

RESOURCE ALLOCATION, INFORMATION COST AND THE FORM OF GOVERNMENT INTERVENTION*

JAMES E. KRIER** AND W. DAVID MONTGOMERY***

In a capitalist society the ordinary activities of economic life are carried out through market transactions. Yet it often occurs, for reasons suggested below, that the economic activities of one individual impinge on the well-being of another without the intervention of such transactions. Economists characterize these as cases of “externality”—situations in which markets fail to mediate interactions between individuals (and situations in which, if proper market coordination did take place, *both* interacting individuals could be made better off). Exploitation of natural resources and depredation of the environment are by no means the only instances of externality, but they are common ones of growing current concern, and they are the instances on which we focus here.

The central core of modern welfare economics is the demonstration that in those realms of activity in which all interactions are reduced to transactions in competitive markets, the result is a situation where no one could be made better off without necessarily making someone else worse off. But the story of the environment is a catalog of cases in which the actions of one or a few deprive many of resources which they often value more highly than those doing the taking. This happens precisely because no individual holds a well-defined and exclusive right to use the resources in question. For the fact is that the institution of private property and the existence of markets are intimately related. But since it appears at present to be impossible to establish effective private property rights in certain resources, and since it seems equally impossible to guarantee that competition shall prevail or all desirable bargains be struck in the exchange of property rights, the question arises whether some substitute for the market

*This paper is a product of the authors' work in the Environmental Quality Laboratory of the California Institute of Technology. The Laboratory consists of an informally organized group of engineers, natural scientists, and social scientists who are dealing with broad, strategic problems of environmental control; the work is supported in part by the RANN Program of the National Science Foundation. We express our appreciation to Professor Lester Lees, Director of the Laboratory, for his encouragement and support. Professor Krier also wishes to acknowledge that some of the ideas in this paper developed in the course of ongoing research for a larger study funded by the Council on Law Related Studies and the Environmental Protection Agency. We are grateful for the comments of Professor Vernon Ruttan, Mark Grady, and those who participated when we presented the paper to a meeting of U.C.L.A. Law School's Jurisprudence Society and to Professor Harold Demsetz's Law-Economics Workshop.

**Professor of Law, University of California, Los Angeles, and Consultant, Environmental Quality Laboratory.

***Assistant Professor of Economics, California Institute of Technology, and Staff Member, Environmental Quality Laboratory.

Replaces California Institute of
Technology Social Science Working
Paper # 11

should be used to mitigate the untoward effects of economic activity. The common substitute, in practice and in academic literature, is government intervention.

Government intervention can appear in many forms. The purpose of this essay is to argue that the same historical and institutional forces which influence the development of a system of private property in turn affect the form of government intervention which will appear when the private property system fails.

In *Toward a Theory of Property Rights*,¹ Harold Demsetz outlines a view of the relationship between externalities and the formation of private property rights. He envisions an original regime of common property and suggests that private property rights emerge when the costs of employing a private property system are more than compensated by gains in allocational efficiency achieved by such a system. These gains are realized through private negotiations which regulate the otherwise wasteful interaction between two individuals. When negotiations occur—when, for example, a polluter and a citizen bargain about the compensation for the suffering caused by pollution—we say that an “externality” has been “internalized.” Externalities abound under systems of common property primarily because of high transaction costs which prevent negotiations. The institution of private property economizes on these costs and thus serves to reduce externalities.

Demsetz does not suggest that private property is the universal institutional response to growing external costs. Indeed, he recognizes the unreality of the example we have just used, noting that in cases like air pollution “it may be too costly to internalize effects through the market place.”² In some situations, then, private property is not a viable response—at least not a viable *sole* response³—to the presence of externalities. Some form of active government intervention—what Demsetz would probably call “state ownership”⁴—is called for. At least, it is called for *if* any response at all is justified in the sense of being worth its costs. Typically, the intervention will be through legislative and administrative bodies (for the judicial role of defining

1. Demsetz, *Toward a Theory of Property Rights*, 57 *Am. Econ. Ass'n Papers & Proceedings* 347 (1967).

2. *Id.* at 357.

3. A rearrangement of private property rights in instances such as smoke pollution might achieve net gains even though some form of centralized government intervention—alone or in conjunction with the rearrangement of rights—might achieve larger net gains. See Calabresi, *Transaction Costs, Resource Allocation and Liability Rules—A Comment*, 11 *J. Law & Econ.* 67, 69 n. 7 (1968).

4. Which he defines as a system where “the state may exclude anyone from the use of a right as long as the state follows accepted political procedures for determining who may not use state-owned property.” Demsetz, *supra* note 1, at 354.

private property rights through common-law rules has been found insufficient). Typically, it will occur in situations involving large numbers of people placing conflicting demands on nonexclusive resources—air, water, scenic beauty, peace and quiet, and so forth. Demsetz does not develop the application of his views to the form of “state ownership” or legislative-administrative intervention with respect to such resources.⁵ We believe his analysis can be extended to help understand the emergence of new forms of such government intervention. But whereas transaction cost between interacting individuals is central to Demsetz’s model, information cost to the government control body is central to ours.

