The determinants of the willingness to donate an organ among young adults: Evidence from the United States and the European Union

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Abstract

The total value of life lost due to death because of waiting for an organ transplant was close to $5 billion in 2006 in the United States, and the excess demand for organs has been increasing over time. To shed light on the factors that impact the willingness to donate an organ, we analyze individual-level data from the United States and the European Union collected in 2001–2002. The rate of willingness to donate an organ is 38% among young adults in the US, and it is 42% in Europe. Interesting similarities emerge between the US and Europe regarding the impact of gender, political views and education on the willingness to donate an organ. In the US, Blacks, Hispanics and Catholics are less likely to donate. In Europe, individuals who reveal that they are familiar with the rules and regulations governing the donation and transplantation of human organs are more likely to donate. In both data sets, individuals who had some encounter with the health care sector—either through a recent emergency room visit (in the US), or perhaps because of a long-standing illness (in the EU), are more likely to become organ donors. Mother's education has a separate positive impact. These results point to some avenues through which organ donation propensities can be enhanced and organ shortages can be alleviated.
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Keywords: USA; European Union (EU); Young adults; Organ donation

Introduction

Because improvements in surgical technology and transplant immunology vastly increased the success rates of organ transplantation, an excess demand for organs has emerged, and the median waiting time for an organ has been increasing over time. Between 1995 and 2000, the number of patients who wait for organ transplantation increased by 80%, while the number of cadaveric donors increased only by less than 12% in the United States (U.S. Department of Health and Human Services, 2002). As of 31 May 2007, 96,559 individuals were on the wait list for an organ transplant in the United States; and in 2006, 6828 individuals died while waiting for organ transplant (Organ Procurement and Transplantation Network, 31 May 2007). This suggests that the value of lost life due to insufficient supply of organs was about $4.8 billion in 2006 (using the median value of a statistical life—$7

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million—in the United States reported by Viscusi & Aldy, 2003). The situation in Europe is similar with around 40,000 patients on wait lists for an organ donation (EU Press Release, 2006). Between 15% and 30% of patients in Europe die on wait lists as a result of shortage of organs (Vermot-Mangold, 2003).

A number of mechanisms have been proposed that aim to reduce or eliminate the disequilibrium where the demand for organs exceeds the supply. Examples of non-controversial proposals are public education and awareness campaigns. Other proposals to increase the supply of organs include implementation of policies such as mandated choice (Chouhan & Draper, 2003), or presumed consent such as the case in Spain (Abadie & Gay, 2006; Bosch, 1999). More controversial ideas include creation of a spot or futures market for organs, where financial incentives are provided to potential donors (see Byrne & Thompson, 2001; Cohen, 1989; Evans, 2003; Goyal et al., 2002; Hansmann, 1989; Radcliffe-Richards et al., 1998, for discussions of issues surrounding market-based solutions to organ shortage).

The legal foundation for removal of organs for transplantation is provided by the Uniform Anatomical Gift Act (UAGA) in the US, which had been passed in some form in all states by 1972. The law allows adults to declare whether they wish to donate their organs after their death (Capron, 2001; Spital, 1996). As detailed in Capron (2001), a 1981 committee, which included the American Medical Association, a presidential commission, the National Conference of Commissioners on Uniform State laws, and the American Bar Association, proposed the Uniform Determination of Death Act, which set the standard for determining death; and within a few years all but three states adopted the statue (Capron & Cade, 2000). In 1984, the adoption of National Organ Transplant Act reinforced the basic tenet of UAGA and provided clarifications for the process of donating and transplantation (Capron, 2001).

Thirty-one percent of the organ procurement organizations indicate that they follow the deceased's wishes regardless of next of kin's preferences. This information is significant, because it suggests that there may be substantial gains from increasing the rate of willingness to donate among overall adult population. For example, it is estimated that the annual number of brain-dead potential organ donors was between 10,500 and 13,800 during 1997–1999 (Sheehy et al., 2003). If within this group of individuals the rate of organ donation willingness (as revealed by a donor card) was 5 percentage points higher than the actual, this would suggest that an additional 525–690 people would be included in the pool of brain-dead potential organ donors with an organ donor card. Given that 31% of the organ procurement organizations honor the deceased's wish regardless of the opinion of the family, the actual number of deceased donors would go up by at least 163–214. Because there were about 5800 deceased donors in 1998, this would imply a 3–4% increase in actual donors.

