CHAPTER 21

Sustainable Scale

Environmental policies are inherently related to scale. In an empty world, environmental goods and services are not scarce resources, and hence not the focus of policies. The issue is whether environmental policies address scale directly or only tangentially. Just as importantly, to be effective, the policies should square with the six design principles outlined in Chapter 20. We will discuss four different types of policy that affect scale: direct regulation, Pigouvian taxes, Pigouvian subsidies, and tradeable permits. We examine how each is applied in the real world.

Direct Regulation

The dominant form of environmental policy affecting scale in most of the world is the regulatory instrument, which can take a variety of forms. Sometimes an activity or substance is considered to have unacceptable costs and is simply banned. For example, many countries no longer allow lead additives to gasoline or the production of DDT, and currently negotiations are under way for banning the production of 12 different persistent organic pollutants (POPs) at a global level. When a substance is sufficiently dangerous, such bans are appropriate.

In other instances, regulation will limit the quantity of a pollutant that can be produced, and set emissions levels for the firms or individuals responsible for producing it. For example, individual paper factories may have legal limits to the amount of waste they can discharge into a river, and in many countries, vehicles have to pass emission tests. In yet other instances, regulations will force all firms or individuals to use the best available control technology (BACT) to limit pollution. BACTs may be imposed on all firms or individuals, or only on new entrants to an industry. BACT regulations play an important role in the U.S. clean air laws.

For fisheries, a common regulation has been to limit the fishing season or regulate the type of equipment that may be used in order to reduce the annual catch.[1] Failure to comply with regulations generally involves fines or other penalties. These policies are therefore known as **command-and-control regulations**.

What are the advantages and disadvantages of such policies? Most of them limit the amount of pollution/resource harvest to an acceptable level, thus contributing to the goal of desirable scale. With renewable resources, regulations may be the best way to address biological requirements. Examples are banning harvests during mating seasons, imposing minimum mesh size on fishing nets, forbidding harvest of gravid females, leaving the best and largest of a species as seed stock, or banning certain harvest methods that are particularly destructive of habitat. Regulations can be applied to everyone equally, or tailored to meet alternative distributional goals. Finally, policy makers are generally familiar with this approach. It is reasonably easy to understand and can be fairly cheap to monitor and enforce—for example, it is very easy to check whether a given firm is using a mandated technology.

The disadvantage is that in general, regulations fail to meet the criteria for allocative efficiency and thus are often not the most cost-effective way to reach a desired goal. Moreover, they fail to provide incentives for surpassing a goal, bringing pollution below the regulated level, for example. These points deserve elaboration.

As shown in Chapter 7, the basic requirement for economic efficiency is that marginal costs equal marginal benefits, at both the individual level and the social level. Ideally, environmental policies should achieve this goal. In practice, however, for our pollution example this would require that we know the marginal social costs of pollution, the marginal net benefits of activities that pollute, and the marginal abatement costs of pollution. Of course, there are really no benefits to pollution *per se*, but all production causes pollution, and we could not exist with no production at all. In reality, it is virtually impossible to know all the marginal costs of pollution, and very difficult for policy makers to know marginal abatement costs. Perfect allocative efficiency is therefore something of a pipe dream.

While we cannot hope for a perfectly efficient solution, we can hope for a cost-effective one. A cost-effective solution achieves a given goal at the lowest cost, even if marginal costs do not exactly equal marginal benefits. It is, therefore, a very desirable goal, but one that is unlikely to be attained by simple regulations. The reason is that command-and-control

[1] Regulating inputs to reduce catch is an entirely different issue than regulating inputs to reduce negative externalities, such as excessive by-catch or habitat destruction.

regulations ignore the second general design principle described in Chapter 20, that policies should sacrifice the minimum of micro-freedom to attain macro-control.

This point is perhaps most readily illustrated with a specific example. Imagine there are three firms polluting a waterway upstream of the drinking water intake valve for a city. A regulatory agency determines that for health reasons, pollution loads should be cut by 40% and demands that each firm cut its emissions correspondingly. The problem is that different firms may have different marginal abatement costs (MACs) and/or different operating costs due to a variety of factors, such as manufacturing process or age of manufacturing equipment. It may be very expensive for one firm to cut its emissions by 40%, and very cheap for another firm to do so.

