Center for the Study of American Business

Designing Global Climate Policy: Efficient Markets versus Political Markets

by Jonathan Baert Wiener

Policy Study
Number 143

December 1997

Washington University in St. Louis

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Executive Summary

Countries meeting in Rio de Janeiro in the summer of 1992, in Berlin in the spring of 1995, and now in Kyoto, Japan, in December 1997 have struggled with the question of how best to respond to potential global climate change. Although the news headlines have centered on *how much* control of "greenhouse gas" emissions countries would undertake in a global treaty, an equally crucial issue is the choice of *how to* control emissions under any such treaty — the choice of "policy design" or "regulatory instrument" embodied in the terms and structure of the global legal regime.

Greenhouse gases (GHGs) include carbon dioxide (CO_2), methane (CH_4), and several other trace gases that trap heat in the earth's atmosphere. The set of regulatory instruments that might be used to control GHG emissions in an international treaty includes: internationally harmonized policy measures; uniform emissions reductions by each country; emissions reductions by each country with the flexibility to trade units of emissions abatement across countries (tradeable allowances); and coordinated emissions taxes.

Cost-Effectiveness

Flexible regulatory instruments such as a market-based system of tradeable emissions allowances can help mitigate the conventional dilemma of costs versus environmental protection — achieving more environmental protection and more innovation at less cost than the alternatives. Experience with national environmental regulation such as the control of SO_2 emissions to combat acid rain provides some basis for optimism about the efficiencies to be gained from an emissions trading program. Studies suggest that an international market-based system of tradeable allowances could achieve a given level of GHG emissions control at global cost savings of 50 percent or more compared to inflexible quantity controls. A trading system also would stimulate greater innovation and diffusion of lower-emissions technologies and practices. Allowance trading appears even better suited to GHGs than to control

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of SO_2, because of the relative absence of local environmental impacts (hot spots) and because of the very wide range of GHG emissions abatement costs across countries, increasing the "gains from trade."

Global Coverage

At the international level, the choice of regulatory instrument confronts an additional factor not ordinarily critical at the national level — participation. Whereas national environmental regulation is adopted by majority rule and, therefore, can bind dissenting interest groups and geographic regions, at the international level each country can be bound only by its voluntary assent. Thus the choice of policy design at the international level must pay acute attention to the incentives it creates for, or against, participation by sovereign nation-states. Without participation by developing countries, a climate treaty might reduce emissions in wealthy countries only to see emissions increase in developing countries. This, of course, would thwart the environmental objectives of the treaty at significant economic cost to industrialized nations (and deter initial action by wealthy countries who fear this very result).

Harmonized policies, uniform emissions controls, and coordinated emissions taxes would offer no direct incentives to developing countries to join the treaty. But a system of allowance trading would attract participation by developing countries which could earn profits from selling emissions allowances (and, at the same time, it would ease the costs of participation by wealthy countries). Because virtually universal participation in any climate treaty will be essential to its environmental and economic success, this coverage-expanding feature of a market-based regulatory instrument for GHG control is of enormous importance.

Implementation

Proposals for an efficient market-based policy design to control GHG emissions have not earned universal acclaim. Some doubt the ability to initiate, monitor, manage and enforce an international emissions trading market to ensure real reductions in global GHG emissions. These concerns apply generically to *any* policy that would constrain emissions, with or without trading; and a market-based policy would actually ease these concerns somewhat. Other concerns — about transaction costs, market power, and nation-state meddling — are germane to an international market-based system. These concerns would need to be addressed in the design of an international allowance trading system.

Politics

The more worrisome problem is that adoption of *efficient markets* for GHG emissions control may be blocked by the distortions present in *political markets*. Individual countries and interest groups may favor globally inefficient policy designs that would, nonetheless, be more to the liking of these interests. Persuading the world that market-based policy designs are efficient may be of little help in surmounting the coalition of interests arrayed against efficiency.

Some may oppose GHG allowance trading because they advance moral and fairness objections to trading pollution allowances. Yet, such a system could offer both improved pollution control and improved relative economic standing for poorer countries. Others may oppose GHG allowance trading because their real agenda is social change in industrialized countries, not cost-effective protection of the global climate. And others, worrying that allowance trading could invite too little, or too much, stringency in the control of GHG emissions, may be pursuing their concerns about the optimal stringency of control by a flank attack on the regulatory instrument for control.

Most interesting, and most troubling, is the possibility that certain industry and national interests may benefit from an inefficient GHG emissions control policy that hurts them a little while it much more substantially raises their economic rivals' costs. Industrialized countries with low domestic emissions abatement costs might be opposing global allowance trading because it would enable their rivals with high domestic abatement costs to purchase equally low-cost abatement services worldwide. An inflexible control regime might be globally inefficient, but it could be an effective weapon for rivalry among competing countries with varying costs of abatement. This strategy of "predation through regulation" might explain some of the observed opposition from industrialized countries to a global market-based policy design, and the preference of these countries for allowance trading only among industrialized countries.

In a related vein, diplomats from both developing and industrialized countries might oppose allowance trading because they feel better able to control official centralized government aid. They may even feel their power base threatened by a system that would empower the decentralized decisions of market actors.

Thus, the problem is not just that policymakers must weigh how much to protect the climate and that they must choose the most efficient policy design for how to protect the climate, but also that efficient market-based policy design must do battle in the *po-*

litical marketplace. Efficient climate policy requires developing not only an efficient policy design, but also a political constituency for efficiency.

Introduction

At the Earth Summit in Rio de Janeiro in 1992, virtually all of the world's countries signed the Framework Convention on Climate Change (FCCC), establishing the basic blueprint for global collective action to manage the threat of the greenhouse effect.[1] The FCCC called on industrialized countries to take actions to limit their emissions of "greenhouse gases" (GHGs), such as carbon dioxide (CO_2), methane (CH_4), and other gases, with the aim of keeping these emissions no higher than their 1990 level in the year 2000.[2] Developing countries are also obliged to take measures to limit emissions, but with no quantitative goal.[3]

In 1995, the governing body of the parties to the FCCC met in Berlin and announced a plan to negotiate a more rigorous constraint on GHG emissions, particularly for the period after the year 2000. The agreement envisioned in this "Berlin Mandate" was to be adopted at the parties' meeting in Kyoto, Japan, in December 1997.[4]

Throughout these negotiations, a crucial issue has been the choice of "policy design" for the treaty — what kind of legal structure would be created, and what impact that structure would have on key outcomes such as costs, environmental effectiveness, incentives, innovation, fairness, participation, trade, and related matters. This paper does not attempt to resolve the scientific controversies surrounding global warming. Thus, it does not consider such questions as whether GHG restraints would have a worthwhile impact on global climate. It assumes that restraining GHG emissions may become an important international commitment, and examines policy alternatives for meeting that objective.

Whatever overall target is set for how much climate protection is warranted, a variety of policy designs could be employed to achieve that goal — each with its own set of advantages and disadvantages. Experience with domestic environmental regulation has shown that the choice of policy design has an enormous influence on these key outcomes just noted. Smart policy design can help mitigate the conventional dilemma of costs versus environmental protection — achieving more protection at less cost than old style uniform control policies.

In the late 1980s, proposals for a global climate change re-

gime centered on command-and-control requirements to mandate specific, uniform fixes in specific sectors of the economy. New climate policy proposals were introduced by the United States in late 1989, and by Norway about a year later, to employ more flexible, performance-oriented policy designs — such as tradeable emissions allowances and emissions taxes — that provide incentives to reduce emissions in the most cost-effective ways. In 1992 the FCCC endorsed an informal version of tradeable allowances, dubbed "joint implementation" (JI), in which countries (or their private sector actors) can reduce global GHG emissions via projects outside their national territories.[5]

A system of joint implementation could protect the global climate most effectively at least cost, stimulate innovation, and mobilize the resource and technology flows to developing countries.

As negotiations toward a binding constraint on emissions have gathered steam in the last three years, interest has intensified in the design of efficient policy instruments, such as a formal system of tradeable emissions allowances. Such a system could protect the global climate most effectively at least cost, stimulate innovation, and mobilize the resource and technology flows to developing countries that will be crucial to engaging those countries in avoiding rapid future emissions growth.

In preparation for the Kyoto meeting, the United States has officially proposed that a formal international system of tradeable emissions allowances be incorporated into the climate treaty.[6] Over 2,000 economists, including several Nobel laureates, have signed a statement endorsing this general approach.[7] Despite their attractiveness, these proposals for efficient market-based policy design have not earned universal acclaim. Concerns have been raised about the ability to initiate, monitor and manage an international emissions trading market to ensure real reductions in global GHG emissions — concerns about allocating allowances, deterring free riders, preventing cross-border emissions "leakage," establishing "baseline" forecasts of business-as-usual emissions, and monitoring compliance.

These concerns, however, apply generically to *any* policy that would constrain emissions. When compared to an emissions limitation policy that did not employ flexible market-based incentives,

a market-based policy would actually ease these concerns. Other concerns — about transaction costs, market power, and nation-state meddling — are germane to a market-based system, and need to be addressed in its design.[8]

The more worrisome obstacle to the adoption of efficient policy design for climate change is the *political economy* of global regulation: individual countries and interest groups may favor inefficient policy designs that would cost global society but would be more to the liking of these interests. Persuading the world that market-based policy designs are efficient may be of little help in surmounting the coalition of interests arrayed against efficiency.

The problem is not just that policymakers must weigh efficient versus inefficient policy designs, but that efficient market-based policy design must do battle in the political marketplace. Efficient climate policy requires developing not only an efficient policy design, but also a political constituency for efficiency.

The Challenge of Climate Change Policy

Whether or not a major new climate accord is reached at Kyoto, the complex and difficult issues of global climate policy will be a defining challenge of the post-Cold War era. The stakes in global climate policy — including ecological and human health, prosperity and poverty, trade competitiveness, technological change — are probably the largest of any environmental policy issue. Rapid and significant global warming might yield damages that dwarf those caused by traditional environmental policy problems like regional acid rain and local habitat loss. But rapid and significant curbs on GHG emissions could also yield social costs that dwarf those imposed by traditional environmental laws.

Agreement on global climate policy is so difficult because the issues are so complex, the impacts of policies are potentially so large and so unevenly distributed, and the costs of erring in any direction are very high.

Global Impacts

The impacts of GHG emissions are essentially global. Each molecule of carbon dioxide (CO_2) — the most abundant GHG — emitted anywhere on the planet has essentially the same global effect on the heat-trapping ability of the earth's atmosphere. The same is more or less true for most of the other major GHGs.

Hence, in contrast to pollutants like airborne toxic substances, there are essentially no local "hotspots" of environmental impacts caused by higher local GHG emissions. The global impacts of re-

ducing GHG emissions are independent of where the emissions abatement takes place.

One implication of globally spread impacts is that the atmosphere is a global open-access resource, and its protection is a global "public good." A given GHG abatement effort has global environmental impacts that everyone shares, and no one can be excluded from sharing the benefits of abatement (indeed, the individual abater is likely to receive only a tiny fraction of the global benefits of her abatement efforts).[9] In addition, the costs of abatement would be borne today while the benefits would largely accrue to future generations. Thus, if GHG abatement is costly to the provider of that abatement, it is highly likely that private markets and individual countries — absent some kind of international cooperation — will invest in substantially less GHG abatement than would be desirable from a global collective point of view.

This is a straightforward implication of the theory of the "tragedy of the commons." Each individual country would prefer to avoid the costs of abatement while enjoying the shared benefit of others' abatement (to "free ride"). If all countries adopt this strategy, there will be an undersupply of abatement effort.[10] If so, without some collective constraint on use of the open-access resource, it will likely be overused — in this case, overloaded with GHGs.

Global Emissions Sources

The sources of GHG emissions are globally dispersed. In every country, virtually every human activity directly or indirectly emits GHGs: fossil fuel and biomass combustion, leaks from natural gas pipelines and coal mines, clearing forests and grasslands, wet rice farming, raising ruminant animals such as cattle and sheep, using nitrogen fertilizers to grow crops, disposing of wastes in landfills, manufacturing nylon, etc. All countries have opportunities to emit GHGs. They also have opportunities to reduce GHG emissions, especially given the opportunity to expand GHG sinks, such as forests, which remove GHGs from the atmosphere.

