Rights, Free Exchange, and Widespread Externalities

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Abstract: Sen's libertarian paradox is ascribed to the inevitable conflict between the Pareto criterion and individuals' rights to create negative externalities. Finite coalitions can effect exchanges of rights through Coaseian bargains in order to resolve inefficiencies due to local externalities. With a continuum of agents, however, finite coalitions are powerless to affect widespread externalities, except those that are regulated by policies such as inefficiently allocated quotas. Then finite coalitions may gain by exchanging such quotas, but Pareto improvements may require originally unused quotas to be confiscated. Thus, the voluntary exchange of rights may exacerbate widespread externalities.

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Rights, Exchange and Externalities

> Again, if he would give us Nuts for a piece of Metal, pleased with its colour; or exchanged his Sheep for Shells, or Wool for a sparkling Pebble or a Diamond, and keep those by him all his Life, he invaded not the Right of others, he might heap up as much of these durable things as he pleased; the *exceeding of the bounds of his* just *Property* not lying in the largeness of his Possession, but the perishing of any thing uselesly in it.
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> — John Locke *Second Treatise of Government* (1689/90), Section 46.

> If an exchange of property rights can be made to mutual benefit, why forbid it? The answer is, to induce a pattern of exchanges that is better on the whole.
>
> — Gibbard (1985, p. 25).

1. Introduction

Most economists do not explicitly consider rights at all, except perhaps property rights. Accordingly, they are unable to justify free exchange except by noting the efficiency gains to which it may or may not give rise. Yet to the lay person, the right to exchange might seem to be one of the most important economic freedoms, well worth the attention of economists — perhaps even of modern economic theorists. Of course, there are a few exceptions to this general neglect, especially the discussion of economic freedoms by Rowley and Peacock (1975, pp. 87–90) and by Peacock (1987). Also relevant are parts of the chapter by Cowan and Rizzo (1995).

Above all, one should not forget the many economists of the "Austrian" school, who have certainly emphasized the importance, in their view, of doing as little as possible to interfere in a laissez faire economy of complete freedom to exchange. Indeed, Cordato (1992) tries to rescue this Austrian approach from its apparent inability to discuss externalities, public goods, or most other issues of public policy by using a notion of "catallactic efficiency". This follows "the distinction that [von] Mises (1949, 1966) and Hayek (1976) have drawn between 'economy' and 'catallaxy' " (Cordato, 1992, p. 11).[1]

Apart from a few surviving "Austrians", most recent writers on free exchange as a right have been philosophers or lawyers. Among these, the most noteworthy would seem

[1] In this connection, I should perhaps report that the *Oxford English Dictionary* does contain the related word "catallactic", meaning "pertaining to exchange", which was derived from a Greek root apparently artificially. Also, during the 19th century "catallactics" was suggested as an alternative subject name intended to be more accurately descriptive than "political economy".

to be Nozick (1974) as a proponent and Gibbard (1985) as an opponent. Nozick explicitly includes voluntary exchange among those activities justified by his "principle of justice in transfer". Previously, similar rights were included in Honoré's (1961) discussion of ownership. Gibbard is careful to distinguish between "intuitionistic" and "pragmatic" defences of free exchange, citing Nozick as the main reference for the former. On the other hand, a prominent pragmatic defence is that free exchange leads to Pareto efficient outcomes in the absence of externalities. Later, Gauthier (1986, p. 13 and ch. IV) goes so far as to declare that "the" perfectly competitive market is a "morally free zone". However, it is not entirely clear whether Gauthier wishes to invoke a pragmatic or an intuitionistic defence of free exchange. For recent insightful criticism of the claims by Nozick and others, see Hausman (1992). Also very relevant are the discussions by Satz (1992, 1995) of two particular kinds of transaction that many regard as morally reprehensible — indeed, so reprehensible that many intuitionists might want to prohibit them.

The well known opposing Marxist view is that what many defenders of capitalism regard as free exchange often gives rise to unacceptable exploitation in practice. For a logically coherent discussion of exploitation, using modern economic terminology, see Roemer (1988) and also Arnold (1990).

On the other hand, there is also an extensive literature on libertarian social choice. In fact, the example of *Lady Chatterley's Lover* which drives Sen's (1970a, b) classic libertarian paradox illustrates how Pareto inefficiency arises from giving individuals the right to create externalities — as has been suggested, at least implicitly, by Hillinger and Lapham (1971) or Fine (1975). One example of this important conflict between rights and externalities is driving private cars, especially on congested roads. Other examples that are more remote from economics include the abuse of religious freedom by those who preach intolerance, or the abuse of freedom of speech by those who disseminate hate.

Yet social choice theory has largely treated rights as inalienable. In particular, there can be no right to exchange rights. Thus, a social choice rule respects rights if and only if it always gives the owner of each right absolute power to decide the corresponding issue. In a game form representation of rights, individuals enjoy unconditional rights to choose whatever strategies they want from a specified set. Of course, the early contribution by Gibbard (1974) on waiving rights was a significant departure. Important later elaborations

of this idea are due to Suzumura (1983), Deb (1994) and others. Nevertheless, the possibility that there are conditions under which individuals might benefit from foregoing their rights voluntarily has not received much attention, especially in recent work.

As already pointed out, standard welfare economics suggests that individuals may gain from exchange. In the most obvious case, such exchanges are of property rights. Indeed, property rights are often best exercised by selling some property in exchange for other property of equal market value which is more desired. Advantageous exchanges, however, might well involve foregoing rights other than property rights — in particular, rights to create externalities. Furthermore, individuals may well be able to gain from trading their rights of any kind in exchange for money — i.e., quantities of a *numéraire* commodity — or more generally, for ordinary economic commodity bundles.