Despite the importance of the subject, little is known about the characteristics of potential organ donors. Previous research on the subject is mostly either theoretical, or empirical with nonrandom, small, geographically limited, or convenience samples. Some studies relied on surveys that covered an entire country, but consisted of small sample sizes. For example, Reubsaet, van den Borne, Brug, Pruyn, and avn Hooff (2001) analyzed a survey of 1836 Dutch adolescents to identify the factors that influence the intention to register as an organ donor, and reported that negative outcome beliefs, anxiety, social outcome expectations (whether parents, friends and partners would expect the person to register as a donor), and involvement with organ donation issues were predictors of the willingness to register as an organ donor. They also found that females reported higher intensions to register, while education and religion had no impact. Popp et al. (2006), who analyzed the attitudes towards living organ donation based on a sample of 250 individuals in Germany, found that gender, religion, age and state of health were not predictors for general donation readiness. Martinez et al. (2001) analyzed the variables that were associated with the donation decision of 68 potential donor families in 13 Spanish hospitals, and reported that knowledge of the family about the deceased's wishes with respect to donation, family's satisfaction with the medical care received, and the number of relatives present at the consent request were related to family's decision.

Other studies focused on small geographic areas, such as one particular city. For example, Lam and McCullough (2000) analyzed the personal attributes that were related to the propensity to donate organs among 122 Chinese-Americans who attended a non-denominational Chinese-American church in Houston, TX, USA. The authors found that the subjects

were influenced by Confucian, and to a lesser extent by Buddhist and other spiritual beliefs. Subjects were most willing to donate their organs after their deaths to close relatives. Yeung, Kong, and Lee (2000) investigated the attitudes of 270 Hong Kong residents towards organ donation, and reported that age, occupation, lack of understanding of organ donation and trust in professional conduct by medical doctors were related to the willingness to donate. Barcellos, Araujo, and da Costa (2005) analyzed people's willingness to donate their organs using a sample of 3159 individuals from the southern Brazilian city of Pelotas, and reported that young and educated individuals and those with high family incomes had higher willingness to donate. Bilgel, Sadikoglu, Goktas, and Bigel (2004) analyzed 983 survey participants from a small town, Ertugrulgazi, in western Turkey. They found that attitudes towards organ donation were related to education level, age and gender. An increase in education was positively related to awareness or organ donation. An increase in age and being female, on the other hand, had a negative impact.

Although these studies provided insights into the determinants of the propensity to be an organ donor, their small sample sizes and/or narrowly defined geographic areas, along with some conflicting findings, make it uncertain whether their results can be generalized. In this paper we document the determinants of the propensity for the willingness to become an organ donor using large representative random samples from the United States and the European Union (EU). Thus, this is the first paper to investigate the issue in large nationally representative samples.

The aim of the paper is not to directly compare and contrast the behavior of individuals in the US to those in the EU. Rather, the goal is to provide information obtained from both settings while highlighting similarities. This is because the survey questions are not identical in the two data sets. Thus, we cannot compare the impact of a particular attribute (such as education) between the EU and US. On the other hand, the directions of the impacts are comparable (e.g. if education increases the propensity to donate in both settings). Furthermore, the relative impacts of various variables within the US or within the EU are comparable (e.g. the magnitude of the impact of mother's education in the US can be compared to the impact of being exposed to an emergency room in the US).

Sources of data

United States and European Union samples

We employ two large data sets for the empirical analyses. For the United States, we use the third wave of the National Longitudinal Study of Adolescent Health (Add Health). The Add Health is the largest and most comprehensive nationally representative survey of adolescents ever undertaken.[1] The first wave of Add Health was administered between September 1994 and April 1995 to 20,745 on a nationally representative set of adolescents in grades 7 through 12. An in-school questionnaire was given to every student who attended one of the sampled 132 US schools on a particular day during the period between September 1994 and April 1995. A random sample of approximately 200 adolescents from each high school/feeder school pair was selected for in-home interviews. The adolescents are interviewed for the second time in 1996 for Wave II, and 15,170 of the original Wave I respondents were interviewed again between August 2001 and April 2002 for Wave III.

We use the data from Wave III, where the individuals are in the age range of 18–28 in 2001–2002. In Wave III, each young adult was asked whether he/she was a registered organ donor. The data also include information about personal characteristics of the individual and information about income, health status, mother's education, emergency room visits, hospital stays, and whether the individual had an accident in the past. An interesting question pertains to the individual's past volunteer activity. In particular, each individual was asked whether he/she participated in volunteer or community service work when he/she was 12–18 years of age as required by parents, school or religious groups. This question will allow us to investigate the extent to which learned altruism has an impact on future altruistic behavior as evidenced by having a donor card.

The data for the EU are obtained from The Eurobarometer Survey series (58:2), the European Commission, Directorate-General Press and Commu-

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nication, Public Opinion Analysis Sector. The survey was conducted between October and December 2002, based on multi-stage national probability samples of the citizens of the EU aged 15 and over, residing in 15 EU member countries (see Table 2). The donation question was asked as follows: "Whatever the rules and regulations, would you personally be prepared to donate one of your organs to an organ donor service, immediately after your death?" This question does not capture as strongly the intent of donation as the American survey does. Therefore, we chose the strongest possible affirmative answer to this question as an indication for willingness to donate. More specifically, possible answers are: yes, definitely; yes, probably; no, probably not; no definitely not; do not know. If the respondent chose the alternative "yes, definitely," we coded him/her as a potential organ donor.

