JOURNAL OF ENVIRONMENTAL ECONOMICS AND MANAGEMENT 14, 54–57 (1987)

The Transferability and Depletability of Externalities

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Received October 30, 1984; revised April 24, 1985

This paper is concerned with symmetry and asymmetry in pollution pricing, as conditions for the attainment of a Pareto optimum in pollution pricing. It has already been claimed (Freeman, *J. Environ. Econom. Manage.* **8**, 321–329 (1984)) that for both depletable and undepletable externalities pollution pricing should be asymmetric. It is shown in this paper that the relevant distinction is not between depletable and undepletable externalities. Rather it is between transferable and non-transferable externalities, the effects of which can or cannot be transferred by the recipient to another party. Optimality requires symmetric pricing for transferable externalities, and asymmetric pricing for non-transferable externalities.

In a stimulating recent article, Freeman [1] disputes the relevance of the distinction between depletable and undepletable externalities outlined in Baumol and Oates' [2] acclaimed textbook. The issue concerns the taxation policy required to achieve Pareto-optimal resource allocation in the presence of a negative externality (or *mutatis mutandis* a positive externality). Baumol and Oates argue that for a depletable externality, a per unit tax is required on the generators of the externality, together with a corresponding payment to the parties affected (this can also be achieved by a bargaining solution). However, for an undepletable externality, optimality requires a tax on the generators, but zero compensation to those affected. Freeman claims that the Baumol and Oates conclusion for a depletable externality is wrong, and that in both bases zero compensation should be paid to the parties affected.

Freeman's argument derives from Baumol and Oates' definitions. For Baumol and Oates: "An externality is present whenever some individual's (say A's) *utility* or *production* relationships include real (that is, nonmonetary) variables, whose values are chosen by others (persons, corporations, governments) without particular attention to A's welfare" [1, p. 17, italics in original]. Undepletable externalities are defined by one characteristic: "... the fact that an increase in the consumption of the good by one individual does not reduce its availability to others" [1, p. 19]. Depletable externalities are not defined explicitly, but clearly Baumol and Oates mean by this term the case where consumption of the good by one individual does reduce its availability to others. The two examples quoted by Baumol and Oates are for the undepletable case the breathing of polluted city air, and for depletability the dumping of garbage on someone else's property. Significantly, Freeman changes the example and for depletability discusses the deposition of acid on land (presumably in rain).

*I am grateful to A. Myrick Freeman III and an anonymous referee for helpful comments on an earlier draft. The usual disclaimer applies.

0095-0696/87 $3.00

The aspect of Baumol and Oates' externality definition stressed by Freeman is that the values of the externality are chosen by others. Since the quantity of acid rain falling on (say) *B*'s land is by definition chosen by *A*, this quantity cannot be affected by the price paid to *B* to receive the externality. Consequently the price paid to *B* is irrelevant for optimum resource allocation. This is the essence of Freeman's objection to Baumol and Oates' analysis.

To extend his argument, Freeman allows for the possibility of mitigating the externality. To counteract acid rain *B* can apply lime to the garden. If this is the case then the utility loss to *B* can change, and so therefore can the optimal tax on *A*. It still remains the case, argues Freeman, that the quantity of acid is determined only by *A*, and that the compensation paid to *B* is irrelevant.

Consider, however, the example of garbage dumping cited by Baumol and Oates. Suppose *B* chooses not to mitigate but to avert the externality—say by raising the height of the garden fence so that garbage cannot be dumped over it. Instead *A* dumps the garbage into *C*'s garden. By averting the externality *B* confers an external cost on *C*. If compensation is payable, then the opportunity cost of the foregone compensation is the penalty paid by *B* for imposing the externality on *C*. Alternatively by accepting the garbage and not forcing *A* to dump it on *C*, *B* confers a social benefit on *C* and is rewarded by compensation. Payment of compensation is clearly appropriate for the achievement of optimality, and Baumol and Oates' argument is thus vindicated.

In theory at least acid rain can also be averted. Suppose *B* erects a plastic sheet over the garden, allowing all rain to run into *C*'s territory; and uses instead a hosepipe for irrigation. In this case Baumol and Oates' analysis of the depletable externality case also applies; *B* should be compensated for accepting the externality and not averting it by *transferring* the externality to *C*. Freeman gets his result by assuming that transfer of the externality is impossible and that mitigation is the only response. With no possiblity of transference, accepting the externality confers no social benefit and compensation is thus irrelevant. It is the example chosen and the assumption about non-transferability that leads to Freeman's result.

