural differences, Rule of Law and Gini on the cadaveric to live kidney transplant ratio for low- and high-income countries. We expect to find that improvements in the rule of law and the state of income equality, particularly among the developing countries, would lead to a greater use of cadaveric kidney transplants. Hence, the associated coefficients should take positive and negative (an increase in the Gini coefficient implies an increase in income inequality) signs, respectively. We also expect to find a significant negative coefficient for the *culture* indicators which capture the differences across countries with respect to the use of cadaveric kidneys. The model we implement to test our claims takes the following form

$$CR = \alpha_0 + \alpha_1 \text{Culture1} + \alpha_2 \text{Culture2} + \gamma_1 \text{GDP} + \beta_1 \text{Gini}_{\text{Low}} + \beta_2 \text{Gini}_{\text{High}} + \eta_1 \text{ROL}_{\text{Low}} + \eta_2 \text{ROL}_{\text{High}} + \varepsilon, \quad (1)$$

where CR denotes the cadaveric to total kidney transplants ratio. Culture1 (Culture2) is a dummy which takes the value 1 for the Muslim (Eastern-religion) countries where the belief system differs from the Christian countries, as proxied by religious beliefs. A country is placed in the low-income group if her GDP per capita is below the 40th percentile for each

year; likewise, a country is placed in the high-income group if her per capita GDP is above the 40th percentile for each year – i.e., if it is in the 60th percentile. Hence, this split can allow us to see the impact of income inequality and the rule of law in relation to CR for low- and high-income countries.¹¹ In all models, we report robust standard errors where we implement the Huber-White variance estimator in place of the traditional calculation.

As was discussed earlier, we can see from column 1 of Table 2 that Gini and ROL play a significant role in the low-income countries: the Gini40 coefficient takes a negative sign and the ROL40 coefficient takes a positive sign. This implies that improvements in income equality and the rule of law would lead to an increase in the CR ratio. However, the same coefficients for high-income countries (Gini60 and ROL60) are insignificant. Interestingly, the coefficients of both culture dummies have a negative sign, and are significant at the 1% level, signalling a low level of cadaveric kidney harvesting in countries where the main religion is Islam or an Eastern religion, in contrast to those countries where Christianity is the main religion. This implies that cultural differences play a significant role in the use of live *versus* cadaveric kidneys. Finally, we see that GDP does not play any significant role in our model.¹²

In order to gauge the robustness of the findings which we present in column 1, we augment the initial model using per capita data relating to public, private and total medical expenses, and present the corresponding results in columns 2-4 respectively. In column 5, we introduce per capita public and private medical expenses simultaneously. The results in columns 2-5 are similar to those in column 1 except for the private health expenditures in columns 3 and 5. In both of those columns, the level of spending on private health expenditures lowers the use of cadaveric kidneys *versus* live kidneys. This indicates that individuals with higher private health expenditures have even higher incentives to seek kidneys from live donors rather than waiting in line for a cadaveric kidney.

Overall, these results confirm and support the results obtained by Anbarci and Caglayan (2007) that improvements in either income equality or in the rule of law could lead to a higher use of cadaveric kidney transplants in the context of low-income countries.¹³ Furthermore, there is considerable evidence that cultural differences play a significant role in the use of live *versus* cadaveric kidneys. Private health expenditures play a minor role overall, while per capita GDP is not a factor in any group of countries.

4. Concluding Remarks

Our findings, which are based on data from 63 countries over the period 1998-2002, not discounting potential policy changes, suggest that the ratio of cadaveric to total kidney transplants can be increased by implementing policies which improve the rule of law and income equality. We also provide evidence that cultural differences play an important role. In particular, when we proxy cultural differences using a religion dummy, we find that the use of cadaveric kidneys is low in societies where the main religion is Islam or an Eastern

¹¹ The 40-60 split provides a sharper categorization between income groups than splitting the data using the mean GDP figures. The results for the mean split are similar to those we report here and are available from the authors upon request.

¹² Splitting incomes into low and high categories does not make any difference to the impact of per capita GDP on the use of live *versus* cadaveric kidneys. We have allowed GDP40 and GDP60 in the regressions but their coefficients were never significant.

¹³ We also carry out a similar exercise computing 3-year averages. The results are similar to those we report here and are available from the authors upon request.

religion relative to societies where it is Christianity. This observation reflects the significance of cultural differences in determining the use of live *versus* cadaveric kidneys. Although there are papers that link health outcomes with income inequality (such as Anbarci et al., 2009), this is the first empirical paper to link health outcomes with cultural/religious differences. We believe that governments and health organizations should work in tandem and encourage people to use and donate cadaveric kidneys, as it may take decades to change the established cultural norms which are imbedded in the fabric of society.

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Table 1: Basic descriptive statistics

Panel A								
	Full Sample		Muslim countries		Eastern-religion countries		Christian countries	
	Live Transp.	Cadaveric Transp	Live Transp.	Cadaveric Transp.	Live Transp.	Cadaveric Transp.	Live Transp	Cadaveric Transp
Average	245	494	362	57	140	64	230	589
Std. dev	786	1238	508	50	238.95	40.68	840	1348
Min	0	0	1	0	9	30	0	0
Max	6178	8938	1585	189	633	151	6178	8938
N	246	246	34	34	10	10	202	202

Panel B												
	Full Sample			Muslim countries			Eastern-religion countries			Christian countries		
	Gini	ROL	GDP	Gini	ROL	GDP	Gini	ROL	GDP	Gini	ROL	GDP
Average	38	4	15848	41	3	10011	40.81	5.07	22443	37.75	4.13	16513
Std. dev	9	1	9784	4	1	5815	9.43	0.31	1456	9.37	1.12	10137
Min	23	2	1143	31	2	1502	23.38	4.56	20316	24.9	1.59	1142
Max	61	6	53385	47	4	20339	48.1	5.54	24109	61.4	5.83	53384
N	237	253	243	21	34	34	10	10	10	206	209	199

Table 2. Factors that affect cadaveric to live kidney transplant ratio

	1	2	3	4	5
GDP	-0.001 [0.006]	-0.002 [0.007]	0.002 [0.005]	-0.002 [0.005]	-0.002 [0.005]
Gini40	-0.015 [0.006]**	-0.015 [0.005]**	-0.012 [0.006]*	-0.015 [0.006]**	-0.012 [0.006]*
Gini60	-0.004 [0.004]	0.002 [0.004]	0.008 [0.005]*	0.004 [0.003]	0.008 [0.005]
ROL40	0.198 [0.079]**	0.212 [0.074]**	0.220 [0.080]**	0.240 [0.071]**	0.237 [0.073]**
ROL60	0.004 [0.057]	0.034 [0.059]	0.011 [0.051]	0.045 [0.049]	0.034 [0.048]
Public health expense	-	-0.095 [0.025]	-	-	-0.009 [0.024]
Private health expense	-	-	-0.048 [0.028]*	-	-0.048 [-0.028]*
Total health expense	-	-	-	-0.029 [0.018]	-
Culture1	-0.472 [0.109]**	-0.490 [0.128]**	-0.467 [0.103]**	-0.520 [0.119]**	-0.484 [0.124]**
Culture2	-0.363 [0.135]**	-0.512 [0.098]**	-0.521 [0.073]**	-0.569 [0.063]**	-0.541 [0.075]**
R-squared	0.62	0.60	0.54	0.62	0.54
N	53	49	49	49	49

Notes: All variables are 5 year averages of data covering 1998-2002. GDP and health expenses are in per capita. Gini and rol series are index series. Significance at 10%, 5% and 1% are denoted by *, **, *** respectively. Robust standard errors are given in brackets.