

Economic Incentives

— *versus* —

Command and Control

WHAT'S THE BEST APPROACH FOR SOLVING ENVIRONMENTAL PROBLEMS?

Winston Harrington and Richard D. Morgenstern

Now, decades after the first environmental laws were passed in this country, policymakers face many choices when seeking to solve environmental problems. Will taxing polluters for their discharges be more effective than fining them for not meeting certain emissions standards? Will a regulatory agency find it less costly to enforce a ban or oversee a system of tradable permits? Which strategy will reduce a pollutant the quickest?

Clearly, there are no “one-size-fits-all” answers. Many factors enter into the decision to favor either policies that lean more toward economic incentives (EI) and toward direct regulation, commonly referred to as command-and-control (CAC) policy. Underlying determinants include a country’s governmental and regulatory infrastructure, along with the nature of the environmental problem itself.

Even with these contextual factors to consider, we thought it would be useful to compare EI and CAC policies and their outcomes in a real-world setting. To do this, we looked at six environmental problems that the United States and at least one European country dealt with differently (see box on page 14.) For each problem, one approach was more of an EI measure, while the other relied more on CAC. For example, to reduce point-source industrial water pollution, the Netherlands implemented a system of fees for organic pollutants

(EI), while the United States established a system of guidelines and permits (CAC). It turned out, in fact, that most policies had at least some elements of both approaches, but we categorized them as EI or CAC based on their dominant features.

We then asked researchers who had previously studied these policies on either side of the Atlantic to update or prepare new case studies. We analyzed the 12 case studies (two for each of the six environmental problems) against a list of hypotheses frequently made for or against EI and CAC, such as which instrument is more effective or imposes less administrative burden.

The Evolution of CAC and EI

Only recently has it been possible to find enough EI policies to carry out a project such as this. Until about 15 years ago the environmental policies actually chosen were heavily dominated by CAC approaches. In the United States, the 1970s saw a great volume of new federal regulation to promote environmental quality, none of which could be characterized as relying heavily upon economic incentives. Since then, however, there has been a remarkable surge of interest in EI approaches in environmental policy. Since the late 1980s, whenever new environmental policies are proposed, it

THE SIX ENVIRONMENTAL PROBLEMS WE STUDIED

In our analysis, we selected six environmental problems in order to compare EI and CAC approaches, which are summarized below. We paired a policy from the United States with one implemented in one or more European countries.

For clarity's sake, although almost all contain some blend of EI and CAC elements, those that are more closely associated with EI instruments are listed first:

1. **SO₂ emissions from utility boilers: Permit market (United States) vs. sulfur emissions standards (Germany)**
2. **NO_x emissions from utility boilers: Emission taxes (Sweden and France) vs. NO_x New Source Performance Standards (United States)**
3. **Industrial water pollution: Effluent fees (Netherlands) vs. Effluent Guidelines and National Pollutant Discharge Elimination System permits (United States)**
4. **Leaded gasoline: Marketable permits for leaded fuel production (United States) vs. mandatory lead phase-outs plus differential taxes to prevent misfueling (most European countries)**
5. **Chlorofluorocarbons (CFC): Permit market (United States) vs. mandatory phase-outs (other industrial countries)**
6. **Chlorinated solvents: Source regulation (United States) vs. three distinct policy approaches (Germany, Sweden, Norway)**

is almost inevitable that economic incentive instruments will be considered and will receive a respectful hearing.

The reasons for the newfound popularity of EI policies are unclear. Perhaps it is due to the growth in awareness of economic incentive approaches among policymakers and policy analysts over the 20 years between 1970 and 1990. In the 1970s these approaches were generally unfamiliar to those outside the economics profession.

Another possibility is the emergence of tradable emissions permits in the late 1970s. Before then, the main EI alternative to the regulatory policies being implemented was a per-unit tax on pollution (sometimes referred to as an effluent fee). By the 1980s the policy community was generally aware of a “quantity-based” EI alternative—tradable emission permits—that seemed to provide the same assurances of the achievement of environmental goals that were offered by CAC approaches.

A third possible cause is the widespread disappointment with outcomes of the CAC regulations adopted in the 1970s. The nearly limitless variety of American industries and industrial processes required the EPA to write very detailed and complex regulations, but despite these efforts, the Agency faced a raft of legal challenges. Regulatory complexity combined with litigiousness delayed the implementation of most regulations far beyond the schedules envisioned by Congress. In other words, much of the enthusiasm for EI could be attributed to disenchantment with CAC.

The Two Sides of the Pond

It is worth underscoring some differences between the United States and Europe that serve as a backdrop to policy decisions and implementation.