I

We begin our own exposition with a brief summary of Demsetz’s argument. His central thesis is that “Property rights [in particular, private property rights] develop to internalize externalities when the gains of internalization become larger than the cost of internalization.”⁶ Private property implies the rights of the owner to exclude others from using, or interfering with the use of, the owner’s property. This is in contrast to communal or common property ownership, where each member of the community has a right of use, but no right to exclude uses of other members of the community.⁷

While these definitions point out a clear distinction between the two systems of property rights, they also suggest a similarity. As Demsetz observes, “Property rights convey the right to benefit or harm oneself or others. . . . [T]hey specify how persons may be benefited and harmed, and, therefore, who must pay whom to modify the actions taken by persons. The recognition of this leads easily to the close relationship between property rights and externalities.”⁸ As Ronald Coase has demonstrated, externalities exist when, and only when, the costs of bringing a harmful or beneficial effect to bear on parties producing and suffering (or enjoying) the effect are greater than the value of taking the effect into account.⁹ The costs of “internalizing” the effects or bringing them to bear on the interacting parties arise from transactions—the need for the parties to be identified and brought together, to negotiate an agreement, and to enforce or police the resulting contract. Externalities, in short, are a function of transaction costs; they exist when “the cost of a

5. Demsetz, *supra* note 1, at 354.

6. Demsetz, *supra* note 1, at 350.

7. Demsetz, *supra* note 1, at 354.

8. Demsetz, *supra* note 1, at 347.

9. Coase, *The Problem of Social Cost*, 3 J. Law & Econ. 1 (1960). See also Demsetz, *supra* note 1, at 348.

transaction in the rights between the parties . . . [exceeds] the gains from internalization."¹⁰

Demsetz builds on the relationship between externalities and property rights by arguing that a regime of private property emerges when changes in relative values make it economic to internalize previously external effects. The point is best understood by brief reference to an example used by Demsetz. He cites evidence of the relationship between development of private rights in land among an Indian tribe and development of the commercial fur trade. At one time the tribe had in essence a system of communal ownership in land and animals. Because of this, it was in no individual's interest to shepherd the animal resource. Relative overhunting can be supposed to have occurred, for each kill by a member of the tribe would garner a unit of gain to him, while the unit of loss would be spread among all the communal owners. In spite of this, hunting before the development of the fur trade was not intense in an absolute sense, simply because of the abundance of animals and each tribe member's demand for only a few animals for food and clothing:

The externality was clearly present. Hunting could be practiced freely and was carried on without assessing its impact on other hunters. But these external effects were of such small significance that it did not pay for anyone to take them into account. There did not exist anything resembling private ownership in land.¹¹

Subsequent establishment of the fur trade most likely led to two developments:

First, the value of furs to the Indians was increased considerably. Second, and as a result, the scale of hunting activity rose sharply. Both consequences must have increased considerably the importance of the externalities associated with free hunting. The property right system began to change, and it changed specifically in the direction required to take account of the economic effects made important by the fur trade.¹²

Eventually, a system of private hunting territory—of private property rights in land—developed among the members of the Indian tribe. The development appears to support Demsetz's reliance on the importance to property rights formation of "changes in production functions, market values, and aspirations . . . , changes in economic values, changes which stem from the development of new technology and the opening of new markets. . . ."¹³ We would summarize Demsetz's

10. Demsetz, *supra* note 1, at 348.

11. Demsetz, *supra* note 1, at 351-52.

12. Demsetz, *supra* note 1, at 352.

13. Demsetz, *supra* note 1, at 350.

observations, but in a way that makes them applicable in a broader context, by saying that *institutions to more efficiently allocate resources tend to develop in response to relatively increasing value of the resources, whether caused by increasing demand or otherwise.*

In part II of this paper we examine how this proposition might contribute to understanding the form of government intervention. Before turning to that task, it is important to confront two questions, the answers to which also play a part in our argument. First, how is it that the institution of private property allocates resources more efficiently than communal ownership? Second, in light of its advantages, why does the institution of private property not always exist in a society from the outset? We shall take each question in turn.

The economist's concept of efficient or optimal resource allocation denotes a situation where no reallocation could benefit someone without necessarily harming someone else; conversely, an efficient allocation has not been realized where a change in the pattern of resource use would benefit some without (necessarily) harming others.