Table 21.1 shows hypothetical abatement costs for three firms, each discharging equal amounts of pollution. A 40% reduction per firm would cost a total of $360,000. The most cost-effective way for society to reduce pollution would be to assess for each additional unit of pollution to be eliminated which firm has the lowest MAC and have that firm make the reduction. This would cost a total of $210,000. If we assume increasing MACs, this rule would lead to identical MACs for all firms undertaking abatement.

THINK ABOUT IT!
Why are MACs identical for all firms under this rule? You may want to review the material on the equimarginal principle of maximization in Chapter 8 to figure this out. The principle is the same.

Unfortunately, the regulators do not really know the firms' abatement costs. While each firm presumably knows its own abatement costs, gathering this information would be costly, and if the goal were to force reductions in this manner, each firm would have an incentive to misinform the regulator.[2] Also, it would hardly seem fair to make some firms reduce pollution far more than others.

Another problem that arises with regulation is that once regulatory goals have been achieved, there is no incentive to reduce pollution any further and few incentives for new pollution reduction technologies. Similarly, if regulations apply to specific areas (such as U.S. clean air laws), there is no incentive not to increase pollution in areas below the

[2]When the EPA first proposed tradeable emission permits in SO_2, industry estimates of MACs were as high as $10,000 per ton. EPA estimates were in the neighborhood of $1000 per ton. Permits currently trade for under $100 per ton. Carol Browner, speech, "Public Health and Environmental Protection in the 21st Century," University of Vermont's 2002 Environmental Literacy Seminar Series. March 25, 2002.

Table 21.1

Marginal Pollution Abatement Costs for Three Firms Emitting 5000 Tons of Pollution Each

MAC	Firm 1	Firm 2	Firm 3
First 20%	$50,000	$10,000	$25,000
2nd 20%	$200,000	$25,000	$50,000
3rd 20%	$400,000	$50,000	$100,000
4th 20%	$800,000	$100,000	$175,000
Final 20%	$1600,000	$500,000	$200,000

maximum allowed level. Yet we have already seen that pollution has marginal external costs even at very low levels (see Figure 12.7).

What we seek, then, are policies that take advantage of the equimarginal principle of maximization by equalizing MACs across firms, provide incentives to develop new technologies for reducing environmental costs, and keep costs low by allowing firms to act on their private knowledge of their own abatement costs. The ideal policy would also set the marginal benefits of production equal to the marginal environmental costs it imposes, but as we stated earlier, environmental costs are largely unknown.

We will now examine three policies that can theoretically achieve these goals: taxes, subsidies, and tradeable permits.

Pigouvian Taxes

Early in the last century, economist A. C. Pigou began grappling with the problem of internalizing environmental externalities. As we discussed in Chapter 10, externalities occur when one economic agent causes an unintended loss or gain to another agent, and no compensation occurs. In the case of a negative externality, the basic problem is that the economic agent is able to ignore a cost of production (or consumption). Under such circumstances, the market equilibrium of marginal costs equal to marginal benefits does not emerge, and some of the wonderful benefits of markets fail to appear. Pigou came upon the simple solution of imposing a tax equal to the marginal external cost. This would force the economic agent to account for all economic costs, creating an equilibrium in which marginal social costs were equal to marginal social benefits.[3]

[3] A. C. Pigou, *The Economics of Welfare*, 4th ed., London: Macmillan, 1932 (originally published in 1920).

Note that this policy requires a change in property rights. When a firm is free to pollute, it has privilege, and those who suffer from the pollution have no rights. A Pigouvian tax essentially creates a property right to the environment for the state, using a liability rule. Firms can still pollute, but they must now pay for the damages from their pollution.

Of course, as we cannot accurately measure marginal environmental costs, the **Pigouvian tax** cannot be set precisely at that level. Even if we did know marginal environmental costs, these costs change with the amount of pollution, and the ideal tax would presumably also have to change. While Pigouvian taxes will not lead to perfectly efficient outcomes, they will reduce environmental costs, and do so cost-effectively. How do they accomplish this?

When abatement costs are less than the tax, it is cheaper for the firm to abate, so that's what they will do. On the other hand, when abatement costs are more than the tax, paying the tax minimizes costs and maximizes profits. This means that after implementation of the tax, the MAC for all firms will be equal to the tax. Firms for which it is cheap to reduce pollution will therefore make large reductions, and firms for which it is expensive will reduce much less. The latter firms will, of course, pay correspondingly more in taxes than the former. Note that no one but the firm needs to know the firm's marginal abatement costs. Each firm acting on its own preferences and own knowledge with a maximum of microfreedom generates the cost-effective outcome desirable to society.

