In Praise of the Commons:

Another Case Study

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ABSTRACT

Common-pool allocation systems do not have the best of reputations in economic literature, since they are normally connected with the dissipation of rents. The present case study argues that in the case of procurement and allocation of human organ transplants a reciprocal common-pool allocation system is superior other systems, including market allocation.

Keywords: common-pool allocation, systems of allocating organ transplants, reciprocity;

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1 Resources, Rents and Ranchers

Common access to purely private resources or, in short, to the "commons", is a kind of resource use which has been practiced all through the history of mankind. Common property in technically private resources has, however, not been a dominant form of an economic activity but rather an exception. Hunting and gathering, fishing or shifting cultivation in clearings made by burning, for all we know, date back to the Stone Age.

It is, therefore, hardly astonishing that this type of resource use was mentioned in Aristotle's *Politeia* (book II, chapter 3). Nevertheless, it took as long as until 1954 for the first thorough economic analysis of common-pool allocation to be carried out by Scott Gordon.[1] And it lasted another fourteen years until, in 1968, Garrett Hardin's widely read and famous article, titled "The Tragedy of the Commons"[2], called the potentially disastrous consequences of common property in technically private resources to the general public's attention.

In general terms common-property use of a technically private resource is given whenever two or more users have potential access to a pool of resources which are exclusive, i.e. strictly rival in use. *Access* to the common resource pool can either be *open* to literally everybody or *limited* to a group of persons entitled by means of certain characteristics or procedures. The "tragedy" of the commons, as diagnosed by Garrett Hardin, consists in an inefficient overuse of the particular resource which can ultimately lead to its complete depletion.

Since, even on a conference on law and economics, I cannot take the theory of the commons to belong to the common pool of knowledge, let me illustrate this point by means of a simple figure. Let x be the number of cattle driven to a pasture area of a given size. MC represents the constant marginal cost or price of an additional cow; *AR* is the average revenue of cattle sold, and the *MR* curves represent the marginal revenue for different numbers of ranchers whose cattle are driven to the pasture in question. A single rancher who is the owner of the pasture would realize a maximum "rent", producer surplus or revenue *DIHB* by driving a number of *x1* cattle to the pasture.

If the pasture was managed as a common-property resource, the access to which is limited to a small group of, say, two ranchers, both can attain maximum rents of *DEFC* and *EJKF* respectively, the sum of which is smaller than the private owner's rent *DIHB.* As the number of ranchers, who have access to the pasture, rises, the sum of producers' rents dissipates more and more and becomes zero at the commons-equilibrium number of x_3 cattle, where, in *L*, the average revenue is equal to the price of a cow.

Here we have the inefficiency theorem (or tragedy thesis): in comparison to a private property regime of the pasture, its common-property use causes an inefficient dissipation of rents and an overuse in the amount of x3 - x1 The degree of overuse can be expected to grow further in proportion to a decrease in the marginal user costs which, for instance, can be due to technical progress. For example, since the invention of radiolocation and motordrive, which both reduced the cost per ton of fish caught, the deep sea has become increasingly overfished and whales are now on the verge of becoming extinct.

Early discussions on possible solutions to the tragedy of the commons focussed either on the privatization of common property resources or on their governmental regulation. The "enclosure movement" in 18th century England[3] is a prominent example for the former, environmental legislation for the latter case. As demonstrated in Figure 1, privatization would bring about an efficient resource use. Governmental regulation could, in principle at least, simulate an efficient market allocation in limiting access to the common pool and in regulating the uniform per capita resource use in such a way that x_1 is the sum of individual resource uses. As it turned out, both solutions come at a cost. The creation of private property rights, their enforcement and control can be very costly. State regulation, too, is not for free and often ends not at x_1 but in results that are disastrous from a welfare perspective.[4] And, as an abundance of case studies published in the last decade or so demonstrate, there is another and often more efficient and less costly solution to the tragedy, namely self-regulation: many groups in all parts of the world were shown to have successfully regulated their members' access to and use of commonly owned resources.[5]