First, of course, we are comparing a single federal system in the United States with the many countries of the European Union (EU). Beginning in the late 1960s, environmental policymaking became centralized in the United States. In Europe, each country has adopted policies according to its own timetable, generally beginning in the late 1960s in the wealthiest nations and sweeping south and east to the former Soviet empire by the 1990s. Environmental policy in Europe is now a mix of country-specific and EU-wide measures, which these cases reflect.

Second, there are major differences between the United States and Europe in the extent of pre-regulatory studies undertaken. Because of the U.S. requirement on agencies like the U.S. Environmental Protection Agency to conduct a Regulatory Impact Analysis before taking action, substantially more information was available about the hoped-for benefits of U.S. policies. A further issue concerns the greater reliance on taxes for regulatory purposes in Europe compared to the United States. A number of European nations use such taxes—sometimes combined with incentive-compatible rebate schemes—to achieve environmental objectives.

In the United States, environmental taxes are virtually nonexistent. Overall, despite these various differences in approaches, we were not able to discern clear differences in regulatory outcomes across the Atlantic: in some cases one or more European nations acted sooner or more aggressively to address environmental problems while in other cases the United States acted sooner or more aggressively.

Testing the Hypotheses

Since the 1970s, when western countries began forming comprehensive environmental policies, there has been a good deal of speculation and disagreement over the differ-

ences between EI and CAC instruments in practice. These discussions boil down to assertions or hypotheses about comparative advantages of each instrument. We compiled a list of the 12 most commonly stated hypotheses, recognizing that different observers might develop very different lists.

Below we discuss the five hypotheses that we consider most important in evaluating a policy instrument. For each, we state the hypothesis, review the original rationale in making it, and then test whether the hypothesis holds up in light of one or more of our case studies.

EI instruments are more efficient than CAC instruments: that is, they result in a lower unit cost of abatement.

RATIONALE: It is commonly believed that EI instruments have an efficiency advantage over CAC instruments, although the case is not airtight. EI instruments are more cost effective at achieving a given emissions reduction. But to get from cost-effectiveness to efficiency requires additional assumptions, including that the system is one of perfect competition and that the emissions are not location-specific. A theoretical counter to this hypothesis is that a CAC instrument can be as efficient if the emissions standard for each plant is chosen so that the marginal costs of abatement equal the marginal social costs of pollutant damage.

PERFORMANCE: The cases we analyzed show that EI is generally more efficient. For example, in looking at the U.S. program of marketable permits to lower SO₂ emissions, realized costs are only about one-half what was expected back in 1990 and about one-quarter of the estimated cost of various CAC standards. EI also achieved substantial cost savings in the elimination of CFCs and lead in gasoline, in part because of cost heterogeneities that could be exploited during the phase-down period. However, in instances where the regulations are so stringent that practically all available abatement measures must be taken, there is little scope for choosing the most cost-effective ones, and EI instruments do not achieve significant cost savings over CAC. EI also enjoys little advantage if all plants face similar abatement costs. Both these conditions limited, for example, the efficiency losses of using CAC for the German SO₂ emissions.

The real advantages of EI instruments are only realized over time, because they provide a continual incentive to reduce emissions, thus promoting new technology, and permit maximum flexibility in achieving emissions reductions.

RATIONALE: The effects of CAC on technology are potentially complex. On the one hand, costly regulations provide a spur to find less costly ways of compliance. On the other, the requirement to install a specific technology conceivably discourages research, since discovering new ways to reduce

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In the United States, examination of patents, in the context of SO₂ policy, suggests that in a CAC regime only cost-reducing innovations are encouraged, while under EI both cost-reducing and emissions-reducing innovations are encouraged.

emissions can lead to more stringent regulations. More stringent performance standards for new plants have the stated objective of promoting technology, but they can also have the pernicious effect of postponing retirements of older, dirtier plants and discouraging entry by outside firms.

PERFORMANCE: EI provides greater incentives than CAC for continuing innovation over time in many, but not all, cases studied. For example, the Swedish NO_x tax induced experimentation in boiler operations that led to substantial reductions in NO_x emissions. Because NO_x emissions from boilers are idiosyncratic, it was unknown beforehand what would work in each boiler. Achieving these reductions from CAC would therefore have been impossible. Similarly, the U.S. SO₂ trading policy induced many nonpatentable boiler-specific innovations on utility boilers. Elsewhere, the Netherlands became a world leader in water purification technologies and its industries adopted more advanced, process-integrated measures to reduce pollutants.

Innovation also occurs under CAC, but the results are often different. For example, the lead phase-down induced emissions reductions in all plants during the period when a CAC policy was employed, but when the policy allowed permit trading and banking, the reductions were concentrated in newer plants with longer expected lifetimes, where the improvements were most cost-effective. In the United States, examination of patents, in the context of SO₂ policy, suggests that in a CAC regime only cost-reducing innovations are encouraged, while under EI both cost-reducing and emissions-reducing innovations are encouraged.