Results

Descriptive statistics of donors and non-donors

The descriptive statistics of the US data are displayed in Table 1. The first column presents the means and standard deviations of the variables in the whole sample. Columns II and III provide the same information for donors and non-donors, respectively. About 36% of the sample indicate that they are registered organ donors. When we calculated the average organ donation willingness using sample weights to arrive at the population mean, we obtained a rate of about 38%. The average age of the sample is about 22, and 47% of the sample is male. Nine percent of the sample indicate that they were required to do volunteer work or community service by parents, school or religious group work when they were young. Fifteen percent of the sample reported having been injured by an accident or having being seen by a doctor because of an accident in the past 12 months. Fifty-nine percent of the sample has been seen in an emergency room during the last 5 years, and 27% of the sample has been admitted to a hospital over the last 5 years for at least a one-night stay. Eighteen percent of the sample indicate that their political persuasion is liberal, and about 53% identify themselves as being in the middle of the political spectrum (middle-of-the-road). Sixteen percent do not work or go to school. About 14% attend school only with no labor market activity, and 24% go to school and work at the same time.

The descriptive statistics of the EU data are displayed in Table 2. We restricted the EU sample to ages 18–28 to be consistent with the US sample. The rate of willingness to donate an organ in the European sample is 44%, and the population-weighted mean is 42%. Although the rate of willingness to donate is 4 percentage points (about 11%) higher among European young adults in comparison to their counterparts in the US, some of this difference may be due to the differences in the way the question was asked in the two samples.

In the European sample, the individuals were asked the age at which they stopped their education. The years of education is calculated as the age of the individual minus the age at which they stopped their education minus 6. This variable, therefore, contains some noise, especially for older individuals, who may have enrolled or re-enrolled at school at later years in life. The survey includes the following question to gauge the political inclination of people. "In political matters people talk of "the left" and "the right. How would you place your views on [the scale of 1 (left-most) to 10 (right-most)]?" We coded individuals as liberal if their range is between 1 and 5. About 65% of our EU sample is liberal according to this measure. The survey also includes the following question: "The donation and transplantation of human organs is subject to (nationality) legislation. Do you know the rules and regulations in (the country) which govern the donation and transplantation of human organs?" *Organ Donation Knowledge* is a binary variable that equals to 1 if the individual answered in the affirmative to this question. About 30% of the respondents in the European sample indicated that they were knowledgeable about the rules and regulations that govern the donation and transplantation of organs.

We estimated probit models for the propensity to become an organ donor for both of our US and European samples. The results reported in the paper refer to the marginal effects and the actual coefficients are available from the authors. Robust standard errors are in parentheses. To investigate the robustness of the results, we also estimated logit models and reported the odds ratios (OR) along with their confidence intervals.

Empirical results from the United States

The results of the analysis of the US sample are presented in Table 3. The marginal effect obtained from probit model indicates that males are about 10