THINK ABOUT IT!

Using the figures in Table 21.1, can you figure out what range of taxes would lead to a 40% reduction in emissions?

Firms continue to pay tax on every unit of pollution that they produce. This means that there is always an incentive for achieving further reductions in pollution and doing so more cost-effectively. Such incentives are perhaps the most important reason that taxes are superior to command-and-control regulations.

In addition to taxes, firms must also pay abatement costs. It is therefore quite possible that total costs to the firm and industry (all related firms together) under the tax will be higher than they would have been under command-and-control regulations (e.g., forcing each firm to cut emissions by 40%). However, relative to society, the tax is a transfer payment and does not count as a cost. And by ensuring that the firms with the lowest abatement costs make the largest reductions in pollution, the tax ensures that actual costs to society are less under the tax than they would have been under regulations. Nor can the tax really be considered unfair to the firm, as it is simply a payment for the costs the firm is imposing on society. It is possible that the tax would even drive some firms out of business, but as long as the tax were no greater than the marginal external environmental cost, it would simply mean that the costs the firm was imposing on society were greater than the benefits it was providing.

> **THINK ABOUT IT!**
> *Can you figure out what the total costs to each firm would be under command and control regulations vs. a Pigouvian tax of $50,001/ton?*

It would be very difficult to predict the decrease in negative externalities that would result from any given tax, and a trial-and-error process might be required. Yet changing taxes every year, or even every few years, creates a burden for firms, who lose the ability to plan for the future. Perhaps the best approach would be to begin with a fairly low tax, but let firms know that the tax will increase over time. This approach would let firms gradually change their practices, reducing overall cost by allowing new technologies to come online before the tax reaches its ultimately desired level.

As long as human populations and the economy are still growing, the demand for activities that impose environmental costs is also likely to grow. This means that to maintain the desired level of environmental amenities or resource depletion, the tax would need to increase over time. As with all environmental policies, the principle of adaptive management is appropriate.

Pigouvian Subsidies

A **subsidy** is a bonus or payment for doing something, the opposite of a tax. A **Pigouvian subsidy** is a payment to each firm for each unit by which it reduces environmental costs; it has many of the same attributes as the tax. Ideally, the subsidy will equal the marginal benefit to society of abating pollution. As long as abatement costs are lower than the subsidy, the firm will reduce pollution. Again this will equalize MACs across the industry, the precondition for a cost-effective outcome. While a tax follows the "polluter pays principle," a subsidy, in contrast, basically assumes that the polluter has the privilege to pollute, and society must pay him not to.

> **THINK ABOUT IT!**
> *Can you figure out what would be the total cost to society of a $50,001/ton subsidy not to pollute (assuming no new entrants to the industry), and the total benefits to each firm net of abatement costs?*

One serious problem with subsidies is that they can perversely lead to an increase in pollution. A subsidy increases the profit margin for the polluting industry, possibly attracting new entrants. While each firm pollutes less than in the absence of the subsidy, more firms could still lead to more total pollution. While many people might justifiably resent the notion of paying people not to impose costs on the rest of society, and the potential outcome of greater pollution is entirely undesirable, this does not mean that Pigouvian subsidies are entirely irrelevant. Pigouvian subsidies can be desirable as an incentive to ecosystem restoration. For example, paying farmers to reforest their riparian zones might reduce nutrient runoff and provide a host of other ecological services. In addition, under international law, sovereign nations have the right to do as they choose with their resources, and there is no global government that could impose a Pigouvian tax on the negative environmental costs of deforestation, for example. Under such circumstances, something like a Pigouvian subsidy may be the best option. We will return to this issue in some detail later.

