How Do Economists Really Think About the Environment?

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Abstract

On a topic like the environment, communication among scholars from different disciplines in the natural and social sciences is both important and difficult, but such communication has been far from perfect. Economists themselves may have contributed to some rather fundamental misunderstandings about how economists think about the environment, perhaps through our enthusiasm for market solutions, perhaps by neglecting to make explicit all of the necessary qualifications, and perhaps simply by the use of jargon that has specific meaning only to other economists. In this brief essay, we seek to clarify some of these misunderstandings and thus to improve future interdisciplinary communication. We hope that natural scientists and other non-economists will take economic analysis and prescriptions more seriously when they see tempered enthusiasm, explicit qualifications, and better definitions. Our method is to posit a series of prevalent "myths" regarding how economists think about the natural environment. We then explain how each myth might have originated from statements by economists that were meant to summarize a more qualified analysis. In this way, we hope to explain how economists really do think about the natural environment.

Key Words: market failure, economic analysis, efficiency, equity

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HOW DO ECONOMISTS REALLY THINK ABOUT THE ENVIRONMENT?

Don Fullerton and Robert N. Stavins*

On a topic like the environment, communication among scholars from different disciplines in the natural and social sciences is both important and difficult. *Science* provides a key forum for such communication. Over the years, a number of articles have addressed the interaction between the environment and the economy, but this communication has been far from perfect. Economists themselves may have contributed to some rather fundamental misunderstandings about how economists think about the environment, perhaps through our enthusiasm for market solutions, perhaps by neglecting to make explicit all of the necessary qualifications, and perhaps simply by the use of jargon that has specific meaning only to other economists.

Therefore, in this brief essay, we hope to clarify some of these misunderstandings and thus to improve future interdisciplinary communication. We hope that natural scientists and other non-economists will take economic analysis and prescriptions more seriously when they see tempered enthusiasm, explicit qualifications, and better definitions. Our method is to posit a series of prevalent "myths" regarding how economists think about the natural environment. We then explain how each myth might have originated from statements by economists that were meant to summarize a more qualified analysis. In this way, we hope to explain how economists really do think about the natural environment.

Myth #1: "Economists believe that the market solves all problems."

As taught to generations of economics graduate students, the "first theorem of welfare economics" states that private markets are perfectly efficient on their own, with no interference from government, so long as certain conditions are met. This theorem, easily proven, is exceptionally powerful, because it means that no one needs to tell producers of goods and services what to sell to which consumers. Instead, self-interested producers and consumers meet in the market place, engage in trade, and thereby achieve the greatest good for the greatest number, as if "guided by an invisible hand" (Smith, 1776). This maximum general welfare is what economists mean by the "efficiency" of competitive markets. Economists in business schools are particularly fond of identifying markets where the

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necessary conditions are met, such as the stock market, where many buyers and many sellers operate with very good information and very low transactions costs to trade well-defined commodities with enforced rights of ownership. These economists regularly produce studies demonstrating the efficiency of such markets.

For other economists, especially those in public policy schools, the whole point of the first welfare theorem is very different. By clarifying the conditions under which markets *are* efficient, the theorem also identifies the conditions under which they are *not*. Private markets are perfectly efficient only if there are no public goods, no externalities, no monopoly buyers or sellers, no increasing returns to scale, no information problems, no transactions costs, no taxes, no common property, and no other "distortions" that come between the costs paid by buyers and the benefits received by sellers. Those conditions are obviously very restrictive, and they are usually *not* all satisfied simultaneously. When a market thus "fails," this same theorem offers us guidance on how to "round up the usual suspects." For any particular market, the interesting questions are whether the number of sellers is sufficiently small to warrant antitrust action, whether the returns to scale are great enough to justify tolerating a single producer in a regulated market, or whether the benefits from the good are "public" in a way that might justify outright government provision of it. A public good, like the light from a light house, is one that can benefit additional users at no cost to society, or that benefits those who "free ride" without paying for it.

Environmental economists are interested in pollution and other *externalities*, where some consequences of producing or consuming a good or service are external to the market, that is, not considered by producers or consumers. With a negative externality, such as environmental pollution, the total social cost of production may thus exceed the value to consumers. If the market is left to itself, too many pollution-generating products get produced.

Similarly, natural resource economists are particularly interested in common property, or open access resources, where anyone can extract or harvest the resource freely. In this case, no one recognizes the full cost of using the resource; extractors consider only their own direct and immediate costs, not the costs to others of increased scarcity (called "user cost" or "scarcity rent" by economists). The result, of course, is that the resource is depleted too quickly.

Thus, clearly, the market by itself does not solve all problems. Indeed, in the environmental domain, perfectly functioning markets are the exception, rather than the rule. Consequently, governments can take a variety of actions to try to correct these market failures. For example, the government may restrict pollutant emissions or limit access to open access resources. If undertaken wisely, government interventions can improve welfare, that is, lead to greater efficiency.