Although most GHG emissions currently emanate from wealthier countries, over the next three decades the balance is forecast to shift to poorer countries, where emissions are currently growing much faster than in wealthy countries.[11] Moreover, constraints imposed on some but not all countries could induce GHG-emitting activities to shift to unconstrained countries — the problem of cross-border "leakage."

Leakage may result in the short term because reduced demand for energy (or reduced supply of timber) would change world

market prices and increase the quantity of energy consumed (or timber harvested) elsewhere. In the longer term, leakage would occur because businesses could relocate to unconstrained countries.

Thus, a climate treaty must be nearly universal in breadth if it is to avoid competitiveness distortions, and to accomplish effective global environmental protection. The competitiveness concern appears to be motivating the U.S. Senate to oppose ratification of any treaty that does not bind developing countries as well.[12] The environmental downsides of "leakage" could warrant nearly global coverage even if there were only minimal competitiveness effects. Thus the policy design adopted in the climate treaty must find a way to maximize coverage of both industrialized and developing countries.

Varying Costs and Benefits

The costs and benefits of GHG emissions abatement vary widely across countries. Abatement costs vary because national differences in technology and economic structure (among other factors) make avoiding future emissions much less costly in some places than in others. One study found a 50-fold difference in GHG abatement costs just within the membership of the European Union.[13] Variation in abatement costs across the entire world, including developing countries, Eastern European countries, and the Former Soviet Union, as well as industrialized countries, is likely to be much greater. This variation in abatement costs implies that, just as with all sorts of other goods and services, there is comparative advantage and thus gains from trade in GHG abatement services.

Abatement benefits also vary because, although the climatic effects of GHGs on the atmosphere are spread globally, countries vary in the physical damage that a given increment of climate change would induce. Some countries may be particularly vulnerable to sea-level rise, storm surges, changes in precipitation, and changes in ocean circulation and monsoon patterns. Other countries may be more resilient or might even stand to gain from some global warming (e.g. colder countries where growing seasons could expand in a warmer world).

Countries may also vary in how much value they place on avoiding equal physical damages due to climate change. For example, wealthier populations might be more inclined to invest scarce social resources in climate protection than might poorer populations struggling to address other more immediate priorities for survival and prosperity.[14]

Thus beneficiaries of climate protection may need to offer side payments to induce cooperation by countries uninterested in, or averse to, limiting GHG emissions. "International transfers ... are likely to serve as both the building blocks of globally optimal action and the cement of global cooperation."[15]

Uncertainty About Costs and Benefits

Climate policy is surrounded by enormous uncertainty. There is great uncertainty about the rate and impacts of climate change (and hence about the benefits of climate protection policy). There is also great uncertainty about the costs of emissions abatement. "Top-down" macroeconomic models tend to show high costs of GHG control; "bottom-up" technology-based analyses tend to show low costs or even long-run benefits.[16]

Because of the enormous uncertainty about the benefits and costs of emissions abatement, the optimal (net-benefit-maximizing) constraint on emissions is very incompletely characterized. Some argue that the optimal near-term climate policy, in light of such uncertainty, would be to impose no immediate constraint on emissions, but rather wait a decade or so while gathering further information and building institutions for adaptive decisionmaking.[17] Hasty adoption of climate policy under great uncertainty could yield "dangers of error and backlash"[18] — policy mistakes that undermine the long-term effort to prevent possible undesirable climate change.

It may even be that the impacts of gradual near-term global warming would be innocuous or even benign.[19] Longer term or rapid global warming, however, might cause substantial damages.[20] Some also point to the "supplementary benefits" of GHG emissions control, such as reductions in urban ozone (smog) and sulfur particulate pollution as fossil fuel combustion is reduced.[21] But a complete analysis requires equal attention to the problem that the reduction in GHGs and associated changes in other pollutants could also cause "supplementary harms" (countervailing risks), such as reduced CO_2 but increased CH_4 from natural gas leaks, or the risks of non-fossil energy sources.[22]

A full analysis of the optimal GHG emissions constraint is well beyond the scope of this paper, nor is it the point of this paper. The point here is to analyze the choice among policy designs to implement a climate policy ("how to" control GHGs), not the optimal degree of policy stringency ("how much" to control GHGs). If no constraint is warranted, the choice of policy design is moot. But if some limits on emissions might be warranted — or if they might

be adopted by diplomats, regardless of what economists advise — then the choice of policy design is crucial.

International Legal Rules and Institutions

The international institutional context is different from the legal institutions for environmental policymaking under national law. The decision-making rule is quite different. There is no majority rule in international law. In general, a country can be bound by the terms of a treaty only if the country agrees to become a party to the treaty.

International treaties are thus more analogous to negotiated multiparty contracts than to majority-vote legislation.[23] Each party's cooperation depends on its perception of its own gain, which in turn depends in part on its perception of whether other parties are likely to keep their end of the deal. Cooperation is essential and delicate.[24]

An international climate change treaty must be not only collectively attractive, but also individually attractive to every signatory.

This institutional arrangement prevents any sovereign nation from being bound by an international law from which it dissents. But it also enables each nation to act as a holdout, insisting on conformance to its interests as the price for its assent. And uncertainty about others' likely cooperation may induce widespread non-cooperation (free riding) even though all would be better off under a cooperative regime.[25] As a result, an international climate change treaty must be not only collectively attractive (improving global well-being), but also individually attractive to every signatory (improving each nation's well-being).

The voluntary assent voting rule inhibits the "tyranny of the majority," but it also makes international treaties difficult to negotiate. It reduces the costs imposed on dissenters, but increases the costs to the group of taking any action.[26] It enables the "tyranny of one" — each nation whose cooperation is needed can hold up and distort the entire treaty.[27] The costs to the entire group of negotiating a consensus treaty are high both in terms of the opportunity cost of the time and effort needed to craft a successful consensus, and in terms of the collective gains foregone when individual countries object on parochial strategic grounds.

Meanwhile, in order to encompass all GHG emissions sources and to prevent "leakage," as noted above, climate protection warrants nearly universal global breadth of treaty coverage, at least of present and future major emitters. Achieving universal coverage under a unanimous assent rule requires a policy design that attracts widespread voluntary participation by sovereign nation-states.

Meshing an international climate treaty with the diverse legal cultures of the participating countries will be a significant challenge. An international climate treaty will cover numerous countries with varying national interests, different legal systems, and diverse cultures. Their interests in environmental protection and in other social priorities will vary widely. Many countries important to a climate treaty may have legal and cultural traditions that are less "market-friendly" than are U.S. norms. Even in the United States, environmental law has only lately begun to shift from central planning to market-based approaches.

The Efficiency of Climate Policy Design

Several different policy designs might be adopted in global climate change policy. Each would have different consequences for efficiency, innovation, distributional equity, participation, and related outcomes. No policy design is perfect; the challenge is to select the best design from among several imperfect alternatives. Normative regulatory theory counsels selection of the policy option that maximizes overall global net benefits (including both environmental and economic consequences, and including qualitative and intangible factors as well as quantified factors), and that achieves a given goal most cost-effectively.

If climate protection is a global public good warranting some collective emissions constraint to prevent overuse — or if international political actors are headed toward agreement on some emissions constraint, regardless of a careful optimality calculation — there remain important choices about which kind of policy design to employ. In principle, societal constraint on the use of an open-access resource may take many forms. They include:

- allocation of rights to use certain areas or amounts of the resource and to exclude others, thereby inducing the owner to face the costs of overuse and to conserve the resource appropriately ("private property");
- rules of social reciprocity inducing mutual restraint within a community that shares the resource in common ("common property");

- collectively legislated requirements regarding the technology of resource use ("command-and-control regulation"); and
- collectively legislated requirements regarding the quantity or price of resource use, inducing users to face the social costs of overuse and to conserve the resource appropriately ("reconstitutive regulation").[28]

Global climate policy involves a public good that is difficult to parcel into private domains (the atmosphere), and involves a large and heterogeneous population (the entire world) that seems unlikely to negotiate efficient private bargains or to embrace shared community norms. Hence the regulatory forms of societal constraint have attracted the most attention.

The "reconstitutive" regulatory designs — tradeable allowances[29] and emissions taxes[30] — have several important advantages over their less flexible command-and-control counterparts. Chief among these is greater *cost-effectiveness* — the ability to deliver a given environmental benefit at lower cost, or to achieve greater environmental benefits at a given cost. Cost-effectiveness is a key criterion under the FCCC, which states in Article 3(3) that "policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost."

But cost-effectiveness in emissions abatement is not the whole story. Several other attributes of policy options warrant examination as well, including incentives for innovation, resource flows to developing countries, and incentives for countries to join the agreement and expand its geographic coverage.

"Policies and Measures"

One option to constrain emissions is to adopt a treaty that obliges parties to engage in coordinated or harmonized policies and measures. For example, the treaty could impose global automobile fuel economy standards (similar to the CAFE standards in force in the United States) or energy efficiency standards for appliances and industrial processes.[31] Or the treaty might even require global installation of specific emissions control technology, such as CO_2 scrubbers on all new coal-fired power plants built after 2020.[32]

These approaches are similar to the tradition of centralized "command-and-control" environmental regulation adopted in many U.S. laws over the last 25 years. It may be hard to imagine international negotiators formulating worldwide design standards for specific technologies, but the prospect should not be discounted.

While the negotiations on the FCCC were underway at the Palais des Nations in Geneva in 1991, another group of diplomats was meeting down the hall behind a door labeled "Group on the Design of the Automobile."

A different version of "harmonized policies" could involve a global agreement to phase out subsidies for emissions-intensive activities, such as subsidies for coal mining and combustion, for certain agricultural exports, and for deforestation.[33] Energy subsidies alone account for a significant percentage of current global GHG emissions.[34] This approach would be similar to the tariff-reduction rounds of the General Agreement on Tariffs and Trade (GATT), but focused on domestic subsidies of GHG-emitting sectors. Because each country could perceive competitive disadvantage if it eliminated its own subsidies unilaterally, international agreement might be necessary to "disarm" these subsidy regimes in partnership.

The United States is moving to adopt market-based performance policies that allow flexibility in the location of abatement efforts among emitters.

Reducing subsidies could be highly cost-effective. But harmonized emission control policies could be highly cost-*in*effective. Requiring all countries to adopt the same policy measure would take no account of the variation in abatement costs across countries, nor of the variation in policy contexts. A harmonized policy that makes sense in one country might make little sense in another.

Uniform technology standards could be even worse. Experience with technology standards in the United States has indicated that: (1) they impose high costs; (2) do not necessarily limit emissions effectively; (3) tend to involve end-of-pipe controls, which ignore more cost-effective process changes and which induce emitters to shift pollution from one medium to another; (4) tend to involve special requirements on new sources, which discourage innovation and encourage emitters to keep older, dirtier equipment in operation longer; and (5) tend to squelch technological innovation because emitters see no gain to developing a technology different from the one mandated by regulation.[35]

U.S. environmental policy, therefore, is moving to adopt performance-based policies that limit emissions or concentrations but

leave the choice of compliance method up to each emitter.[36] This compliance flexibility encourages diverse cost-effective approaches and technological innovation. Further, the United States is moving to adopt market-based performance policies that allow flexibility in the location of abatement efforts among emitters.[37] It would be ironic if the international climate change treaty were to ignore this learning and adopt a high-cost, low-innovation approach to GHG emissions control.

A Quantity Constraint (Targets or Caps)

A frequently discussed policy design for climate change is a performance-based quantitative limitation on emissions — imposing a "target" or "cap" on emissions. The FCCC sets a "fuzzy" target, obliging industrialized countries to take steps to limit emissions with the "aim" of returning to the 1990 level by 2000. In the talks flowing from the Berlin Mandate, other targets have been suggested, such as reducing industrialized country emissions in the year 2010 to 5 or even 15 percent below their 1990 level.

Inflexible: National Caps

A policy design commonly advocated in the climate negotiations would require each country to cap its emissions at a certain target level by a certain date, acting on its own. These national caps would add up to a global aggregate constraint on the quantity of emissions.