Several conditions have been identified, the fulfillment of which makes self-regulation feasible and efficient; the most important of these conditions are clearly defined rules of access and resource use, monitoring of compliance, sanctioning of their violation, and the existence of mechanisms to resolve conflicts. The latest of these case studies which came to my attention explains the evolution of rules among Californian surfers concerning the sequence in which surfers are allowed to ride the waves of the Pacific ocean.[6]

As I mentioned, the theory of the commons developed along an impressive line of case studies to which I intend to add another one. Strictly speaking, I wish to present an analysis of a specific way of common-pool allocation of human organs which are to be used in transplant surgery.[7] The main point of my paper is that this specific type of common-pool allocation is not only completely "untragic" in that no rent dissipation will occur, but also that it is superior to other forms of allocation which are practiced or conceivable. In a nutshell, and in a certain opposition to common economic wisdom, I shall argue that, at least in the case under consideration, a point can be made in praise of the commons.

2 Systems of Procuring Human Organs for Transplantation

If trading of organs was legally permitted, economists would predict markets for transplants to emerge, since organs, such as kidneys or corneas, have the properties of being marketable private goods in being strictly rival in use and excludable. However, most if not all legal systems prohibit commercial trade in transplants. Organs of potential living donors are treated as demerit goods in the sense that donors are considered by legislators to be in need of being protected from themselves[8]; the commercial use of the organs of deceased individuals is prohibited by reference to the widely accepted value judgment that the chance to prolong one's life by means of a transplant should not depend on a recipient's ability to pay.

In short, legislators share the view expressed by Daniel Callahan who studies medical ethics: "In theory there ought to be no laws that would stop competent adults from selling (or buying, M. T.) whatever they want. But the potential for abuse is just too great."[9]

A futures market for organs to be harvested after one's death would certainly fail to exist because the net present value of an organ sold on such a market, even if it would realize one million Dollars on spot, would be minuscule or even negative, simply because only the organs of one in a thousand dead are suitable as transplants. A corresponding amount of one thousand Dollars, discounted to the point in time in which the contract is signed, can easily be lower than the transaction costs of writing that contract.

It is for these reasons that in most or perhaps in all legal systems transplantable organs are not allocated on markets but rather by means of different types of statutory common-pool systems. These systems are similar in the sense that the suitable organs of a certain group of potential donors (or suppliers), after their death, become part of a common pool out of which recipients (or demanders) are served according to certain pre-defined criteria. The statutory systems of pools of transplants differ, however, in the way potential donors are determined.

In most countries of the world two main systems of management of the organ commons are being used in a narrow and an extended form respectively. The first of them which I term "compulsory system" declares all citizens potential donors, unless one explicitly refuses to serve as a donor of organs after one's death. In the second system, which I call the "consensual system", a potential donor has to explicitly agree to harvesting her organs after her death. In the extended forms of both systems the deceased person's next of kin can declare her presumable disapproval or consent in case the deceased person had omitted a declaration of intention during her lifetime. The former system of a compulsory organ commons is practiced for example in Austria, Belgium and Brazil, whereas the latter more usual one is legal practice in Germany.

Both systems differ in the original attribution of property rights to a person's organs: whereas the compulsory system defines the property rights to human organs as belonging to the public domain, the consensual system ascribes the property rights to the individual herself. In consideration of the respective costs of enforcing, the effective property rights of an individual to her organs may turn out to be reversed: it only takes a simple declaration of refusal for a person to take the right to her organs out of the public domain, whereas a complicated disposition by will must be set up to effectively prevent one's surviving family members from agreeing to the harvesting of one's organs.

Under both types of transplantation law potential donors contribute unconditionally to a future common pool of available transplants, in the sense that they do not acquire a title to either the payment of a price or to a preferential assignment of a transplant in case they are in need of one. Their motivation to donate cannot be their immediate self-interest.

This is because all those who stand in need of transplant surgery have a common legal claim to the stock of transplants available at that time. The allocation of a transplant to a certain patient, i.e. the privatization of one resource unit out of the common pool, is carried out by a third party, for instance the physician in charge, according to medical criteria such as tissue tolerance, chance of success and waiting time.