Myth #2: "When economists do see a market problem, they always recommend a market solution."

In a variety of contexts, economists tend to search for instruments of public policy that can fix one market essentially by introducing another, allowing each to operate efficiently on its own. If pollution imposes large external costs, for example, the government can establish a market for rights to emit a limited amount of that pollutant. Such a market for tradable emission permits can be expected to work fine, so long as there are many buyers and sellers, all are well informed, and the other conditions of the previously-stated theorem are met. In this case, the government's role is to enforce the rights and responsibilities of permit ownership, so that each ton of emissions is matched by the ownership of one emission permit. Then the market for the output will also work fine, since the producer has to pay a price for each permit that reflects the social cost of the associated pollution. Equivalently, producers can be required to pay a tax on their pollutant emissions that reflects the external social cost. Either way, the result--in theory--will be the efficient amount of pollution abatement, undertaken at minimum aggregate abatement cost.

This tradable-permit approach has much to recommend it, and can be just the right solution in some cases, but it is still a "market." Therefore the outcome will be efficient (by the same welfare theorem) only if certain conditions are met. Research indicates that these conditions are sometimes met, and sometimes not (Hahn and Hester, 1989). Again, round up the usual suspects. Could the sale of permits be monopolized by a small number of buyers or sellers? Do problems arise from inadequate information or significant transactions costs? Will the government find it too costly to measure emissions in order to enforce the rights of permit ownership? If the answer to any such question is "yes," then the permit market may work less than optimally. The environmental goal may still be met, but at more than minimum cost.

An example may help. To reduce acid rain in the United States, the Clean Air Act Amendments of 1990 require electricity generators to hold a permit for each ton of sulfur dioxide (SO_2) they emit. A robust market for the permits has emerged, in which well-defined prices are broadly known to many potential buyers and sellers. Okay so far. Through continuous emissions monitoring, the government is able to keep track of SO_2 emissions from each plant. Equally important is that penalties are significantly greater than incremental abatement costs and hence are sufficient to ensure compliance. Overall, this market works fairly well (Schmalensee *et al.*, 1998); acid rain deposition is being reduced by 50 percent, and in a cost-effective manner.

A permit market achieves this efficiency through trades, because any firm with a high cost of abatement can buy permits from another firm with a low cost of abatement, which thus reduces the total cost of abating pollution. These trades also switch the source of the pollution from one firm to another, which is unimportant when any emissions equally affect the whole trading area. This "perfect mixing" assumption is certainly valid for global problems like greenhouse gases or the effect of chlorofluorocarbons on the stratospheric ozone layer. It may also work reasonably well for a regional problem like acid rain, to the extent that acid

deposition in downwind states of New England is about equally affected by SO_2 emissions that were traded among upwind sources in Ohio, Indiana, or Illinois. It does not work perfectly, however, since acid rain in New England may *increase* if a plant in New England sells permits to a plant in the mid-west.

At the other extreme, many environmental problems might *not* be addressed appropriately by tradable-permit systems or other market-based policy instruments (Hahn and Stavins, 1992). One example is a hazardous air pollutant such as benzene that does not mix in the airshed and can therefore cause localized "hot spots." Since a firm can buy permits and increase local emissions, permit trading does not ensure that each location will meet a specific standard. Moreover, the damages caused by local concentrations may increase nonlinearly. If so, then even a permit system that reduces total emissions might allow trades that move those emissions to a high-impact location and thus increase total damages.

In other cases, the problem with a market-based approach may have more to do with the costs of administering the system. For example, it is difficult to imagine a practical tradable-permit or emission-tax system for mobile source air pollution. The administrative costs of monitoring emissions and permit holdings would likely be prohibitive, at least until new technologies become available at lower cost (Harrington *et al.*, 1995). Even as economists suggest partial market approaches such as buying and retiring old vehicles (Alberini *et al.*, 1995), the best combination of policy instruments is likely to include some non-market approaches like mandated pollution control equipment. The bottom line is that no specific policy instrument, or even set of policy instruments is a panacea. Market instruments do not always provide the best solutions, and sometimes not even satisfactory solutions.

Myth #3: "When non-market solutions are considered, economists still use only market prices to evaluate them."

No matter what policy instrument is chosen, it is necessary to identify the environmental goal of that policy. For example, should vehicle emissions be reduced by 10 percent, 20 percent, or 50 percent? Economists frequently seek to identify the efficient degree of control, that which provides the greatest net benefits. This means, of course, that both benefits and costs need to be evaluated. True enough, economists typically favor using market prices, whenever possible, to carry out such evaluations, because these prices reveal how members of society actually value the scarce amenities and resources under consideration. Unlike other social scientists, economists are generally wary of asking people how much they value something, since respondents may have incentives to behave strategically and therefore not to provide unbiased assessments of their own valuations. Instead, economists prefer to "watch what they do, not what they say." For example, individuals reveal their preferences when they are observed to pay more for a house in a neighborhood with cleaner air, all else equal (Smith and Huang, 1995). To control for other differences, these "revealed preference methods" are often statistical in nature, but the point is to use market prices to observe how individuals reveal their valuations.