Compliance with such caps would have to be monitored by an international body, based on national reporting of emissions inventories, with international verification. The regime would impose penalties on violators for exceeding the caps or reporting false information.

Inflexible caps would allow each nation the choice of domestic abatement options — intra-national flexibilty — and in this performance-based respect would be more cost-effective than a treaty imposing harmonized policies or technology standards. But inflexible caps would not take advantage of the variation in abatement costs across countries, and so would be less cost-effective than a set of caps with cross-national flexibility in the location of abatement.

Flexible: Allowance Trading, JI, and Banking

An alternative to inflexible national caps is a flexible quantity-based policy in which countries accept national caps, but have

flexibility *where* abatement occurs (cross-national, spatial flexibility) and *when* abatement occurs (temporal flexibility).

Spatial Flexibility. The global impacts of GHG abatement are independent of the location of that abatement, yet the costs of GHG abatement vary widely across countries. Thus, allowing flexibility where abatement occurs — "spatial" or "locational" flexibility — can offer significant cost savings. Just as with other desireable goods and services in an economy, where opportunities vary, there are potential gains from trade; all benefit via mutual cooperation.

Two types of international markets in cross-boundary emissions trading have been proposed. One is a formal market, a system of tradeable allowances or "cap and trade." In this market, the international agreement sets a treaty-wide cap on emissions, and allocates an initial total of GHG emissions allowances (privileges to emit) to each participating country for each year. National governments then sub-allocate these allowances to subnational entities (the private sector), which hold allowances and conduct trades. The allowances are fungible and may be traded internationally. Organized exchanges arise to facilitate trades. At the end of each year, each country's report of its actual emissions (verified by an international monitoring body) is compared to the allowances held by its emitters; if the country's emissions exceed its allowances, it is subject to sanctions.

Allowing flexibility where abatement occurs can offer significant cost savings.

In this formal market system, businesses in countries with low-cost abatement options will sell allowances at a profit, and businesses in countries with high-cost abatement options will purchase allowances rather than incur the high cost of local abatement. The aggregate abatement will be the same — the global cap will be achieved — but the location of abatement will be different than under an inflexible caps approach, because here the high-cost abaters will invest in abatement services provided by low-cost abaters. The prospect of earning a profit on allowance sales will encourage businesses to devise lower-cost ways to reduce emissions. This system is similar to the model used in the U.S. sulfur dioxide allowance trading system enacted in 1990 to control acid rain.

In an "informal" market, the international agreement sets

national obligations to reduce emissions, but does not allocate formal allowances. Instead, each country is bound to achieve its emissions obligation and may meet that obligation in part through contracts for abatement services outside its territory.

Emitters seeking to invest in abatement services may purchase "credits" for emissions abatement from projects in other countries, including projects in host countries not subject to emissions caps. In order to determine whether these credits represent real reductions in actual emissions, abatement must be measured against baseline forecasts of what emissions would otherwise have been at the host project.

The system of "joint implementation" (JI) launched by the FCCC corresponds to this informal market model. Because the 1992 FCCC does not set a binding quantitative cap on emissions, a formal system of tradeable allowances was not germane. Instead, during the FCCC negotiations, the United States proposed in 1991 that the FCCC allow countries to enter into "cooperative arrangements" to limit emissions. At about the same time, Norway similarly proposed that countries implementing measures to limit emissions under the FCCC should be allowed to do so "jointly."[38] Hence the term "joint implementation," or "JI."

But JI hit a bump in 1995. Article 4(2)(d) of the FCCC directs the Conference of Parties (COP) to "take decisions regarding criteria for joint implementation," and at its first meeting in Berlin in March 1995, the COP set criteria for a "pilot phase" of JI to last no longer than until the year 2000. This pilot phase allows JI but, in deference to countries which expressed concern about licensing a full market in GHG abatement services, it expressly disallows the receipt of any "credits" for extraterritorial abatement investments.

Without credits to record in satisfaction of their own emissions abatement obligations, there is little incentive for emitters to invest in JI.[39] The prices that investors do offer for no-credit JI projects will be so low that far fewer hosts will be interested in such deals. The pilot phase has thereby created a political Catch-22 for JI. If no one participates in the pilot phase, critics will label JI a failure; but if there is substantial participation, critics will assert that credits are unnecessary.

Temporal Flexibility. A second form of flexibility involves the timing of abatement. Because capital investments such as large electric power plants last a long time, it can be much less costly to match abatement efforts to the turnover of the capital stock. Some businesses might want to wait until current equipment is scheduled to be replaced and then make very large emissions reductions. Other businesses might be ready to make very large

emissions reductions right away and would want to apply these extra reductions to future years.

The mechanisms for temporal flexibility are typically dubbed "banking" and "budgets." Under "banking," emitters assigned yearly emissions caps would be able to "save" extra reductions achieved in early years for later "withdrawal," allowing for less stringent caps in future years. Emitters might also be permitted to "borrow" against future caps by emitting more than their caps in the early years and then repaying via tighter caps in the future. Under a "budget" approach, emitters would be assigned aggregate caps over several years with the flexibility to spread these emissions over the period as they see fit.

Flexible policy provides more cost-effectiveness, greater incentives for innovation, resource flows to developing countries, and is more likely to attract expanded participation.

Temporal flexibility could reduce costs, but it would not generate all of the advantages of spatial flexibility. Temporal flexibility would not, for example, generate resource flows to developing countries. And although the spatial location of emissions does not affect global environmental impacts, the timing of emissions may well affect global environmental impacts. Earlier emissions have more long-lasting impacts, hence earlier abatement may be more environmentally protective than later abatement.[40] If so, "borrowing" of future years' allowances may require payment of a positive "interest rate," i.e. higher future reductions, to render it environmentally equivalent.

Quantifying the Advantages of Flexibility. Flexible policy design has substantial advantages over inflexible constraints and technology standards. Flexible policy provides more cost-effectiveness, greater incentives for innovation, resource flows to developing countries, and is more likely to attract expanded participation.

A system of international tradeable emissions allowances would accomplish the cost-effectiveness gains from spatial flexibility. A simple example is shown in Table 1 for a world of two countries, A and B. Requiring each country to install a particular emissions control technology, such as a scrubber, would require A and B to each spend $40, for a total cost of $80.

An inflexible quantity constraint, requiring each country to cut its emissions independently by 20 percent, results in a global emissions total of 8, at a cost of $50. Allowing locational flexibility under the quantity constraint — creating a market for emissions abatement services, in which the high-cost abater (B) can pay the low-cost abater (A) to reduce another unit (from 4 to 3) on B's behalf — yields the same global emissions total of 8, but at a global cost of only $20. A earns at least $10 in payments from B in return for A's extra abatement. The global cost savings of $30 (below the $50 total cost of the inflexible uniform policy) would be shared by A and B as profits for A (above its cost of $10) and/or savings for B (below its next best option at $40).

Numerous studies of policies to limit GHG emissions show that allowing global flexibility in the location of GHG emissions abatement would cut the estimated global cost, compared to an equal constraint on emissions without such flexibility, by roughly 50 percent.[41] Actual estimates of cost savings vary depending on the stringency and timing of the emissions constraint, the countries covered by the constraint, the countries eligible to participate in the emissions trading system, and other factors.

Numerous studies show that allowing global flexibility in the location of GHG emissions abatement would cut the estimated global cost by roughly 50 percent.

In the climate policy context, a potential 50 percent cost saving is likely to be huge. Several models suggest that a best estimate of the total global cost over the next five decades of holding GHG emissions in the industrialized countries to 20 percent below their 1990 level by the year 2010, without flexible policy design, would be almost $2 trillion (in a range from $1.5 trillion to $8 trillion).[42] Hence a 50 percent cost saving offered by spatial flexibility would mean saving about $1 trillion or more.

One recent study by several of the world's top climate economists, using four different energy-economic models, found that adopting spatial flexibility would reduce the costs of a stringent constraint (in which industrialized countries must reduce emissions by 20 percent below 1990 levels by the year 2010, and other countries are unconstrained) by 70 percent. (The study found that adopting both spatial and temporal flexibility would reduce costs by a bit

more, up to 80 percent.)[43]

This study also found that the cost saving due to spatial flexibility was greater than the cost saving realized by adopting a somewhat less stringent, but still inflexible, constraint: delaying an inflexible 20 percent emissions reduction below 1990 levels to the year 2020 instead of the year 2010 cut costs by 30 percent; and just capping emissions inflexibly at 1990 levels after the year 2000 cut costs by 60 percent. Moreover, these weaker but inflexible constraints would also mean lower climate protection benefits, which the efficient policy designs would not entail.[44] In other words, selecting an efficient policy design can be more important than making some adjustments to policy stringency.

Still, these models remain imperfect representations of reality. They might overstate cost savings because, for example, they typically omit the "transaction costs" involved in arranging contracts for trade in emissions abatement services.[45]

On the other hand, they might understate cost savings. The models generally consider cost savings only across regions and omit possible additional cost savings among countries within regions. They also typically examine only energy-sector CO_2 abatement opportunities, whereas reducing emissions of methane (CH_4) from energy systems, and decreasing CO_2 via storage in forest sinks, would open even lower-cost abatement options.[46] Moreover, innovation spurred by flexibility could further reduce costs.

Maximizing cost-effectiveness saves resources for important social goals, such as reducing poverty, improving health care, reducing local pollution, and supporting education. Lowering the price of abatement can also be expected to increase the amount of abatement undertaken — making GHG emissions control less costly enables the group of countries to "buy" more emissions control than they otherwise would.

In addition, the new opportunity to profit by selling GHG abatement services motivates emitters and other entrepreneurs to devise better ways to control emissions. This would spur technological innovation and further improve the cost-effectiveness of global emissions control.[47]

Furthermore, this policy design has built-in inducements to expand the breadth of treaty coverage, reducing free riding and leakage. More industrialized countries can be expected to join an international treaty if the costs of participation are lower, and more developing countries would join if they could earn revenues from allowance sales. A market-based policy would channel resources and technology to low-cost abaters in return for allowance sales.

Since low-cost GHG emissions abatement opportunities appear to be more plentiful in developing countries and in Eastern Europe, where older energy systems need upgrades and carbon-storing forests can be protected or expanded, the market-based approach promises substantial resource flows to these areas.

Indeed, studies suggest that under a globally inclusive market-based policy in which industrialized countries must stabilize or cut their emissions at or below 1990 levels by 2010 (and developing countries can emit as much as they would have emitted with no climate policy in place, or earn revenues for selling reductions from that level), the financial value of international payments for abatement would dwarf total official Overseas Development Assistance and might even match or exceed the total of all resource flows, public and private, now going to developing countries.[48]

Gains to developing countries would both save abatement costs to industrialized ones, help improve the prosperity and health of people in developing countries, and broaden participation on the climate treaty.

Even more striking is the finding in some of these studies that the developing countries would be net *losers* under an industrialized country-only emissions control rule (without trading), because the reduction in imports and economic growth in the industrialized countries would reduce the export earnings of developing countries.[49] These studies indicate that developing countries would be net *gainers* — better off than if *no* action were taken by anyone — under a policy that restricts industrialized countries' emissions and allows them to obtain abatement services worldwide (unleashing a major new revenue stream for developing states).[50]

These gains to developing countries would both save abatement costs to industrialized ones, help improve the prosperity and health of people in developing countries, and broaden participation on the climate treaty. These resource flows would help put developing countries on a lower-emissions economic growth path — bringing lower-emissions technologies and practices to countries that otherwise might increase their emissions so rapidly that costly emissions controls undertaken by industrialized countries would be of little global effect. Gaining development country participation in any GHG emissions control effort seems essential to any effec-

tive climate treaty; without it, industrialized countries' abatement efforts would be futile and competitiveness-conscious industrial states would not participate to begin with. A market-based policy would create an automatic mechanism and powerful incentives for industrialized countries to invest in developing countries, and for the latter to see abatement as a new source of economic value and foreign investment earnings.

