DESIGNING INSTRUMENTS FOR RESOURCE AND ENVIRONMENTAL POLICY

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Contents

Summary

This article discusses the choice of policy instruments to deal with environmental and natural resource issues. It shows that there is a wide spectrum of different instruments with different properties. The choice between them depends critically on both the ecological and technical peculiarities of a particular issue and on the socio-economic context.

There are numerous criteria for the selection and design of instruments. Traditional focus on efficiency must be supplemented with a proper analysis of the distribution of costs among stakeholders and the political feasibility of policy implementation.

1. Introduction

This article discusses the selection and design of policy instruments to deal with both environmental deterioration and the degradation of natural resources. Natural scientists, engineers and biologists tend to see the solution to these problems in terms of their own disciplines and see economics and economists probably more as a cause of problems than a source of solutions. While understandable this is unfortunate and mistaken. Economics holds the vital keys to the *implementation* in society of the technical or biological methods that other scientists devise. There are environmentally reasonable ways of supplying energy, building, transport, agriculture etc. These technical solutions provide the *possibility* of production with less carbon emissions, less risk of nuclear accidents, less toxins, less air pollution, pesticides etc. However the *adoption* of these techniques in real economies will depend on social "rules".

This article concerns the formulation of those rules and shows that there are more options than just taxes or the imposition of technical standards. Among the policies highlighted are: The creation of well-defined property rights, subsidies, taxes, charges (of different kinds—emission, input, output), user fees, tariff construction, deposit refunds, tradable permits or catch quotas of different kind, technology standards, emission standards, bans, quotas, the provision of information, labelling and the provision of infra structure or other public goods.

2. The need for policy instruments

Aside from the size of the human population, the other major determinants of our impact on eco-systems are of course material consumption and technology (of both consumption and production). One of the frustrations of many environmentalists is seemingly simple solutions to many serious environmental problems do not get implemented. This article is about the design of policy instruments intended to facilitate their implementation. First the need for environmental policy instruments is discussed in terms of market and policy failures. Among the market failures are external effects, public goods, common pool resources, non-competitive markets and imperfect information. All these market failures have to be analysed based on a solid understanding of the evolution of property rights. It is the exact definition of these rights that defines the characteristics of the market and of the market failures.

Property is a "bundle" of rights such as the right to use the property for direct utility or productive purposes as well as the rights to sell, lease and inherit the property and the right to exclude others. Other rights may be to move, change or even destroy or dispose of the property. There are important legal, cultural and psychological aspects to ownership. Historically property rights have evolved to include more types of rights. An economist would see this as a response to our need to minimize uncertainty and transaction costs as well as a reflection of increased scarcity as population grows in a finite space. The history of property rights is closely related to the development of property rights to land. After this, rights have been gradually extended to more complex issues leading to rights to water, subterranean rights and various forms of common property. Understanding these developments is important since it provides the

underpinning to understand the rights to other natural and environmental resources including less tangible objects such as biodiversity and clean air.

Externalities are non-market 'side-effects' of production or consumption. This is well illustrated by soil erosion from hillside agriculture leading to the siltation of dams, pollution of drinking water and destruction of coral reefs. These are real costs but typically they are not borne by the farmers who cause them. The same applies to the health effects of air pollution from industry and traffic or from pesticide spraying and numerous other activities. The very existence of these side effects can be thought of as a consequence of incomplete property rights.

Public goods are 'goods' or services that are enjoyed in common such as public defence, law and order and the clean (or dirty) air of the city centre. The market tends to not supply these goods sufficiently since once the good is provided it is hard to exclude those who do not pay which means that no-one will pay—at least not in the ordinary sense of market transactions. Instead political processes are needed (such as the election of a government which collects taxes and finances public goods).

A common pool resource is important for production or consumption but generally not easily amenable for private ownership. The resource may be mobile like fish or the costs of fencing may be too high. Instead the resource may be managed cooperatively by a village. Just like public goods may be under-supplied by the market so common pool resources may be over-utilized if the sense of communal ownership control is not strong enough to limit access by the users.

Non-competitive markets such as monopolies or oligopolies imply that supply is distorted. Typically too little produce will be sold at too high a price. This is bad since it implies a loss to the economy. In some particular cases it may however have some advantages from an environmental viewpoint. If the monopolized market is for a good with negative environmental externalities then a lower level of production might be desirable. The occurrence of monopolies in the economy is partly related to underlying cost structures such as decreasing costs of large-scale production. When monopolies are deemed harmful they are typically regulated by policy makers.

Of all the market failures asymmetric information is perhaps the most pervasive. Economists often point out that there are no "free lunches" yet still assume "perfect information". Understanding the characteristics of information asymmetry not only helps in the design of policy instruments to deal with monitoring difficulties, it goes to the heart of the essential dilemma of how to promote social goals such as equity or income redistribution without destroying the incentives for work and efficiency. Imperfect markets and imperfect information make the simple laws of welfare economics break down. In the perfect market model the efficient solution is also one that maximises welfare but in a more realistic model of the world one can no longer deal with efficiency and equity separately. This makes the analysis more complex but also much more relevant particularly in developing countries.