Table 1
Descriptive statistics—United States

Variable name	Definition	Overall mean (S.D.) (I)	Donors mean (S.D.) (II)	Non-donors mean (S.D.) (III)
Organ donor	Dummy variable = 1 if the individual is a registered organ donor, 0 otherwise	0.358 (0.479)	–	–
Age	Individual's age	21.958 (1.771)	21.937 (1.734)	21.969 (1.792)
Male	= 1 if male, 0 otherwise	0.470 (0.499)	0.412[***] (0.492)	0.502 (0.500)
White	= 1 if white, 0 otherwise	0.664 (0.473)	0.774[***] (0.418)	0.602 (0.490)
Black	= 1 if black, 0 otherwise	0.213 (0.409)	0.144[***] (0.351)	0.251 (0.434)
Hispanic	= 1 if Hispanic, 0 otherwise	0.160 (0.367)	0.104[***] (0.305)	0.191 (0.393)
US-born	= 1 if the individual was born in the US, 0 otherwise	0.920 (0.271)	0.951[***] (0.217)	0.903 (0.295)
Married	= 1 if married, 0 otherwise	0.173 (0.378)	0.172 (0.378)	0.173 (0.378)
Catholic	= 1 if catholic, 0 otherwise	0.252 (0.434)	0.229[***] (0.420)	0.266 (0.442)
Protestant	= 1 if protestant, 0 otherwise	0.403 (0.491)	0.407 (0.491)	0.401 (0.490)
No religion	= 1 if no religion, 0 otherwise	0.201 (0.401)	0.214[***] (0.410)	0.194 (0.395)
Required volunteering	= 1 if the individual was required to do volunteer work when young, 0 otherwise	0.094 (0.291)	0.107[***] (0.309)	0.087 (0.281)
Healthy	= 1 if the individual's health is in is good, very good, or excellent condition.	0.954 (0.209)	0.961[***] (0.195)	0.951 (0.216)
Income	Total income of the individual	14024.1 (15603.8)	14455.1[**] (14619.5)	13783.9 (16,122.3)
Mother-high school	= 1 if mother has high school education; 0 otherwise	0.319 (0.466)	0.311 (0.463)	0.323 (0.468)
Mother-more than high school	= 1 if the individual's mother has more than high school education; 0 otherwise	0.437 (0.496)	0.514[***] (0.500)	0.393 (0.489)
Accident	= 1 if injured by an accident during past 12 months; 0 otherwise	0.149 (0.356)	0.153 (0.360)	0.146 (0.353)
Emergency room	= 1 if the individual has been seen in an emergency room during past 5 years; 0 otherwise	0.587 (0.492)	0.609[***] (0.488)	0.575 (0.494)
Hospitalization	= 1 if the individual has been admitted to a hospital during past 5 years; 0 otherwise	0.268 (0.443)	0.264 (0.441)	0.270 (0.444)
Middle-of-the-road	= 1 if the individual considers him/herself politically on the middle of the spectrum, 0 otherwise	0.526 (0.499)	0.510[***] (0.500)	0.535 (0.499)
Liberal	= 1 if the individual considers him/herself politically on the left of the spectrum, 0 otherwise	0.184 (0.387)	0.230[***] (0.421)	0.158 (0.365)
No work, no school	= 1 if the individual is neither attending school nor working; 0 otherwise	0.162 (0.369)	0.122[***] (0.328)	0.184 (0.388)
Just school	= 1 if the individual is attending school only; 0 otherwise	0.136 (0.343)	0.154[***] (0.361)	0.126 (0.332)
Work and school	= 1 if the individual is both attending school and working; 0 otherwise	0.242 (0.429)	0.270[***] (0.444)	0.227 (0.419)
No. of observations		13,653	4887	8767

A *, **, or *** indicates that the difference in the means between donors and non-donors is statistically different from zero at 10%, 5%, and 1%, respectively, for the corresponding variable.

percentage points less likely to become a registered organ donor in comparison to females. Blacks are 19 percentage points less likely to donate in comparison to whites (the left-out category). Individuals in other race categories are about 13% less likely to do so. Hispanics are about 11 percentage points less likely to become an organ donor than others.

Individuals who are born in the US are 7 percentage points more likely to donate in comparison to those who are born elsewhere and migrated to the US. Marital status has no impact on the propensity to be a registered organ donor. Religious affiliation is controlled for by four categories: whether the person is Catholic, Protestant, not religious, or whether the person belongs to another religion such as Judaism, Muslim, or Buddhaism (the omitted category). Catholics are 4 percentage points less likely to donate in comparison to individuals who are Jewish, Muslim, Buddhist or adherents of some other religion. Individuals who classify themselves as liberal are 8 percentage points