These gains from a GHG emissions abatement market are not purely speculative. Similar results have been demonstrated in practice with the markets that have been created to address regional pollution problems. The United States has used market-based approaches to phase out lead (Pb) in gasoline, to cut emissions of sulfur dioxide (SO_2) as a means to reduce acid rain, to control urban pollutants in Los Angeles, and to control overharvesting of fisheries. The cost savings in the lead and SO_2 cases were substantial, at least 50 percent, compared to a control policy in which no trades were allowed.[51] And the SO_2 experience suggests that the more cost-effective market-based policy enabled the Congress to "buy" more pollution control than it would have if control were more expensive; Congress had an implicit social budget constraint, and it "spent" up to that budget at the estimated price per ton of SO_2 for different options. The SO_2 policy also stimulated significant technological innovation and energy efficiency investments. New Zealand has successfully used market-based policy to manage its fisheries.[52] Internationally, there is precedent in the Montreal Protocol's limited market in CFC production.

GHGs may be an even better subject for a market-based policy than these successful antecedents. Unlike SO_2 and urban pollution hazards, most GHGs involve no problem of local "hotspots" in which emissions "bunching" through allowance purchases could escalate local damages. And the diversity of abatement costs for GHGs is likely to be larger than the range for SO_2 and other regional pollutants.

A Price Constraint (Taxes)

A constraint on the price of GHG emissions — a global GHG tax, or a system of coordinated national taxes — could, in principle, generate the same cost-effectiveness gains as quantitative constraints on emissions with tradeable allowances. Compared to a quantity-constrained system of tradeable allowances, a tax would pose less risk of high cost overruns. The tax would fix the upper end of the price that emitters would pay, whereas allowance prices would be uncertain and could escalate. But the tax would offer less

certainty that emissions would be abated than would a quantitative limit on emissions. Which risk is of greater social concern — cost overruns or emissions overruns — would be important in choosing between a quantity-based constraint and a price-based constraint.[53]

A tax would avoid the transactions costs of the emissions abatement market, though it would involve the major administrative costs of estimating and collecting the tax. An international or nationally coordinated tax system would raise thorny questions about who collects the revenues, who controls the use of the revenues, and on what criteria. By contrast, a market in emissions abatement services would leave the financial decisions in the hands of many decentralized private decisionmakers, each investing in a small part of the overall market.

A tax system would require the same monitoring and compliance enforcement systems as quantity constraints. Someone must check to be sure emitters are paying taxes on their full emissions. But the tax policy might be circumvented by unobservable national tax cuts and subsidies targeted to counteract the burden of the GHG tax on high-emitting industry sectors. The complexity of national tax codes could make it very difficult for outsiders to monitor full compliance with a GHG tax. Although tax relief and subsidy games might also be played to cushion domestic industries from the costs of complying with quantity-based policy designs, these strategies would not influence the total emissions of the country under a quantity-based regime, whereas they would influence the total emissions under an international tax regime.

In addition, emitters can be expected to oppose taxes (or auctioned allowances) which force them to pay for every unit of their emissions. Allowances issued to emitters for free (such as in proportion to their historical emissions) do not force emitters to pay for all their residual emissions. Similarly, technology-based standards and inflexible quantity constraints do not charge emitters for their base emissions.

Thus emitters can be expected to lobby in particular against emissions taxes and allowance auctions.[54] This political pressure makes adoption of a GHG tax less likely, and it makes surreptitious circumvention of any international GHG tax that is adopted even more likely.

Perhaps most importantly, unlike a market in abatement services, an international GHG tax would not create an automatic mechanism and incentive for resource transfers to developing countries, which are a key to getting developing countries engaged in

GHG emissions abatement efforts on terms acceptable to them. Although the tax revenues could be used for foreign aid to developing countries, the revenues could also be retained for national fiscal purposes (e.g., deficit reduction, as is assumed in many models which estimate low costs of a GHG tax). Using the tax revenues for international transfers to poorer countries would mean a highly visible increase in official government foreign aid, which might face political opposition in both donor and recipient countries. A formal allowance market would accomplish these transfers via decentralized private sector trade, not government aid.

The Politics of Climate Policy Design

Efficiency is about aggregate gains; political adoption is largely about the distribution of gains and losses.[55] In contrast to normative regulatory theory, positive regulatory theory seeks to explain not which policy design is optimal, but which policy design actually gets adopted by political decision makers. If political calculations diverge from socially efficient calculations, adopted policy will diverge from efficient policy.

Countries have multiple objectives in the climate change negotiations, and categorizing countries' policy views in any simple way is fraught with error. Nation-states are thinking not only about climate protection benefits but also about numerous other considerations. For example, they are concerned about (1) their competitive economic status with respect to current and potential rivals; (2) their autonomy and sovereignty; (3) principles of fairness and moral dessert; (4) domestic social and economic goals unrelated to climate change or for which climate policy is a convenient vehicle; and (5) global environmental protection.

The decision of each country to favor or oppose any treaty proposal is a multi-level, multi-player "game," involving the national government; different political factions and different branches within the national government; subnational jurisdictions (states, provinces); non-governmental organizations (NGOs) representing environmental interests, industry interests, and other interests; and other groups. Political decision makers consider not only their countries' national interests but also their own power, prospects for reelection, and other personal goals.

Meanwhile, although much theoretical and some empirical scholarship has been undertaken on the political economy of U.S. environmental policy,[56] much less has been conducted on the political economy of international environmental regulation.[57] The

fact that many countries have expressed concerns about a market-based approach to controlling GHG emissions, despite the advantages of such a policy design, suggests the need for this research. If emissions trading is so great, why is it so hard to get it adopted?

The Coalition in Favor of Efficient Policy Design

The United States is now pressing for the creation of a full formal market in tradeable GHG emissions allowances as a prerequisite for signing an emissions limitation agreement in Kyoto. The June 1997 draft protocol circulated by the State Department would establish a market-based system of formal international allowance trading among countries covered by emissions caps, and it would confer official credit on joint implementation (JI) projects undertaken in other countries. It also would allow intertemporal flexibility through saving and borrowing, with an interest rate to be charged on borrowing.

The United States is joined in its support of a cost-effective policy design by countries including Norway, Japan, Canada, Australia, and New Zealand. These countries tend to be high-cost abaters for whom a cost-minimizing policy design would be important.[58] The United States and New Zealand are also two of the countries with the most extensive national experience in employing allowance trading;[59] and the Nordic nations have recently conducted experimental GHG allowance trading games.[60]

The industrialized advocates of tradeable allowances get some support from some low-cost abaters who seek the resource flows from allowance sales — such as Costa Rica, Poland, the Czech Republic, and possibly Mexico and South Korea. These countries may prefer to earn revenues without incurring caps, however, and thus tend to endorse JI (with credits) more vocally than a cap and trade system.

International support for a GHG tax has been less visible. Economists tend to model a cost-effective policy as a tax, but few countries have advocated such a policy. This may reflect emitting countries' hesitation to impose costs on every unit of their residual emissions; they would prefer tradeable allowances allocated in proportion to historical emissions (or some other non-auction method).[61] In the early 1990s, France proposed an international carbon tax, with the proceeds to be put in an internationally managed fund and used to finance purchases of low-GHG-emitting energy technologies in developing countries. This proposal probably had less to do with France's advocacy of cost-effective policy than with France's prospect of making profits. It might hope to sell its

nuclear energy technology to developing countries newly financed by the fund, and to face low compliance costs under such a tax in light of its heavy reliance on nuclear energy for its own electricity.

The Coalition Against Efficient Policy Design

The sources of opposition to GHG allowance trading are varied and not always clear. Several intuitive hypotheses, in part or in concert, may help explain the observed opposition to tradeable allowances at the international level. These hypotheses are as yet empirically untested and are not necessarily descriptive of any party's actual views.

Market Defects

Objections to allowance trading may derive from genuine concerns about the functioning of a market-based policy design at the international level. The legal and analytic weaknesses of international institutions pose special problems for market-based policy design not present at the national level.

Concerns have been raised about the ability to initiate, monitor and manage an international emissions trading market to ensure real reductions in global GHG emissions — concerns about allocating allowances, deterring free riders, preventing cross-border emissions "leakage," establishing "baseline" forecasts of business-as-usual emissions, and monitoring compliance. These concerns, however, apply generically to *any* international policy that would constrain emissions. When compared to an emissions limitation policy that did not employ flexible market-based incentives, a market-based policy would actually ease these concerns.[62]

Allowance trading would defuse the allocation impasse by enabling post-treaty reallocations to ease the distortions of initial allocations. It would offer built-in incentives for participation by both wealthy and poorer countries (lower costs for the former, and allowance sale revenues for the latter), thus reducing free rider and leakage problems. And a cap and trade regime would be no worse than inflexible policy in its measurement, monitoring and compliance functions.

Monitoring and enforcement would be necessary under any treaty that sought to limit countries' emissions, whether the treaty employed allowance trading or not. The political motivations that help explain nation-states' reluctance to invest in optimal protection of global public goods, and their opposition to the adoption of

efficient market-based policies, might also contribute to opportunistic evasion or shirking once a treaty is adopted. All international law is vulnerable to noncompliance. A treaty with formal allowance trading would employ the same monitoring and enforcement methods as a quantity-based treaty without trading. Countries would report their national emissions inventories, which would be subject to independent verification. If a country's emissions exceeded its allowed total for that year, such noncompliance would subject that country to agreed penalties, including fines (perhaps levied against bonds posted by the country in advance) and perhaps multilateral trade sanctions. But a market-based treaty would enable better compliance assurance than a treaty without allowance trading. First, trading would reduce the costs of compliance, thus reducing the incentives to violate the treaty. Second, a wider arsenal of penalties could be brought to bear on the violator, including reducing the country's future allowance allocations pro rata for its past exceedances. Third, under an allowance trading system, new constituencies would arise to favor compliance and lobby in favor of strong national enforcement, such as holders of shares in the allowance "futures" market who would stand to lose if future allocations were curtailed.

A market-based treaty would enable better compliance assurance than a treaty without allowance trading.

Some argue that a system of tradeable GHG allowances is a "political non-starter" because developing countries will refuse to accept caps, and industrialized countries will refuse to make large resource transfers.[63] But *any* binding control regime will face difficult political hurdles, and a cap and trade system has important advantages over the alternatives. Resource transfers via allowance sales can make accepting phased-in caps (with future growth headroom) attractive to developing countries. It is hard to see how developing countries could be engaged in any emissions control without such resource flows. Proposals for national taxes or harmonized policies would not generate such resource flows, so they would fail to engage developing countries. Without developing countries on board, industrialized country action to limit global emissions would be frustrated by rapid emissions growth in developing countries, and by leakage that could offset industrialized country

constraints. Moreover, industrialized countries would be highly unlikely to constrain their own emissions without developing country participation, given industrialized countries' fear of the competitive disadvantage from GHG leakage to developing countries.[64]

Meanwhile, wealthy countries would undertake the large resource transfers contemplated under a cap and trade system because these resource transfers would be a bargain. They would yield significant (50 percent or more) cost savings compared to a policy that constrained emissions but did not allow wealthy countries to purchase abatement services in low-cost developing countries. And these resource transfers would be handled via myriad small private transactions, which would not raise the political specter of official foreign aid.

In contrast to these generic concerns, certain problems *are* particularly germane to an international market-based climate policy. These include the problems of high transaction costs in the JI and allowance markets; market power; and meddling in the international market by national governments.

Transaction costs can be increased by limits and conditions imposed on JI and allowance trading. They can be reduced by formal allowance trading on organized exchanges.[65] But proposals to reduce search and negotiation costs through centralized allowance purchasing and selling agents (such as the World Bank or a G-77 sales office) would only create new problems of market power.[66]

Market power is especially a concern if the market involves a small group of countries, a narrow scope of gases and sectors, cartels or state-run players (such as a state-run energy company in a large allowance seller such as China or Russia), and if the voting rules enable strategic exclusion of candidate new members.[67] Because there is no international antitrust law, the GHG allowance trading market will need to be designed to deal with market power on its own terms. The market would need to require sub-allocation of allowances to private sector entities, could retain a central reserve of allowances to deploy against price manipulation, and should include customized competition rules for the GHG allowance market.[68] Still, effective antitrust enforcement against nation-states may be difficult, to say the least.[69]

National government meddling in the global allowance market may include border taxes, limits on trading, exercise of market power by state-run businesses, and expropriation of allowances or of JI projects. Efforts by American states to interfere with the U.S. SO_2 trading system were rebuffed under the free trade doctrine of the U.S. Constitution's "commerce clause."[70] Such practices by nation-states might likewise be inhibited by the international law

governing free trade (GATT/WTO), but this depends on the untested question of the applicability of such trade law to a novel object of trade like GHG emissions allowances.[71]

Morals

Some may oppose cost-effective policy design because their goal is not climate protection per se but rather moral condemnation of those responsible for pollution. In this view, what is most important is the moral statement society expresses in law, not the consequences of the law. This philosophy seeks to blame and punish those who cause high emissions, not to achieve efficient or optimal correction of market "externalities."[72] It views pollution as ethically wrong, not economically inefficient. From this vantage point come arguments that tradeable allowances would amount to "licensing the right to pollute."[73]

The moralist view overlooks some practical realities and promotes the very evil it would punish.