Of course, there are many rights, especially property rights, whose use or exchange does not create any externalities. If such rights were to be distributed equitably, it would be hard to justify the denial of any rights that fail to create externalities. After all, such rights do not conflict with the Pareto criterion. In fact, as shown by Coughlin (1986) and Hammond (1995b), when preferences are "privately oriented", Pareto efficiency actually requires all individual rights to be exercised in full. In this sense, rights like property rights which create no externalities pose no ethical challenge except the important one of arranging their equitable distribution. Since this paper is about potential Pareto improvements from exchanging general rights, and especially about how these differ from the usual potential Pareto improvements from exchange, it naturally focuses on the rights to create externalities.

It is well known that externalities generally give rise to Pareto inefficient equilibrium allocations. Actually, for some economists, this is virtually the definition of externality. Not surprisingly, therefore, full Pareto efficiency requires making the rights to create negative externalities suitably scarce, and allocating these rights appropriately. Then it is natural to ask whether free exchange of the rights to create externalities has the useful role to play that economists expect of free exchange of property rights. In fact, as Section 2 argues in connection with Sen's original example, there can indeed be gains from exchanging rights even in the face of negative externalities. After all, such exchanges are little more than an instance of that kind of Coaseian bargaining whose outcome is, by definition, a

Pareto efficient allocation. Furthermore, a standard remedy for externalities is to create new property rights ensuring appropriate control of the activities causing externalities, as a way of internalizing them. For this property rights remedy to work, in the sense of yielding a Pareto efficient allocation, the rights must typically be freely exchangeable. Otherwise a Pareto improving redistribution of rights may be possible. For example, it is commonly claimed that many externalities could be resolved, and the overall allocation of resources made Pareto efficient, by allowing free trade in pollution permits or licences to create other kinds of externality.[2]

Another often suggested remedy for the inefficiencies that arise because of externalities is to allow unrestricted bargaining between those who create and those who experience each externality. Following ideas emanating from the work of Coase, it is then usually assumed that such bargaining will continue until no further Pareto improvements are possible because a Pareto efficient set of arrangements has been reached. This second remedy is clearly closely related to the first: property rights can be the subject of a bargain, and the outcome of any bargaining process is likely to be affected by pre-existing property rights.

The unrestricted bargaining remedy can be expected to work well in economies with not too many agents. Markets, however, typically require many participants in order to remove any monopoly power that might impede Pareto efficiency. This paper treats the case when there are many agents, so that markets can be expected to function reasonably well. It also allows only coalitions of bounded size to form and rearrange the externality creating activities of their members.

In fact, the paper discusses what finite coalitions can achieve in continuum economies of the kind considered in the important work of Aumann (1964, 1966) and Hildenbrand (1974). In such economies, any finite coalition is of measure zero — i.e., a null set. The bulk of the paper then concentrates upon the special case of widespread externalities, defined as those that remain unaffected if any agents in a null set change their respective externality creating activities. Such externalities have been considered by Kaneko and Wooders (1986, 1989), Hammond, Kaneko and Wooders (1989), and also Hammond (1995a, c). They have the special feature that, if any merely finite coalition exchanges property rights and/or the rights to create widespread externalities, this has no effect upon either equilibrium prices or

[2] In Hammond (1995a), I have discussed some of the limitations of this common claim.

the externalities. If any non-null set of agents exchanges rights, however, the result could be deleterious changes in the externalities, perhaps combined with adverse price changes, which leave everybody worse off in the end. Such a possibility seems related to Hart's (1975) well known example of how opening a market for a new security, unless it gives rise to a complete set of markets, can produce a Pareto inferior allocation. Then the issue is whether one can arrange compensation for both price and externality changes so as to ensure that each agent is better off.

This paper, however, asks whether finite coalitions can gain by exchanging rights. To address this question, Section 3 begins by considering an economy with a continuum of agents but no widespread externalities. It argues that, while exchange does confer private benefits on the members of any finite trading coalition, unrestricted exchange is like adding new markets. Then, while there are always *potential* gains from exchange, achieving *actual* Pareto gains requires compensation for those who lose from adverse relative price movements, as in the usual results on the gains from trade in international economics.

Thereafter, Section 4 briefly sets out a general model of a continuum economy with widespread externalities. It recapitulates the definitions of Nash– and of Pigou–Walrasian equilibria that were given in Hammond (1995a). Then it argues that such equilibria are "f-externality constrained" Pareto efficient. This means that there is no scope left for finite coalitions to gain from exchanging rights. This is true even if no attempt is made to restrict the activities which create widespread externalities. Of course, large coalitions may still be able to improve the widespread externalities.

What Section 4 shows, in effect, is that gains from exchanging rights between members of a finite coalition can only occur when rights to create externalities are rationed in some way, other than through a "Pigou" price mechanism. Accordingly, Section 5 considers what happens if initially there is direct rationing through quotas that each consumer is not allowed to exceed. It then discusses how to adapt the usual gains from trade results that were discussed in Section 3 in order to show that there are benefits to exchanging these quotas, provided that widespread externalities are not altered as a result. An important limitation is that often there are some originally unused quotas, in which case there will be a deleterious increase in the widespread externalities as a result of exchanging these quotas.

The final Section 6 summarizes the main conclusions. It also discusses some other practical obstacles that add to the cost of allowing rights to be exchanged freely.

