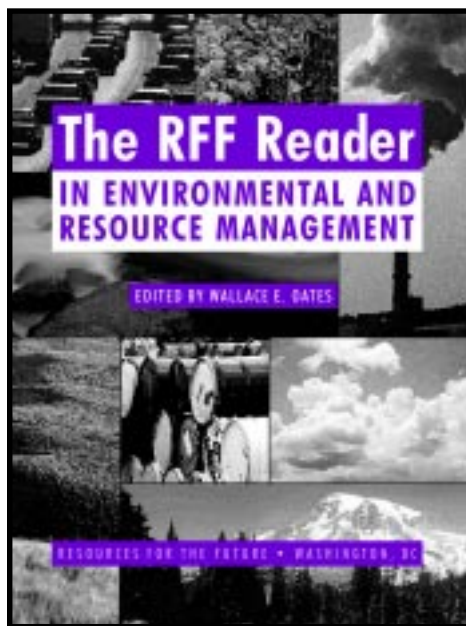


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An Economic Perspective on Environmental and Resource Management

An Introduction

Wallace E. Oates

The central concern of economics is the allocation of scarce resources. The basic problem is one of using our limited means to provide an array of goods and services that satisfies peoples' preferences in an efficient and equitable manner. It doesn't require much reflection to realize that our environmental resources are scarce. Clean air and water, the diversity of species, and perhaps even a stable global climate are clearly not available in unlimited supply, irrespective of human activities. Perhaps economics has something useful to say about the management of our environment.

This is indeed the case. I shall suggest here that economics has three basic and important messages for environmental protection. First, economic analysis makes a compelling case for the proposition that an unfettered market system will generate excessive pollution. A market system, in a sense, "overuses" many of the services provided by the environment, resulting in excessive environmental degradation. Thus, economics makes a basic and persuasive case for the need for public intervention in the form of environmental regulation.

Second, economics provides some guidance for the setting of standards for environmental quality. It provides one approach to answering the question: How clean should the environment be? In fact, this approach is simply a straightforward application of the general economic principle that any activity should be extended to the point where the marginal benefits equal the marginal costs.

And third, once we have determined the standards or targets for environmental quality (and even if—incidentally—this

determination is made irrespective of marginal analysis), economics has some important things to say about the design of the policy instruments to achieve these standards. In particular, economic analysis suggests how we can structure policy measures so as to realize our environmental goals in the most effective and least-cost ways.

In this introduction, I want to explain and explore these three ideas, for nearly all the papers in this volume draw on this conceptual framework in one way or another. In fact, it is the purpose of this volume to show how basic economic analysis can help us to understand the causes of environmental degradation and to design policies to protect and improve the environment.

Free Markets and the Environment

Economists have a deep appreciation of the market system. Guiding the individualized choices of both consumers and producers, a system of markets has the capacity to channel our limited resources into their most highly valued uses. In pursuing their own gain, individuals (as Adam Smith put it) “are led by an invisible hand” to promote the social good.

Markets generate and make use of a set of prices that serve as signals to indicate the value (or cost) of resources to potential users. Any activity that imposes a cost on society by using up some of its scarce resources must come with a price, where that price equals the social cost. For most goods and services (“private goods” as economists call them), the market forces of supply and demand generate a market price that directs the use of resources into their most highly valued employment.

There are, however, circumstances where a market price may not emerge to guide individual decisions. This is often the case for various forms of environmentally damaging activities. In the first half of this century at Cambridge University, A.C. Pigou set forth the basic economic perspective on unpriced goods (encompassing pollution) in his famous book, *The Economics of Welfare*. Since Pigou, many later economists have developed Pigou’s

insights with greater care and rigor. But the basic idea is straightforward and compelling: the absence of an appropriate price for certain scarce resources (such as clean air and water) leads to their excessive use and results in what is called “market failure.”