Thus, under both systems the stock of available transplants is managed as a common pool under open access conditions. The supply of organs to the common pool and the demand for certain units of that pool are not interconnected by some control variable, such as the price, which interconnects supply and demand on a market; there is no reciprocal link whatsoever between demand and supply. Therefore, and other than in a market, changes in the demand for transplants do not affect their supply and vice versa; there simply is no adjustment mechanism to equilibrate demand and supply. Since the price of a transplant is zero and the extraction costs to the patient are minuscule, because, as a rule, an insurance company will have to pay, the *total demand* for transplants will be dependent solely on the number of organic diseases in the population that require transplant surgery. This in turn is a function of variables such as the size of the population, changes in average life expectancy and progress in surgical procedures.

The *total supply* of transplants under these systems of allocation will hinge upon the fraction of those people in the population who totally altruistically choose to volunteer as potential donors or refrain from opting out of the compulsory system and, alas, on the number of lethal accidents in traffic, sports and the home, since young adult accident victims are ideal donors. Given the usual criteria of brain death and medical suitability of the organs, only one in a thousand deceased individuals are possible donors. As it is to be expected under these circumstances and these incentives to donate, a permanent and growing excess of demand of transplants over supply can be observed. This shortage becomes visible in prolonged waiting lists for transplant surgery.[10] It is little wonder that death on the waiting list is a deplorable but rather frequent event.[11]

In Germany, for instance, only one half of the hearts, kidneys, livers and corneas needed as transplants are available at present.[12]

3 The Reciprocity System

In order to reduce or even close the gap between the number of transplants supplied and demanded, Breyer and Kliemt[13] have suggested an allocation system to which they refer as the "priority solution." For reasons which will become clear in what follows, I prefer to call it the reciprocal system.

Their proposal provides a system of multilateral contracts by which every contracting party commits herself to donate, in case of her brain death, one certain or perhaps even all of her organs suitable for transplantation to the common pool of transplants. In return every contracting party, in case she should come into the situation of being in need of transplant surgery, has a claim to a suitable organ harvested from deceased contracting parties. Those who did not enter the multilateral contract, even if they registered as donors in other allocation systems, do not have a claim to organs in the reciprocal pool, unless there is a situation of oversupply.

This system of multilateral contracts creates reciprocity of claims and obligations among the contracting parties: only those willing to be potential suppliers have the right also to be organ recipients, if the need arises. In contrast to the different types of common-pool allocations of transplants discussed above, the reciprocity system limits access to the pool to those who registered as potential donors. The originators of what they refer to as the priority solution note several of its advantages in comparison to the solutions in operation:

"Account is being taken of the basic value of respecting the autonomous declarations of will of citizens of full age who take responsibility for themselves ... The motivation to donate organs will be strengthened since a more encompassing claim to receive a transplant in case of an affection is connected with it; most importantly, however, a psychic barrier will be broken because a decision over one's readiness to donate will not solely consist of pondering over one's death but over one's own survival in case of a serious disease (a 'framing effect')."[14]

These advantages, the authors argue, give good reasons for anticipating a higher yield in donated organs than for instance in the consensual or the compulsory systems.[15] But they forgo a closer analysis of the decision to qualify for access to the reciprocity system. Such an analysis seems to be indispensible, however, because a rational and self-interested decision-maker will join only if she can expect an additional net benefit in comparison to other established systems. In what follows, an attempt is made to identify and roughly estimate the individual benefits and costs associated with different allocation systems for transplants.

4 Individual Benefits and Costs of Alternative Allocation Systems for Transplants

The expected individual net utility U_i^{net} of a person i of receiving a transplant in the case of a disease, is equal to the difference between the expected total utility U_i and the expected total cost or disutility C_i of being/becoming a member of such an allocation system.

$$(1) \qquad U_i^{net} = U_i(EYL) \cdot r \cdot e^{-\lambda h} - C_i \cdot e^{-\lambda h} \text{ with } \frac{\partial U_i}{\partial EYL} > 0.$$

U_i is a function of the number of additional years of life EYL which i could expect to realize if she were to receive a transplant in case of an organopathy. U_i and C_i are to be discounted continuously with a rate $-\lambda$ that reflects i's time preference over the period h. h is the length of the period between the age in which one joins (or has to join) the allocation system and the average age in which a disease occurs that requires transplantation.[16] r stands for the probability of a member of a certain age group to be in need of a transplant at some point of time in the future. r equals approximately the specific morbidity rate in the population which is assumed to be constant. In what follows it is supposed for simplification that r and $e^{-\lambda h}$ equal one. This is an innocuous assumption since only the absolute amounts of utilities and costs are influenced, not however the rank order of the systems. And, also to simplify matters further, it is assumed that there is no problem of tissue tolerance.