2. Gains from Exchange in Sen's Example

The well known example which drives Sen's (1970a, b) classic libertarian paradox involves two individuals, labelled Lewd and Prude respectively, and one copy of the book *Lady Chatterley's Lover*. Recall that this novel by D.H. Lawrence had been the subject of a rather sensational court case in England some years before. In order to allow gains from exchanging rights, I shall expand Sen's example to include an extra *numéraire* commodity called "money" that can be transferred in order to compensate for giving up the right to read or not to read the novel. Unlike Sen, I shall also assume that it is feasible for both individuals to read the novel, one after the other.

Let m^L and m^P denote the non-negative amounts of money allocated to Lewd and Prude respectively. Also, for $i \in \{ L, P \}$, let $r^i \in \{ 0, 1 \}$ be an indicator variable whose value is 0 if i does not read the novel, but is 1 if i does read it. Thus, the example involves a simple two-person economy in which feasible allocations are described by combinations $(m^L, m^P, r^L, r^P) \in \Re^2_+ \times \{ 0, 1 \} \times \{ 0, 1 \}$.

Assume next that Lewd's and Prude's preferences can be represented by utility functions $u^L(m^L, r^L, r^P)$ and $u^P(m^P, r^L, r^P)$, and that these functions are continuous in the variables m^L and m^P respectively. Also, for all fixed non-negative values of m^L and m^P, assume that u^L and u^P satisfy the following conditions:

$$u^L(m^L, 1, 1) > u^L(m^L, 0, 1) > u^L(m^L, 1, 0) > u^L(m^L, 0, 0)$$
$$u^P(m^P, 0, 0) > u^P(m^P, 0, 1) > u^P(m^P, 1, 0) > u^P(m^L, 1, 1)$$

Note how, if only one person is going to read the novel, both individuals prefer that it should be Prude. Otherwise these are the preferences that correspond in an obvious way to each individual's label, with each individual wanting the other to make the same decision as themselves regarding whether to read the book or not.

For each individual $i \in \{ L, P \}$ and pair $(r^L, r^P) \in \{ 0, 1 \} \times \{ 0, 1 \}$, let $e^i(r^L, r^P; u)$ denote the minimum amount of money which i needs in order to reach the feasible utility level u. Thus, $e^i(r^L, r^P; u)$ is defined implicitly by $u^i(e^i(r^L, r^P; u), r^L, r^P) = u$ when this equation has a (finite) solution; otherwise $e^i(r^L, r^P; u) = +\infty$.

Suppose that, in the absence of any exchange of rights, both individuals simply exercise their free choice to read the book or not, as they wish. Suppose too that they have fixed endowments of money equal to $\bar{m}^L$ and $\bar{m}^P$ respectively. Then the resulting allocation will be $(\bar{m}^L, \bar{m}^P, 1, 0)$, with only Lewd choosing to read the novel. Let $\bar{u}^L := u^L(\bar{m}^L, 1, 0)$ and $\bar{u}^P := u^P(\bar{m}^P, 1, 0)$ denote the resulting utility levels of the two individuals.

One way in which gains from exchanging rights will be possible is if there exists a transfer $\tau_{PL} > 0$ from Prude to Lewd with the property that

$$u^L(\bar{m}^L + \tau_{PL}, 0, 0) > \bar{u}^L \quad \text{and} \quad u^P(\bar{m}^P - \tau_{PL}, 0, 0) > \bar{u}^P$$

and so

$$\bar{m}^P - e^P(0, 0; \bar{u}^P) > \tau_{PL} > e^L(0, 0; \bar{u}^L) - \bar{m}^L > 0$$

In this case Lewd can renounce any right to read the novel in exchange for the transfer τ_{PL}, in which case both agents will benefit. Such an exchange is possible if and only if the compensation $e^L(0, 0; \bar{u}^L) - \bar{m}^L$ which Lewd needs for being denied the chance to read the novel is less than the amount $\bar{m}^P - e^P(0, 0; \bar{u}^P)$ which Prude is willing to pay in order to avoid the externality that would arise if Lewd were to read the novel.

A second way in which there can be gains from exchanging rights is if there exists a transfer $\tau_{LP} > 0$ from Lewd to Prude satisfying the inequalities

$$u^L(\bar{m}^L - \tau_{LP}, 1, 1) > \bar{u}^L \quad \text{and} \quad u^P(\bar{m}^P + \tau_{LP}, 1, 1) > \bar{u}^P$$

and so

$$\bar{m}^L - e^L(1, 1; \bar{u}^L) > \tau_{LP} > e^P(1, 1; \bar{u}^P) - \bar{m}^P > 0$$

In this case Prude can agree to read the novel and then take an examination based upon it. Lewd agrees to make the transfer τ_{LP} immediately after an independent assessor certifies that Prude has passed the examination. Once again, both agents benefit. Such an exchange is possible if and only if the compensation $e^P(1, 1; \bar{u}^P) - \bar{m}^P$ which Prude needs for reading the novel and taking the examination is less than the amount $\bar{m}^L - e^L(1, 1; \bar{u}^L)$ which Lewd is willing to pay in order to ensure that Prude does read the novel.

Both the above exchanges were of rights against money. Neither exchange will benefit the two individuals simultaneously if it happens that both $e^L(0, 0; \bar{u}^L) + e^P(0, 0; \bar{u}^P)$ and

$e^L(1,1;\bar{u}^L) + e^P(1,1;\bar{u}^P)$ exceed $\bar{m}^L + \bar{m}^P$. Then appropriate compensation is impossible because both individuals value their rights too highly relative to the externality. Even in this case, however, the fact that both $u^L(\bar{m}^L, 0, 1) > u^L(\bar{m}^L, 1, 0)$ and $u^P(\bar{m}^P, 0, 1) > u^P(\bar{m}^P, 1, 0)$ makes a direct exchange of rights possible. Lewd agrees to postpone reading the novel at least until after Prude has had the opportunity to read it, and also never to read it at all if, before a date specified in the agreement, Prude passes an examination based on its content. In this exchange, no money changes hands. Moreover, provided it can actually be arranged, such an exchange is always mutually beneficial.