Some archetypal examples can illustrate the type of problems to be faced:

Many of the World's fisheries are showing decreasing yields. To maintain catches, earnings and employment the fishermen increase their efforts with larger boats, smaller mesh size and sophisticated technologies such as sonar and satellite navigation. If they were to reduce effort they would, as a collective, often be able to catch more at lower costs. This would clearly be a benefit to all yet a classical market failure is present here: there is no ownership to the waters nor to the fish and so this is a common pool resource and the fishermen are caught in the dilemma of collective action. This is often referred to as the tragedy of the commons although this is misleading: it is a tragedy not of commons (they can and are often sustainably managed) but of open access. This is clearly a situation where market failure calls for policy intervention to restrict fishing effort. And governments often do intervene but typically in the past they have pursued the exact opposite of the policy they should. Instead of encouraging restraint they have "helped" the fishermen by subsidizing boats and technology thus lowering their price and in fact increasing effort. This implies that the misguided design of policy instruments has in fact added policy failure to market failure and typically exacerbated the problem. On top of this comes a certain degree of monitoring difficulty due to asymmetric information. Government authorities will never have as detailed information as the individual skippers concerning catches, effort and other conditions. This makes the use of many policy instruments such as regulations difficult. Some countries have however successfully implemented tradable quota schemes that appear to be working well, while others have functional common property resource (CPR) arrangements at the local levels. Within these CPRs the dilemma of collective action is at least partly solved by local collaboration and cooperation. Local fishermen are the only people with sufficient information to be able to monitor each other and CPR institutions may be designed to give them an incentive to do this in a constructive way.

In many countries the 'energy crisis' of the 1970s led to research into technologies for 'energy-saving' and 'alternative' energy production. In later years the prospect of resource depletion has subsided but local and global pollution problems such as global climate change have continued to put pressure on this kind of research. The research has of course not solved all problems but it has met with some success. Many good technologies exist for reducing energy use in transportation, lighting, heating and industrial processes. One might think of fluorescent lighting, heat pumps, 'hyper-cars', tyristors or wind power, solar power and bio-fuels. Nevertheless they do not get used simply because the consumer price of energy is still too low and many technologies are not commercially viable. Present prices do not include the external costs related to local and global environmental problems. The costs of children and adults getting asthma and bronchitis in the large urban areas are real costs (health and productivity loss) just like the costs associated with the risks of climate-induced sea-level rise. These costs, however, do not generally appear on our electricity bills or in the price of gasoline. Taxes, permits or other policies are needed to internalize these costs so that the consumer faces the real total cost of energy, which will automatically encourage the adoption of energy-efficient techniques.

The users of natural resources such as grazing lands typically know their bio-type quite well and have the knowledge to manage it rationally and even optimally. However they operate at high levels of risk and quite close to the absolute margin of destitution which can result in unsustainable behavior. They may not dare to invest in new productive and

sustainable methods but continue to use methods which are damaging to the ecosystem. These practices, although unsustainable may be individually rational adaptations to missing markets for savings and insurance thus showing the detrimental effect of this market failure. The income and equity aspects of these environmental issues are often crucial. Charging taxes to reduce herds, fishing or traffic may solve the congestion and over-utilization problems but will still be resisted if they leave the users with less welfare since the taxes collected are used for purposes that are perceived as unproductive by the local users (such as central bureaucracies or even the private pockets of some politicians or civil servants). In these cases instruments are needed that give the local users a price signal that internalizes externalities without transferring the money out of the local community. There are numerous ways of doing this. One may be through permits that are allocated freely to local users and another may be through levying charges rather than taxes and then using the revenues for local environmental or resource funds that may be allocated in numerous ways decided on locally. Many environmental fees in developing countries do actually operate in this way.

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Biographical Sketch

Thomas Sterner is Professor of Environmental Economics at the University of Gothenburg, Sweden. He earned his PhD in Economics 1986 with a thesis on energy demand in Mexican industry, became an associate Professor 1989, and full Professor of Environmental Economics in 1995.

He has published over 55 articles and books (including over 30 journal articles).

He directs the Environmental Economics Unit (EEU) which has half a dozen PhDs and about 20 graduate students from all over the World. The EEU specialises in the economics of the environment and natural resource management in both OECD countries and in developing countries. During 1998-99 Sterner was a consultant to the World Bank and Gilbert White Fellow at Resources for the Future (RFF). He is currently a university fellow at RFF. His professional work focuses mainly on the economics of policy instruments and on transport and energy economics.

Through extensive collaboration with aid organizations such as Sida and the World Bank as well as other international bodies such as the Beijer Institute, RFF, IEED, CATIE, EEPSEA and others the EEU runs a number of research and training programs for capacity building in environmental economics (see http://www.handels.gu.se/econ/EEU).

Thomas Sterner is currently the Chairman of the Board of the Centre for Environmental Economics in Gothenburg. He is also on the Research Board for Göteborgs Energi. He was Guest Editor for **Environmental and Resource Economics**, Spring 1998.

Professor Sterner has taught a variety of courses in micro- and development economics, transport economics, energy economics and environmental economics. He has been the tutor for more than 10 PhD theses in economics at Gothenburg during 1990-2000.