EYL depends on $YL(t)$, the difference between m, which is the length of life expectancy *with* a transplant, and k, which is the length of life expectancy *without* a transplant or with a diseased organ, both are calculated at the time of occurrence of the disease $t = 0$. YL is assumed to fall one year with every year that passes after the occurrence of the disease. This assumption covers the fact that the whole body is affected, say, by a heart or a kidney disease. The *additional* life expectancy YL due to a transplant surgery can be taken as given for the members of an age group (not yet diseased). *EYL,* then, is the sum of the products of additional years of life expectancy *YL(t)* rendered possible by a transplantation at a point in time *t* that lies within the period *k,* and the probability p_t to receive a transplant in *t.*

$$(2)\quad EYL = \sum_{t=0}^{k} YL(t) \cdot p_t \,,$$

where

$$(3)\quad YL(t) = m - k - t \;(\text{i.e.}\, \frac{\partial YL}{\partial t} = -1) \text{ and } YL(t) = 0 \text{ for } t \geq k, \text{ and}$$

$$(4)\quad p_t = (1-q)^t \cdot q \,.$$

Thus, the expected value of additional years of live *EYL* solely depends on *q. q* is defined as the ratio between the number of organs supplied, *S,* and the number of organs demanded, *D,* in a year (allotment quota).

The allotment quota *q* is assumed to be constant over time for reasons of simplification.[17] It is treated here as a proxy for the probability of receiving a transplant in one of the periods *t.* The total demand for organs per year, *D,* is equal to the product of the number *n* of members of the respective relevant group and the quota of indicated transplantations per year, B. In the case of (the narrow and extended types of) the consensual and compulsory systems, the total population of the respective jurisdiction, *B,* is the relevant group, whereas in the reciprocal system it is the number of people, who are party to the multilateral contract which can range from 2 to *B.*

The annual supply of organs S is the product of the number of members n of the relevant group minus one (since any donor can donate only for others, but not for herself), the quota of donors in the respective relevant group, a, the mortality quota y, and the share of suitable donors in the number of deceased, S .

$$(5) \quad q = \frac{S}{D} = \frac{(n-1)\cdot\alpha\cdot\gamma\cdot\delta}{n\cdot\beta},$$

with $0 < \alpha, \beta, \gamma, \delta \leq 1$, and q=1 for $\frac{S}{D} \geq 1$.

For large values of n, for instance the 82 million citizens of Germany, the ratio $(n\text{-}1)/n$ is close to one; for the smallest number of contractors in a reciprocity systems, 2, the ratio is 0.5.

Under the narrow consensual system, the quota of donors, α^N, will be smaller than the donor quota under the extended consensual system, α^E, since under the latter not only the donor herself but also her next of kin can allow her organs to be harvested, and so both quotas will be smaller than one. Since everybody who joins the reciprocal system thereby declares herself a potential donor, α^R is equal to one. As β, γ and δ are determined exogeneously and can be taken to be constant in the medium term, and given that $\alpha^N < \alpha^E < \alpha^R$, it is also true for large groups of, say, more than a thousand members (because $(n\text{-}1)/n = 0.999 \approx 1$) that $q^N < q^E < q^R$.

In the case of Germany, where the extended consensual system is legal practice, about 5 percent of the population explicitly agree to be potential donors ($\alpha^N = 0.05$).