The moralist view overlooks some practical realities. Under an allowance trading system, industrialized emitters would *pay* to reduce emissions -- they would still have to shoulder the burden of generating global emissions reductions. Second, *any* policy amounts to a "license to pollute" unless it is a total ban on emissions. Inflexible national caps, harmonized policies, and technology-based standards (all of which the moralists often prefer to trading) would all license countries to emit significant amounts of GHGs. Moreover, whereas GHG taxes and tradeable allowance systems make the emitters pay for their emissions (by paying the tax, purchasing allowances, or foregoing the revenues they would earn by selling their allowances), the alternative policies license countries to emit for *free*. Once the polluter installs the specified technology, or meets the cap, the remaining pollution is free of charge. Hence tradeable allowances would force polluters to pay *more* effectively than the inflexible policies the moralists tend to favor.

Furthermore, there is a moral irony here. The moral claim is that the person who causes higher emissions is blameworthy and should be punished irrespective of the pragmatic consequences. But the case for tradeable allowances argues that because they are more cost-effective than alternative policies, and because they pro-

vide continuous incentives for technological innovation and diffusion, tradeable allowances would lead countries to undertake more emissions abatement than they would under alternative, higher-cost policy designs. They also would attract more countries to join the emissions control regime. If so, then those who oppose tradeable allowances and favor inflexible policy designs (on moral or other grounds) would be the people directly responsible for *increasing* global emissions. The anti-trading moralist would thus cause higher emissions. The moralist view promotes the very evil it would punish.[74]

Fairness

A related but distinguishable view is that fairness requires the industrialized countries to "take the lead" in controlling GHG emissions first, before developing countries are asked to make any sacrifices in this effort. On this view, flexible policy designs such as tradeable allowances may be letting industrialized emitters off "too easy," letting them pay their way out of their "fair share" of sacrifice.

Even some who would tolerate allowance trading or JI also propose that it be limited to a small percentage of a wealthy country's total compliance to ensure that these wealthy nations shoulder their costs mostly at home.[75] Leadership by industrialized countries is seen as "fair" because they are wealthier, or because they have historically contributed the bulk of the elevated atmospheric concentrations of GHGs (they have "used up the common space"), or both. It would be unfair, in this view, to make poorer developing countries worse off for a problem caused by wealthier nations.

Whether or not one agrees with these fairness claims, they do not counsel rejection of flexible cost-effective policy designs such as allowance trading. In fact, allowance trading would be *more* fair to developing countries than alternative policy designs. Industrialized countries would "take the lead" under an allowance trading system; they would pay the costs of global emissions abatement. The initial allocation of allowances is a matter of political bargaining, but developing countries would almost certainly demand and receive allowances with generous "headroom," roughly enough to emit up to their baseline forecasts. Hence the burden of most or all of the reduction from the global baseline forecast would be allocated initially to industrialized countries. Moreover, developing ones would thereby be able to sell large quantities of extra allowances at a profit — a new and valuable asset which they formerly did not have. Far from asking developing countries to sacrifice, this arrangement would be a great boon to developing countries

even as it reduced global abatement costs. As discussed above, a treaty controlling emissions in industrialized countries without allowance trading would hurt developing countries as well by decreasing wealthy nations' demands for imports from the developing countries. The latter would be net losers, even worse off under such a treaty than under no treaty at all. But a treaty employing allowance trading would reduce the loss of developing countries' export sales to industrialized countries by reducing the abatement costs on them), and moreover would deliver resource flows to developing states from allowance sales.[76] The combined result is major gains to developing countries from an allowance trading treaty — they would be net winners, even better off than under no treaty at all.[77]

Hoping for industrialized countries to "take the lead" without any constraint on developing countries' emissions growth is wishful.

The basic logic of international law and of allowance trading markets — voluntariness — precludes any treaty in which developing countries are asked to sacrifice beyond their desires. Treaty compliance requires voluntary assent. Developing countries would not join a treaty that disserved their interests. Thus as a purely practical matter, the treaty must make them better off. The same is true of each allowance transaction or JI project; it must make the involved developing parties better off, or the transaction will not occur. JI and allowance trades are voluntary arrangements that necessitate mutual benefit.

Saying that industrialized countries must control emissions at home, not overseas, is profoundly *un*fair to developing countries. It assumes a zero-sum game in which sacrifices by industrial countries are gains for developing ones, but the real world does not work that way. It ensures a treaty in which developing economies are net losers, whereas under allowance trading they could be net gainers. Requiring industrial countries to act only at home is like insisting that rich people must only spend their money in rich neighborhoods, and never invest in poorer neighborhoods. Denying developing countries the revenues from GHG allowance sales in the name of fairness to them is particularly ironic, given that many (notably excepting small island states) probably would put far more value on the benefits they would reap from allowance sales —

in prosperity and in control of local pollutants — than they would on global climate protection.Hoping for industrialized countries to "take the lead" without any constraint on developing countries' emissions growth, and for such a move to lead developing countries by persuasive example, is wishful. Industrial countries concerned about competitiveness will not do so; the result will be no treaty at all.

If such a treaty were adopted, it would likely be counterproductive. Leakages and increased emissions in developing countries could offset or exceed abatement in industrial ones. Leakage would make developing economies more GHG-intensive and, thus, less likely to join the treaty in the future.[78]

Social Engineering

A different perspective favoring high-cost climate policy may be held by those whose real agenda is a transition from "hard path" to "soft path" energy systems and from high-consumption to low-consumption lifestyles in industrialized countries. Many groups have been fighting for decades to replace fossil fuels and nuclear energy with solar power and energy conservation. The climate policy negotiations may just be another venue for this social agenda to be pressed. These social engineers may oppose cost-effective climate policy designs because, by easing the costs on industrialized countries, such policy designs could reduce the pressure on them to shift to wholesale alternative energy systems and to change their high-consumption lifestyles. Allowance trading will encourage conserving forests in developing countries and investing in new energy technologies in developing areas. Hence the social engineers criticize JI and tradeable allowances or try to limit the scope of overseas abatement services to a small fraction of industrial countries' compliance measures, arguing that these states should bear most of the costs at home.

It may well be true that optimal energy policy would induce a greater shift to solar power and conservation than does present policy. Fossil fuels may be underpriced (at least in the U.S.) compared to the optimal price when their environmental impacts are included. A better solution to this problem would be full social-cost pricing of these fuels and products, not an inefficient climate policy. Building excessive costs into a climate policy has all the downsides articulated previously (including higher cost, less climate protection, and less participation). It also thwarts the protection of the world's forests and investments in technological innovation for de-

veloping countries. If social engineers want a technological reformation, they should favor it in these countries as well as in industrial ones.

Stringency Gaming

Opposition to tradeable allowances might also be a move to exert leverage over the stringency of the policy constraint. Such games might be played by both sides.

Advocates of aggressive climate protection may be withholding support for trading until it is paired with a stringent cap. They may fear that trading is so complex or open to abuse that it will not result in effective emissions limits. Or they may simply realize that trading is desired by high-cost abaters and thus can be used as a bargaining chip to extract concessions on the stringency of the cap. Even if these advocates like trading, they may initially say they oppose it as a ploy to twist the arms of those who oppose a stringent cap.

Meanwhile, skeptics of aggressive climate policy may fear the opposite: that cost-effective tradeable allowances would be an all-too-alluring "fast train to the wrong station." They possibly fear that the cost-saving claims of trading will entice countries to blithely adopt *overly* stringent quantity-based emissions limits which are then resistant to relaxation even as costs escalate.

These two opposing critiques can lead both agressive advocates and skeptics to say they favor a high-cost policy design. Of course, the stringency of climate policy should be chosen with great care. But gaming policy stringency by promoting a high-cost policy design is a very dangerous tactic — both parties might just get what they are asking for. The aggressive advocates risk imposing a very costly treaty or getting no treaty at all. The skeptics' gambit of urging a higher-cost "slow train," in the hopes that it will derail any GHG limitations agreement, may just invite a much more costly, inflexible treaty design.

Rent-Seeking

Another source of opposition to cost-effective policy design and tradeable allowances may be those who would profit from an inefficient, high-cost policy. It is now common to explain national regulatory policy choices as the result of "rent-seeking" — political pressure by special interests who gain economic favors from distortionary policies.[79] In the climate policy context, the rent-seekers (and their potential victims) view the treaty as a negotiation over competitive

advantage, not environmental protection. At least three hypothetical kinds of rent-seeking seem helpful in explaining the observed opposition to tradeable allowances for GHG control.

The first is trade rivalry. Some countries may favor high-cost policy designs because, even though such a policy would cost them something, it would cost their trade rivals far more. In particular, low-cost abater countries may favor costly policies that sock it to their high-cost abater trade rivals. These low-cost abater countries are acting as predators, seeking to exploit the heterogeneity in abatement costs across countries for competitive gain.[80] Tradeable allowances would give every country the same chance to find low-cost compliance options worldwide, depriving the predators of the opportunity to burden their rivals.

Second, some countries may see the negotiations as a zero-sum game, in which the costs they impose on other countries amount to benefits for their country. For example, some may think that high costs imposed on industrialized countries will hold back their economic growth and thus help developing countries to "catch up."

Third, rent-seeking may be occurring within countries' political regimes. Allowance trading would assign to the private sector the role of transferring resources from industrialized countries to developing countries, through myriad decentralized transactions. But powerful interests in governments in both industrial and developing countries may prefer to keep control over these resource transfers in central government hands. Consider that the diplomats negotiating the treaty often come from the very government agencies and elite cliques which would be enlarged and enriched by the task of handling these resource transfers. Riding herd on private sector transactions might be much more difficult for these government officials, and letting the private sector handle such wealth might even undermine the political position of elites in some countries.

Applying the Hypotheses

These positive political hypotheses can be assessed in a preliminary way in terms of the positions taken by opponents of JI and allowance trading in Europe and among developing countries.

Europeans' Opposition to Trading

European opposition to tradeable allowances may be based on misunderstanding, on disagreement about the merits of allowance trading, and on the failure of trading advocates to explain the mer-

its and allay concerns. Europe has little experience with environmental allowance trading, and may not share U.S. confidence in this policy design.[81] Still, other reasons may also underlie European opposition.

Europeans may be suspicious of the United States and of allowance trading, until the latter agrees to an emissions target. Many environmental groups in the U.S. acid rain (SO_2) debate favored allowance trading only after it was connected to a stringent cap.

Europe, in particular Germany, may be guided more by a Kantian perspective in which the solution to pollution is moral conduct (cease polluting) rather than a Benthamite perspective in which pollution is seen as a market failure to be corrected by market pragmatism. From this perspective it may make little sense to consider flexible schemes of reallocation; the simple solution is for each country to "act properly." Combined with the lack of experience with trading in practice, this perspective may explain Europeans' response that allowance trading is "just not the way we think about these things."

Preliminary evidence suggests that the industrialized countries which oppose or would limit allowance trading are also the countries who face low abatement costs.