This is not to suggest, however, that economists are concerned only with the financial value of things. Far from it. The financial flows that make up the gross national product represent only a fraction of all economic flows. The scope of accounting may be defined by that which is financial, but the scope of economics is much broader. It encompasses the allocation and utilization of all scarce resources. For example, the economic value of the human-health damages of environmental pollution is greater than the sum of health-care costs and lost wages (or lost productivity). It includes what lawyers would call "pain and suffering." Economists might use a market price indirectly to measure revealed preferences rather than stated preferences, but the goal is to measure the total value of the loss that individuals incur.

For another example, the economic value of some parcel of the Amazon rain forest is not limited to its financial value as a repository of future pharmaceutical products or as a location for eco-tourism. That so-called "use value" may only be a small part of the properly-defined economic valuation. For decades, economists have recognized the importance of "non-use value" of environmental amenities such as wilderness areas or endangered species. Indeed, these may be public goods, like the light from the lighthouse, since they can be enjoyed by additional individuals at no cost to society, and because those who benefit can "free ride" without paying. The market failures for these goods make it particularly difficult to quantify these values empirically, since we cannot use market prices! But the point is that benefit-cost analysis of environmental policies, virtually by definition, cannot rely exclusively on market prices (Arrow *et al.*, 1996).

Why then do economists insist on trying to convert all of these disparate values into monetary terms? Not because dollars have any particular standing conceptually, but simply because a common unit of measure is needed to be able to "add apples and oranges." How else can we combine the benefits of ten extra miles of visibility plus some amount of reduced morbidity, and then compare these total benefits with the total cost of installing scrubbers to clean stack gases at coal-fired power plants? Money, after all, is simply a medium of exchange, a convenient way to add together or compare disparate goods and services. Similarly, the dollar in a benefit-cost analysis is nothing more than a yardstick for measurement and comparison. Thus, even when economists do ask people to state their valuations (through contingent valuation methods described in, e.g., Mitchell and Carson, 1989), they essentially seek monetary valuations. Economists use these monetary equivalents in their calculations simply because a better set of common units is not available.

Myth #4: "These economic analyses are concerned only with efficiency rather than distribution."

Many economists do tend to give more attention to measures of aggregate social welfare than to measures of the distribution among members of society of the benefits and costs of policies. The reason is fairly clear. An improvement in economic efficiency can be determined by a simple and unambiguous criterion--an increase in total net benefits. What constitutes an improvement in distributional equity, on the other hand, is inevitably the

subject of considerable dispute. Nevertheless, many economists do analyze distributional issues thoroughly. The more difficult problem, not yet solved in a satisfactory manner, is how to combine efficiency and distributional issues in a unified analysis.

Available data often permit reliable estimates of the impacts of environmental policies on important subgroups of the population (Christiansen and Tietenberg 1985). On the other hand, environmental regulations are neither effective nor efficient tools for achieving redistributional goals. Some economic studies consider only efficiency issues, and some consider only distributional issues, but the best analyses recognize the scope of their contributions and their limits. Although benefit-cost analyses often emphasize the overall relation between benefits and costs, a good analysis will also identify important distributional consequences.

Conclusions

So where does this leave us? First, despite their apparent reputation, economists do not necessarily believe that the market solves all problems. Indeed, many economists--ourselves included--make a living out of analyzing "market failures" such as environmental pollution. These are situations in which *laissez faire* policy leads not to social efficiency, but to inefficiency. Second, when economists identify market problems, they do not (or, at least, should not) always recommend market solutions. Admittedly, our profession's tendency is to consider first the feasibility of market solutions, because of their potential cost-effectiveness, but the "hot-spot" example makes clear that market-based approaches to environmental protection are no panacea. Third, when market or non-market solutions to environmental problems are being assessed, economists do not limit their analysis to financial considerations. The scope of economic analysis is much broader than financial flows. The only reason that monetary equivalents are used in benefit-cost calculations is that a more convenient set of units is simply not available. Fourth, and finally, although the efficiency criterion is by definition aggregate in nature, economic analysis can tell us much about the distribution of both the benefits and the costs of environmental policy.

Having identified and sought to dispel four prevalent myths about how economists think about the natural environment, we close by acknowledging that our profession bears some of the responsibility for the existence of these and other misunderstandings about economics. Like their colleagues in the other social and natural sciences, academic economists focus their greatest energies on communicating to their peers within their own discipline. Greater effort can certainly be given by economists to improving communication across disciplinary boundaries.

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