One final point bears mentioning. While Pigouvian taxes or subsidies may lead to the welfare-maximizing outcome of marginal social costs equal to marginal social benefits, the same does not hold true at the level of the individual. This is a result of the fact that many environmental costs are public bads. Every individual suffers from the same amount of environmental cost, yet each individual has different preferences concerning those costs. A perfect market solution would have to distribute the tax among the afflicted population to exactly compensate for the marginal damage they suffer from the environmental cost. Of course, it would be impossible to determine the marginal cost curve for every individual on the planet, and individuals would have incentives to misinform the agency collecting this information if it would influence how much of the tax they were to receive. Also, if individuals were compensated for the externalities they suffer, they might do less to avoid externalities, and this too could reduce efficiency.[4]

Tradeable Permits

Tradeable permits are another cost-effective mechanism for achieving a specific goal. Rather than increasing prices through a tax to reduce demand, tradeable permits require society to set a **quota**, a maximum amount of pollution or resource depletion that it will allow. This approach is currently used in the United States to regulate SO_2 emissions, and in several countries to regulate fisheries.

What factors should determine the allowable quota? From the economist's perspective, the ideal quota should be set so that the marginal

[4]E. T. Verhoef, "Externalities." In J. C. J. M. van den Bergh, *Handbook of Environmental and Resource Economics*, Northhampton, MA: Edward Elgar, 1999. Again we reiterate that "efficiency" should not be the sole criterion for decision making in any case.

benefit from one more unit of pollution or harvest is exactly equal to its marginal social and private cost. Uncertainty and ignorance probably make this ideal unattainable. Even if we could accurately estimate marginal costs at the existing scale, as we learned in Chapter 19, the very act of setting the quotas (scale) changes the prices used in calculating the costs and benefits.

In the case of renewable resource harvests, quotas should recognize that renewable resource stocks can provide a flow of harvests but are simultaneously funds that provide a stream of services over time. The quota should recognize this dual nature of renewable resources. Where quotas are currently used in fisheries, managers focus almost entirely on the stock-flow aspect of the resource, virtually ignoring the fund-service aspect. While we are admittedly far more ignorant concerning the exact role of ecological fund-services, we do know their value is not zero, and they should not be ignored. At the very least, quotas should be determined with substantial input from ecologists to ensure that they provide sufficient slack with respect to ecological thresholds (remember general design principle #3 in Chapter 20). The quota process should also respect the principle of adaptive management, allowing adjustment as new information becomes available.

THINK ABOUT IT!

If fisheries managers decide to take an ecological economic approach to establishing harvest quotas and explicitly incorporate the fund-service benefits of fish stocks into their decisions, what impact will this have on the quota? Draw a graph showing the sustainable yield curve and total private cost curve for a fishery, and label the following points: (1) the open access equilibrium and (2) the annual profit-maximizing quota. Relative to points 1 and 2, in what region of the graph would you find the quota that maximizes net present value? In what region would you find the quota that maximizes benefits from both the stock-flow and fund-service nature of the resource? In determining optimal quotas, do you think policy makers should discount benefits to future generations? Why or why not?

Once established, the quota is then distributed among polluters and resource users in the form of permits or individual quotas. Permits may be auctioned off or distributed for free, and the distribution process can be designed to achieve other social goals, such as greater income equality. Permits can be issued annually, or once and for all. They can be for set quantities or for a proportion of an adjustable quota. Many variations are possible. A permanent permit for annual emissions or annual resource depletion provides firms with the most certainty for future plans, but annually adjustable permits may be necessary in the presence of imperfect information, natural variation, and ecosystem change.

Once firms own the permits, they are free to buy and sell them, as is the case with any other market good. If permits are for pollution, the firm will abate pollution as long as that is cheaper than the cost of a permit, and will use permits when abatement costs are more expensive. Again this leads to equimarginal abatement costs, a precondition for cost-effective outcomes, and again allows maximum micro-freedom. If permits are for resource depletion, the firms with the most profitable use of the resource will be able to pay the highest price for the permits. This theoretically ensures that the resource will be allocated toward the most desirable ends, but, we reiterate, only if we believe individual "votes" concerning the desirable ends should be weighted by individual wealth.

THINK ABOUT IT!

Again using Table 21.1, if each firm is given quotas to emit 6000 tons of pollution, who will actually end up emitting the pollution, what is the possible price range for the quotas/ton, and what is the range of final net costs of pollution abatement to each firm?

Quotas also require a change in property rights, but whereas taxes impose a liability rule, quotas impose a property rule. The owner of the quota essentially owns the waste absorption capacity (a rival good made excludable by quotas) of the medium into which they are emitting wastes. The right may initially be awarded to the government, members of the community affected by the pollution, or to the polluters. The same principle is true when quotas are used to end privilege in an open access regime.

