MODELS FOR ENVIRONMENTAL REGULATION: CENTRAL PLANNING VERSUS MARKET-BASED APPROACHES

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I. INTRODUCTION

Today the Soviet Union and other nations that have employed state socialist economies are moving toward market economies. The deficiencies of central planning and the advantages that a market economy provides in decentralized decisionmaking and flexible incentives are the primary factors motivating this transition. As these nations develop their environmental protection institutions, they should look to market mechanisms to protect the environment. The United States, despite its market-based economy, has relied heavily on central planning-style, "command-and-control" tools to achieve its environmental protection goals. As the high cost and limited effectiveness of these tools has become more evident, the United States has begun shifting to the use of market-based incentives in its environmental policies. The Soviet Union can learn from the United States's experience and adopt its own market-based environmental protection strategies.

An individual planning to use a resource must take into account the costs that it will have to pay to acquire or use the resource. The individual usually does not pay attention, however, to the impacts that its use of the resource will have on others, because these impacts are not incorporated into the market price incentives or other inducements—such as centrally planned production quotas—that gov-

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ern its decision. These impacts are a kind of "externality": a cost that is "external" to the resource user's decisionmaking calculus. A typical example is environmental degradation. Polluters generally can use the air or water as a dumping ground for free, and people other than the polluter bear most of the costs of degraded air or water quality. Because the polluter is not confronted with the need to pay for this degradation, he or she produces more degradation than society as a whole desires.

Several legal and policy tools are available to address this problem of externalities. Under technology-based command-and-control regulation, the government instructs each resource user on exactly how to operate its activities—for example, what pollution-control technology it should install or even how much it should operate a business. Command-and-control "performance standards" require resource users to achieve a given, uniform level of environmental performance but allow them some flexibility in choosing the specific technology to achieve that performance. "Market-based" mechanisms impose a tax or an equivalent price incentive on the pollution or other negative externalities that a resource user creates. This type of mechanism gives polluters incentives to reduce pollution, so that government-specified aggregate pollution limits are achieved, but allows each individual polluter flexibility in deciding how much to clean up and what methods to use. Other tools include environmental impact analyses (EIAs), which require decisionmakers to assess and consider the environmental impacts of proposed actions; and information disclosure rules, which require a resource user to publish for the public materials regarding the nature of its activities. This Article discusses each of these tools below.

II. Externalities in Government Resource Management

When government agencies decide on resource uses, they usually do not consider the full social costs and benefits of their actions. The decisionmakers are officials in specialized bureaucracies with particular missions, and they typically do not pay attention to the environmental impacts of their decisions on others outside their mission area. Government-run military factories, for example, typically have manufactured weapons without adequately addressing the environmental pollution that their activities cause. Another example is government-run electricity-generating plants, which often produce electricity through high-pollution processes and sell it for less than the full cost (including environmental costs) of producing it. Such practices have caused serious environmental damage. In fact, environ-

mental degradation from government-run facilities is a common problem in both the Soviet Union and the United States. In the United States, this problem has plagued management of the national forests, federal water and dam projects, and military weapons plants and facilities. In the Soviet Union, where government agencies have run a much larger part of all economic activity, heavy pollution and degradation characterize almost every industry, sometimes in crisis proportions.

At the same time that it is causing environmental harm, the federal government is responsible for protecting public health and the environment from injury. This raises the question of how the government can effectively "regulate itself." In theory it could impose environmental restrictions on its own activities and have one agency, such as the United States Environmental Protection Agency (EPA), enforce those rules against other agencies through administrative procedures. In practice this mechanism has not entirely succeeded, in part because environmental enforcement authority is weak when it challenges other high-priority government policies. Instead, the United States has ended up relying on two other enforcement mechanisms. First, the federal government imposes environmental restrictions on agencies and then allows state governments to bring enforcement actions in court against those agencies. In addition, it permits citizens to bring such enforcement action.

The United States's National Environmental Policy Act (NEPA) imposes another important obligation on federal agencies—they must perform an environmental impact statement (EIS) before undertaking any major action. The EIS must include an assessment of both the environmental impacts of the proposed project and the reasonable alternative courses of action. An agency thereby is forced to think about the effects of its proposed action beyond its narrow mission area: to consider the externalities that it may impose. Under NEPA, citizens can sue a federal agency that fails to conduct an adequate EIS, and obtain an injunction to block the proposed agency action until the EIS is revised to the court's satisfaction. The NEPA process also exposes to public scrutiny the adverse environmental impacts of a project. Public pressure often can induce a federal agency to find less damaging ways of achieving this mission.

