Research Department
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Pollution Pricing

The 1970s brought environmental issues to the forefront of public consciousness. The Clear Air and Water Acts and the National Environmental Policy Act, as well as more specialized legislation, were passed during the decade in an unprecedented effort to clean up and protect the environment. However, recent polls indicate environmental quality remains a concern of Americans despite the major efforts to regulate pollution that followed this legislation. Economists meanwhile have been warning that the current structure of environmental laws and policies are unlikely to achieve satisfactory results. In this *Letter*, we explore the economists' preferred policy of pricing pollution.

Economics and pollution

According to economic theory, excessive pollution results from the failure of the marketplace to place a correct price on certain inherently valuable resources—most notably clean air and clean water. The marketplace has no difficulty properly pricing other important resources, such as iron ore and labor, because the ownership of these resources is unambiguous. In the case of air and many sources of water, however, ownership is unassigned and, therefore, the resources cannot be priced and sold. The failure to define ownership clearly is usually due to the "joint use" nature of many natural resources. The air over a city, for example, is jointly used by all the inhabitants, but owned by no one.

Without a market mechanism to allocate these resources, they are *treated* as costless inputs to production processes despite the fact that their loss to an alternative use (for breathing or drinking and other production processes) has tremendous value. Socially unacceptable levels of pollution occur, therefore, when jointly used clean water and clean air resources are "overconsumed" by certain users. Polluters impose on other users of the same resource costs that are greater than the value of the resource to them.

The Coase theorem

In concept, the simplest remedy to this problem, of course, would be to extend ownership rights to clean air and clean water so that the price mechanism could be exploited. At first glance, such a suggestion seems impractical because of the problem of determining who should own the resource. In fact, as was argued by R.H. Coase in 1960, the efficient social use of these resources in competitive markets does not depend on who receives the rights to them. The rights could even be assigned to the polluter.

For example, if the ownership rights to a polluted river were assigned to its polluter, the users of the river who are bearing the costs of the pollution would have an incentive to bribe the polluter to reduce or cease his pollution. A profit-maximizing polluter would have an incentive to reduce his pollution as long as the value of the water to other users—as reflected in the bribe—is greater than its value to his use or greater than the cost to him of installing equipment to abate the pollution. (In the extreme, the polluter may be bribed to simply cease operations completely.)

Surprisingly, the result is the same if the pollution rights were assigned to the non-polluting users of the river. The polluter would have to bribe these other users to pollute. Again, the maximum he would pay would be the value of the water to him in his production process or the cost of cleaning it up after use. The production decisions of the polluting industry and the cleanliness of the river water would be the same as in the case where ownership was assigned to the polluter. This notion has come to be known as the Coase Theorem.

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Creating markets for clean air and clean water is appealing because the forces of the marketplace, which function so well in other contexts, can be relied upon to allocate and economize without further governmental oversight. But there are obvious practical difficulties with the suggestion, such as the wealth distribution effects of the assignment of ownership rights and the logistical difficulties of bringing the affected parties together in a forum in which a price could be negotiated.

As a practical solution, some economists suggest that ownership rights be assigned to the government, and that the government establish standard prices (differentiated by location, type of pollution, and other factors) that it will charge for the right to pollute. Ideally, these "pollution prices" would reflect the marginal cost to society of an additional unit of a particular pollutant. Economists have derived such estimates for certain pollutants. The work by Lester Lave, for example, suggests that the social cost of an additional unit of sulphur dioxide (a common industrial air pollutant) in a typical U.S. location in 1979 was $304 million for a one-percent decrease in atmospheric sulfates.

In general, such pseudo-market pricing exercises are complicated by the difficulty in devising unambiguous values for such pollution costs as illness and loss of life. As a practical matter, reasonable estimates of pollution prices may need to be adjusted later to achieve the socially desirable level of environmental quality.

Pricing vs. regulation

Even in its least precise form, however, economists argue that the pricing of pollution would be vastly more efficient than the current system of regulations and standards. Under the current system, all polluters must conform to a single standard or face a penalty or other administrative action. A major inefficiency of this approach arises because different polluters face different pollution abatement costs.

A pollution pricing system could decrease the total cost of achieving a given level of environmental quality because those able to clean up least expensively would be induced to reduce emissions drastically and, in the process, compensate those for whom it would be prohibitively expensive to clean up. Charging for reducing emissions achieves this effect automatically; those with inexpensive clean-up alternatives will find it more profitable to avoid the charge by reducing their emissions.

Pollution bubbles

There are currently no operational examples of a pure effluent charge system or Coase-type ownership rights allocation. However, a number of attempts to introduce a market mechanism into emission decisions suggests how powerful economic incentives might be in changing polluting behavior.

Borrowing from the Coase idea of ownership of clean air, for example, the Environmental Protection Agency in the 1970s authorized the creation of "bubbles" —conceptual domes, over geographic areas —under which firms are given limited rights to clean air. A regulatory standard is maintained under each bubble. Each firm is given the right to pollute up to the regulatory standard and earns emissions credits (for sale or future use) if it pollutes less than the standard. Moreover, these credits can be traded—firms desiring to increase their emissions under the bubble can buy credits from firms that are "under-polluting."