In fact, as Gibbard (1974) originally propounded, it is always possible in principle for any finite set of individuals to agree which rights should be exercised and which should be waived in a way that guarantees Pareto efficiency. This is just another instance of the tautology that, if groups of individuals always find some Pareto improvement whenever at least one is available, the allocation that results in the end is bound to be Pareto efficient. Of course, many people associate this tautology, perhaps rather misleadingly, with Coase.

3. Finite Exchanges in a Continuum Economy

The rest of the paper will consider an economy with a continuum of agents, as described by Aumann (1964, 1966), and then more fully by Hildenbrand (1974). The space of agents will be $(I, \mathcal{B}, \alpha)$ where I is the unit interval $[0, 1]$ of the real line, the family $\mathcal{B}$ of measurable sets is the Borel σ-algebra generated by the open sets, and α is Lebesgue measure defined on those sets. For later reference, recall the following standard terminology from measure theory. A measurable set of agents $I^0 \subset I$ is *null* whenever $\alpha(I^0) = 0$. And a statement S_i about each agent is true *for almost all* $i \in I$ if S_i is false for at most a null set of agents.

Assume that there is a finite set G of exchangeable private goods. In this section, suppose that G is partitioned into the set T of goods that are traded initially, complemented by the disjoint set $N = G \setminus T$ of goods that cannot be traded until after new markets have been allowed to open. For each individual $i \in I$, let $x^i = (x^i_T, x^i_N) \in \Re^G = \Re^T \times \Re^N$ denote i's net trade vector of exchangeable goods, expressed as the combination of the vector x^i_T of initially traded goods, together with the vector x^i_N of goods that cannot be traded initially.

Next, each individual $i \in I$ is assumed to have a feasible set $X^i \subset \Re^G$ of net trade vectors x^i, over which is defined a (complete and transitive) preference ordering R^i. Let

P^i denote the corresponding strict preference relation. For technical reasons, assume that the two correspondences $i \mapsto\!\!\!\!\rightarrow X^i$ and $i \mapsto\!\!\!\!\rightarrow \text{Graph}\, R^i$ both have closed values for every $i \in I$ and also graphs which are measurable subsets of $I \times \Re^G$ and of $I \times \Re^G \times \Re^G$ respectively, when both these Cartesian products are given their natural product σ-algebras. Assume too that each individual's preference ordering R^i is *locally non-satiated* w.r.t. the set T of traded goods in the sense that, given any $x^i = (x^i_T, x^i_N) \in X^i$ and any open neighbourhood $V \subset \Re^T$ of x^i_T, there exists some $\tilde{x}^i_T \in V$ with $(\tilde{x}^i_T, x^i_N) \in X^i$ for which $(\tilde{x}^i_T, x^i_N)\ P^i\ x^i$.

In this economy, a *feasible allocation* $\mathbf{x}$ is a measurable mapping $\mathbf{x} : I \to \Re^G$ such that:

(i) $x^i \in X^i$ for almost all $i \in I$;

(ii) $\int_I x^i\, d\alpha = 0$.

Suppose that initially traded goods are exchanged at a non-zero *price vector* $p_T \in \Re^T$, which each individual $i \in I$ is forced to take as given. In addition, each individual is prevented from exchanging goods in the set N, and so $x^i_N = 0$. Hence, i faces the *constrained budget set*

$$B^i(p_T) := \{\, x^i \in X^i \mid x^i_N = 0;\ p_T\, x^i_T \leq 0 \,\}.$$

Given this constrained budget set, say that i is in *individual equilibrium* at $\hat{x}^i \in B^i(p_T)$ provided that $p_T\, x^i_T > 0$ whenever $(x^i_T, 0)\ P^i\ (\hat{x}^i_T, 0)$. Obviously, this is equivalent to preference maximization over the set $B^i(p_T)$. Provided that the preference relation R^i is locally non-satiated as regards traded goods in the set T, it must then be true that $p_T\, \hat{x}^i_T = 0$.

Also, say that i is in *individual compensated equilibrium* at $\hat{x}^i \in B^i(p_T)$ provided that $p_T\, x^i_T \geq 0$ whenever $(x^i_T, 0)\ R^i\ (\hat{x}^i_T, 0)$. Obviously, this is equivalent to expenditure minimization over the *upper contour set* $\{\, x^i \in X^i \mid (x^i_T, 0)\ R^i\ (\hat{x}^i_T, 0) \,\}$. Once again, local non-satiation of R^i w.r.t. goods in the set T implies that $p_T\, \hat{x}^i_T = 0$.

A *Walrasian equilibrium* is then a pair $(\hat{\mathbf{x}}, p_T)$ consisting of a feasible allocation $\hat{\mathbf{x}}$ which satisfies $\hat{x}^i_N = 0$ for almost all $i \in I$, together with a price vector p_T, such that almost every $i \in I$ is in individual equilibrium at $\hat{x}^i$. Note that feasibility implies market clearing for all traded goods.

Similarly, a *compensated Walrasian equilibrium* is a pair $(\hat{\mathbf{x}}, p_T)$ consisting of a feasible allocation $\hat{\mathbf{x}}$ which satisfies $\hat{x}^i_N = 0$ for almost all $i \in I$, together with a price vector p_T, such that almost every $i \in I$ is in individual compensated equilibrium at $\hat{x}^i$.