Domestic political constituencies in Europe may dislike trading, perhaps based on moralist, fairness, or social engineering grounds. And these groups and Green Parties may be even more influential in European politics than are their counterparts in U.S. politics. Environmental groups in the United States used to be generally hostile to allowance trading, until several policies using tradeable allowances were adopted over many environmental groups' objections and then proved successful (e.g. the lead phasedown and the CFC phaseout). The role of the Environmental Defense Fund (EDF) in helping design the SO_2 trading system for acid rain control may also have reduced objections. Nowadays, one hardly hears the moralist critiques of trading ("license to pollute") in the United States; the debate is almost entirely a pragmatic discussion of which policy designs best accomplish desired goals. It may take time and experience, and philosophical change for the positions of European environmental groups and Green parties to evolve in this direction.

Of most concern is the possibility that European opposition reflects predatory trade rivalry among industrialized countries.

Industries in Europe may want to impose higher costs on their rivals in the U.S. and Japan by insisting on non-tradeable, CO_2 only controls, which the Europeans would be able to meet at lower cost than could their rivals. Flexible and comprehensive policies would erase this cost advantage for European industry. Preliminary evidence suggests that the industrialized countries which oppose or would limit allowance trading are also the countries which face low abatement costs, relative to the industrialized countries which favor allowance trading.[82] Meanwhile, the EU proposal for the treaty to be adopted in Kyoto would allow differentiation of GHG control obligations within an EU "bubble." This suggests that the EU can favor flexible policy design when its own interests warrant — that its objections to global allowance trading are strategic, not substantive or philosophical.[83]

Thus, in addition to other explanations, European opposition to cost-effective allowance trading may derive from the preference of both European environmentalists and European industries for an inflexible, high-cost policy design.[84] If so, this opposition will be difficult to overcome. It will likely be couched in moralist language for public relations purposes.[85] Empirical studies are needed to test this hypothesis and reveal such strategic rent-seeking against trade rivals if indeed it is occurring.

Developing Countries' Opposition to Trading

The majority of developing countries (voiced through the G-77 negotiating bloc) seem opposed to allowances trading.

As with European opposition, much may be based on inexperience and misunderstanding, on the failure of trading advocates to explain the merits and allay concerns, and on genuine disagreement about policy merits. Still, there may be other reasons for opposition.

Developing countries may see climate policy as a zero-sum game in which losses to industrial ones are gains to themselves. They may think that high costs and slower growth imposed on industrial countries will enable developing states to "catch up" economically. But this perception is surely wrong, as discussed above because costs to industrial countries mean reduced imports from developing ones, which harms the latter's economies; developing countries would be *worse* off economically under an inflexible industrialized emissions constraint and better off under a global allowance trading regime.[86]

Developing countries may resist accepting any cap on their own emissions, even if it is coupled with large resource transfers.

But, if this is so, they must be assessing their ability to increase emissions indefinitely as more valuable than the revenue they would receive for allowances. This suggests that expected allowance prices might be too low to attract the participation of developing countries.

In particular, these countries may fear "carbon colonialism" — the prospect that industrialized countries would exercise power over their economies through allowance purchases. Sometimes this fear is expressed as a concern that the best abatement options of developing countries will be "skimmed off" by industrial ones, leaving only more costly abatement options in the future when caps become binding on all nations.

Developing countries may fear "carbon colonialism" — the prospect that industrialized countries would exercise power over their economies through allowance purchases.

But developing countries could just set allowance prices to reflect the full long-run opportunity cost of giving up the allowance. If the price is too low, the allowance would not be sold. If the allowance is sold at a price that covers the opportunity foregone, then in the future developing countries would have sold the attractive abatement option, but they would also have the even more lucrative return on investment from the revenues received for the allowance.

This fear, like the fear that caps will constrain economic growth more than the allowance sale revenues will stimulate it, probably reflects real doubts about the competitive efficiency of the allowance trading market. Developing countries fear that allowance prices will not cover long-run costs because price competition by other similar states will prevent raising prices to full social value, and because market power exercised by industrialized countries will depress prices. This market power could take the form of a monopsony purchasing agent (e.g. the World Bank) or the asymmetric information and expertise held by wealthy countries which are adept at playing the global markets game.

A related issue is that developing countries may fear intrusive exploitation of their resources by former colonial powers. They may worry that their land would become controlled by industrial investors, such as for carbon-storing forest plantations. This may not seem like a real concern in a market economy where land is

commonly bought and sold and is not seen as the basis of economic value, but it could be a sharp concern in an agrarian state-run economy where land is viewed as the national patrimony and as the only secure basis for durable prosperity. Foreign ownership of land-use rights may be particularly politically volatile in countries where foreign colonial dominion is a living memory.

To deal with these concerns about the market power of industrial countries, developing states might be holding out for higher allowance prices or for other concessions. It is odd, however, that their initial strategy on JI was to declare that as a legal matter, JI under the 1992 FCCC applied only to Annex I countries. This claim rested on a strained reading of Article 4(2)(a), which plainly states that parties undertaking policies and measures to limit net GHG emissions "may implement such policies and measures jointly with other Parties." There is no limitation on which parties they may be. Nonetheless, developing countries asserted that they were legally ineligible to participate in JI. It is a curious strategy for someone trying to bid up the price of participation to say that participation is flatly illegal. If this is so, there is no price increase or other concession that could induce participation. Either the assertion about their legal ineligibility was a strategic mistake, or bidding up the price was not the developing countries' motivation.

An alternative hypothesis is that developing governments' representatives to the climate treaty negotiations may gain "rents" at home from managing, or skimming, government-to-government aid, but not from private financial flows. Private financial flows may even seem threatening to political elites in developing countries. So these nations might benefit from private sector allowance trading, but their diplomats might have reasons to resist. This is not just a problem in developing states. For similar reasons of bureaucratic power, diplomats from industrial countries may also prefer government-controlled aid to private-sector trade flows. If this hypothesis is accurate, countries' positions on allowance trading might vary depending on whether the domestic allies of the market sector (e.g. finance and economic ministries) are well represented on their climate change negotiating or policymaking teams.

Developing countries' fears of low allowance prices deriving from market power, and of intrusive landholdings, need to be addressed on the merits. Policy designs need to be articulated that ensure competition among investors, diversified ownership through mutual funds and fungible allowances, and time-limited allowances (more akin to leases than sales). Proposals to concentrate investment decisions in one entity, such as the World Bank, may only drive developing

countries away from participation in such a market.

The hypothesized rent-seeking behavior of diplomats needs to be studied. If it is indeed occurring, merely bringing it to light could be sufficient to undermine the case against trading. Further, a prime strategy for trading advocates would be efforts to involve the pro-market government agencies and businesses in the relevant countries.

Conclusions

Though a portion of this paper reviewed "the challenge of climate change policy," this paper is first and foremost an analysis of the efficiency and politics of various climate change policy alternatives. It is not about whether global climate change is a serious imminent threat, but rather about how to design an efficient and politically feasible policy *if* there is an international consensus to control greenhouse gas emissions.

Flexible market-based policy designs such as internationally tradeable GHG allowances promise enormous advantages over inflexible alternatives. These advantages include: (1) global cost savings of 50 percent or more; (2) major stimulus for innovation and diffusion of improved technologies (particularly to developing countries); (3) large resource flows to poorer countries (at a cost that is worthwhile to industrialized countries); (4) and built-in incentives for increased breadth of participation and treaty coverage. No other policy design combines all of these advantages.

Although concerns about allowance allocation, free riders, leakage, baselines, and monitoring and compliance are often raised as difficulties of a tradeable allowance regime, these concerns afflict *any* climate policy that would place an effective constraint on GHG emissions. Moreover, compared to an inflexible emissions constraint, formal allowance trading would actually *ease* these concerns.

In contrast to these generic concerns, problems particularly germane to market-based climate policy include high transaction costs in the JI and allowance markets, market power, and meddling in the international market by national governments. These problems deserve closer scrutiny and climate policy needs to be designed to ameliorate each of these concerns.

Climate policy design is not just a once-and-for-all choice, but must contemplate the long-term nature of the climate change issue and, thus, the long-term architecture of policy institutions.[87] There must be flexibility to adjust the overall constraint in light of adaptive learning over time, subject to the decision costs and dis-

ruption costs of frequent readjustments. Different policy designs may inculcate different attitudes toward adjustments. Allowance holders may resist relaxing the stringency of the constraint, whereas taxpayers may resist tightening its stringency. Devices such as time-limited allowances, a futures market, and advance notice of adjustments (much as central banks foreshadow changes in interest rates) could reduce transitional dislocations in an allowance system.

If an allowance trading system is adopted, it will be imperative to keep transaction costs low to enhance cost-effectiveness and to ensure the latitude to reallocate initially assigned allowances easing the impasse over the initial allocation method. Key steps include:

- relying on private sector actors to conduct trading; requiring little or no preapproval of each individual trade;
- imposing few or no taxes or discounting on JI or on allowance sales across the board;
- imposing no limits on the amount of trading, reportable abatement credits, or types of abatement technologies that can be employed;
- fostering organized exchanges to facilitate trades and spread information;
- fostering mutual funds to diversify risk among JI projects;
- and making opt-ins easy (or automatic) with no large barriers to entry (save appropriate buffers against allowance price destabilization).

Perfect integrity of the allowance trading system should not be the enemy of overall social efficiency. Monitoring and accounting criteria should be rigorous without overburdening the trading system. The major societal and environmental gains from trading, from attracting more participants, and from comprehensive coverage of all GHGs and sectors, justify a system that is effective without demanding perfect precision.

Most importantly, analysts need to take seriously the distinct political economy of *international* environmental regulation. Much effort has gone into studying the positive political theory and practice of national regulation. Given the stakes involved in issues like global climate policy, vigorous study of the political economy of international regulation is warranted.

If the climate negotiations are not just (or even mostly) about

the climate protection consequences of policy designs, but are also (or mostly) about moral visions, fairness, social engineering, trade rivalry and predation, or political power, then a wholly different approach may be needed to understand and predict actual climate policy. Empirical study of these hypotheses is sorely needed.

International application of efficient policy design confronts some institutional challenges not faced in the national domestic context. The voting rule is quite different at the international level; the requirement of voluntary assent invites greater play for holdouts, free riders, and special-interest rent-seekers. The treaty must meld the diverse legal systems and cultures of over 150 countries, some of which are important to the climate problem but not especially market-oriented.

The optimal geographic coverage of a climate treaty appears to be nearly universal, but achieving this result under a voting rule of voluntary assent requires choosing a policy design that attracts nearly universal (or widespread and growing) participation. By lowering costs and offering resource flows, allowance trading appears to be the best policy design for ensuring broad participation. Meanwhile, allowance trading works best when many countries participate and the exercise of market power is thereby checked. A GHG market should not be limited to industrialized ("Annex I") countries — any interested country should be invited to participate.

Adoption of an efficient policy design requires building a political "constituency for efficiency." Education about the efficiency advantages of allowance trading may increase the demand for and supply of such policies, but may not be enough if the political opposition derives from a non-efficiency or anti-efficiency agenda. Opposition to efficient policy design motivated by non-climate political and economic objectives needs to be studied and revealed. The distribution of gains from an efficient policy design to each country — such as cost savings, allowance sale revenues, and local pollution control — needs to be analyzed and publicized. These local gains could provide the basis for assembling a political constituency for efficiency in relevant countries.

Given the voting rule of unanimity, one way that efficiency might be ensured in climate policy design is for a major player to be a holdout in favor of efficiency. The most likely candidate to play this role is the United States. Thus future global climate policy design may depend fundamentally on the U.S. policy position, as it did in the negotiations leading to the adoption of the FCCC in 1992.

Compared to the alternatives, the current U.S. proposal for

formal allowance trading has to be judged encouraging. Still, it can be improved, and it remains to be seen how the U.S. policy is advanced toward the Kyoto meeting in December 1997 and thereafter.

Some say the environment is too important to be left to markets. Others say the environment is too important to be left *out* of markets. Integrating global environmental protection with world markets — if it can surmount the political obstacles to efficient policy design — promises dramatic environmental and economic rewards.