One issue with quotas is that there may be little incentive to reduce total pollution or resource extraction below the quota. If the quota is carefully chosen, this need not be a problem. Within a tradeable quota system, any profit-maximizing firm still has the incentive to reduce emissions or resource harvest so that it may sell a portion of its quota. Thus, while quotas will not drive undesirable activities below the quota level, they provide incentives for reaching quotas ever more cost-effectively. Also, if the economy or population is growing, quotas ensure that resource use will not grow.

Many economists have pointed out that if environmentalists think a quota is too high, they are free to purchase shares of the quota and discard them. Unfortunately, we again run into the problem of public good provision here. The environmentalist would incur the entire cost of purchasing the permit but share the benefits with everyone. In addition, if permits are issued annually in variable amounts, then the government could potentially issue more permits in response to those being purchased and not used. Alternatively, if the regulatory authority decides too many permanent permits were issued to begin with, or new information changes the assessment of how many permits are desirable, the government can readily purchase some back and not use them, as we illustrate with the following case study.

Tradeable Permits vs. Shorter Seasons

As we have previously discussed, oceanic fisheries have been heavily overfished, and policies are urgently needed to address this problem. A number have been tried, providing good evidence for the superiority of solutions that maximize micro-freedom. Within this context, we will compare efforts in the United States to reduce unsustainable fish harvests by shortening the season with efforts in New Zealand to implement quotas and tradeable permits.

The halibut fishery is one of the oldest on the Northwest coast of the Americas, and by 1960, open access conditions had led it to be fished almost to extinction. In 1960, the International Pacific Halibut Commission (IPHC) was created to regulate the annual harvest and restore the catch to the maximum sustainable yield. Harvests were limited by imposing a season, which was then gradually reduced as required. This method proved highly effective at restoring the population and increasing the annual harvest. However, by the early 1990s, the season was as short as one or two 24-hour periods per year (depending on how long it took to reach the annual quota established by the IPHC), during which fishermen engaged in a mad race to maximize their share of the catch.

What are the implications for efficiency and cost-effectiveness of such a short season? First, fishing is already one of the most dangerous industries, and engaging in a mad race just makes it that much more dangerous, especially if the "season" happened to coincide with bad weather. Loss of life was frequent. Boats often captured so much fish they were in danger of sinking, and sometimes did. Fishermen were forced to cast as many lines as possible, ensuring that some would be lost. The situation was made worse when the large number of boats caused lines from different boats to get tangled and cut, perhaps leaving already hooked halibut to die. The 2-day open access fishery led fishermen to invest in more equipment to take more fish in a shorter period. In spite of increasing stocks, the season was continually shortened, and the equipment (and labor force) then went unused out of season. Almost all halibut fishermen also take other fish with the same equipment, but the net result was still excess capacity. Demands for rapid harvest led to poorer treatment of the fish, and a lower quality product.

Once landed, all of the fish arrived at the market at the same time. There was therefore a very limited market for fresh halibut, and most had to be frozen. Again, large capital investments were required to create the infrastructure for freezing all the halibut in such a short period, and there was excess capacity for the remainder of the year. Processing fish by freezing is capital-intensive, and it therefore increased the barriers to market entry, threatening to limit competition. Processing fresh fish, in contrast, is labor-intensive and has far lower capital costs.

In 1990, when Canada modified its system by establishing individual quotas for ships and extending the season, it created a market for fresh halibut. In fact, because Canadian halibut was mostly sold fresh, Canadian fishermen enjoyed a 70% price premium over their Alaskan counterparts. The failures of the U.S. system were so pronounced that in 1995, the U.S. instituted an individual fishing quota system as well. The quotas were assigned to currently active fishermen based on their recent harvests. They were intended to allow fishermen to extend their harvest efforts over the entire season, thereby paying more attention to quality than to speed. Some leasing and trading of the quotas were allowed, but with strict limits on concentration of shares.[5]

New Zealand's fisheries went through the cycles typical of most countries. At first the resource was scarcely exploited, with the exception of inshore fisheries. In the 1970s, seeking to exploit a new source of foreign exchange, the government began a program of subsidies to develop the industry. The result was overcapitalization (basically too many boats chasing too few fish) and dramatic declines in fish populations. In 1982, the government forced fishermen who earned less than 80% of their income from fishing out of the market. This had a highly negative impact on Maori fishermen, who traditionally earned their living from a variety of activities, but it did little to reduce pressure on the fishery. Then, in 1986, New Zealand decided to follow the economists' advice and implement a system of transferable fish quotas. Similar systems are also in place in Iceland and the Philippines.