The bubble concept mixes regulatory standards with market incentives to encourage more efficient achievement of the regulatory standard than would be possible with regulation alone. Firms for which it is very expensive to abate will buy emissions credits, and firms that can abate cheaply will have an incentive to do so and can profit from the sale of the emissions credits.

The long-run efficacy of such a market-oriented approach is illustrated by an actual bubble and emissions bank instituted in Louisville, Kentucky, in 1979. After institution of the bubble, suspended particles, sulphur dioxide, volatile organic compounds, and carbon monoxide emissions from point sources declined even though the pollution standard remained the same. An illustration of the cost-saving effects of the Louisville bubble is provided by General Electric, which faced a decision of whether to spend $1.5 million to install pollution control equipment to retrofit an old process line or to shut it down. GE opted instead to lease emissions credits banked by International Harvester, which found compliance relatively easy. The arrangement cost GE $60,000 instead of the $1.5 million it would have cost to retrofit the old process line.

Water effluent charges

Another illustration of the power of market incentives to induce a change in polluting behavior lies in the charges levied against firms to dump into municipal water systems. Levying these charges makes it necessary for firms to consider the cost of polluting as another cost in their production process. Evidence from a study of five such systems by Hudson, Lake and Grossman confirms that effluent pricing stimulated changes in firm behavior that ranged from slight modifications of production methods to actual innovations in the production process.

The industrial city of South San Francisco provides a specific example. The city levies a surcharge for toxic waste disposal into the municipal waste system based on concentration and weight of suspended solids above a threshold level. In 1974, South San Francisco made the application of the charge much more stringent. Although hardly a controlled experiment, the results suggested the responsiveness of pollution to pricing. In the year that the changes were instituted, there was a dramatic drop in pollutants entering the municipal water system. Biochemical oxygen demand dropped from 4.21 to 3.34 million lbs/year, chemical oxygen demand dropped from 8.31 to 7.54 million lbs/year and suspended solids dropped from 2.64 to 1.61 million lbs/year.

Solid waste pricing

Pollution pricing also has an application in solid waste management. In 1972, Oregon instituted a policy akin to pollution pricing to reduce roadside litter due to bottle disposal. Under the "bottle bill," the purchaser of a beverage pays a deposit that is refunded if the empty container is returned to the retailer. In effect, the law encourages disposal through the retailer; if bottles are thrown by the wayside or disposed of privately, the consumer loses the deposit.

The retailers and bottlers did not wish to become the avenue of disposal (or recycling) of bottles and the law has been controversial because of this aspect. Nonetheless, the small deposit charge radically reduced roadside litter. In the first year following implementation of the law, random roadside counts indicated a container litter level of only 10 to 20 percent of the year before. Although deposits on beverage containers remain a controversial method of "pricing" bottle litter, Oregon's experience provides further evidence that pricing is an effective way of influencing pollution behavior. Experiences in the five other states that implemented bottle bills (Vermont, Maine, Michigan, Iowa and Connecticut) confirm this.

Conclusion

Unfortunately, the attraction of pollution pricing to economists is not widely shared by policymakers. Explicit pricing of pollution brings its cost into the open, with pollution pricing bearing an uncomfortable resemblance to taxes. Nevertheless, using regulation instead of prices does not eliminate the cost of abatement. Indeed, economic logic suggests the overall costs of achieving a given level of environmental quality would be lower with pricing than with a standard regulatory approach.

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BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT

(Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount Outstanding 6/29/83	Change from 6/22/83	Change from year ago Dollar	Change from year ago Percent
Loans (gross, adjusted) and investments*	163,127	837	1,733	1.1
Loans (gross, adjusted) — total#	141,638	877	978	0.7
Commercial and industrial	44,338	159	79	0.2
Real estate	56,233	3	− 1,291	− 2.2
Loans to individuals	23,938	151	575	2.5
Securities loans	2,594	190	337	14.9
U.S. Treasury securities*	8,266	− 13	1,781	27.5
Other securities*	13,221	− 27	− 1,025	− 7.2
Demand deposits — total#	41,387	1,229	− 550	− 1.3
Demand deposits — adjusted	28,557	16	588	2.1
Savings deposits — total†	66,179	− 266	35,586	116.3
Time deposits — total#	65,724	518	− 30,158	− 31.5
Individuals, part. & corp.	59,699	538	− 26,693	− 30.9
(Large negotiable CD's)	18,363	− 323	− 16,687	− 47.6

Weekly Averages of Daily Figures	Week ended 6/29/83	Week ended 6/22/83	Comparable year-ago period
Member Bank Reserve Position			
Excess Reserves (+)/Deficiency (−)	111	87	80
Borrowings	812	573	254
Net free reserves (+)/Net borrowed(−)	− 701	− 487	− 174

* Excludes trading account securities.
\# Includes items not shown separately.
† Includes Money Market Deposit Accounts, Super-NOW accounts, and NOW accounts.

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