Table 1

A Hypothetical Example of Gains from Tradeable GHG Allowances

	(0) No GHG Control		(1) Install Scrubber		(2) Each Reduce 20%		(3) Each Reduce 20%, with Trading	
	Emissions	Cost	Emissions	Cost	Emissions	Cost	Emissions	Cost
Country A	5	0	4?	$40	4	$10	3	2@10 = $20 - $10+ from B = $10
Country B	5	0	4?	$40	4	$40	5	$10+ paid to A
Global Total	10	0	8?	$80	8	$50	8	$20

Note: Requiring each country to install a particular emissions control technology would b even more costly. It would require A and B to each spend $40, for a total of $80, with emissions reductions that would likely be less than the desired amounts.
Source: Author's calculations

Notes

1. See *Report of the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change* (FCCC), Fifth Session, 2d Part, New York, 30 April - 9 May 1992, United Nations Document A/AC.237/18 (Part II)/Add.1 (1992), reprinted in 31 I.L.M. 851 (hereinafter "FCCC").

2. FCCC Article 4(2)(a), 4(2)(b).

3. FCCC Article 4(1).

4. United Nations Framework Convention on Climate Change, Conference of the Parties, First Session, Berlin, 28 March - 7 April 1995, Agenda Item 6(c), "Review of the Adequacy of Article 4, Paragraph 2(a) and (b) of the Convention, including Proposals related to a Protocol and Decisions on Follow-Up," Document FCCC/CP/1995/L.14 (7 April 1995); see also *United Nations Climate Change Bulletin*, No. 7 (FCCC Secretariat, Geneva: 2nd Quarter 1995).

5. See FCCC Article 4(2)(a) ("These Parties may implement such policies and measures jointly with other Parties"). On the U.S. proposal for policy design which became codified in this and related provisions of the FCCC, see Richard B. Stewart and Jonathan B. Wiener, "The Comprehensive Approach to Climate Change: Issues of Design and Practicality." 9 *Ariz. J. Int'l & Compar. L.* 83 (1992); Richard B. Stewart and Jonathan B. Wiener, "A Comprehensive Approach to Climate Change: Using the Market to Protect the Environment," *American Enterprise*, Nov.-Dec. 1990, at p. 75.

6. U.S. Submission to the UN FCCC Secretariat, containing "U.S. Draft Protocol Framework," attached to memorandum of Mark G. Hambley, Bureau of Oceans and International Environmental and Scientific Affairs (OES), U.S. Department of State, June 4, 1997.

7. See letter from Kenneth J. Arrow, Dale W. Jorgenson, Paul R. Krugman, William D. Nordhaus, and Robert M. Solow, January 3, 1997; see also Peter Passell, "Economic Scene: Yawn. A Global-Warming Alert. But This One Has Solutions," *New York Times*, February 13, 1997 (reporting on letter signed by over 2,000 economists endorsing tradeable allowance system to deal with global warming).

8. See Jonathan Baert Wiener, "Designing Markets for International Greenhouse Gas Control," Issues Brief, Resources for the Future (RFF), October 1997 (available at http://www.rff.org).

9. See Joseph E. Stiglitz, "The Theory of International Public Goods and the Architecture of International Organizations," Background Paper No. 7, Third Meeting of the United Nations High-Level Group on Development Strategy and Management of the Market Economy, Helsinki Finland (8-10 July 1995), pp. 1, 7.

10. See Stiglitz, supra note 9, at 1, 7; Garrett Hardin, "The Tragedy of the Commons," 162 *Science* 1243 (1968). Private bargains to manage the shared resource, as suggested by Ronald H. Coase, "The Problem of Social Cost," 3 *J. Law & Economics* 1 (1960), are unlikely where large and dispersed groups, uncertain causal linkages, and rife free riding all make such transactions very costly. See William J. Baumol and Wallace E. Oates, *The Theory of Environmental Policy*, pp. 9-13 (Cambridge University Press, 2nd ed., 1988); Howard K. Gruenspecht and Lester B. Lave, "The Economics of Health, Safety and Environmental Regulation," in 2 *Handbook of Industrial Organization*, pp. 1507, 1513-1514 (Richard Schmalensee and Robert D. Willig, eds., New York: North-Holland/Elsevier, 1989); W. Kip Viscusi, John M. Vernon and Joseph E. Harrington Jr., *Economics of Regulation and Antitrust*, pp. 716-717 (Boston: MIT Press, 2nd ed., 1995).

11. See Intergovernmental Panel on Climate Change (IPCC), *Climate Change 1995: Economic and Social Dimensions of Climate Change*, pp. 254-256 (James P. Bruce, Hoesung Lee, and Erik F. Haites, eds., Cambridge University Press, 1996) (hereinafter "IPCC Econ. 1995").

12. The Byrd resolution passed the Senate 95-0 in July 1997. See also John J. Fialka, "Senators Warn Global-Warming Pact Largely Hinges on Developing Nations," *Wall Street Journal*, June 20, 1997, at p. A20.

13. See Scott Barrett, "Reaching a CO_2-emission Limitation Agreement for the Community: Implications for equity and Cost-Effectiveness," 1 *European Economy*, p. 3 (1992).

14. See William J. Baumol, "Environmental Protection and Income Distribution," in *Redistribution Through Public Choice*, pp. 93-114 (Harold M. Hochman and George E. Peterson, eds., Columbia University Press, 1974) (demand for environmental protection typically increases with income).

15. IPCC Econ. 1995, at p. 71.

16. See IPCC Econ. 1995, chapter 9; National Academy of Sciences, *Policy Implications of Greenhouse Warming — Synthesis Panel Report*, pp. 60-63 (1991).

17. E.g. Richard Schmalensee, "Greenhouse Policy Architecture and Institutions," MIT-CEEPR 96-008 WP (September 1996), at pp. 3-8; M.E. Schlesinger and X. Jiang, "Revised Projection of Future Greenhouse Warming," 350 *Nature*, pp. 219-221 (1991). But see James K. Hammitt, "Evaluation Endpoints and Climate Policy: Atmospheric Stabilization, Benefit-Cost Analysis, and Near-Term Greenhouse Gas Emissions," Center for Risk Analysis, Harvard School of Public Health (19 November 1996).

18. Eugene Skolnikoff, "The Policy Gridlock on Global Warming," 79 *Foreign Policy*, pp. 77, 91 (Summer 1990).

19. Evidence on this point is reviewed in Jonathan Baert Wiener, "Protecting the Global Environment," in *Risk vs. Risk: Tradeoffs in Protecting Health and the Environment*, pp. 193-225 (John D. Graham and Jonathan Baert Wiener, eds., Harvard University Press, 1995).

20. See Intergovernmental Panel on Climate Change (IPCC), *Climate Change 1995: Impacts, Adaptation and Mitigation of Climate Change* (R.T. Watson, M.C. Zinyowera and R.H.Moss, eds., Cambridge University Press 1996); Robert L. Peters and Thomas E. Lovejoy, eds., *Global Warming and Biological Diversity* (New Haven: Yale University Press, 1992).

21. See IPCC Econ. 1995 at pp. 157, 215-218, 271, 409; Roy Boyd, Kerry Krutilla and W. Kip Viscusi, "Energy Taxation as a Policy Instrument to Reduce CO_2 Emissions: A Net Benefit Analysis," 29 *J. Envtl. Econ. & Mgmt.*, p. 1 (1995).

22. See Wiener, supra note 19. See Randall Lutter and Christopher Wolz, "UV-B Screening by Tropospheric Ozone: Implications for the National Ambient Air Quality Standard," 31 *Envtl. Science & Technology*, no. 3 (March 1997) at pp. 142A-146A.

23. See Andrew Hurrell and Benedict Kingsbury, "The International Politics of the Environment: An Introduction," in *The International Politics of the Environment: Actors, Interests and Institutions*, pp. 1-11 (Andrew Hurrell and Benedict Kingsbury, eds., Oxford: Clarendon Press, 1992).

24. See Detlef Sprinz and Tapani Vaahtoranta, "The Interest-Based Explanation of International Environmental Policy," 48 *Int'l Organization*, pp. 77-105 (Winter 1994).

25. See Hurrell and Kingsbury, supra note 23, at p. 5; Viscusi, Vernon and Harrington, supra note 10, at pp. 737-740.

26. See Dennis C. Mueller, *Public Choice II* (New York: Cambridge

University Press 1989) at p. 54; James Buchanan and Gordon Tullock, *The Calculus of Consent*, pp. 63-91 (Ann Arbor: University of Michigan Press, 1962).

27. Even after becoming party to the treaty, nation-states can withdraw. Although such withdrawal might be made technically illegal under the terms of a treaty, the practical issue is whether any enforceable penalties can be brought to bear against the defector. The threat of withdrawal gives the nation a continuing ability to exact concessions from other parties to the treaty.

28. See Guido Calabresi and A. Douglas Melamed, "Property Rules, Liability Rules, and Inalienability: One View of the Cathedral," 85 *Harv. L. Rev.*, p. 1089 (1972); Martin Weitzman, "Prices vs. Quantities," 41 *Review of Economic Studies*, p. 477 (1974); Richard B. Stewart, "Reconstitutive Law," 46 *U. Md. L. Rev.*, p. 86 (1986). The classic argument for price tools is A.C. Pigou, *The Economics of Welfare* (1920); see also Baumol and Oates, supra note 10. The classic argument for quantity tools is Coase, supra note 10. See also Thomas D. Crocker, "The Structuring of Atmospheric Pollution Control Systems," in *The Economics of Air Pollution*, pp. 61, 81-84 (Harold Wolozin, ed., 1966); John H. Dales, Pollution, *Property and Prices* (Toronto: University of Toronto Press, 1968); W. David Montgomery, "Markets in Licenses and Efficient Pollution Control Programs," 5 *J. Econ. Theory*, p. 395 (1972).

29. See Crocker, Dales, and Montgomery, cited supra note 28.

30. See Pigou, supra note 28; Baumol and Oates, supra note 10.

31. For example, the Bergen Declaration (1989) advocated coordinated adoption of more stringent automobile fuel economy standards. See Richard Cooper, "A Treaty on Global Climate Change: Problems and Prospects," Harvard University, draft October 1996 (suggesting that nations could more readily agree on a set of "actions" rather than on national emissions targets).

32. See Jae Edmonds and Marshall Wise, "Exploring a Technology Strategy for Stabilizing Atmospheric CO_2," Pacific Northwest Laboratory, Washington D.C., draft August 1, 1997.

33. See Murray Weidenbaum, Christopher Douglas, and Michael Orlando, Toward a Healthier Environment and a Stronger Economy: How to Achieve Common Ground (St. Louis, MO: Center for the Study of American Business, Washington University, January 1997).

34. See World Bank, *World Development Report 1992: Development and the Environment*, p. 161 (Oxford University Press, 1992).

35. See Daniel J. Dudek, Richard B. Stewart and Jonathan B. Wiener, "Environmental Policy for Eastern Europe: Technology-Based versus Market-Based Approaches," 17 *Colum. J. Envtl. L.*, p. 1 (1992).

36. See Executive Order 12866 (October 1993); Beth S. Ginsberg and Cynthia Cummis, "EPA's Project XL: A Paradigm for Promising Regulatory Reform," 26 *Envtl. L. Rep.*, pp. 10059 (February 1996).

37. See Dudek, Stewart and Wiener, supra note 35; Robert W. Hahn and Robert N. Stavins, "Incentive-Based Environmental Regulation: New Era from an Old Idea?" 18 *Ecol. L. Q.*, p. 1 (1991).

38. The FCCC incorporated both formulations. Article 3(3) encourages "cost-effective" efforts to be "carried out cooperatively by interested Parties;" and Article 4(2)(a) provides that "Parties may implement such policies and measures [to limit net GHG emissions] jointly with other Parties."

39. Emitters may still be motivated to use the pilot phase of JI to pursue public relations rewards, to learn about JI and make international contacts in anticipation of participating in a full market, to satisfy non-FCCC emissions limits such as national or state/provincial requirements where credit is granted, and to make early investments in projects that could generate real credits after the pilot phase ends

40. Note that in several models of temporal flexibility, the marginal intertemporal transfers of abatement have close to no net impact on accumulated GHG concentrations. E.g. Richard Richels, Jae Edmonds, Howard Gruenspecht and Tom Wigley, "The Berlin Mandate: The Design of Cost-Effective Mitigation Strategies." Energy Modeling Forum 14, Stanford University, draft of February 3, 1996, Figure 6.