The source of this failure is what economists term an *externality*. A good example is the classic case of the producer whose factory spreads smoke over an adjacent neighborhood. The producer imposes a real cost in the form of dirty air, but this cost is “external” to the firm. The producer does not bear the cost of the pollution it creates as it does for the labor, capital, and raw materials that it employs. The price of labor and such materials induces the firm to economize on their use, but there is no such incentive to control smoke emissions and thereby conserve clean air. The point is simply that whenever a scarce resource comes free of charge (as is typically the case with our limited stocks of clean air and water), it is virtually certain to be used to excess.

Many of our environmental resources are unprotected by the appropriate prices that would constrain their use. From this perspective, it is hardly surprising to find that the environment is overused and abused. A market system simply doesn’t allocate the use of these resources properly. In sum, economics makes a clear and powerful argument for public intervention to correct market failure with respect to many kinds of environmental resources. Markets may work well in guiding the production of private goods, but they cannot be relied upon to provide the proper levels of “social goods” (like environmental services).*

But if we can’t rely on markets to “manage” our environmental resources, what principles should we employ to regulate their use? To this I turn next.

*Two qualifications are worthy of note here. First, there are some cases where voluntary negotiations among a small group of affected parties can effectively resolve an externality. Such cases are the subject of the famous paper by Ronald Coase, “The Problem of Social Cost,” *Journal of Law and Economics* (October 1960), pp. 1–44. Although the Coasian treatment has gotten considerable attention

The Setting of Standards for Environmental Quality

There is a basic economic principle that indicates the efficient level of any economic activity: extend that activity to the level at which the benefits from an additional "unit" of the activity equal the costs. Economists sometimes refer to these extra units as *incremental* or *marginal*. Thus, the condition for the economically correct level of any activity can be stated simply as the equality of marginal benefits with marginal cost.

The intuition here is straightforward. So long as higher levels of a particular service yield additional (marginal) benefits that exceed the additional (marginal) costs, we are obviously better off providing the additional units of the service than not providing them. But it clearly would not be a good idea to go past the point where marginal benefits equal marginal cost, for any units past this point would cost more than they are worth (i.e., marginal cost would exceed marginal benefits for such units).

The moral of this exercise for environmental policy, from the standpoint of economic efficiency at least, is that we should set standards for environmental quality such that the benefits at the margin from tightening the standards further exactly equal the marginal cost of pollution abatement (often called *marginal abatement cost*). Note that this implies that, in general, the economically efficient

in the literature, its applicability remains limited. The major environmental problems, including, for example, urban air pollution and water pollution, cannot be addressed through voluntary market mechanisms; they require public regulatory intervention. Second (and closely related), one might envision a system where markets were supplemented by a perfect tort system such that polluters were fully liable for the costs of any damages that they impose on society. Such liability could, in principle, provide the needed incentives for efficient levels of pollution abatement. Liability rules, in fact, have an important role to play in environmental protection, but the various imperfections inherent in any practicable legal system for environmental protection leave a large role for other forms of regulatory measures.

level of pollution is not zero. The cost of a perfectly pure environment would simply be too much to make it worthwhile. Economics is, in a sense, rather pragmatic when it comes to setting standards for things. It recognizes that tradeoffs and compromises are needed in order to make the best use of our limited resources.

While this guidance for the setting of environmental standards seems straightforward and sensible in principle, it is not so easy to implement. Consider, for example, the case of improved air quality. In considering the benefits from a proposal to introduce a more stringent standard for clean air, we must somehow quantify the improvement in well-being that comes with the associated reduced levels of illness and increased longevity. And this, along with any other benefits (such as reduced damage to materials and wildlife), must be compared to the additional abatement costs that the measure would entail. Such quantitative analyses are not easy, but neither are they impossible. Part II of this volume presents a series of short essays that take up some of the difficult problems that arise in *benefit-cost analysis*.