Coase has shown that if the costs of negotiation among all persons affected by conflicting uses of a given resource are zero, the market will invariably produce an optimal allocation.¹⁴ The reasoning behind this conclusion has been lucidly summarized by Guido Calabresi:

[T]here is a misallocation when a situation can be improved by bargains. If . . . bargains are costless . . . transactions will *ex hypothesi* occur to the point where bargains can no longer improve the situation; to the point, in short, of optimal resource allocation. We can, therefore, state as an axiom the proposition that all externalities can be internalized and all misallocations . . . can be remedied by the market, except to the extent that transactions cost money. . . .¹⁵

Externalities exist when the costs and benefits of resource use are not fully taken into account. The externalities are not taken into account because the cost of the accounting procedure (transaction cost) outweighs the gains to be achieved thereby.

The institution of private property reduces some transaction costs, thereby making possible more efficient allocations than in the case of communal ownership. First, private as opposed to communal ownership automatically internalizes some externalities (or automatically avoids the need for some transactions) by fully concentrating the benefits *and* costs of some decisions about resource use on the private owner. When a member of the Indian tribe kills one animal on his

14. Coase, *supra* note 9.

15. Calabresi, *supra* note 3, at 68. We have for the sake of clarity edited out of the quotation certain qualifications not important to the point we are making.

land, he enjoys a full unit of benefit but, unlike the result with communal ownership, suffers a full unit of detriment as well. "This concentration of benefits and costs on owners creates incentives to utilize resources more efficiently."¹⁶

Second, private as opposed to communal ownership reduces the costs of negotiating over remaining externalities, simply because it reduces the number of contracts necessary to take external effects into account. A system of common property allows any member of the community to exploit the communal resource. Accordingly, it is necessary for *all* to agree about resource use. But with private ownership, a decision by one private owner is unlikely in many cases to produce spillovers affecting *all* other private owners, but rather only a few adjacent ones. As a result only a few rather than all owners need negotiate an agreement that takes the effects into account. The costs of transacting—the chief impediment to efficient allocation—are accordingly reduced.¹⁷

Let us turn to our second question. If the institution of private property promotes efficient resource allocation by automatically internalizing some externalities, and by reducing the costs of internalizing others, then why does the institution not always exist in a society from the outset, rather than emerge (as Demsetz argues) from a regime of communal ownership? We can suggest several answers. First, it must be recognized that a system of private property *invites* transactions that might be unnecessary under communal ownership. It is possible to imagine communal ownership of a resource sufficiently plentiful that each member of the community could satiate his demands simply by exploiting the resource, and still some of the resource would remain. But with private ownership of the same quantity of the resource, costly transactions would be necessary to satisfy all demands unless the original distribution of private ownership rights happened to conform to the pattern of individual demands. Thus, private ownership will, under certain conditions, entail apparently unnecessary costs.

A system of private property, as compared to communal ownership, also entails costs of another sort. Even when a resource is so scarce that, unlike our example above, transactions would serve a useful purpose, the *overhead costs* of providing a private property system may exceed the present value of all future gains from trade net of transaction cost. As Demsetz has pointed out in other work,¹⁸ there are costs associated simply with the provision of a private property-

16. Demsetz, *supra* note 1, at 356.

17. Demsetz, *supra* note 1, at 356-57.

18. See Demsetz, *Some Aspects of Property Rights*, 9 J. Law & Econ. 61, 62 (1966); Demsetz, *The Exchange and Enforcement of Property Rights*, 7 J. Law & Econ. 11, 13-14 (1964).

private market system. The government must define the property rights and decide who owns what; it must set up a system to protect ownership. Thus, when Demsetz says that private property rights develop "when the gains of internalization become larger than the cost of internalization,"¹⁹ he must mean not merely that the costs of transacting are exceeded by the gains thereby realized, but (ironically) that the costs of having a system that economizes on the costs of transacting are also worthwhile. Otherwise, according to the development of his argument, the private property institution would not emerge, for it would have existed from the outset!

II

It should be apparent that the concept of "transaction cost" is central to Demsetz's analysis—indeed, it is central to the entire body of welfare economics concerned with the formation, exchange, and enforcement of property rights. Unfortunately, however, the concept has not been clearly articulated in the literature. Broadly conceived, it would appear to include the costs of interacting parties identifying each other, informing each other of a willingness to deal, carrying out and memorializing negotiations, and enforcing the resulting agreement.²⁰ An attempt has been made to refine the concept of transaction cost by breaking it down into components: information cost, contracting cost, and policing cost.²¹ This tripartition is hardly crucial, but with some revision it is useful for our purposes.