Consider a *status quo* Walrasian equilibrium $(\bar{\mathbf{x}}, \bar{p}_T)$ which represents what will happen if no exchanges of goods in the set N are allowed. Suppose then that finite coalitions are allowed freely to exchange goods in the set N as they wish. Any allocation $\hat{\mathbf{x}}$ which ultimately results from such a process of free exchange must have the property that, except for a null set of exceptional agents $I^0 \subset I$, no finite coalition $C \subset I \setminus I^0$ can block by reallocating its own resources in order to reach an allocation $x^i \in X^i$ to each member $i \in C$ such that $\sum_{i \in C} x^i = 0$ and $x^i \; P^i \; \bar{x}^i$ for all $i \in C$. Hence, only finite coalitions C that include members of the negligible set I^0 remain able to gain from further exchange. This implies that the allocation $\hat{\mathbf{x}}$ meets the requirements to be a member of the *f-core* of the economy. Arguing as in Hammond, Kaneko and Wooders (1989), or in the more general model of Hammond (1995c), there must then exist prices $(\hat{p}_T, \hat{p}_N)$ at which $\hat{\mathbf{x}}$ is a compensated Walrasian equilibrium. Under well-known standard sufficient conditions, or some generalizations which are extensively discussed in Hammond (1993), this compensated Walrasian equilibrium will actually be a Walrasian equilibrium.

In this sense, even exchange which is limited to finite coalitions results in a new Walrasian equilibrium, with a larger set of traded goods. Nevertheless, this extended trade may not benefit all, or even almost all, individuals. Initially, each individual i's net trade vector is $(\bar{x}^i_T, 0)$, satisfying the budget constraint $\bar{p}_T \, \bar{x}^i_T = 0$. After free exchange, almost every individual $i \in I$ has a new net trade vector $(\hat{x}^i_T, \hat{x}^i_N)$, satisfying the new budget constraint $\hat{p}_T \, \hat{x}^i_T + \hat{p}_N \, \hat{x}^i_N = 0$. In order to use a revealed preference argument to show that, even if i has not benefited from trade, at least he is no worse off, the condition $\hat{p}_T \, \bar{x}^i_T \leq 0$ must be met, implying that i can afford the old net trade vector $(\bar{x}^i_T, 0)$ at the new prices $(\hat{p}_T, \hat{p}_N)$. But in fact $\hat{p}_T \, \bar{x}^i_T$ may well be positive, indicating that the terms of trade in the old markets have turned against i as a result of all the new exchanges of goods in the set N. Then, if $\hat{p}_T \, \bar{x}^i_T$ is large enough, individual i may have been made worse off.

To ensure that nobody loses from free exchange in this way, it is well known that lump-sum compensation of those who suffer from adverse relative price changes is generally required. Specifically, suppose that each individual i receives a net lump-sum transfer

$m^i(p_T, p_N)$, as a function of the price vector (p_T, p_N), that is equal to $p_T\,\bar{x}^i_T$. Hence, each individual faces the new budget constraint $p_T\,x^i_T + p_N\,x^i_N \leq p_T\,\bar{x}^i_T$. Note that the transfers $m^i(p_T, p_N)$ balance because $\int_I \bar{x}^i_T\,d\alpha = 0$ and so

$$\int_I m^i(p_T, p_N)\,d\alpha = \int_I p_T\,\bar{x}^i_T\,d\alpha = 0$$

for every possible price vector (p_T, p_N). Thus, those who gain from trade are being required to compensate those who lose.

Now, standard techniques for demonstrating existence of Walrasian equilibrium in a continuum economy apply in this new situation. Suppose that $(\hat{\mathbf{x}}, \hat{p}_T, \hat{p}_N)$ is a such a Walrasian equilibrium. Because $\hat{p}_T\,\bar{x}^i_T = m^i(\hat{p}_T, \hat{p}_N)$ by construction, each individual $i \in I$ can afford the *status quo* net trade vector $(\bar{x}^i_T, 0)$, and so the revealed preference argument does apply. At least almost nobody loses from free exchange.

Grandmont and McFadden (1972) propose a different rule for compensating losers which ensures that, when any non-null set of agents gain from free exchange, then almost all will. To state this rule, first define

$$E^i(p, \bar{x}^i) := E^i(p_T, p_N, \bar{x}^i) := \min_{x^i} \{\; p_T\,x^i_T + p_N\,x^i_N \mid x^i \in X^i;\; x^i\; R^i\; \bar{x}^i \,\}$$

as the mininum net transfer which i needs at prices $p = (p_T, p_N) \in \Re^G$ in order to be no worse off than at $\bar{x}^i = (\bar{x}^i_T, 0)$. Note that $E^i(p_T, p_N, \bar{x}^i) \leq p_T\,\bar{x}^i_T$ for all $i \in I$ and all price vectors p. Then define $\bar{E}(p) := \int_I E^i(p, \bar{x}^i)\,d\alpha$ as the population mean of the net transfers $E^i(p, \bar{x}^i)$. Of course,

$$\bar{E}(p) \leq \int_I p_T\,\bar{x}^i_T\,d\alpha = 0$$

for all price vectors p. When $\bar{E}(p) = 0$, giving almost all the losers compensation for the relative price changes induced by expanded free exchange leaves no surplus, and there are no strict gains to almost everybody. But when $\bar{E}(p) < 0$, suppose that each individual i receives the net transfer $m^i(p) = E^i(p, \bar{x}^i) - \theta^i\,\bar{E}(p)$ as a function of the price vector p, where θ^i is some positive constant for each i. Furthermore, suppose that the associated function $\theta : I \to \Re_+$ is measurable and also satisfies $\int_I \theta^i\,d\alpha = 1$. Then the transfers will evidently balance. Once again, standard techniques for demonstrating existence of Walrasian equilibrium in a continuum economy apply. Finally, whenever $\bar{E}(\hat{p}) < 0$ in the

new equilibrium, it will be true that $m^i(\hat{p}) > E^i(\hat{p}, \bar{x}^i)$ for all $i \in I$, implying that almost all individuals are better off as a result of the exchanges of goods in the set N.