III. Externalities in Market Economies

A. Market Failure

Private market decisionmakers also often ignore the social and environmental impacts of their actions. Many markets provide in-

centives to producers of goods and services to satisfy consumers' desires, but fail to incorporate in the prices of producers' production inputs and commodity outputs the environmental costs that the polluter, as well as other negative effects of resource use, impose on society at large. This is the familiar concept of "market failure."

One example of a market externality is water pollution arising from a factory's industrial operations. This pollution imposes a cost on the neighbors of the factory, such as the local fishers who lose their livelihood when fish die, or the local residents whose health is impaired. That cost, however, is not included in the price that the factory pays for its raw materials or that consumers pay for its products. As a result, the factory has no incentive to reduce pollution. If companies had to pay for the costs of pollution, and if they included these costs in the price of their products, consumers would have to pay more for the products of companies that polluted more, and cleaner companies would sell more products.

Where market failures are serious, government intervention to correct such failures is often justified.[1] The decision to intervene, however, is not the end of the story. There are different mechanisms for correcting market failures. The selection among them is critical.

B. Traditional Regulatory Responses

Over the last twenty years in the United States, the main model for the design of regulation has been the technology-based command-and-control standard. In some cases the central government specifies the precise technologies or designs that industry must install. In other cases, it expresses central standards in performance terms, for example, requiring all polluters in a given category to limit emissions to a specific percentage or amount. In theory, polluters have flexibility to meet such standards through a variety of techniques. In practice, however, regulators typically base such standards on the use of a specific technology, and polluters face strong administrative incentives to use that technology in order to demonstrate compliance.

Many United States laws regulating pollution and hazardous waste, including the Clean Water Act (CWA) and the Clean Air Act

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[1] While market failure is a necessary condition for government intervention, it is not sufficient. There also can be "government failure": policies can fail to achieve their intended results or even be counterproductive. Intervention is warranted where its benefits exceed its costs.

(CAA), embody command-and-control measures. This approach has produced uniform, inflexible standards that result in high compliance costs, restrict innovation, discourage efficient use of resources, and require detailed central planning of economic activity. While some of these regulatory controls have been initially effective in limiting environmental degradation, they also have proved to be costly and less effective over the longer term.

The command-and-control approach often is implemented through regulations requiring "best available control technology" (BACT) or a level of performance based on BACT. The government uses these technology-based standards because they give the impression of accomplishing results—after all, what could be better than "best?" Moreover, imposition of technology controls ensures reduction of pollution out of the "end of the pipe."

The United States's experience, however, has shown that the BACT approach has several important drawbacks. First, a technology-based approach is insensitive to the costs and benefits of applying each control technology at each site. It requires the same type of control at each site, even if some other means of reducing pollution at that site would be cheaper or environmentally preferable. Second, technology standards discourage innovation in control technologies. When the government designates a technology as "best" and mandates it adoption, that technology is "locked in," capturing the market and discouraging the development of innovations that could improve performance. For example, if the government designates one type of flue gas desulfurization technology as BACT and requires that all firms install it, other techniques for sulfur removal have no economic value, because they are excluded from the market. Over time, this barrier to innovation seriously impairs the ability of technology-based standards to protect the environment.

Third, a technology standard discourages improvements in conservation: raw material choices and efficiency improvements that would reduce the production of pollutants requiring treatment or disposal. Requiring the adoption of specific control technologies gives businesses no incentive to conserve fuels or otherwise minimize emissions once the control technology is in place. Pollution prevention activities, such as redesigning production processes or changing raw materials inputs to reduce the total quantity of pollution produced, often can be more effective than capping or treating what comes out of the discharge pipe. Further, end-of-the-pipe controls tend to address each kind of pollution separately, or "piecemeal,"

simply moving pollutants from one environmental medium—whether air, land, or water—to another instead of addressing the total quantity of all pollutants discharged into all media.

Fourth, the BACT approach often results in far more stringent controls on new plants than existing plants. While some differential is justified given the fact that the costs of retrofitting old plants are higher than the costs of building controls into new plants, the implementation of BACT in the United States often has unduly hindered the construction of new plants, discouraging the capital investment and innovation that are necessary to promote economic growth. Because newer plants are typically cleaner plants, this discourages environmental improvement as well.

Fifth, a technology-based approach requires a large centralized government bureaucracy to study industries and choose technologies. Decisions are slow, unresponsive, and costly. Because of the problems in gathering and processing information in a control bureaucracy, the standards produced are often inappropriate to local circumstances or obsolescent.