We will be discussing government intervention in the market place as a mode of resource allocation. In the broad sense, transaction costs are attached to this mode just as they are to any other, such as the market.²² But the breadth is misleading; the costs of government intervention are not usually associated with the costs of market negotiations between the regulated and the government agency. In

19. Demsetz, *supra* note 1, at 350.

20. See Coase, *supra* note 9, at 15. See also, Demsetz, *Contracting Cost and Public Policy*, in Joint Economic Committee, 91st Cong., 1st Sess., *The Analysis and Evaluation of Public Expenditures: The PPB System* 167, 169 (Joint Comm. Print 1969) (transaction cost includes "the costs of search and negotiation in the market place and the cost of insuring that voluntary agreements are honored"); Arrow, *The Organization of Economic Activity: Issues Pertinent to the Choice of Market Versus Nonmarket Allocation*, *id.* at 47, 59-60.

21. See Anderson & Crocker, *The Economics of Air Pollution: A Literature Assessment*, in *Air Pollution and the Social Sciences* 133, 161 n. 6 (P. Downing ed. 1971). Information cost "means the cost of obtaining the information about the attributes of the goods in question and the state of nature necessary to enter into bargaining or market transactions." Contracting cost means "the cost of finding the market or someone with whom to bargain as well as the costs associated with the actual transaction. Included would be the costs of forming and maintaining coalitions with fellow buyers or sellers." Policing costs are "simply the costs of insuring that the terms of a transaction, once made, are adhered to." *Id.*

22. See Arrow, *supra* note 20, at 60.

one of his papers, for example, Demsetz discusses the costs of transacting in the market place and then states:

Nonmarket allocation devices will, of course, have costs of their own. If taxes are used, there is the cost of collecting and enforcing tax payments. Governmental costs of searching for and administering potentially beneficial resource reallocations must be incurred.²³

As this statement implies, the primary costs of government intervention²⁴ are information and policing costs.²⁵ But here we expand the meaning of information cost to make it adaptable to nonmarket (governmental) modes of allocation: information cost is the cost of gaining and communicating the knowledge necessary to achieve a more efficient allocation of a given resource—or, in Demsetz's terms, the "costs of searching for . . . potentially beneficial resource reallocations. . . ." Policing cost is the cost of enforcing application of the new knowledge—of "administering potentially beneficial resource reallocations."

We can now state our thesis and give some evidence for it.

THE THESIS

We argue that as a governmentally allocated resource increases in relative value, government intervention tends to evolve toward forms that economize on information costs associated with a more efficient allocation of the resource. Our point can be clarified through an example.

Governmental intervention at both the state and federal levels has existed for some time with respect to pollution of the air and water resources. The form of intervention has been distinctly and almost uniformly that of regulation—the setting of mandatory standards accompanied by penalties for their violation. Regulation is at the opposite pole from a private property-private market system; it can be seen as a process of the state freely granting a right initially owned by it and then *prohibiting* its subsequent transfer to any other individual. But regulation is not the only form government intervention might take in cases of private property-private market failure. Essentially two other forms exist which occupy a middle ground

23. Demsetz, *supra* note 20, at 169.

24. We put aside here what we call the secondary costs of government intervention, such as costs brought about by government-produced misallocations of resources. A market too can be characterized by these secondary costs, in addition to the primary costs of transactions.

25. This is not to suggest that there is no "contracting" or negotiating within the mode of government intervention. Bargains occur in the course of passing a law, and in its application—or "negotiated" enforcement. On the former, see G. Tullock, *Private Wants, Public Means* 69-70 (1970); on the latter, see G. Hagevik, *Decision-Making in Air Pollution Control* (1970) (especially Pts. I and III).

between government fiat and a self-regulating market. One, subsidization, has seen some use in this country. Subsidies implicitly recognize a property right in polluters, for they consist of direct or indirect payments to polluters to reduce their emissions. The other form, pricing, does not imply property rights in polluters, for under a pricing system payments are exacted from polluters for each unit of pollution they produce. As a means to control pollution, pricing has been almost entirely ignored in this country until very recently.²⁶

The best-known method of pricing pollution, the emissions or effluent tax, exacts a predetermined payment from polluters for each unit of pollution they produce. This pricing method differs from a pure market in private property rights for the simple reason that the magnitude of the price of pollution is not determined by the forces of supply and demand. Some other method of choosing an appropriate price must be found—a point to which we will return.²⁷

We speculate later as to why the regulatory form of intervention has been predominant. Our purpose here is to make some brief observations about: (1) the allocative inefficiencies characteristic of the regulatory method; (2) the high information costs associated with any attempt to reduce those allocative inefficiencies; (3) the manner in which a pricing system can economize on information costs while achieving greater allocative efficiency than the regulatory alternative.²⁸ We then turn to evidence of increasing value of the air and water resources, and associate this evidence with trends toward utilization of pricing systems to control pollution problems.