There is an apparent difference between the garbage dumping and acid rain cases in that in the former case *B*'s action causes *A* to redirect the pollution to *C*, whereas in the latter case *B* directly undertakes the act of transference to *C*. However the net effect of aversion by *B* is the same in both cases, implicitly or explicitly to transfer the pollution to *C*. Where receptors can transfer the externality among themselves in this way Pareto optimality requires a regime of symmetric pricing. The polluter generates pollution or not, depending upon whether the cost of suppressing pollution exceeds the price (explicit or implicit) paid by the polluter. Receptors transfer or suffer pollution, depending upon whether the cost of suffering pollution exceeds the price (explicit or implicit) paid to the receptor. The polluter's choice variable concerns the levels of pollution; how its burden is distributed across receptors is determined by the actions of the receptors, and receptor prices are necessary to guide this process.

The discussion so far has assumed that the transference of pollution is costless. As with mitigation, taking the costs of transference into account does not qualitatively affect the analysis. The decision by the receptor to accept or transfer pollution must take into account the transference cost. However, what is relevant for the current discussion is that it must also take into account the cost of the pollution to the receptor to whom it is transferred.

It is clear that in terms of own assumptions the analyses of Freeman and Baumol and Oates are both valid. What is required is a theoretical approach which encompasses all possible situations. This can be done in two ways.

The first approach is to accept Freeman's position that the recipient of pollution cannot affect its magnitude, and that compensation is therefore irrelevant. However, with this approach it must also be recognized that aversion by transferring the pollution is also an externality generating activity. As such it should be penalized by taxation the same way as the original generation of pollution. This means that implicitly the acceptance and non-transference of pollution is rewarded.

The second approach is to follow Baumol and Oates, but to replace the distinction between depletable and undepletable externalities by that between transferable and non-transferable externalities. Undepletable externalities are necessarily non-transferable. For these and for non-transferable depletable externalities, the acceptance of an externality confers no social benefits, and need not therefore be rewarded. For transferable depletable externalities, however, acceptance and non-transference of the externality confers a benefit on the rest of society. In this case optimality requires that non-transference be rewarded and transference of the externality implicitly penalized. The symmetric payment of compensation to the receptor of transferable pollution is a means of satisfying the requirement.

As policy prescriptions the two approaches are equivalent in both leading to the attainment of Pareto optimality. They differ with respect to income effects. Without denying their relevance, income effects are not considered in the current paper. There are other grounds, however, for preferring the second approach. Since pollution can be transferred many times, but accepted only once, the costs of intervention are likely to be higher if transference is taxed rather than acceptance rewarded. Also, the information requirements are greater. The authorities are required to monitor every act of pollution transference rather than simply to identify the final recipients of transferable pollution.

In practice it is simpler to compensate those accepting all types of pollution. Since compensation is irrelevant for achieving optimality with respect to non-transferable pollution, nothing is lost if it is paid anyway. There will of course be income effects. These and other factors (see, for example, Mishan [3]) are likely to be of equal or greater importance in real world policy making. The current paper is restricted to the theoretical requirements for the attainment of a Pareto-optimal allocation.[1]

The conclusion of this paper is that the analytical approach to externalities outlined by Baumol and Oates should be retained, with a small modification. The relevant distinction is not that between depletable and undepletable externalities. Rather it is between transferable and non-transferable externalities, the effects of which can or cannot be transferred by a recipient to another party. Otherwise, Baumol and Oates' analysis carries through. No formal exposition of the optimality conditions is presented in this paper. The interested reader can obtain this for undepletable externalities, and for depletable, transferable externalities from Baumol and Oates [1, pp. 34–48], and for depletable, non-transferable externalities from Freeman [2, pp. 175–177].

[1]An anonymous referee has emphasized that income effects, in as much as they affect entry and exit decisions by firms (and location decisions) do have implications for economic efficiency. Where such factors are important, they would appear to support the case for taxing the transfer of externalities. In practice, however, efficiency considerations are likely to be outweighed by the equity aspects of income effects.

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