C. Market-Based Regulatory Responses

Recently, United States environmental policy increasingly has employed market-based incentives. Because the underlying problem is that private markets are operating imperfectly, the better approach for government action often will be to "reconstitute" the market. Rather than overriding the market with central planning, the government reorients the market by providing incentives that promote environmental protection. Revising the market's system of pricing or consumer demand to include environmental considerations can turn the indefatigable creativity of diverse and flexible responses by market actors to environmental advantage. It reduces overall social costs because those who can prevent degradation most cheaply are encouraged to do so most. Finally, it advances environmental protection as the incentives spur innovation in environmentally benign technologies and processes, and as efficient use of resources, such as conservation of fuels, is put on equal footing with installation of control technology.

The government can attach a tax or a fee to each unit of emissions, effectively forcing emitters to internalize the costs that pollution imposes on society. The theory is that each emitter will reduce its emissions to the point that its costs of control become as expensive as paying the tax or fee. This point will vary for each emitter, but

the aggregate emissions reduction will correspond to the level of the tax or fee exacted.

Under the concept of tradeable allowances, the government imposes a limit on the total quantity of emissions, issues allowances adding up to that total, and then allows emitters to buy and sell allowances among each other. Each emitter must hold an allowance for each unit of its actual emissions or face heavy penalties. The aggregate emissions cannot exceed the total level that the government has set, but the amount for which any individual firm is responsible will vary. Those who can control emissions more cheaply will do so and sell their excess allowances at a profit, while those for whom control is more expensive will purchase allowances. The market price of the allowances operates like a fee on emissions, forcing purchasers to internalize the costs of their emissions.

A deposit-refund system is like a fee with a rebate. For example, those who generate a hazardous waste must pay a fee to the government for each unit of waste generated; when they properly treat and dispose of the waste, they receive a refund. This arrangement provides incentives to reduce waste output and to treat and properly dispose of those wastes that are generated. Illegal dumping of untreated wastes would equal a forfeit of the deposit and is therefore not profitable.

Information disclosure policies require companies to report to the public about the environmental characteristics of their products and services, the substances they keep on their premises, and their discharges into the environment. Consumers who care about the environment will switch their purchases to firms that produce environmentally sound products and services, giving such firms a competitive advantage over their dirtier rivals. In addition, public information about pollution and its hazards can create informal public pressure on firms to reduce these hazards.

In general, market-based instruments address each of the five drawbacks to command-and-control policies. First, market-based mechanisms make effective use of the variation in costs of control to minimize overall costs. Under a market-based incentive approach, each source gets the flexibility and the financial incentive to reduce pollution and other forms of environmental degradation in the cheapest and most effective way. As a result, polluters can achieve a given level of overall environmental protection at a far lower cost than under rigid, uniform command-and-control standards. In general, the cost savings of market-based approaches already tried in the United States have been quite significant, ranging up to fifty

percent or more as compared to command-and-control policies. For an economy like that of the Soviet Union, striving to protect its environment with very limited financial resources, this kind of cost saving can be absolutely essential. Second, market-based mechanisms spur creativity and innovation. Under a market-based incentive approach, rather than simply being told by the government what technology to install, firms have a strong economic and competitive incentive, as well as the necessary flexibility, to develop better, cheaper, and more powerful pollution reduction techniques.

Third, market-based incentives encourage conservation and efficient use of resources. Because each firm is free to choose its least cost response in order to reduce overall pollution, it need not only install end-of-the-pipe control devices. The firm also can find new and better ways of producing its products: methods and processes that use less materials and hence result in less pollution. For example, instead of installing a smokestack pollution-removal device, the firm may decide to use fuel more efficiently, reducing both pollution and energy resource use. In addition, market-based incentives avoid the problem of piecemeal measures that rely on end-of-the-pipe controls. Market-based approaches can be more readily designed to set incentives to reduce the total quantity of pollution, rather than to control one kind of pipe at a time and only move pollution from one form to another.

Fourth, the regulatory bias against new facilities disappears because both old and new sources must pay the same tax or face the same price for allowances. Fifth, a market-based approach reduces the need for a large centralized bureaucracy. An important role for the government remains: to set taxes or pollution allowances; monitor performance, such as emissions; and ensure, through vigorous enforcement, that firms are not exceeding their allowances or evading the payment of required fees. No longer, however, is a huge staff of engineers and technicians in the central government needed to determine what quantity of emissions each of hundreds of thousands of plants should control and to select specific technological controls. That responsibility devolves to private managers, who have up-to-date, detailed information about local conditions and opportunities.