(1) The regulatory approach to pollution problems characteristically proceeds by establishing an ambient standard of quality and a set of emission limitations designed to meet that standard. The important point to note here is that the emission limitations are *uniform* for each pollutant source or class of sources. The uniformity is inherently inefficient: different pollution sources have different marginal costs of control; some can control more cheaply than others, and there would be net savings to society if some plants were required to reduce

26. See, e.g., J. Krier, *Environmental Law and Policy* 300-301 (1971).

27. Pricing systems which approximate more closely a pure market in private property rights have also been proposed. In one such system a fixed quantity of licenses, conferring a private right to pollute, would be issued by the government and sold to polluters (or distributed arbitrarily among polluters, who then would be able to resell). In such a system the price is determined by market forces, but the supply is fixed by the government. See J. H. Dales, *Pollution, Property, and Prices* 93-100 (1968); Montgomery, *Markets in Licenses and Efficient Pollution Control Programs*, 5 *J. Econ. Theory* 395 (1972).

28. We do not discuss subsidization in this paper. In practice, if not in principle, subsidies are as inefficient as regulatory measures. See, e.g., Krier, *The Pollution Problem and Legal Institutions: A Conceptual Overview*, 18 *U.C.L.A. Rev.* 429, 468-70 (1971). Nor do we discuss policing costs. Our assumption, which we believe to be reasonable, is that policing costs need not vary significantly among methods of intervention.

emissions to a greater and others to a lesser degree.²⁹ The inefficiency may, however, be counterbalanced by the savings which result from the minimal need for information in systems of uniform standards.

(2) One could avoid the allocative inefficiency of uniform standards by establishing emission limitations varying with the marginal control costs of each source. But "to do this would require a fantastic amount of information that in practice would be very difficult and expensive to get."³⁰ Much time and effort would be required of the regulator to gather the data needed to formulate and implement variable standards, if the data could be gotten at all! There is little reason to suppose that factory managers have much explicit information about marginal control costs. Moreover, there would be a tremendous incentive to overstate those costs, for the higher the costs, the less stringent the required degree of control. In short, *the information costs associated with variable standards would be enormous*. Gains in allocative efficiency would be eaten up by the costs incurred in achieving them. The information costs are an expense of administering the program, and the regulatory method thus reflects a tension between allocative and administrative efficiency.

(3) Pricing systems can achieve varying emission outputs while avoiding the high information costs associated with varying emission regulations. A properly set, uniform emission fee would achieve the collectively established ambient standards at least cost to society. The reasons for this are relatively simple. As we said above, different polluters have different marginal costs of control. Assuming (more than reasonably, we believe) that each polluter wishes to minimize its costs, each will blend abatement and emission fee expenses in the way it finds cheapest for it. A fee that results in the desired ambient quality has achieved that level of quality at least cost to society.³¹

29. See Dales, *supra* note 27, at 85.

30. Dales, *supra* note 27, at 85. Other difficulties might also arise. For example, would it be equitable to require the most efficient pollution controller to spend the most on abatement measures?

31. See Baumol, *On Taxation and the Control of Externalities*, 62 *Am. Econ. Rev.* 307 (1972); Ruff, *The Economic Common Sense of Pollution*, The Pub. Interest, Spring (1970) at 69. As Baumol puts it, with an emission fee or some other variant of a pricing system, "it can be shown that, unlike any system of direct controls [*i.e.*, regulation], it promises, at least in principle, to achieve decreases in pollution or other types of damage to the environment at minimum cost to society." Baumol, *supra*, at 319. In a footnote to this observation Baumol states: "This proposition has been suggested elsewhere . . . and will be fairly obvious to anyone familiar with the analysis of the allocative effects of price changes and their efficiency properties. Specifically, suppose it is desired to reduce the pollution content of a river by *k* percent. Obviously a *k* percent reduction in the number of gallons emitted by each of the plants discharging wastes into the river will generally not be the desired solution. The theorem in question then asserts the following:

Given the production of any desired vector of final outputs by the plants along the river, a tax per gallon of effluent sufficient to reduce the overall pollution content

While there are substantial information costs associated with choosing and applying the proper emissions tax,³² they are less than the costs of devising and employing a system of varying emission regulations *equal to the pricing program in allocative efficiency*. Even if the costs of obtaining information from polluters are the same under both approaches, total information cost of the pricing system will be lower. Information must under either flow in two directions, not only from polluter to government but subsequently from government to polluter as well. But with varying regulations, a different piece of information must be determined and communicated to each polluter. With a uniform (and efficient) emissions tax, on the other hand, one piece of information does for all.

SOME EVIDENCE

We have suggested that as demand for a governmentally allocated resource increases—that's to say, as the resource becomes more scarce—government intervention tends to evolve toward forms that economize on information costs associated with a more efficient allocation of the resource—specifically in our case, to pricing systems. Our argument thus far is much like Demsetz's. As a resource becomes more scarce, it usually becomes more valuable, and efficient allocation of the resource becomes more worthwhile. It is only worthwhile, however, if it can be achieved without corresponding increases in the costs of information. And we have tried to show that a pricing system economizes on information costs while at the same time “[i]t automatically achieves an efficient allocation of the required reduction in emissions among the offending firms. . . .”³³

of the river to the desired level will automatically achieve this decrease at minimum total cost to all plants combined.