Hence, allowing goods in the set N to be freely exchanged among members of finite coalitions will typically benefit some individuals. In the absence of appropriate compensation, however, some others may well be made worse off. In this sense, free exchange of goods in the set N is itself a form of widespread externality, though of a purely redistributive kind that does not involve any Pareto inefficiency. Indeed, it seems to be another instance of what some economists such as Shubik (1971) have called a "pecuniary externality" — see also Hausman (1992). These conclusions should be remembered when discussing the free exchange of rights later on.

4. Equilibrium with Widespread Externalities

Widespread externalities will now be introduced into the continuum economy, following the formulation in Hammond (1995a) rather closely. Specifically, assume that in addition to the finite set G of exchangeable private goods, there is a disjoint finite set E of externalities. As before, for each individual $i \in I$, let $x^i \in \Re^G$ denote i's net trade vector of exchangeable goods. But now let $e^i \in \Re^E$ denote the vector of externalities that i creates. Also, suppose that each agent $i \in I$ is affected by the mean externality vector $z = \int_I e^i \, d\alpha \in \Re^E$. Specifically, conditional on z, each individual $i \in I$ is assumed to have a feasible set $F^i(z) \subset \Re^G \times \Re^E$ of pairs (x^i, e^i). Assume too that a (complete and transitive) conditional preference ordering $R^i(z)$ is defined on $F^i(z)$. Let $P^i(z)$ denote the corresponding strict preference relation.

In this model, a *feasible allocation* $(\mathbf{x}, \mathbf{e}, z)$ consists of measurable mappings $\mathbf{x} : I \to \Re^G$ and $\mathbf{e} : I \to \Re^E$ such that:

(i) $(x^i, e^i) \in F^i(z)$ for almost all $i \in I$;

(ii) $z = \int_I e^i \, d\alpha$;

(iii) $\int_I x^i \, d\alpha = 0$.

Throughout this section it is assumed that all exchangeable goods are freely traded at a non-zero price vector $p \in \Re^G$. So that the losers from free exchange can be appropriately compensated by the gainers, suppose too that there are *lump-sum transfers* given by a

measurable mapping $\mathbf{m} : I \to \Re$ satisfying $\int_I m^i \, d\alpha = 0$. Each individual $i \in I$ is forced to take the price vector $p \in \Re^G$, the mean externality vector $z \in \Re^E$, and i's own transfer m^i all as given. Hence i faces the *conditional budget set*

$$B^i_C(p, m^i; z) := \{\, (x^i, e^i) \in F^i(z) \mid p\, x^i \leq m^i \,\}.$$

Given this conditional budget set, say that i is in *individual equilibrium* at $(\hat{x}^i, \hat{e}^i) \in B^i_C(p, m^i; z)$ provided that $p\, x^i > m^i$ whenever $(x^i, e^i)\ P^i(\hat{z})\ (\hat{x}^i, \hat{e}^i)$. Obviously, this is equivalent to conditional preference maximization over the set $B^i_C(p, m^i; \hat{z})$.

A *Nash–Walrasian equilibrium with lump-sum transfers* (or NWELT) is then a collection $(\hat{\mathbf{x}}, \hat{\mathbf{e}}, \hat{z}, p, \mathbf{m})$ consisting of a feasible allocation $(\hat{\mathbf{x}}, \hat{\mathbf{e}}, \hat{z})$, a price vector p, and transfers $\mathbf{m}$, such that almost every $i \in I$ is in individual equilibrium at $(\hat{x}^i, \hat{e}^i)$ given $\hat{z}$. Note that once again feasibility implies market clearing for private goods. Also, conditional on $\hat{z}$, each individual i chooses e^i without any restriction beyond individual feasibility and the choice of an x^i satisfying the budget constraint $p\, x^i \leq m^i$. Thus, within the budget set $B^i_C(p, m^i; \hat{z})$, the choice $(\hat{x}^i, \hat{e}^i)$ can be regarded as a best response to the mean externality $\hat{z}$ resulting from the choices of all the other players. In this sense, there is a Nash equilibrium in the (generalized) game where each player $i \in I$ is restricted to choose some $(x^i, e^i) \in B^i_C(p, m^i; \hat{z})$.

The concept of Pigou–Walrasian equilibrium is an obvious and simple extension of the corresponding concept of Nash–Walrasian equilibrium. Indeed, consider price systems of the form $(p, t) \in \Re^G \times \Re^E$, where $t \in \Re^E$ is the *Pigou price vector*, together with lump-sum transfers m^i $(i \in I)$, where $\mathbf{m} : I \to \Re$ is a measurable function. Thus, t could be a vector of net taxes imposed by the government with a view to allocating the total widespread externality vector z efficiently between different consumers. Alternatively, it could be the free market price vector for permits to create all the different kinds of widespread externality.

Accordingly, the budget constraint of each individual $i \in I$ becomes $p\, x^i + t\, e^i \leq m^i$. Given the mean externality vector z, each individual $i \in I$ will be confronted with the (conditional) *Pigou–Walrasian budget set*

$$B^i_{PW}(p, t, m^i; z) := \{\, (x^i, e^i) \in F^i(z) \mid\ p\, x^i + t\, e^i \leq m^i \,\}.$$

Evidently $B^i_{PW}(p, 0, m^i; z) = B^i_C(p, m^i; z)$, so that the Pigou–Walrasian budget set reduces to $B^i_C(p, m^i; z)$ when the Pigou price vector $t = 0$.

