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Chapter 5

How economists see the environment[1]

On a topic such as the environment, communication among those from different disciplines in the natural and social sciences is both important and difficult. Economists themselves may have contributed to some misunderstandings about how they think about the environment, perhaps through enthusiasm for market solutions, perhaps by neglecting to make explicit all the necessary qualifications, and perhaps simply by the use of jargon.

There are several prevalent myths about how economists think about the environment. By examining them here, we hope to explain how economists really do think about the natural environment.

Myth of the universal market

The first myth is that economists believe that the market solves all problems. The 'first theorem of welfare economics', as taught to generations of economics students, is that private markets are perfectly efficient on their own, with no interference from government, provided certain conditions are met.

This theorem, easily proved, 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'[2]. 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 necessary conditions are met, such as the stock market, where many buyers and sellers operate with good information and low transaction costs to trade well-defined commodities with enforced rights of ownership.

Other economists, especially those in public policy schools, have a different approach to this theorem. 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 transaction costs, no taxes, no common property and no other 'distortions' 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 in the real world.

When a market thus fails, this same theorem offers guidance. For any particular market, it asks 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 lighthouse, benefits additional users at no cost to society.

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 (not considered by producers or consumers). With a negative externality, such as environmental pollution, the total social cost of production may exceed the value to consumers. If the market is left to itself, too many pollution-generating products are made.

Similarly, natural-resource economists are interested in common property, or open-access resources, where anyone can extract or harvest the resource freely and no one recognises the full cost of using the resource. Extractors consider only their own direct and immediate costs, not the costs to others of increased scarcity ('user cost' or 'scarcity rent'). The result is that the resource is depleted too quickly.

So, the market by itself demonstrably does not solve all problems. Indeed, in the environmental domain, perfectly functioning markets are the exception rather than the rule. Governments can try to correct these market failures, for example by restricting pollutant emissions or limiting access to open-access resources, which can improve welfare and lead to greater efficiency.

Myth of market solutions

A second common myth is that economists always recommend a market solution to a market problem. 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 tradeable emission permits will work if there are many buyers and sellers, all are well informed, and the other conditions of the 'first theorem' are met. In this case, the government's role is to enforce the rights and responsibilities of permit ownership, so that each unit of emissions is matched by the ownership of one emission permit. Then the market for the output will also work, as 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 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 tradeable-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 only if certain conditions are met. But these conditions are not always met[3]. Could the sale of permits be monopolised by a small number of buyers or sellers? Do problems arise from inadequate information or significant transaction costs? Will the government find it too costly to measure emissions? If the answer to any such question is yes, the permit market

may work less than optimally. The environmental goal may still be met, but at more than minimum cost.

As an example, to reduce acid rain in the United States, amendments to the Clean Air Act of 1990 require electricity generators to hold a permit for each tonne of 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. Through continuous emissions monitoring, the government can track SO_2 emissions from each plant. Equally important, penalties are significantly greater than incremental abatement costs and hence are sufficient to ensure compliance. Overall, this market works; acid rain deposition is being reduced by 50 per cent in a cost-effective manner.

A permit market achieves this efficiency through trades because any company that has high abatement costs can buy permits from another that has low costs, so reducing the total cost of abating pollution. These trades also switch the source of the pollution from one company to another, which is unimportant when any emissions equally affect the whole trading area. This 'perfect mixing' assumption is certainly valid for global problems such as greenhouse gases or the effect of chlorofluorocarbons on the stratospheric ozone layer. It may also work reasonably well for a regional problem such as acid rain, because 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. But it does not work perfectly, as acid rain in New England may increase if a plant there sells permits to a plant in the mid-west.

At the other extreme, many environmental problems might not be addressed appropriately by tradeable-permit systems or other market-based policy instruments[4]. One example is a hazardous air pollutant such as benzene that does not mix in the airshed and so can cause localized 'hotspots'. Because a company 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.

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 of market prices

The next myth is that, when non-market solutions are considered, economists still use only market prices to evaluate them. No matter what policy instrument is chosen, the environmental goal of that policy must be identified. For example, should vehicle emissions be reduced by 10, 20 or 50 per cent? Economists frequently try to identify the most efficient degree of control that provides the greatest net benefit. This means, of course, that both benefits and costs need to be evaluated. True enough, economists typically favour 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.

Economists are wary of asking people how much they value something, as respondents may not provide honest assessments of their own valuations. Instead, actions may reveal their preferences, as when individuals pay more for a house in a neighbourhood with cleaner air, all else being equal[5].

This is not to suggest 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 economics encompasses the allocation and use 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), as it includes what lawyers would call 'pain and suffering'. Economists might use a market price indirectly to measure revealed rather than stated preferences, but the goal is to measure the total value of the loss that individuals incur.

To take another example, the economic value of part of the Amazon rainforest is not limited to its financial value as a repository of future pharmaceutical products or as a location for ecotourism. That 'use' value may only be a small part of the properly defined economic valuation. For decades, economists have recognised the importance of 'non-use' value of environmental amenities such as wilderness areas or endangered species. The public nature of these goods make it particularly difficult to quantify these values empirically, as we cannot use market prices! The important fact is that benefit–cost analysis of environmental policies, virtually by definition, cannot rely exclusively on market prices[6].

Economists insist on trying to convert all these disparate values into monetary terms because a common unit of measure is needed to be able to add them up. 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.

Myth of efficiency

The last myth we address here is that these economic analyses are concerned only with efficiency rather than distribution. Many economists do give more attention to measures of aggregate social welfare than to measures of the distribution of the benefits and costs of policies among members of society. The reason is that 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 analyse 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[7]. On the other hand, environmental regulations are neither effective nor efficient tools for achieving redistributional goals. The best economic analyses recognise the contributions and limitations of efficiency and distributional measures.

Where does this leave us?

To summarise, economists do not necessarily believe that the market solves all problems. Indeed, many economists, ourselves included, make a living out of analysing market failures such as environmental pollution in which laissez-faire policy leads not to social efficiency, but to inefficiency. When economists identify market problems, their tendency is first to consider the feasibility of market solutions because of their potential cost-effectiveness, but market-based approaches to environmental protection are no panacea. When market or non-market solutions to environmental problems are being assessed, economists do not limit their analysis to financial considerations but use money as a unit of measurement in the absence of a more convenient unit. And although the efficiency criterion is by definition aggregate in nature, economic analysis can reveal much about the distribution of the benefits and costs of environmental policy.

Having identified and sought to dispel four prevalent myths about how economists think about the natural environment, we acknowledge that our profession bears some responsibility for the existence of such misunderstandings. Like their colleagues in 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 made to improve communication across disciplinary boundaries.

Notes

1 Published with permission from *Nature* **395**: 433–434 (1998).

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5 Smith, V.K. & Huang, J-C. (1995). *Journal of Political Economy* **103**: 209–227.
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7 Christiansen, G.B. & Tietenberg, T.H. in Kneese, A.V. & Sweeney, J.L. (eds.) (1985). *Handbook of Natural Resource and Energy Economics Vol. 1*, North-Holland, Amsterdam: 345–393.