Table 2
Descriptive Statistics—European Union

Variable name	Variable description	Overall mean (S.D.)	Donors mean (S.D.)	Non-donors mean (S.D.)
Organ donor	Dummy variable = 1 if the individual will definitely donate his/her organ after the death, 0 otherwise.	0.441 (0.497)	–	–
Age	Individual's age	23.320 (3.072)	23.494** (3.102)	23.182 (3.042)
Education	The number of years of education	13.901 (3.090)	14.141*** (3.108)	13.712 (3.064)
Student	= 1 if the individual is currently in school, 0 otherwise.	0.348 (0.477)	0.353 (0.478)	0.345 (0.476)
Liberal	= 1 if the individual considers him/herself politically on the left side, 0 otherwise.	0.646 (0.478)	0.683*** (0.466)	0.617 (0.486)
Married	= 1 if the individual is married, 0 otherwise.	0.131 (0.337)	0.134 (0.340)	0.128 (0.335)
Divorced	= 1 if the individual is divorced, 0 otherwise.	0.006 (0.079)	0.006 (0.080)	0.006 (0.078)
Male	= 1 if the individual is a male, 0 otherwise.	0.494 (0.500)	0.456*** (0.498)	0.524 (0.500)
Rural	= 1 if the individual lives in rural area, 0 otherwise.	0.307 (0.461)	0.298 (0.458)	0.314 (0.465)
Large town	= 1 if the individual lives in a large town, 0 otherwise.	0.373 (0.484)	0.362 (0.481)	0.382 (0.486)
Health problem	= 1 if the individual has a long-standing health problem, 0 otherwise.	0.141 (0.349)	0.172*** (0.378)	0.117 (0.322)
Organ donation knowledge	= 1 if the individual knows the rules or regulation about organ donation in his/her country, 0 otherwise.	0.299 (0.458)	0.376*** (0.485)	0.239 (0.426)
Belgium	= 1 if the individual is a citizen of Belgium, 0 otherwise.	0.056 (0.230)	0.044** (0.204)	0.066 (0.248)
Denmark	= 1 if the individual is a citizen of Denmark, 0 otherwise.	0.070 (0.254)	0.096*** (0.295)	0.049 (0.215)
Greece	= 1 if the individual is a citizen of Greece, 0 otherwise.	0.066 (0.248)	0.056 (0.231)	0.073 (0.260)
Italy	= 1 if the individual is a citizen of Italy, 0 otherwise.	0.060 (0.237)	0.069 (0.254)	0.053 (0.223)
Spain	= 1 if the individual is a citizen of Spain, 0 otherwise.	0.080 (0.271)	0.100*** (0.300)	0.064 (0.244)
France	= 1 if the individual is a citizen of France, 0 otherwise.	0.059 (0.236)	0.054 (0.226)	0.064 (0.244)
Luxembourg	= 1 if the individual is a citizen of Luxembourg, 0 otherwise	0.039 (0.194)	0.044 (0.204)	0.035 (0.185)
Netherlands	= 1 if the individual is a citizen of The Netherlands, 0 otherwise.	0.077 (0.267)	0.062** (0.241)	0.089 (0.285)
Portugal	= 1 if the individual is a citizen of Portugal, 0 otherwise.	0.055 (0.228)	0.063 (0.243)	0.049 (0.215)
Great Britain	= 1 if the individual is a citizen of Great Britain, 0 otherwise.	0.059 (0.235)	0.063 (0.243)	0.056 (0.229)
Finland	= 1 if the individual is a citizen of Finland, 0 otherwise	0.078 (0.268)	0.094** (0.292)	0.066 (0.248)
Sweden	= 1 if the individual is a citizen of Sweden, 0 otherwise	0.072 (0.258)	0.078 (0.269)	0.067 (0.250)
Austria	= 1 if the individual is a citizen of Austria, 0 otherwise	0.050 (0.219)	0.036*** (0.186)	0.062 (0.241)
Germany	= 1 if the individual is a citizen of Germany, 0 otherwise.	0.085 (0.280)	0.050*** (0.218)	0.113 (0.317)
Ireland	= 1 if the individual is a citizen of Ireland, 0 otherwise.	0.094 (0.293)	0.091 (0.288)	0.097 (0.296)
No. of observations		1768	779	989

A *, **, or *** indicates that the difference in the means between donors and non-donors is statistically different from zero at 10%, 5%, and 1%, respectively, for the corresponding variable.

Table 3
The determinants of organ donation propensity (United States)

Variable	Probit regression		Logistic regression	
	Marginal effect	Standard error	Odds ratio	Confidence interval
Age	0.120**	(0.054)	1.737	(1.077, 2.804)
Age-squared	−0.003**	(0.001)	0.988	(0.977, 0.999)
Male	−0.099***	(0.009)	0.640	(0.591, 0.692)
Black	−0.192***	(0.009)	0.389	(0.351, 0.431)
Hispanic	−0.111***	(0.012)	0.582	(0.514, 0.660)
Other race	−0.129***	(0.013)	0.523	(0.453, 0.605)
US-born	0.072***	(0.017)	1.399	(1.182, 1.655)
Married	−0.006	(0.012)	0.972	(0.876, 1.078)
Catholic	−0.041***	(0.014)	0.835	(0.735, 0.949)
Protestant	−0.011	(0.013)	0.951	(0.847, 1.068)
No religion	−0.007	(0.015)	0.971	(0.854, 1.104)
Required volunteering	0.042***	(0.015)	1.203	(1.060, 1.364)
Healthy	0.027	(0.020)	1.130	(0.940, 1.358)
Income ($thousands)	0.001***	(0.278)	1.003	(1.001, 1.006)
Mother-high school	0.082***	(0.015)	1.451	(1.272, 1.655)
Mother more than high school	0.137***	(0.014)	1.861	(1.637, 2.117)
Accident	0.024**	(0.012)	1.110	(0.998, 1.235)
Emergency room	0.034***	(0.009)	1.163	(1.074, 1.259)
Hospitalization	−0.004	(0.010)	0.981	(0.895, 1.076)
Middle-of-the-road	−0.001	(0.011)	0.992	(0.901, 1.092)
Liberal	0.079***	(0.014)	1.412	(1.257, 1.586)
No work no school	−0.053***	(0.012)	0.786	(0.700, 0.881)
Just school	0.038***	(0.014)	1.186	(1.055, 1.334)
Work and school	0.029***	(0.011)	1.138	(1.034, 1.253)
No. of observations	13,653		13,653	
Log-likelihood	−8,314.5		−8,309.9	