Then the combination $(\hat{\mathbf{x}}, \hat{\mathbf{e}}, \hat{z}, p, t, \mathbf{m})$ is a *Pigou–Walrasian equilibrium with lump-sum transfers* (or PWELT) if $(\hat{\mathbf{x}}, \hat{\mathbf{e}}, \hat{z})$ is a feasible allocation satisfying, for almost all $i \in I$, both $(\hat{x}^i, \hat{e}^i) \in B^i_{PW}(p, t, m^i; \hat{z})$ and also $p\,x^i + t\,e^i > m^i$ whenever $(x^i, e^i) \in F^i_C(\hat{z})$ with $(x^i, e^i)\ P^i(\hat{z})\ (\hat{x}^i, \hat{e}^i)$. Thus, $(\hat{\mathbf{x}}, \hat{\mathbf{e}}, p, t, \mathbf{m})$ is effectively a Walrasian equilibrium with lump-sum transfers in the economy with complete competitive markets in both private goods and externalities, but with the mean externality vector $\hat{z}$ fixed. Also, a NWELT is effectively just a PWELT for which the Pigou price vector t happens to be 0.

As in Hammond (1995a), a feasible allocation $(\hat{\mathbf{x}}, \hat{\mathbf{e}}, \hat{z})$ is said to be *f-externality constrained Pareto efficient* if, except for a null set $I^0 \subset I$ of exceptional agents, no finite coalition $C \subset I \setminus I^0$ can find an alternative allocation $(x^i, e^i) \in F^i_C(\hat{z})$ $(i \in C)$ to its members which satisfies the three conditions that: (i) $\sum_{i \in C} x^i = \sum_{i \in C} \hat{x}^i$; (ii) $\sum_{i \in C} e^i = \sum_{i \in C} \hat{e}^i$; and (iii) $(x^i, e^i)\ P^i(\hat{z})\ (\hat{x}^i, \hat{e}^i)$ for all $i \in C$. Hence, only finite coalitions C that include members of the negligible set I^0 are able to gain from exchanging combinations of goods and externalities. In fact, it is easy to prove, in an entirely standard way, that any PWELT allocation is f-externality constrained Pareto efficient. Pareto improvements can only result from changes made by (large) coalitions of positive measure which affect the widespread externalities in a beneficial way. Since a NWELT is a particular instance of a PWELT, the same is true for those externalities which are not controlled at all.

5. The Gains from Exchanging Quotas

Now suppose that rights to create externalities are limited by some sort of quota scheme instead of Pigou prices. Suppose too that there are no lump-sum transfers. So, in addition to the usual conditional budget constraint $(x^i, e^i) \in B^i_C(p, 0; z)$ when $m^i = 0$, each individual $i \in I$ faces the additional constraint $e^i \leqq q^i$ for some vector of quotas $q^i \in \Re^E$. Here, the choice of sign in each constraint $e^i_k \leq q^i_k$ reflects what is probably the usual case, which is when quotas limit the external diseconomies that individuals are allowed to create. But if k is an external economy and the quota q^i_k requires a minimum contribution toward creating k, this can also be accommodated if one thinks of $-e^i_k$ as representing the magnitude of this contribution. For then the kth constraint of the vector inequality $e^i \leqq q^i$ can be expressed equivalently as $-e^i_k \geq -q^i_k$. Also, note that if $k \in E$ is such that $q^i_k = +\infty$, then i's right to create e^i_k units of externality k is totally uncontrolled. On the other hand, if $e^i_k \geq 0$ is required for feasibility and if $q^i_k = 0$, then there is total prohibition.

Let $B^i_Q(p, q^i; z)$ denote the subset of $B^i_C(p, 0; z)$ that results when the extra constraints $e^i \leqq q^i$ are imposed. It is easy to modify the earlier definitions of Nash–Walrasian equilibrium and of compensated Nash–Walrasian equilibrium to reflect these quota constraints simply by replacing $B^i_C(p, 0; z)$ with $B^i_Q(p, q^i; z)$ throughout.

Suppose now that, if the exchange of quotas were to remain prohibited, the economy would reach a *status quo* Nash–Walrasian equilibrium without lump-sum transfers, but with quota constraints, of the form $(\bar{\mathbf{x}}, \bar{\mathbf{e}}, \bar{\mathbf{q}}, \bar{z}, \bar{p})$. Arguing as in Section 3, if free exchange of quotas were allowed, the result would be an allocation in the f-core. In fact, this will be a Walrasian equilibrium without lump-sum transfers of the form $(\hat{\mathbf{x}}, \hat{\mathbf{e}}, \hat{z}, \hat{p}, \hat{t})$. Here, for each externality $k \in E$, the price $\hat{t}_k$ that each individual pays is really the price of the corresponding quota rather than the Pigou price of the externality itself. Nevertheless, whenever $\hat{t}_k > 0$, individuals who buy quotas will use them all — that is, they will choose $\hat{e}^i_k = \hat{q}^i_k$. On the other hand, if $\hat{t}_k = 0$, then individuals will buy as many quotas as they need in order to accommodate their unconstrained levels $\hat{e}^i_k$ of the externality k. Hence, it loses no generality to impose the requirement that $\hat{e}^i_k = \hat{q}^i_k$. Therefore, in equilibrium we can assume that $\hat{e}^i = \hat{q}^i$ for almost all $i \in I$. In this sense, there is no real difference after all between buying quotas and buying the rights to create externalities. Thus, $(\hat{\mathbf{x}}, \hat{\mathbf{e}}, \hat{z}, \hat{p}, \hat{t})$ can be regarded as a Pigou–Walrasian equilibrium.