It is impossible to indicate the exact percentage of people in the population who would agree to the harvesting of the organs of a deceased relative because only the family members of a fraction of those deceased individuals who would be suitable as donors are being asked. This also means that the supply of organs could be raised even within the given allocation system. Between 50 and 70 percent of those who are being asked declare their consent. Assuming that the quota of consenting relatives in the whole population is equal to 0.45, α^E would amount to 0.5. As mentioned above, the supply of transplants in Germany is about half of that demanded, i.e. presently q^E is about 0.5.

If these rough estimates were approximately correct, by inserting them into equation (5), it would follow that $\beta = \gamma \cdot \delta$. This means, that, hypothetically, the number of potentially suitable transplants per year would suffice to cover the yearly demand; the actual supply, however, falls short of demand because the donation quota is smaller than one. If the reciprocal system was used instead, the annual need for transplants would be fully covered due to the higher donation quota of one. For certain organs, corneas and kidneys for instance, even an oversupply can be expected because most patients need a single organ whereas cadavers are capable of procuring more than twenty. Death on the waiting list, an event not unusual under the current system, would not occur anymore since everybody in need of a transplant could be immediately provided for.

An example, in which I assume that $\beta = \gamma \cdot \delta$, and which makes use of the above estimates for $\alpha^N = 0.05$, $\alpha^E = 0.5$ and $\alpha^R = 1.0$, and in which the values for *m* and *k* are arbitrarily chosen to be 12 and 5 respectively, shows the following results for *EYL* as a function of *q*:

- Narrow consensual system: $EYL^N = 1.23$ years
- Extended consensual system: $EYL^E = 6.00$ years
- Reciprocal system: $EYL^R = 7.00$ years

FIGURE 2

Given these parameters, the reciprocal system ranks highest with respect to the number of additional years of life gained from a transplantation, that a representative individual i can expect, followed by the extended and the narrow consensual systems. Since, by assumption, the marginal utility of an additional year of life is positive, the same rank order holds concerning the respective total utilities.

I was unable to get hold of data on the basis of which the effective donors' quota in a compulsory system, a^c, could be estimated. Considerations of plausibility are of little help in this case. One could argue, for instance, that a^c must at least have the value of a^N, since someone who volunteers as a donor unconditionally should do so in any allocation system. Empirical analyses of voluntary and commercial blood donation systems[18] suggest however that the motivation to register as a donor may well erode within a non-voluntary allocation system such as sale or compulsion; therefore a^N cannot be considered a "natural" lower boundary for the value of a^c. Nor is, on the other hand, a^R a kind of "natural" upper boundary for a^c, unless the cost of opting out is prohibitively high. This would be equivalent to a system in which membership is not only compulsory but also cannot be resigned. In reality opting out is neither forbidden nor will it probably be very costly; even the opportunity cost of withdrawal is zero since being a potential recipient of a transplant does not presuppose being a potential donor because of the non-reciprocity of the system. It is for these reasons that one can safely assume that a^c will be substantially smaller than one.

In the case of a small number of members of the reciprocal system, the differences in expected life expectancies diminish compared to the alternatives; in the above example, for the smallest possible number of only two contracting parties, EYL^R shrinks to 6, which is equal to EYL^E.

Given these equal expected values of *EYL*, a rational and risk-avert decision-maker will prefer the extended voluntary system to the reciprocal system, since the standard deviation of the latter, σ^R, will be greater that that of the former, σ^E (because $B >> 2$). Thus, at first glance, there seems to exist a threshold problem[19] for the reciprocity system: it is only above a certain minimum number of members that the preference order over the systems switches again in favour of the reciprocity system.

Such a threshold problem does not hamper the other systems: Voluntary donors choose to join the system unconditionally, whereas compulsory donors, as far as their initial membership is concerned, do not have a choice to make. This disregard of an individual's right to choose her own fate is regarded by many as a very high cost associated with the compulsory system.

Organizing a reciprocal system with the necessary minimum number of members to transgress this threshold seemingly constitutes a collective good problem, which can only be solved under special circumstances. But this problem would be relevant only if each individual was forced to select one of these options. Since, however, everyone who joins the reciprocal system, whether she wants it or not, remains in the voluntary system as a potential receiver of a transplant, one lives - in a transitional period at least - in the best of all possible worlds in being free not to have to choose. Joining the reciprocal system does not cause an opportunity cost of foregoing the utility of additional years of life which one might realize as a recipient in the voluntary system.