The dependent variable is dichotomous, which takes value i if the respondent is a registered organ donor, and zero otherwise. The coefficients are marginal effects. Robust standard errors are in column II. *, **, and ***represent statistical significance at 10%, 5%, and 1% confidence level, respectively. Confidence interval for the odds ratio is at 95% significance level.

more likely to be an organ donor in comparison to those are on the right of the political spectrum. As the income of the individual goes up, so does the propensity to donate an organ. If the mother has a high school education, her child is about 8 percentage points more likely to donate an organ in comparison to a child with a mother who has no high school diploma. Having a mother who has more than high school education increases the child's likelihood of donation by 14 percentage points in comparison to having a mother with no high school diploma.

Individuals' school and labor market activities are captured by four mutually exclusive dummy variables: Just School, Just Work, Work and School, No Work No School. People who do not work or go to school are 5 percentage points less likely to donate in comparison to those who just work and do not attend school. Those who attend

school but do not work (Just School = 1) are about 4 percentage points more likely to donate and those who work and go to school at the same time are nearly 3 percentage points more likely to donate in comparison to those who work but do not go to school.

If the individual had an accident he/she is about 2 percentage points more likely to be an organ donor in comparison to those who did not experience an accident. Having an emergency room visit during the last 5 years increases the propensity to donate by about 3 percentage points. If the young adult was required to do volunteer work when younger, this increases his/her propensity to donate by 4 percentage points.

The results obtained from the probit model are consistent with those obtained from the logit specification. For example, based on the ORs reported in column (III) of Table 3 we see that

males are 36% less likely to donate than females, and blacks are 61% less likely to donate in comparison to whites (OR 0.389, CI: 0.35–0.43). The same is true for other variables. In cases where the marginal effects from the probit models are positive and significant (negative and significant), the ORs are greater than (less than) one. When the estimated marginal effect from the probit models is not statistically different from zero, the 95% confidence interval of the OR includes 1 (i.e., the lower bound of the confidence interval is less than 1, and the upper bound is greater than 1).

Results from the European Union

Table 4 displays the results from the EU. The specifications in columns (I) and (II) pool all observations from the EU without distinguishing between countries. It could be the case that certain

unobserved country characteristics (such as cultural, historical and religious patterns) may affect the donation propensity in that country. To control for such unobservable country-specific factors, we also estimated the model with the addition of country-level dichotomous variables (columns III and IV). The omission of these dummy variables will not cause any bias as long as these unobserved factors are uncorrelated with the control variables. Columns (I) and (III) report the marginal effects from the probit models, and columns (II) and (IV) report the ORs from the logit regressions. As illustrated in Table 4, the results are very similar between the specifications (i.e. when the model is estimated with and without country dummy variables). Furthermore, the conclusions are the same between probit and logit specifications.

The results are interestingly similar between the United States and Europe. For example, parallel to

Table 4
Determinants of organ donation propensity (European Union)

Variables	Probit regression marginal effects (I)	Logistic regression odds ratios (II)	Probit regression marginal effects (III)	Logistic regression odds ratios (IV)
Liberal	0.076*** (0.022)	1.372 (1.149, 1.638)	0.082*** (0.026)	1.410 (1.140, 1.745)
Married	0.00004 (0.042)	1.001 (0.713, 1.406)	−0.009 (0.039)	0.972 (0.708, 1.335)
Divorced	−0.068 (0.167)	0.756 (0.197, 2.906)	−0.052 (0.147)	0.817 (0.241, 2.768)
Male	−0.049** (0.020)	0.818 (0.697, 0.960)	−0.050** (0.025)	0.816 (0.668, 0.997)
Education	0.010 (0.006)	1.040 (0.988, 1.093)	0.007 (0.005)	1.03 (0.987, 1.075)
Rural	−0.035 (0.037)	0.867 (0.642, 1.172)	−0.014 (0.034)	0.948 (0.721, 1.247)
Student	0.003 (0.046)	1.014 (0.702, 1.464)	−0.001 (0.035)	0.999 (0.749, 1.332)
Large town	−0.048 (0.031)	0.820 (0.640, 1.051)	−0.015 (0.031)	0.94 (0.734, 1.205)
Age	−0.119*** (0.045)	0.614 (0.429, 0.878)	−0.133** (0.068)	0.578 (0.334, 1.000)
Age-squared	0.003*** (0.001)	1.011 (1.003, 1.019)	0.003** (0.001)	1.012 (1.001, 1.024)
Health problem	0.099*** (0.025)	1.490 (1.221, 1.818)	0.085** (0.035)	1.415 (1.069, 1.874)
Knowledge	0.157*** (0.019)	1.890 (1.619, 2.207)	0.176*** (0.027)	2.059 (1.644, 2.578)
Belgium			−0.070 (0.069)	0.742 (0.416, 1.324)
Denmark			0.188*** (0.067)	2.169 (1.237, 3.802)
Greece			−0.006 (0.068)	0.975 (0.564, 1.685)
Italy			0.034 (0.071)	1.147 (0.650, 2.025)
Spain			0.160** (0.065)	1.921 (1.136, 3.249)
Luxembourg			0.082 (0.080)	1.394 (0.732, 2.656)
Netherlands			−0.077 (0.064)	0.723 (0.421, 1.240)
Portugal			0.115 (0.073)	1.59 (0.883, 2.862)
Great Britain			0.049 (0.072)	1.214 (0.684, 2.155)
Finland			0.130* (0.068)	1.697 (0.986, 2.924)
Sweden			0.069 (0.068)	1.323 (0.772, 2.269)
Austria			−0.113 (0.069)	0.617 (0.335, 1.133)
Germany			−0.169*** (0.057)	0.478 (0.279, 0.817)
Ireland			0.039 (0.064)	1.1687 (0.703, 1.943)
No. of observations	1768	1768	1768	1768
Log-likelihood	−1174.71	−1174.71	−1139.64	−1139.82