Of course, many rights are inherently indivisible. It might be thought that this creates problems for the existence of a Walrasian equilibrium. Indeed, similar problems can already arise in the economy described in Section 3, since there it was not assumed that individuals' preference orderings R^i or even their feasible sets X^i were convex. But as discussed in Yamazaki (1978, 1981), Hammond (1993), and Coles and Hammond (1995), such existence problems tend to disappear if there is a continuum of individuals with dispersed characteristics — see also Sondermann (1975) and Trockel (1984).

Assume moreover that the total availability of quotas per head remains fixed. Then one will have

$$\hat{z} = \int_I \hat{e}^i \, d\alpha = \int_I \hat{q}^i \, d\alpha = \int_I \bar{q}^i \, d\alpha \geqq \int_I \bar{e}^i \, d\alpha = \bar{z}.$$

Were it also true that $\hat{z} = \bar{z}$, the arguments of Section 3 could now be applied to the conditional continuum economy with $\bar{z}$ fixed. The set T of initially traded goods would be replaced by G, and the set N of non-traded goods by E, the set of externalities. Then there would be potential gains from free exchange within finite coalitions, but actual Pareto gains would require suitable lump-sum compensation of any losers from relative price changes.

However, now there is the new feature that $\hat{z} = \bar{z}$ only when $\bar{q}^i = \bar{e}^i$ for almost all $i \in I$. That is, potential gains occur when there were almost no unused quotas in the *status quo*. Otherwise, for at least one of the externalities $k \in E$, it will be true that $\bar{e}^i_k < \bar{q}^i_k$ for a non-null set of individuals, implying that $\hat{z}_k > \bar{z}_k$. Then this change in externality k could well rule out even potential Pareto gains. Indeed, a strictly Pareto inferior allocation could easily result. Only by confiscating quotas that were unused in the *status quo* can this possibility be avoided, in general.

6. How Free Exchange Can Be Costly

As shown in Section 3, even in the absence of other externalities, giving individuals the right to exchange a larger set of goods can create redistributive externalities. As usual, the potential gains from exchange do not become actual Pareto gains, in general, unless those who would otherwise lose from relative price movements receive suitable compensation from those who gain. When there are widespread externalities whose creation is controlled by quotas, Section 5 showed how the free exchange of those quotas may fail to produce even potential gains. This is because quotas that would otherwise have gone unused are likely to be transferred to those who will wish to use them. Hence, the level of the widespread externality is likely to change in an adverse way.

None of this discussion has dealt with other important obstacles to the achievement of Pareto gains from expanded free exchange. In particular, when individuals have private information determining what they would have transacted in the absence of expanded free exchange, proper compensation for adverse relative price movements is generally impossible. The second best schemes devised in Hammond and Sempere (1995), with their frozen consumer prices and markets which get cleared by adjusting commodity taxes, are hardly more practicable.

Essentially this paper has been about limits to the economic gains from free exchange, not only of goods and services in the usual sense, but also of the rights or duties to create externalities. It should not be forgotten, however, that there can be other costs, possibly much larger, to expanded free exchange in certain goods and services. For example, evading taxes by participating in the undergound economy is in some obvious sense promoting free exchange, but at the cost of undermining a society's ability to provide public goods that benefit everybody, including tax evaders. Similar illegal activites such as smuggling or bribing public officials or politicians are often even worse than tax evasion because of the negative externalities they cause.

Examples where the costs are less evident include transactions that are judged by many not to be worth trying to suppress, yet are currently either illegal or else involve contracts that courts are unlikely to enforce. A rather dramatic example of the second category was the surrogate motherhood case in the U.S.A. concerning Mary Beth Whitehead — see also Satz (1992). The first category of "marginally" illegal transactions might include some

"victimless crimes" such as prostitution (Satz, 1995), supplying drugs to adult addicts, or selling alcohol during the Prohibition era in the U.S.A. Another case where the alleged costs are particularly difficult to discern concerns the freedom to exchange labour internationally — i.e., to become an "economic" migrant.[3]

Nevertheless, it is important to understand how expanded freedom to exchange can provide new opportunities for the criminal or the merely unscrupulous. The reported development of an unofficial market in India for human kidneys destined for use in transplant surgery has led not only to some poor people selling one of their kidneys voluntarily, especially when they need to repay a burdensome debt. There have also been reports of people being kidnapped and waking up to find that one of their kidneys has been removed against their will. Similar outrages have been linked to the international traffic that supplies babies born in poor countries for adoption by people in rich countries. Also, of course, many people object to drug dealing or prostitution, especially near where they live or work, because such activities tend to attract more violent forms of crime. In all these cases, any gains from allowing voluntary exchange must be balanced against the need to prevent greedy people from arranging coerced exchange involving, quite possibly, outright theft or even murder.

The above objections to expanded free exchange admittedly concern only some cases which may be rather special. They do not deny that freer exchange may often be beneficial. They also fail to address directly the intuitionist argument that freedom to exchange should be valued for its own sake — but that task has been undertaken most capably by Gibbard (1985, especially p. 25). At most, it has been shown here that there may be economic costs to set against any benefits from freedom *per se*. Sometimes, however, these costs can be very large.

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[3] For some recent discussions of the economic costs and benefits of international migration, see Brecher and Choudhri (1990), Freeman (1993), Kemp (1993), Wildasin (1994), and also Hammond and Sempere (1996), amongst others.

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