The proof of the theorem is a straightforward exercise in constrained maximization. . . . It works, of course, because the lower the marginal cost of reduction in pollution outflows of a particular plant, the larger the reductions it will pay it to undertake to avoid the corresponding tax payment.

“What is surprising about the proposition, if anything, is that, unlike many results in welfare analysis, it does not require the firms along the river, or any other firms, to be perfect competitors, nor does it have to assume that they maximize profits rather than share of market or growth or some other target variable. All it requires is that the firms wish to produce whatever output they select at minimum cost to themselves.” *Id.* at 319, n. 15.

32. See, e.g., Davis & Kamien, *Externalities, Information and Alternative Collective Action*, in Joint Economic Committee, 91st Cong., 1st Sess., *The Analysis and Evaluation of Public Expenditures: The PPB System 67, 83* (Joint Comm. Print 1969) (“immense informational requirements necessary for the implementation of . . . [an emissions tax] scheme. A little reflection will make it apparent that the government agency imposing a tax . . . will need to know the production technologies of all the entities involved.”).

33. Baumol, *supra* note 31, at 308. Notice we say *only* that a pricing system efficiently allocates the resource *within the ambient standard* among the pollution sources, *not* that it produces an ambient standard that is itself efficient or optimal. At present, no operational technique exists to determine optimal allocations of nonexclusive resources like the waste

We find evidence for our thesis in the increasing demands placed upon such natural resources as air and water and in the almost revolutionary recent interest in "the pricing of pollution" in the United States.

On the first point, one can encounter quibbles. But even those who imply that in absolute terms overall environmental quality might be improving concede that the supply of this luxury good "has fallen far short of the rising effective demand . . . , and the supply of certain critical goods, such as pure air and water, has virtually vanished."³⁴ It is true that in some areas recent improvements in air and water quality have been realized, thanks largely to the feverish interest in the environment that began in the mid-sixties. But the very feature that many believe spawned that interest—rapid growth in population and consumption—promises a relative and probably too an absolute deterioration of the quality of air and water resources by the mid-1980s at latest.³⁵ For example, recent work suggests that air quality in the Los Angeles Basin will gradually improve until about that time, and then—because of increases in population and consumption (particularly of automobile driving)—once again begin to deteriorate. And this with one-hundred percent application of the best that control technology presently has to offer.³⁶

Increasing concern about proper use of air, water and other natural resources has been accompanied by increasing interest in emission fees and other pricing mechanisms; the correlation is underscored by the fact that writers commenting on the first phenomenon also note the second in the same breath.³⁷ Some notion of just how revolutionary the change in attitude has been can be gathered from events of the last few years. A 1969 news article in the *New York Times* told of "objections" to Senator Proxmire's proposal for an effluent tax to control water pollution. The story listed conservationists' complaints about the measure and implied that the tax would be nothing more

disposal capacities of air and water. See Baumol, *supra* note 31, at 316, 318-20. With pricing, as with regulation, the ambient standard is set legislatively—Baumol says "More or less arbitrarily," Baumol, *supra* note 31, at 307, we say hopefully with a legislative eye open to the costs of achieving a certain standard and the benefits realized thereby.

34. See, e.g., Jacoby, *The Environmental Crisis*, The Center Magazine, Nov.-Dec. 1970, at 37-38.

35. See, e.g., *id.* at 39 (exponential decline in amenities); Kneese & d'Arge, *Pervasive External Costs and the Response of Society*, in Joint Economic Committee, 91st Cong., 1st Sess., *The Analysis and Evaluation of Public Expenditures: The PPB System* 87, 102 (Joint Comm. Print 1969) (rapid nonlinear increase in external costs with economic and population growth); Dale, *The Economics of Pollution*, N.Y. Times, Apr. 19, 1970, § 6, pt. I (Magazine), at 27, 28, 40-41 (pollution and the law of compound interest).

36. Based on work at the Environmental Quality Laboratory, California Institute of Technology. See, L. Lees, *et al.*, *Smog: A Report to the People*, 122-26, 144 (1972).