CAC policies achieve their objectives quicker and with greater certainty than EI policies.

RATIONALE: In the early 1970s, CAC was seen as the way to expedite compliance, even if the approach was not the least costly. It appeared then that EI instruments, particularly emissions fees, would not achieve the same objectives.

PERFORMANCE : The evidence from the cases is mixed. Supporting the relative effectiveness of CAC is the U.S. effort to phase out the solvent trichloroethylene (TCE), in which EPA ultimately mandated limits. The EI aspects of the rule did not attract significant industry participation. In phasing out leaded gasoline in Europe, progress would have significantly slowed without mandating catalytic converters and maximum lead content in addition to tax differentials.

On the other hand, several cases argue that EI policies are more effective. In the Dutch water case, for example, the influence of effluent fees on organic waste-load reductions was prompt and large. Similarly, by eliciting industry cooperation, the trading and banking program probably achieved a much more rapid phase-down of lead in gasoline than

would have been possible with a CAC program that industry would have opposed.

A final point on effectiveness is that two cases show that both approaches can result in significant environmental gains, but with undesirable longer-term side effects. In the United States, NO_x emissions from coal-fired power plants were reduced, but the standards, which only affected new plants, caused firms to extend the life of older, more-polluting plants to avoid the costs associated with newer ones. In Sweden, TCE users persuaded the public and authorities that complete implementation of a ban would cause them undue harm. They received numerous waivers and exceptions, thus undermining the authority of the environmental agency and perhaps emboldening other firms to oppose other regulations.

Regulated firms are more likely to oppose EI regulations than CAC because they fear they will face higher costs, despite the greater efficiency of EI instruments.

RATIONALE: Although EI instruments may have lower social costs overall, firms pay higher costs under EI than CAC. Under CAC, the argument goes, the polluting firm pays to abate pollution; under many EI instruments, the firm pays the cost of abatement plus a fee for the remaining pollution it discharges. The firm is better off only if the abatement cost is lower by an amount at least as great as the fee payments.

PERFORMANCE: Experience on both sides of the Atlantic suggests that no government has put this hypothesis to the test, which, in a way, is strong support for it. In nearly all cases, governments eliminate the burden of EI instruments by returning fees to the firms. For example, in France, revenues collected through NO_x discharge fees subsidized the firms' abatement investments, while in Sweden the fees were returned to the firms on the basis of the energy they produced. In the United States, where the EI instrument of choice is a tradable permit, the permits have always been given away rather than auctioned off.

CAC policies have higher administrative costs.

RATIONALE: Administrative costs are determined by the amount of interaction between the regulator and regulated source. Supporters of this hypothesis note that the complexity of setting and enforcing specific requirements is higher than implementing fee-based EI policies. In addition, fees for increased emissions tend to rise gradually, whereas with CAC, a line separates compliance from violation. The potentially high incremental cost at the point of violation gives regulated sources an incentive to defend themselves legally rather than accept sanctions, thus adding to the regulators' burden.

PERFORMANCE: The cases show no clear pattern. While the

CAC-oriented Effluent Guidelines program in the United States imposed high administrative costs on EPA, so did the EI instruments of the lead phase-down program. Looking at SO₂ reduction, the EI oriented U.S. trading program gained a reputation for low administrative costs, but the SO₂ reduction program in Germany does not show evidence of higher administrative costs than a comparable EI program. Overall, because the evidence on this hypothesis is mixed, we could not form a firm conclusion about whether policy outcomes supported or refuted it.

Apples and Oranges?

Questions of effectiveness and efficiency were at the core of the initial selection of policy instruments in the 1970s and 1980s. As these cases show, EI instruments appear to produce cost savings in pollution abatement, as well as innovations that reduce the overall cost. The concern that EI instruments are not as effective is not borne out in our analysis. However, the finding about EI's economic efficiency is tempered by evidence that polluting firms prefer a CAC instrument because of its perceived lower costs to them. In all but one of the case studies, the actual or potential revenue raised by EI instruments had to be reimbursed in some way to the firms. This, of course, means the revenues cannot be used for other purposes.

In the 1970s, almost all environmental policies relied on direct regulation, with very rare instances of EI instruments. Since the late 1980s, on the other hand, whenever a new policy is proposed, policymakers at least consider, and often select, an EI instrument. That said, almost all the policies that we studied are a blend of both, beginning as a CAC policy and then having EI elements added or substituted. In the 12 cases we studied, in fact, only a few (reduction of SO₂ emissions in Germany, TCE in Germany and Sweden) had no EI elements in their design. Moreover, we can report significant environmental results from the cases we studied. Averaged across all 12, emissions fell by about two-thirds when compared to baseline estimates. Most outcomes either met or exceeded policymakers' original expectations. This is encouraging news for those seeking environmental improvements in the future. ■

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