It is interesting in this regard that the early major pieces of environmental legislation in the United States almost completely ignored the economic approach to the setting of environmental standards. The Clean Air Act Amendments of 1970, which still embody the basic principles for air-quality management in the United States, literally directed the U.S. Environmental Protection Agency to set standards for air quality so stringent that *no one anywhere in the United States* would suffer any adverse health effects from air pollution. The courts have consistently held that, since this law was silent on the role of costs in setting air quality standards, they may *not* be taken into account. Two years later, the U.S. Congress declared in the Clean Water Act Amendments of 1972 that our goal was the complete elimination of "all discharges into the navigable waters by 1985."

Some of these extreme strictures have been relaxed in later legislation and their implementation modified by presidential executive orders. For

example, in Executive Order 12291, President Ronald Reagan required benefit-cost studies for all major new regulatory measures (as President Jimmy Carter had done under an earlier executive order). Such systematic studies of the benefits and costs of proposed programs continue in the executive branch. Moreover, there have been overtures in Congress to override provisions in laws that prohibit costs from being considered, but they have not come to a vote. In fact, we find ourselves currently subject to a somewhat puzzling and conflicting set of requirements. First, the legislation for some programs explicitly rejects benefit-cost studies while others require them. Second, and more maddeningly, even where a law prohibits regulators from considering costs, they must still conduct benefit-cost analyses for major rules!

This is not to say that the findings from a benefit-cost study should constitute the sole criterion for deciding whether or not to undertake a new environmental program. The uncertainties inherent in such studies and the importance of other objectives suggest that it would probably be unwise to institute a rigid rule requiring that any proposed program pass a benefit-cost test. At the same time, such analyses surely provide important information that should be an integral part of the decisionmaking process.

The Choice of Policy Instruments

Once we have set specific targets for environmental programs, there remains the critical and challenging task of designing a set of regulatory measures to attain the targets. Here again, economics provides some valuable insights. In particular, it is important that a regulatory regime achieve its targets effectively and in the least costly way. A good system of regulatory instruments will both minimize abatement costs in the short run and provide incentives over the longer term for polluters to discover and introduce yet better techniques for controlling polluting waste emissions.

It is here that a set of incentive-based policy instruments has real appeal. Our earlier discussion

suggested that excessive pollution results from the absence of an appropriate price to induce controls on waste emissions. The implication is that we can correct the resulting market failure through the introduction of the missing price. Economic analysis thus points directly to a concrete policy proposal: the introduction of a surrogate price in the form of a unit tax on polluting waste emissions. Such a tax can play the role of the missing price by providing the needed incentive to polluters to economize on their use of the environment (see chapter 10).

To take an example, suppose that we have set a standard for air quality that requires that sulfur emissions in a particular region be cut by 50 percent. One way of achieving this goal would be to introduce a tax per pound of sulfur emissions and simply raise the tax to a sufficiently high level to induce a 50-percent reduction in sulfur discharges. Moreover, such a regulatory strategy has some important properties. It is straightforward to show that such a system of effluent taxes can attain the target at the minimum total cost to society. In addition, it provides an incentive over the longer term to seek out new and cheaper ways to control waste emissions, for such R&D efforts by polluting firms can reduce their tax bills and increase their profits. Systems of environmental taxes (or "green taxes," as some call them) effectively redirect the powerful profit motive of the market to the protection of the environment.

The environmental-tax approach is not the only way to mobilize economic incentives on behalf of the environment. An interesting alternative, one actually being used in the United States to reduce sulfur emissions on a national scale, is a system of tradable emissions permits (see chapters 11 and 12). Under this approach, the environmental authority issues a limited number of permits, each of which allows a certain number of pounds of pollutants per year to be emitted into the environment. The total number of such permits is limited to ensure that the predetermined standard for environmental quality is attained. But these permits have the important property that they can be

traded: they are bought and sold in a market. Like the tax approach, such a system of tradable permits generates a price for polluting waste emissions that promotes a least-cost pattern of pollution-control efforts among sources and likewise provides the needed longer-run incentive for the search and introduction of improved control technologies. Some form of such a system, incidentally, is under serious consideration for use on a global scale to address the problem of global warming (see chapter 36).