37. See, e.g., Dale, *supra* note 35, at 44, 47 (emission fees being "increasingly explored").

than a license to pollute.³⁸ Today the scene is radically different: Federal and state legislation—some enacted, some proposed—provides for, or at least requires consideration of, emission taxes as a control measure;³⁹ and “several politically important conservation groups, which previously had opposed the charges approach, have stepped solidly behind the effort to levy pollution charges or taxes.”⁴⁰ Indeed, some conservationists have joined together to form the Coalition to Tax Pollution.⁴¹ We do not mean to suggest that the new interest in pricing systems reflects an entirely conscious effort to exploit their efficiencies (although to the extent that economists are involved, some conscious effort surely exists), any more than Demsetz argues that the evolution of private property represents a conscious endeavor to adjust to new resource problems. Demsetz views the pattern of adjustment as made up of “hit-and-miss” experiments, and simply suggests that “in a society that weights the achievement of efficiency heavily,” those experiments that prove to have relative advantages in these terms will survive.⁴² We say little beyond this. Deterioration of natural resources has produced dissatisfaction with the present modes of government intervention,⁴³ and the current attention being given to pricing is likely little more than a “hit-and-miss” (but fortunate) experiment. A test of our thesis, and perhaps of Demsetz’s, will be the survival of pricing systems. A further test will be whether other techniques of pricing, which appear to bring with them even lower information costs than emissions taxes, will come to be in vogue.⁴⁴

38. Hill, *Objections to a Tax on Pollution*, N.Y. Times, Dec. 10, 1969, at 38.

39. At the state level, Vermont has enacted a program to charge waste dischargers an effluent fee until they come into compliance with standards set by the state’s water quality legislation. Vt. Stat. Ann. tit. 10, §912a (1970). Maine, Wisconsin, and Illinois, among other states, are considering “more nearly pure” effluent charge strategies for water quality control. See *Resources for the Future*, *Resources*, 9, 10, Jan. 1972 [hereinafter cited as *Resources*]. On the federal level, President Nixon and the Council on Environmental Quality have supported emission charges, and legislation calling for effluent charges to control water quality has been introduced. *Id.* Regulations promulgated under the Clean Air Amendments of 1970, 42 U.S.C. §§1857-58(a) (1970), include emission taxes among the measures which states may employ as part of an air quality control strategy. See, e.g., E.P.A. Reg. §§ 420.1(n)(2), 420.6(a)(2), 36 Fed. Reg. 15487-88 (1971). See also 36 Fed. Reg. 15486 (1971).

40. *Resources*, *supra* note 39, at 10.

41. *Resources*, *supra* note 39, at 10. The *Resources* article contains a good summary of the recent conservationist interest in pricing systems.

42. Demsetz, *supra* note 1, at 350.

43. E.g., *Resources*, *supra* note 39, at 10. (“The change in position results mostly from their [conservationists’] conclusion that the conventional enforcement-subsidy strategy is not working.”)

44. For example, a system in which marketable rights to pollute are issued in fixed quantity by the government, see Montgomery, note 27 *supra*, can achieve the same outcome as the emissions tax but with even lower information costs, since in such a system it is unnecessary that the government estimate how emissions will change when a tax is levied. That is to say, it is easier to determine the number of rights to achieve a certain level of quality than it is to determine the price which will do so. See *supra* note 27.

III

Earlier in this paper we outlined Demsetz's thesis and discussed why it is that the institution of private property, with its apparent advantages, might not always exist in a society from the outset. We propose to close by examining our own thesis in the same way. If pricing systems can achieve efficient allocations while at the same time economizing on the costs of information relative to other equally efficient systems, why have they not been the primary means of legislative intervention in the cases we have been discussing?

By considering the information costs associated with a pricing system, our thesis can be supported in the same overhead-cost terms by which we supported Demsetz's. The government initially intervened to allocate the resource because of market breakdowns. While the resource was sufficiently valuable to justify intervention, its value was small enough that the gains from an efficient allocation by the government were not worth the information costs associated with achieving them. So uniform regulations, which, thanks to their crudeness, entail little information cost, have been used. Over time, however, increasing value of the resource makes any efficiency gains more worthwhile, while associated information costs remain more or less fixed. When value has increased sufficiently, one would (according to our argument) expect to see a shift to pricing systems to realize those efficiency gains, because the higher information costs associated with such systems are now worthwhile and also lower than the information costs of a regulatory system *equal in allocative efficiency*.

It thus far appears that our analysis, taken together with Demsetz's, would lead to a Panglossian conclusion. Demsetz suggests that within the realm of the private market, institutions will naturally develop such that private bargains will work to allocate resources as efficiently as possible, since all bargains in which gains from trade exceed the costs of realizing them will take place. Presumably, however, Demsetz would recognize that in at least some cases government intervention might nevertheless be able to improve upon the best possible market allocations. But now we have suggested that more efficient institutions of government intervention will tend to evolve whenever the costs of setting up and employing the new institutions are less than the gains thereby realized. Surely this is the best of all possible worlds, for no market or governmental institution which does not develop could possibly improve upon those which do. In short, whatever happens is fine, at least in terms of efficiency.

This conclusion, however, can be avoided, for though Demsetz's analysis suggests an important factor in the development of institu-

tions, other influences are at work as well. Let us give some examples in the case of pricing systems.