The same is true for the compulsory system with the difference, however, that one must explicitly opt out in order to join the reciprocal system, simply because nobody can donate an organ twice. Thus, joining a reciprocal system would always be favourable under these conditions; the threshold problem, though principally existing, then is inoperative.

On the one hand, the lack of any need to select one of the systems prepares the ground for the initiation of a reciprocal system. On the other hand, and not without some irony, for most legislators who do not consider the reciprocal system to be politically palatable, the legal rule that one can join only one of the systems, would constitute a substitute, although a weak one, for a blunt prohibition of the reciprocal system.

The individual costs C_i to a potential donor connected with the alternative allocation systems discussed, equal the sum of the specific costs of joining a system on the one hand, such as information and contracting costs or an entrance fee to cover the system operating costs, and on the other hand the disutility caused by the knowledge that some day, with a certain probability, one will rise from the dead with an incomplete body. A person who declares herself a donor in the narrow consensual system thereby reveals that to her these costs are zero or negligible, and presumably she would also accept the extended consensual system. As mentioned above, it is not clear whether she would also tolerate the compulsory system, because she might regard the implied violation of her self-determination as a disutility in itself.

Someone who does not join the consensual or reciprocal systems or who opts out of the compulsory system, thereby reveals that for her the disutility of removing her organs after brain death is high. Perhaps for reasons of religious faith she wishes to appear with her complete body before the Last Judgment. These psychic costs will be felt to be particularly high in the extended consensual system, because the effective property rights to one's own body are most attenuated in this system. Persons of this type - one might for instance think of Jehova's Witnesses - can be regarded as unconditionally demotivated to donate.

Regardless of the allocation system there will always be a certain percentage of people who are unconditionally willing to donate and another fraction of individuals who are unconditionally unwilling to do so. In non-reciprocal allocation systems the rest of the group or population, insofar as they act in a rational and self-interested way, can be expected to choose the dominant strategy not to be potential donors but potential recipients. As discussed above, this is not a viable strategy in the reciprocal system.

Since the operating costs of the reciprocal system plausibly will not differ greatly from those of the other systems, it can be expected that the existing rank order of the total individual utilities of the alternative allocation systems will be mirrored in the rank order of the expected individual net utilities.

In addition to this, the expected individual net utility of the non-reciprocal systems will fall as the number of members of the reciprocal system rises. This is because among those who become contracting parties to the reciprocal system there will be some who were unconditional donors in the compulsory or consensual systems before. In my opinion this is a safe assumption because it would be implausible to suppose that the unconditional donors' altruism goes so far as to prefer those of all people as potential recipients who refuse to donate themselves. If, for example, a considerable part of the population of a jurisdiction has come to join a reciprocal system, among which there is a corresponding share of formerly unconditional donors, then a^N, a^E and a^c will fall as will correspondingly the total expected individual utilities of the systems. Those potential donors who leave the non-reciprocal systems exert a negative externality on the potential recipients in the sense that they cause the ratio of donors to recipients to fall.[20] Once the threshold mentioned above is passed, a process of crowding out the non-reciprocal systems will take place, and in a final equilibrium the reciprocal system will be left as a natural monopoly which comprises the whole group or population with the obvious exception of the unconditional refusers.

Both, the compulsory and the voluntary systems, could be easily converted into reciprocal systems by excluding those from receiving a transplant in case of an organopathy who either opt out of the compulsory system or choose not to join the voluntary system as potential donors. I would conjecture that, given the reciprocity of the systems and equal (or zero) transaction costs of withdrawing from or joining the systems, the number of potential donors and the respective donation quotas would be roughly the same, no matter how the property rights to the cadaveric organs are attributed. In any kind of a reciprocal system the expected negative externalities one imposes upon the other members in being a potential organ recipient are compensated by the expected positive externalities which one causes in also being a potential donor. However, as far as the attribution of property rights is concerned, the important difference in the recognition of the value of individual self-determination remains.