Market-based approaches, however, will not be suitable for solving every environmental problem. For example, market-based policies usually tie incentives to a quantitative measure of environmental performance, such as the quantity of emissions, so they require information about emissions or discharges. Where such information

is very hard to obtain, a technology-based approach may be necessary, at least in the short run. It is also possible to combine economic incentives and traditional forms of regulation. For example, regulations can require a base level of control by all plants in a given industrial grouping, while taxes on emissions above the base level can provide flexible, cost-effective incentives for additional reductions.

D. Market-Based Approaches in Action

1. Examples of Current Programs

a. The Lead Phase-down

Lead is a toxic substance, linked to brain damage in people who eat or inhale it. In 1982, under the CAA, the EPA issued regulations reducing the allowable lead content of gasoline. The agency simultaneously authorized trading, within and among refiners, of the remaining allowed content of lead in their gasoline. Leaded gasoline producers and importers could transfer, that is, buy and sell, lead content credits freely among themselves, but their credits expired quarterly if unused. In 1985, the EPA further lowered the lead content limits. To provide leaded gasoline producers and importers with additional flexibility in complying with the new limits, the agency issued regulations permitting producers and importers whose gasoline in 1985 contained less lead per gallon than the applicable standard to "bank" lead content credits: to avoid the expiration of their credits. The "banking" regulations then permitted these producers and importers to "withdraw" their lead content credits through the end of 1987 and to apply them to help meet the new, more stringent lead content standards that took effect in 1985.

Banking and trading were active and resulted in cost savings on the order of hundreds of millions of dollars over the few years of the program. Firms were not required to apply to the EPA for permission to enter into trades; they simply reported their trades to the government as part of their regularly required reports of the lead content in their gasoline. The program successfully reduced the lead content in gasoline by ninety percent.

b. Chlorofluorocarbon Reduction

Both trading and taxes are now tools in the effort to phase out chlorofluorocarbons (CFCs) in order to protect the stratospheric

ozone layer. To implement the 1987 Montreal Protocol (and its 1990 update, the London Adjustments and Amendments) and the national legislation following from it, the EPA has issued regulations requiring a phase-out of CFC production and consumption by the year 2000 and implementing the phase-out by issuing depreciating allowances to each producer and importer of CFCs. CFC producers, importers, and other interested parties may trade these allowances. The EPA is able to monitor production and imports of CFCs and to keep track of allowance trades. Producers are aware of potential buyers and sellers and can trade allowances freely.

In addition to issuing CFC allowances, the United States has imposed a tax on CFC production and importation. Like the allowance trading system, by increasing CFC prices, this tax provides a market for the development and use of substitutes for CFCs.

c. The Pinelands Development

The state of New Jersey successfully has used a somewhat different allowance approach to regulate development of the Pinelands, a forest zone that the state wishes to protect from excessive development. Here the allowances are not for emissions but for rights to develop property. Property in parts of the Pinelands is slated for preservation, and the owners of that property may agree to be prohibited from developing their land. In return, the state would issue them "transferable development rights" (TDRs) that they may sell to others wishing to develop land in other areas of the Pinelands. Each owner would receive different amounts of TDRs depending on the value to society of preserving that owner's property. In areas in which development is permitted, landowners must hold TDRs to develop their property. Thus, the total amount of development in the Pinelands is capped, and the regional distribution is partly restricted, but the precise allocation of development on permissible properties is left to the market for TDRs. In addition, no current land owner is entirely deprived of the former market value of his or her land, because those whom the state bars from developing their own land receive TDRs to sell to others. The government has established a TDR exchange to facilitate trades—the exchange buys TDRs from willing sellers and sells them to interested buyers.

2. An Example of a Program Nearing Implementation: The Bush Administration Plan to Reduce Acid Precipitation

The Bush Administration proposed, and in 1990 Congress passed, new CAA legislation to reduce emissions of materials that contribute

to acid precipitation, or "acid rain." A key feature of the Administration Plan is the use of transferable emission allowances. The law requires a roughly fifty-percent permanent reduction, within ten years, in the total emission of sulfur dioxide—one of the main precursors of acid precipitation—from fossil fuel-burning electric generating plants, which are the primary source of sulfur dioxide emissions in the United States.

Each plant will receive emission allowances based on its historic energy capacity. The government will reduce these allowances gradually each year in order to achieve the fifty-percent reduction after ten years. Each plant is free to reduce emissions in any way it chooses, whether by use of end-of-the-stack scrubbers, or low-sulfur fuels, the development of new, lower-emission combustion technologies, or investment in conservation by its customers (and hence lower electricity demand and generation). Utilities that reduce their emissions below the amount permitted by their allowances would be able to sell those "extra" allowances as "credits" to other utilities for whom purchasing allowances is cheaper than investing in emissions reductions. Emissions reduction therefore would become a profit center for electric utility plants. Market forces would determine the relative degree of emissions control that each plant achieves, but total emissions ultimately would be reduced by fifty percent. In order to make the fifty-percent reduction permanent, new plants would have to buy allowances from existing sources. The government would play a "market maker" role, retaining a limited share of the total supply of allowances to ensure their availability for sale to individual new or expanding plants.