The dependent variable is dichotomous, which takes value i if the respondent strongly reveals his/her willingness to donate an organ, and zero otherwise. The coefficients are marginal effects. Robust standard errors are in parentheses. *, **, *** represent statistical significance at 10%, 5%, and 1% confidence level, respectively. Confidence intervals for odds ratios are at the 95% confidence level.

the results from the United States, in Europe individuals who consider themselves on the left side of the political spectrum (*Liberal*) are more likely to be prepared to donate their organs. Being a male is associated with a 5 percentage point reduction in the probability of organ donation (alternatively, based on the estimated ORs, males are about 18% less likely to donate). An additional year of education increases the willingness to donate by about 1 percentage point, although the coefficient is borderline significant. As is the case in the US data, marital status has no effect on the willingness to donate. Individuals who have a long-standing medical condition are 9–10 percentage points more likely do be organ donors. If the individual is aware of the rules and regulations about organ donation in his or her country, the propensity for organ donation is 16–18 percentage points higher, which is a very substantial effect.

There is considerable variation across countries in their residents' propensity to donate an organ. In Table 4 the left-out country is France. Thus, Table 4 indicates that holding individual characteristics constant, Germans are 17 percentage points less likely to donate an organ than French. On the other hand, Spaniards, Danish and Finnish people are more likely to donate. These results are consistent with fact that Spain leads the world in organ donation and transplantation with about 35 donors per million individuals (European Commission Press Release, 2006). Finland is also ranked high among the European countries with about 20 donors per million individuals (Lindgren, Pere, & Hockerstedt, 2000).

Discussion

Alleviating the shortage of donated organs constitutes a serious challenge for public and health officials both in the United States and the EU. Policies targeted to increase the willingness to donate are useful avenues to raise the supply of organs. This is because, in the US, about one-third of organ procurement organizations follow the deceased's wishes regardless of the family's preferences. Furthermore, it is also documented that families are much more likely to consent to organ donation if they knew that the deceased had a donor card. This suggests, for example, that a 5 percentage point increase in the willingness of organ donation (as revealed by a donor card) would translate into a

3–4% increase in actual organ donations as detailed in the introduction.

Although earlier research generally reported a positive relationship between education and willingness to donate an organ, the findings were mixed on the impact of other personal characteristics such as gender and religious affiliation. This could partially be due to fact that previous research had to rely on very small samples or on data from one particular city or town due to paucity of data.

We found that in the US being black reduces the propensity to be a registered organ donor by 19 percentage points among 18–28 year olds, in comparison to whites. The reluctance to donate organs is a well-known characteristic of blacks in the US (Rozon-Solomon & Burrows, 1999; Spigner, Weaver, Cardenas, & Allen, 2002). Although our data do not allow us to identify the exact mechanism why the rate of organ donation is lower among blacks, a number of possible explanations can be provided for this result. For example, it has been stated that African-Americans are less willing to trust the medical system which has mistreated and badly served them (Siminoff & Arnold, 1999). Other potential factors include concerns about respectful treatment of the body, and fear of declaration of death prematurely (Callender & Miles, 2001; McNamara et al., 1999).