5 Are the Commons to Be Praised in the End?

The reasons discussed might well suffice to give three cheers for the reciprocal commons in transplants. Firstly, and in contrast to most kinds of common-pool allocations, a dissipation of rents will not take place. Secondly, with respect to widely shared value judgments it seems to be more acceptable than a market allocation of transplants. Whereas, on a market, the ability to reciprocate in money terms depends on the unequal distribution of income and wealth, the ability to reciprocate in the reciprocal commons discussed above is perfectly equally distributed since every potential donor, rich or poor, is endowed with the same set of organs. Thirdly, in the reciprocal system a yield of donated organs can be expected which will certainly be not lower than in any other system but most probably much higher.

The conditions under which this particular type of a common-pool allocation appears so favourable are quite special, though. By conditioning access to the common pool on reciprocity, the problems of provision and appropriation of transplants are being solved at the same time. Other than in a market it is reciprocated not in money but in kind.

Negative externalities which anybody, who extracts a resource unit from a common pool, exerts on others are strictly limited by the fact that one single resource unit (or very few of them), one heart or a certain volume of blood, satiates the need in question; one more unit would cause a zero or even a negative marginal utility. Therefore, the incentive to overuse this particular kind of a common pool practically does not exist.

To cheer this particular form of a common-pool allocation seems to be fully justified because the truly "tragic" event of death on the waiting list can be avoided. One should, however, hesitate before cheering too loudly, since the conditions under which its results are so favourable are very special ones.

Notes

1. Gordon, H. S. (1954).
2. Hardin, G. (1968).
3. See Dahlman, C. J. (1980).
4. Many examples can be found in Bromley, D. W. (1991).
5. See for instance Ostrom, E. (1990); Ostrom, E, Gardner, R. and Walker, J. (1994) or Bromley, D. W. (ed.) (1992).
6. Ríder, R. (1998).
7. This form of organ allocation, dubbed "club solution" by the authors, was first suggested by Breyer, F. and Kliemt, H. (1995). The authors dispensed however with an analysis of how rational individuals would rank different systems of organ allocation according to their respective benefits and costs.
8. Tíetzel, M. and Miiller, C. (2001).
9. Quoted by Frank, R. N. (1986), 181.
10. In the US, for instance, the number of patients on waiting lists has risen 313 percent. Cf. Byrne, M. M. and Thompson, P. (2001), 70.
11. In 1998 alone, over 4000 patients on waiting lists died in the US. See Byrne, M. M. and Thompson, P. (2001), 69.
12. Cf. Hecht, D. (1998), 185.
13. See Breyer, F. and Kliemt, K. (1995).
14. Breyer, F. and Kliemt, H. (1995), 137.
15. Breyer, F. and Kliemt, H. (1995), 138.
16. Since a person's suitability as a donor declines with age, whereas the risk of becoming diseased grows, there may be strategic incentives concerning the age of joining an allocation system and corresponding conflicts of interests between the members of different age groups. In order to curb these one might think of fixing a certain age after which the option of joining expires.

17. This assumption is plausible for a period of several years. In the long run, however, progress in medical technique, changes in life expectancy and in the relative frequency of accidents will influence the value of q.

18. Cf. Titmuss, R. (1970).

19. In the above analysis the problem of tissue tolerance was excluded by assumption. Yet, in reality the probability to be provided with a transplant of a sufficient degree of tissue tolerance for a certain recipient within the period of occurrence of an organopathy rises as the number of potential donors in the system grows. This will shift the threshold to larger numbers of n.

20. The corresponding positive externality which is exerted by an additional member of the reciprocal system on the other members becomes smaller as the number of members grows. Since every additional member, who was a potential donor in the non-reciprocal systems, causes an opportunity cost to the members of the reciprocal system in the sense that they have to expect fewer additional years of life as potential recipients in the respective non-reciprocal systems, parameter values are conceivable such that the marginal utility of an additional member falls below the marginal opportunity costs. Under these conditions the members of the reciprocal system might consider to restrict the admission. The occurrence of a number of reciprocal systems of optimal size then is to be expected. If, however, one of the systems has to be selected, this effect will not occur.