The process is simple. Scientists determine the total allowable catch (TAC) for each species from each of several geographic areas, typically with the goal of achieving maximum sustainable yield. From this number they subtract the expected take by the sport fishery and set aside 20% for the Maori. (An 1840 treaty awarded rights to all New Zealand fisheries to the Maori, but New Zealand chooses not to honor this treaty.) The remainder is the **total allowable commercial catch (TACC)**, which is divided up into **individual transferable quotas (ITQs)**, which may be

[5]K. Casey, C. Dewees, et al. The Effects of Individual Vessel Quotas in the British Columbia Halibut Fishery, *Marine Resource Economics* 10(3): 211–230 (1995): C. Pautzke and C. Oliver, Development of the Individual Fishing Quota Program for Sablefish and Halibut Longline Fisheries off Alaska. Anchorage, Alaska: North Pacific Management Council, 1997. Online: http://www.fakr.noaa.gov/npfmc/Reports/ifqpaper.htm.

bought, sold, or leased on the market. The initial ITQs in terms of tons of fish were awarded to fishermen in proportion to their catch history. To make the ITQs more attractive to fishermen, initial awards were close to historic catches and exceeded the TACC. The government then purchased back sufficient ITQs to reach the TACC. Fish populations fluctuate naturally, and so did the TACC. Initially, the government was forced to buy or sell ITQs whenever the TACC changed. Then, in 1990, ITQs were changed to represent a proportion of TACC.

In terms of scale and allocation, the policy has been very effective. Fish populations have recovered, though there have been problems with the introduction of new fish species into the market, because typically little is known about their life cycles. For example, considerable evidence suggests that orange roughy has been overexploited in spite of the TAC. In terms of efficiency, fishermen now need only invest enough to capture their share, lowering their capital costs. Harvests are spread out over a longer period, increasing the market for fresh fish. Fishermen can purchase ITQs for different species when they have a large by-catch[6] and sell or lease ITQs when they fail to meet their quota. Less efficient fishermen can sell their quotas to more efficient ones. The value of fisheries in New Zealand has apparently doubled in recent years.

The impact on distribution, however, is far less desirable. ITQs tend to concentrate in the hands of the larger firms, leading to concentration of the wealth in a lucrative industry. Maoris—in spite of the treaty awarding them rights to all the fisheries—have disproportionately been forced out of the market. Part of the problem lies in access to credit. ITQs do not count as collateral for bank loans. When the TAC decreases, small-scale fishermen lack collateral for bank loans to purchase more ITQs, while large firms have other assets they can use as collateral. In part, this problem stems from the initial allocation of ITQs based on catch histories. Those firms that played the largest role in overexploiting the fisheries initially were rewarded with more ITQs.[7]

The case of New Zealand fisheries shows the importance of separate policies for achieving separate goals. The TACC (one policy instrument) set the scale, and the ITQs (a separate policy instrument) achieved effi-

[6]By-catch is the harvest of species different from the target species. Depending on the species and the existing laws, by-catch may be kept or thrown back. By-catch is often killed in the harvest but is nonetheless thrown back. Dolphins as by-catch for some types of tuna fisheries, and sea turtles as by-catch for some types of shrimp fisheries, have received considerable attention. For some fisheries such as shrimp, by-catch may be more than ten times the mass of the target species.

[7]P. Memon and R. Cullen, Fishery Policies and their Impact on the New Zealand Maori, *Marine Resource Economics* VII(3): 153–167 (1992); New Zealand Minister of Fisheries, *The Quota Management System*, no date. Online: http://www.fish.govt.nz/commercial/quotams.html. R. Bate, "The Common Fisheries Policy: A Sinking Ship" *Wall Street Journal*, June 2000. Online: http://www.environmentprobe.org/enviroprobe/evpress/0700_wsj.html.

cient allocation. But the policies did not address distribution issues, which turned out to be problematic. They require a third instrument, perhaps one that could limit the concentration of ITQs to help maintain market competitiveness and avoid forcing poorer fishermen out of the market.