We also found that Catholics were less likely to donate an organ. The same is true for Hispanics. One potential reason for this finding is that Hispanics may be less knowledgeable about the facts of organ donation. Interviews conducted with individuals of Hispanic ethnicity suggest that fears of organ being removed before death, doctors taking action to hasten a patient's death, concern for the condition for the body after death, and suspicion about the fairness of the organ distribution system are the major reasons for low donation rate among this group (Roark, 1999; Verble & Worth, 1996, 1998). Although we cannot address the reasons for low-donation rate among Hispanics and African-Americans, the findings point to a need for more effective educational and public awareness programs targeted for these groups. The issue is likely to be increasingly significant as the Hispanic population is projected to more than double between 2000 and 2030 (from 35 million [12.6% of the population] to 73 million [20% of the population]) (U.S. Census Bureau, 2005).

Previous studies generally provided evidence on the positive impact of education on the willingness

to donate an organ. In this study we documented the positive impact of mother's education level on the individual's propensity to donate. Specifically, in the US, having a mother with more than high school education increases the propensity to donate by about 14 percentage points in comparison to a person who has a mother with no high school education. In the EU, an additional year of education increases the propensity to donate by 1 percentage point. General education is likely to raise the individuals' awareness on the importance of the problem of organ shortage. Taken together, these results point to the importance of general education on increasing the propensity to become an organ donor.

The impact on donation propensity of having experienced an accident or an emergency room visit may be due to a higher consciousness or exposure to the significance of organ donation among these individuals. This result suggests that efforts targeted towards individuals who had contact with heath care organizations in these domains may be effective avenues to generate increase in donation rates.

In the US, higher income is also associated with higher propensity to donate an organ, but the magnitude of the impact is not as large as those of other covarites. Our results suggest that an additional $10,000 of income increases the propensity to donate by about 1 percentage point.

The study also has some limitations. We are not able to include additional policy variables in the model because the datasets do contain other such variables. Also, as mentioned in the data section, the measurement of the outcome variable is not identical between the US and the EU samples. It should also be noted that the education variable in the EU survey contains some measurement error. It is well known that the estimated impact of a variable is biased towards zero (toward finding no impact) if that variable is measured with error. Thus, our estimate may serve as a lower bound to the true effect of education. The samples used in this paper consisted of young adults. In 2001, the average age of living organ donors was 39 in the United States (Nathan et al., 2003). To the extent that these young adults have 20–30 years in front of them to actually donate an organ makes it important to investigate the behavior of this age group. At the same time, when we analyzed the sample of all adults (18 and over) in the EU data, we found that the results were virtually identical between the two groups.

Volunteer work as a child is found to increase the individual's propensity to donate an organ. Volunteer work itself is a donation activity, and this result reflects the role of developing a higher sense of social consciousness at early ages in life. However, we refrain from suggesting a causal link between volunteer work and organ donation because the effect may also be due to some unobserved factor. For example, some unobserved family attribute, such as parents' altruism, might have motivated the child to do volunteer work when young. Also, parents' altruism might have been transferred to the child in the household. In this scenario, it is the behavior and example of the parents that motivate the individual to donate, and not his past volunteering experience. However, in the data, the reported required-volunteer activity could be due to school or a religious group, diminishing the potential impact of unobserved family attributes.

The determinants of organ donation propensity identified in this paper are interestingly consistent between Europeans and Americans, and they can be classified in three groups. In the first group are factors that cannot be influenced by policy makers. Examples are gender (males have a lower propensity to donate organs), race and ethnicity in the United States (whites having a higher propensity and blacks and Hispanics having a lower propensity in comparison to other races and non-Hispanics), political affiliation (individuals with liberal tendencies have higher propensities to donate), and religion (Catholics are less likely to donate). Even though policy makers cannot take action to change any of the group characteristics of these individuals, allocation of resources towards or more effective campaigns targeted at certain groups may have the intended impact of increasing the organ donation rate.

The long-run tool that has an impact on the donation behavior is the education of the individual. Education has a positive effect on the willingness to donate both in Europe and the US. Furthermore, holding constant the individual's education, mother's education has an additional positive impact. Thus, an increase in education has an inter-generational effect on donations as well. An interesting result obtained in the US pertains to learned altruism. Individuals who were required to do volunteer work or community service when they were younger have higher donation propensities, although it cannot be ruled out that unobserved characteristics of the family where the individual grew up in may be responsible for this outcome.

Some short-run tools lend themselves to quick policy actions. For example, individuals who reveal that they are familiar with the rules and regulations governing the donation and transplantation of human organs are more likely to donate. This suggests that campaigns to educate the public along this dimension may have a positive impact on the rate of donations. It is found that individuals who had some encounter with the health care sector, either through an emergency room visit during the last 5 years (in the US) or perhaps because of a long-standing illness (in the EU), are more likely to become organ donors. This also provides a useful avenue in the near-term through which limited resources can be spent to increase the rate of organ donations.

Acknowledgment

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