The costs savings of this trading plan over a plan that does not employ trading are estimated at about $1 billion per year or higher. The trading plan also creates a strong financial incentive for utilities to engage in energy conservation and technological innovation, whereas a rule requiring utilities to adopt specific emissions control mechanisms such as scrubbers would discourage both of these.

3. Examples of Programs Under Discussion

a. Hazardous Wastes

For several types of hazardous wastes, such as lead-acid batteries and solvents, it is important not only to reduce the total quantities generated but also to ensure that whatever is generated is carefully handled. Prohibiting landfill disposal of such substances or mandating disposal in certain designated sites can lead to illegal "midnight

dumping." An alternative, market-based option is the use of deposit-refund systems to encourage waste minimization and proper disposal. Such a system relies on retailers charging a deposit on the sale of the item; the deposit is refunded when the purchaser returns the item to the retailer or a treatment facility. A deposit-refund system gives purchasers an incentive to minimize the initial generation of waste and properly to treat and dispose of wastes that they do generate. The states of Maine and Rhode Island now operate deposit-refund systems for lead-acid batteries.

b. Climate Change

If nations or the international community decide to take action to address potential climate change, the use of market-based incentives could be extremely helpful in implementing policy. Numerous sources emit a multitude of greenhouse gases (GHGs) in every sector of the economy, including energy, agriculture, and transportation—"sinks" such as forests and oceans absorb these gases. The widely varying costs of control across gases, sectors, and nations as well as the global dispersion of the emissions, make market mechanisms especially attractive in this context.

Options for addressing GHG emissions include tradeable allowances and fees. Either of these mechanisms could be employed domestically or internationally, although the considerations may differ in each context. To the extent feasible, an allowance or fee should be comprehensive, including all GHGs (carbon dioxide, methane, nitrous oxide, CFCs, and hydrochlorofluorocarbons, and its precursors) and all sinks or reservoirs of GHGs, such as forests. An index could be devised to express, in terms of carbon dioxide-equivalence, the relative contribution of each gas to global climate change. The tax or allowance could then be expressed in carbon dioxide-equivalents, allowing nations or sources the flexibility to achieve requirements by reducing whatever GHG or expanding whatever sink was cheapest and most feasible for each nation or source.

Under tradeable allowances, GHG emitters would receive allowances and be free to trade them. Because the cost of limiting GHG emissions is likely to vary considerably among emitters, market-based allocation of compliance burdens could achieve significant cost savings and promote innovation. Trading is a particularly appropriate tool for addressing GHG emissions because, unlike toxic air and water pollutants, GHG emissions mix globally in the atmosphere. Moreover, the spatial distribution of their emissions sources is es-

sentially irrelevant—they do not pose the problem of local toxic "hotspots" that some pollutants do.

International trading could begin informally as cooperative arrangements among nations. For example, one nation could provide another nation with technology and investment to reduce emissions, or with assistance in reforestation, and receive in return a part of the resultant GHG reduction as a credit against its own emission reduction obligations. Regional or group "bubbles" could be authorized to foster regional trading. Ultimately, an international market in allowances traded among private actors could develop. Either formal or formalized trading would facilitate the transfer of resources and technology, on a decentralized market basis, to developing nations and the Soviet Union and Eastern European nations to assist them toward a low-GHG pattern of economic development.

IV. Market-Based Incentives in Economies in Transition

It is especially appropriate for the Soviet Union and Eastern Europe to consider starting now with a market-based approach to environmental law. Market-based environmental policies are most effective when a government employs them from the beginning, and function less smoothly when grafted onto a command-and-control base. For example, if the first round of policy requires installation of a specific technology, it is difficult to implement a second round of policy that allows firms the flexibility to choose control strategies as though the technology rule has not been imposed. In addition, the cost savings from the market-based policy will not be as large once the technology rule is already in place.

Although environmental law in the United States started with centrally planned, command-and-control measures and only later began to employ market-based incentives, other nations need not repeat this history. They can adopt market-based incentive approaches for environmental protection from the outset. The Soviet Union and the nations of Eastern Europe have a unique opportunity to build sound markets for their economies and adopt sound market-based environmental policies at the same time.

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