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Figures

Figure 1:
The "tragedy of the commons".

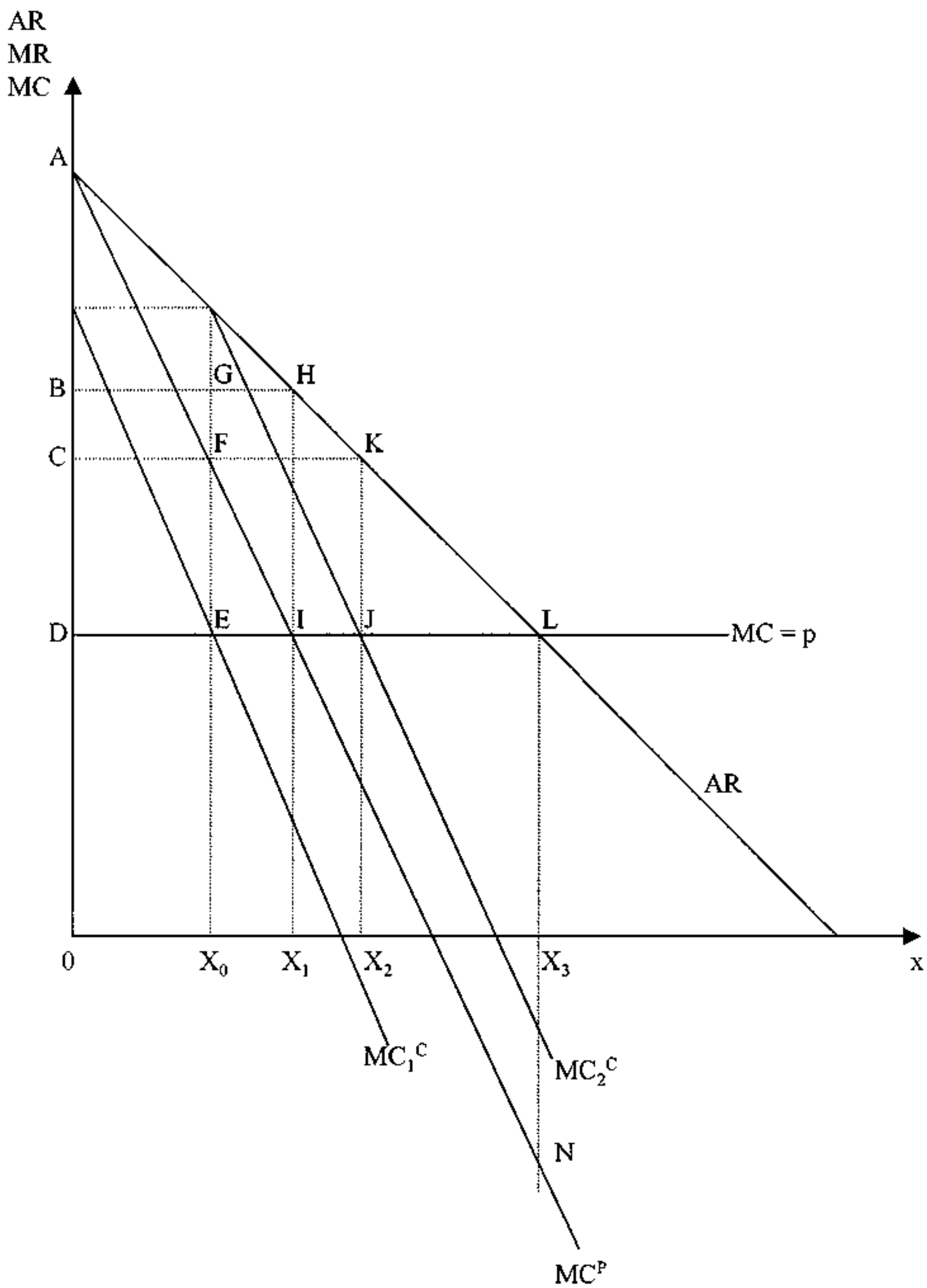

Figure 2:
Expected additional years of life (EYL) as a function of the allotment quota q.