Recall that the initial legislative attacks on pollution in the United States came as the result of dramatic pollution episodes. These produced direct and immediate government reaction of the most straightforward nature. "Wrongdoers" were identified and criminal penalties established—all to placate public concern. The response typified what Willard Hurst has called our "bastard pragmatism," or hostility to theory:

This was dramatic action, which conveyed the appearance of decisive resolution of problems. These features made it a type of legal action which too well fitted our native impatience and the strain of bastard pragmatism which preferred the more obvious, close-to-hand, shortly-accomplished action as compared with multi-factored, long-term planning and organization.⁴⁵

Another facet of this pragmatism was a "preoccupation with operating technique (the 'practical') and our relative impatience with understanding (the 'theoretical'). . . ."⁴⁶ Pricing systems are largely theoretical—nonmechanical innovations as opposed to the mechanical-technological innovations so tied up with the regulatory approach to pollution over the past fifty years. The diffusion of nonmechanical innovations in advanced societies such as our own has typically been relatively slow.⁴⁷

Narrow interests can also retard the development of socially efficient institutions, or spur the development of inefficient ones. While pricing promises to achieve a given ambient level at least cost to society, it is not clear that it would do so at least cost to the regulated class. Each pollution source will act to minimize its total costs *under the constraint of the tax*, but this sum may often be larger than the total expenditure by a source under an existing system of uniform regulations.⁴⁸ The fact that a pricing system yields a net

45. J. Hurst, *Law and Social Process in United States History* 293 (1960).

46. *Id.* at 31.

47. See, e.g., E. Rogers, *Diffusion of Innovations* 129 (1966). *But see id.* at 133.

48. Since this is a somewhat contentious point, the mathematically minded reader should consider the following example. Assume two polluters with the following equations stating the cost of emitting pollution at various rates e_i :

$$C_1 = 50 - 10 e_1 + \frac{1}{2} e_1^2$$

$$C_2 = 50 - 10 e_2 + e_2^2 .$$

Assume that the ambient quality standard is achieved whenever $e_1 + e_2 = 9$, and that initially there is a uniform regulation such that $e_1 = e_2 = 4.5$. Under this regulation costs to firm 1 are 15.1 and costs for firm 2 are 25.2. Total cost is 40.3. Now suppose that a uniform emissions tax of 4

savings for society does *not* mean these savings will be distributed to the pollution sources. To the extent that pollution sources see pricing systems as disadvantageous, one would expect industry opposition to them—and with some success, since the legislative battle would be between a relatively concentrated group of well-organized polluters and a diffused public.

Finally, we must point out the weakness in our implicit assumption that government works to maximize efficiency, even if free of pressures from concentrated interest groups. Unlike a private entrepreneur,⁴⁹ government officials are by no means always in a position to capture the benefits of efficiency gains that might be achieved by institutional reform; accordingly, incentives for reform will not always be strong. But the point should not be carried too far. In principle, it is possible to distribute those benefits in such a manner that no one is made worse off, and many are made better off, than under the previous regime. In the long run, one could expect that in any system where government is responsive to the wishes of a majority of its constituents, a change which benefits that majority without harming any significant group would be adopted.

Considerations like these suggest that institutional form will respond to other than simply the forces of efficiency, and worthwhile changes will on occasion not occur at all; sometimes they will be untimely; at other times they will be in answer to broad demands for fairness and justice rather than to concerns with efficiency. But this is not to say that forces of efficiency will not also be felt. And the fact is that we can observe “changes in technology and relative prices” and

per unit of emission is imposed. Each firm will equate its marginal control cost to the tax. Since we have

$$MC_1 = -10 + e_1$$

and

$$MC_2 = -10 + 2e_2,$$

it follows that in response to the emissions tax, $e_1 = 6$ and $e_2 = 3$ will be chosen, producing the desired air quality. But what is the cost? Total control cost is $8 + 29 = 37$, which is less than total control cost under uniform regulation and therefore better from society's point of view. But each firm is now paying a tax on the pollution which remains, which amounts to $4 \times 6 + 4 \times 3$ or 36, giving a total cost to polluters of 73. The emissions tax involves a transfer from polluters to society as a whole which, unless refunded to polluters in some way, can leave them worse off than under inefficient regulation. See Dolbear, *On the Theory of Optimum Externality*, 57 *Am. Econ. Rev.* 90 (1937); Mishan, *On the Theory of Optimum Externality: Comment*, 58 *Am. Econ. Rev.* 523 (1968).

49. See, e.g., Coase, *The Nature of the Firm*, 4 *Economica* 386 (1937), in *Readings in Price Theory* 331 (G. Stigler & K. Boulding eds. 1964).

"the emergence of new . . . state-owned property rights . . . in response."⁵⁰

⁵⁰. Demsetz, *supra* note 1, at 350. See generally, L. Davis & D. North, *Institutional Change and American Economic Growth* (1971).