As with the setting of environmental standards, the economic approach to the choice of policy instruments was essentially ignored in early environmental legislation. Instead, environmental authorities employed *command-and-control* (CAC) techniques for pollution control. Such CAC regimes often consisted of directives from the environmental authority to individual polluters that specified, at times in considerable detail, the precise forms of control measures that were to be adopted. Many studies have documented the unnecessarily high costs that these programs imposed on polluters and the economy. Not only this, but such measures typically provided little in the way of incentives for efforts to develop more effective control technologies.

Over time, we have come to appreciate the need for attaining our environmental objectives efficiently. For one thing, if we can keep control costs down, we will be in a position to do more in the way of environmental cleanup. There has, in consequence, been a growing interest in the use of incentive-based policy instruments, including not only taxes and systems of transferable permits, but such things as deposit-refund systems and various forms of legal liability that can, in certain instances, give polluters appropriate inducements for adopting control measures. Even where the CAC approach is still used, it is recognized that it is important not to specify control technologies, but to allow the source some flexibility in determining the most effective and least-cost way to comply with the limit that the regulatory authority imposes on its emissions.

Some Concluding Observations

In this introduction, I have focused attention on three basic ideas or lessons that economic analysis provides for environmental and resource management. Economics does, of course, have some interesting and important things to say on other matters. In Part 4 of this volume, for example, there are two essays addressing the issue of “environmental federalism,” the question of how to assign regulatory responsibility for environmental management among the different levels of government. These essays suggest some principles for making this assignment. Part 7 takes up the matter of “environmental justice.” Even here, where ethical considerations are so prominent, we find that an understanding of the economics of the problem is essential to an appreciation of the complexity of the policy issue.

More generally, the reader will find that the three ideas discussed in this essay manifest themselves in a wide variety of forms in the essays that make up this book. Even the issue of biodiversity in Part 6, again one with important ethical content, involves choices in the use of our scarce resources and thus inescapably has economic dimensions. Perhaps the most challenging of all—because of its enormous potential consequences, scientific uncertainties, and distant time horizon—is the issue of global climate change. Part 8 offers five essays on this critical issue. In view of its importance and inherent difficulty, researchers at RFF have, and are, devoting a major effort to the study of climate change and the range of available policy responses on both a national and global scale.

The final section of the volume presents a few papers on the problems of addressing pressing environmental issues in the developing countries and those nations making the transition from formerly communist regimes to more democratic and market-oriented systems. I want to acknowledge that this topic probably deserves more attention than it receives here. The course of environmental management in the developing world is clearly going to have a profound impact on the future of

the global environment. And here the issue of scarce resources presses especially hard on the capacity to introduce ameliorative measures for the environment. Sensible goals and efficient policy measures may be even more important in this setting than in the industrialized world.

During the past thirty years, the sense of the importance of the economic perspective on environmental and resource management has been steadily growing. I surely don't mean to suggest that this is the whole story; obviously it's not. But our experience with environmental legislation and policy has made it clear that ignoring the lessons of economics takes a heavy toll on our efforts to clean up the environment and to do so in a relatively

inexpensive way. This last point is becoming increasingly important as we try to raise environmental quality yet further. We have come a long way in cleaning up the air in our cities and our polluted lakes and rivers. This has been relatively easy in the sense that there existed straightforward measures for improving the environment when initiating cleanup programs. In the current lingo, we have picked the "low-hanging fruit," and we now must invest in more difficult and higher-cost methods for further environmental improvements. This means that there will be an even larger premium both on the selection of sensible environmental targets and the design of cost-effective regulatory measures to attain these targets.