Policy in Practice

We see, then, that policies are available that meet environmental goals cost-effectively and that provide incentives for reducing pollution, resource depletion, and so on, even after those goals have been met. Most of these policies are widely accepted by economists as cost-effective solutions, yet regulatory agencies in general seem to prefer the less efficient command-and-control regulations. Why is this so? There are a number of reasons.

Environmental regulations often are administratively simple and may have low monitoring costs. Regulatory agencies have substantial experience with these options, and institutions can be slow to change. Conceptually, regulations are simple and widely perceived as fair, at least when they affect everyone equally. Many regulators pay little attention to cost, and may be more concerned with reducing their own transactions costs than with lowering the costs to polluters. Abundant other reasons also exist, but considerable evidence suggests that in many circumstances, the overall costs to society of reaching a given target are higher under regulation than under mechanisms that allow a maximum of micro-level freedom by relying on market allocation, subject to macro-level control.

In the United States, the cap and trade systems have had some success on a limited basis (e.g., SO_2), while in Europe the tax scheme, referred to as "ecological tax reform," has been more popular. The idea is sold politically under the banner of "revenue neutrality"—the government taxes the same total amount from the public, just in a different way. Following the design principle of gradualism, European governments have sought to impose the most desirable resource tax first, and to couple it with the worst existing tax, eliminating the latter to the extent that revenue from the former permits. Thus, one may get a "double dividend"—the environmental benefit of taxing a resource whose price is too low, plus the fiscal benefit of getting rid of a distortionary or regressive tax.[8] Subsequently, one seeks to couple the next most desirable resource tax with the next worse other tax, and so on.

The slogan of ecological tax reform is: "Tax bads, not goods." The idea is to shift the tax burden from value added by labor and capital

[8]The existence of a "double-dividend" is a source of frequent dispute among environmental economists but is more accepted by ecological economists.

(something we want more of) to "that to which value is added"—namely, the throughput and its associated depletion and pollution (something we want less of). It seems a matter of common sense to tax what you want less of and stop taxing what you want more of. Ever suspicious of common sense, however, neoclassical economists have invented general equilibrium models with particular assumptions (such as the familiar production functions with no resource inputs) that lead to counterintuitive results. We find these models in general to be artificial and unconvincing. In any case the policy, at an incipient level, seems to be working in Europe.[9] The main political dilemma European governments face in trying to implement ecological tax reform seems to be maintaining competitive advantage in international trade by keeping resource prices low, versus internalizing external costs in prices and thereby raising them to the detriment of competitive advantage—a problem we encountered in our look at globalization.

This latter problem is a severe and general policy difficulty. Our fifth general policy design principle stated that the domain of the policy-making authority should coincide with the domain of actions open to those who cause, or are affected by, the policy (see Chapter 20). If a policy is enacted to limit pollution and a firm can avoid compliance simply by moving across a boundary, then the extent of domains does not coincide. Globalization, as we saw in Chapter 18, expands the domain of actions to the entire world, while keeping the domain of public policy confined to the national level. Because national policies are easily evaded in such a situation, we have a general weakening of public policy along with an increase in the relative power of private individuals and corporations. Public efforts at the national level to deal with poverty, environmental degradation, public health, education, and even macroeconomic goals of full employment without inflation are all automatically sacrificed to the overriding goal of growth in the global production of market goods, as stimulated by free trade and free capital mobility.

This is why people are demonstrating in the streets of Seattle, Prague, Genoa, Washington, D.C., and anywhere else the WTO, the IMF, and the World Bank meet. Shortening the length of the meetings and changing the venue to places like Qatar do not address the issues raised by critics. Is it too much to hope that the concepts of ecological economics can provide a framework in which the legitimate claims of both growth and limits can be recognized?

[9]B. Bosquet, Environmental Tax Reform: Does It Work? A Survey of the Empirical Evidence, *Ecological Economics* 34(1): 19–32 (2000).

BIG IDEAS to remember

- Direct regulation
- Command-and-control regulations
- Pigouvian taxes and subsidies
- Tradeable permits (quotas)
- Abatement costs
- Total allowable commercial catch (TACC)
- Individual transferrable quotas (ITQs)
- Ecological tax reform