41. E.g. Alan Manne and Richard Richels, "The Berlin Mandate: The Costs of Meeting Post-2000 Targets and Timetables," 24 *Energy Policy*, pp. 205-210 (1996); Richels, Edmonds, Gruenspecht and Wigley, supra note 40; U.S. Government, "Economic Effects of Global Climate Change Policies," Results of the Research Efforts of the Interagency Analytic Team (IAT) (draft dated May 30, 1997); Jean-Marc Burniaux, John P. Martin, Giuseppe Nicoletti and Joaquim Oliveira Martins, "The Costs of Reducing CO_2 Emissions: Evidence from GREEN," OECD Economics Department Working Paper No. 115, OCDE/

GD(92)117 (Paris: OECD, 1992).

42. Richels, Edmonds, Gruenspecht and Wigley, supra note 40, Figure 3.

43. Ibid., Figure 4.

44. Ibid. at 10 and Figure 8.

45. See Daniel J. Dudek and Jonathan Baert Wiener, "Joint Implementation, Transaction Costs, and Climate Change," OCDE/GD(96)173 (Paris: OECD, 1996).

46. See Richard B. Stewart and Jonathan B. Wiener, "The Comprehensive Approach to Global Climate Policy: Issues of Design and Practicality," 9 *Ariz. J. International & Comparative L.*, pp. 83, 94 and n.45 (citing studies by DOE and the World Bank showing that including all GHGs lowers the cost of abatement, compared to a CO_2-only policy, by about 75 percent; and including the forest sector lowers the cost of abatement, compared to an energy-sector only policy, by about 90 percent).

47. See Adam B. Jaffe and Robert N. Stavins, "Dynamic Incentives of Environmental Regulation: The Effects of Alternative Policy Instruments on Technology Diffusion," 29 *J. Envtl. Econ. & Mgt.* S43-S63 (1995).

48. See Edward A. Parson and Karen Fisher-Vanden, "Joint Implementation and Its Alternatives: Choosing Systems to Distribute Global Emissions Abatement and Finance," Environment and Natural Resources Program, Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University (April 28, 1997), at p. 5; Scott Barrett, "Transfers and the Gains from Trading Carbon Emission Entitlements in a Global Warming Treaty," chapter VII *in Combating Global Warming: Study on a System of Tradeable Carbon Emission Entitlements* (Geneva: UNCTAD 1992); Manne and Richels, supra note 41.

49. See Manne and Richels, supra note 41; Richels, Edmonds, Gruenspecht and Wigley, supra note 40.

50. Ibid.

51. See Robert W. Hahn and Gordon L. Hester, "Marketable Permits: Lessons for Theory and Practice," 16 *Ecol. L. Q.*, p. 361 (1989). Some or much of the cost savings in the SO_2 case may derive from the performance-based (intra-firm) flexibility introduced in the 1990 law, rather than the trading (inter-firm) flexibility the law also afforded.

52. See Dudek, Stewart and Wiener, supra note 35, at p. 45.

53. See Weitzman, supra note 28; Gruenspecht and Lave, supra note 10, at pp. 1516-1519; Robert N. Stavins, "Correlated Uncertainty and Policy Instrument Choice," 30 *J. Envtl. Econ. & Mgt.*, p. 218 (1996).

54. See James M. Buchanan and Gordon Tullock, "Polluters' Profits and Political Response: Direct Controls Versus Taxes," 65 *Amer. Econ. Rev.*, p. 139 (March 1975); Nathaniel Keohane, Richard Revesz and Robert Stavins, "The Positive Political Economy of Instrument Choice in Environmental Policy," RFF Discussion Paper 97-25 (February, 1997), at p. 31 and nn. 53-54.

55. See e.g. Donald N. Dewees, "Instrument Choice in Environmental Policy," 21 *Economic Inquiry*, pp. 53, 53 (January 1983) ("The general failure to adopt policies of proven efficiency has been viewed with despair by economists. But if we are to understand why policies are not adopted and to develop policy designs that may be both efficient *and* politically attractive, we must analyze the essence of political decisions: the distributional effects of policies.") (citation omitted). See also Keohane, Revesz and Stavins, supra note 54, at 41; Hahn and Stavins, supra note 37.

56. For reviews see Keohane, Revesz and Stavins, supra note 54; Robert W. Hahn, "The Political Economy of Environmental Regulation: Toward a Unifying Framework," 65 *Public Choice*, p. 21 (1990); Roger Noll, "The Politics of Social Regulation," in R. Schmalensee and R. Willig, eds., *Handbook of Industrial Organization*, vol. 2 (1989).

57. A notable example is Sprinz and Vaahtoranta, supra note 24.

58. See IPCC Econ. 1995 at pp. 254, 318.

59. See Dudek, Stewart and Wiener, supra note 35.

60. See Peter Bohm, "A Joint Implementation as Emission Quota Trade: An Experiment Among Four Nordic Countries," *Nord* 1997:4 (Copenhagen: Nordic Council of Ministers, 1997).

61. See Buchanan and Tullock (1975), supra note 54.

62. See Jonathan Baert Wiener, "Designing Markets for International Greenhouse Gas Control," Issues Brief, Resources for the Future (RFF), October 1997 (available at http://www.rff.org).

63. E.g. Cooper, supra note 31; Warwick McKibben and Peter Wilcoxen, "A Better Way to Slow Climate Change," Brookings

Policy Brief No. 17, June 1997.

64. Hence the Byrd Resolution passed 95-0 in July 1997.

65. See Daniel J. Dudek and Jonathan Baert Wiener, "Joint Implementation, Transaction Costs, and Climate Change," OCDE/GD(96)173 (Paris: OECD Environment Directorate, Nov. 1996). See also Robert N. Stavins, "Transaction Costs and Tradeable Permits," 29 *J. Envtl. Econ. & Mgmt.*, pp. 133-148 (1995); Vivien Foster and Robert W. Hahn, "Designing More Efficient Markets: Lessons from Los Angeles Smog Control," 38 *J. Law & Econ.*, pp. 19-48 (April 1995).

66. See Dudek and Wiener, supra note 65, at p. 53.

67. See Wiener, supra note 8; Robert W. Hahn, "Market Power and Transferable Property Rights," 99 *Quarterly J. Econ.*, p. 753 (1984); Walter S. Misiolek and Harold W. Elder, "Exclusionary Manipulation of Markets for Pollution Rights," 16 *J. Envtl. Econ. & Mgmt.*, pp. 156, 164 (1989); Hege Westkog, "Market Power in a System of Tradeable CO_2 Quotas," 17 *Energy J.*, pp. 85, 86 (1996).

68. See Richard B. Stewart, Jonathan Baert Wiener, and Philippe Sands, "Legal Issues Presented by a Pilot International Greenhouse Gas Trading System" (Geneva: UNCTAD, November 1996) at pp. 33-35.

69. See Eleanor M. Fox, "Toward World Antitrust and Market Access," 91 *Amer. J. Int'l L*, p. 1 (1997).

70. See "Pollution Control: Unshackling the Invisible Hand," *The Economist*, January 4, 1992, at p. 66 (states seeking to meddle in SO_2 allowance market); Alliance for Clean Coal v. Miller, 44 F.3d 591 (7th Cir. 1995) (striking down Illinois law restricting use of low-sulfur out-of-state coal enacted in response to 1990 acid rain SO_2 trading program); Elizabeth Bailey, "Allowance Trading Activity and State Regulatory Rulings: Evidence from the US Acid Rain Program," MIT CEEPR Working Paper 96-002 (March 1996).

71. See Stewart, Wiener and Sands, supra note 68, at 35-40.

72. See Steven Kelman, "Cost-Benefit Analysis: An Ethical Critique," 5 *Regulation*, no. 1 (January-February 1981) at pp. 33-40.

73. This viewpoint is described (not endorsed) by Howard Margolis as seeing polluters "as intrinsically evil. So of course whatever these actors want to do should be impeded: probably whatever they want to do is bad, and, even if on this occasion it is

not, undercutting their claims to legitimacy and authority is a good thing anyway. And since the by-products of these disgusting institutions are profoundly polluting, it is implausible that they can really be cleaned up at all and downright wrong to suppose that they can be cleaned up easily – that is, without some significant expiation of the sin they represent." Howard Margolis, *Dealing with Risk*, p. 25 (Chicago: University of Chicago Press, 1996).

74. Unless the moralist advocates a truly zero emissions policy.

75. See Karin Arts, Paul Peters, Nico Schrijver, and Peter van Sluijs, "Legal and Institutional Aspects," in *Joint Implementation to Curb Climate Change: Legal and Economic Aspects*, pp. 1, 48-53 (Onno Kuik, Paul Peters and Nico Schrijver, eds., Dordrecht Netherlands: Kluwer Academic Publishers 1994) (citing proposed limits on JI).

76. Furthermore, if the local "supplementary benefits" of GHG abatement are important in developing countries – as is suggested by the high levels of local air pollution in Mexico City and Beijing, among others – then allowance trading provides a direct mechanism to control that pollution, which domestic-only action by industrial countries would do nothing to address.

77. See supra text accompanying notes 47-49.

78. See Schmalensee, supra note 17.

79. E.g. George J. Stigler, "The Theory of Economic Regulation," 2 *Bell J. Econ.*, pp. 3-21 (1971); Sam Peltzman, "Toward a More General Theory of Regulation," 19 *J. Law & Econ.*, pp. 211-240 (1976); Robert Tollison, "Regulation and Interest Groups," in *Regulation: Economic Theory and History*, pp. 59-76 (Jack High, ed., Ann Arbor: University of Michigan Press, 1991).

80. E.g. Ann P. Bartel and Lacy Glenn Thomas, "Predation Through Regulation: The Wage and Profit Effects of the OSHA and the EPA," 30 *J. Law & Econ.*, pp. 239-264 (1987); Michael T. Maloney and Robert E. McCormick, "A Positive Theory of Environmental Quality Regulation," 25 *J. Law & Econ.*, pp. 99-124 (1982); Tollison, supra note 79, at pp. 64-66; Peter B. Pashigian, "Environmental Regulation: Whose Self-Interests are Being Protected?" 23 *Econ. Inquiry*, pp. 551-584 (1985); Bruce A. Ackerman and William T. Hassler, *Clean Coal / Dirty Air* (New Haven: Yale Univ. Press 1981).

81. See Keohane, Revesz and Stavins, supra note 54, at p. 2 n.7 (citing Stewart 1996 draft).

82. The IPCC cites "bottom-up" studies showing that Germany, France, and the Netherlands face low domestic GHG abatement costs - indeed close to zero cost to keep their emissions at 1990 levels by 2000 – but that the U.S., Japan, Norway and others face much higher domestic abatement costs. See IPCC Econ. 1995 at pp. 318, 321. These bottom-up studies are probably more pertinent to industry-specific perceived costs, and hence to industries' strategic behavior, than are macroeconomic top-down studies of costs to the entire economy.

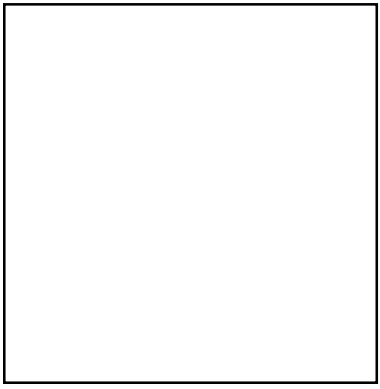
83. The predation strategy is complicated by the fact that under a tradeable allowances system, the low-cost abaters could also earn revenues from allowance sales (depending on their initial assignment of allowances). Thus, predation makes sense if the low-cost abaters would gain more from an inflexible policy's impacts on high-cost rivals than they would gain from a flexible policy's revenue prospects. Global GHG allowance trading would direct allowance sale revenues to developing countries and Eastern Europe, not to Western Europe, whereas an inflexible policy would hurt the United States and Japan relative to Western Europe. But trading among industrialized countries ("Annex I") only could direct revenues to Western Europe. In short, to be politically successful, a trading policy must not only reduce abatement costs to each country, but must deliver gains exceeding those of predation.

84. This would reflect the combination of both "Baptist" (environmentalist) and "Bootlegger" (industry rent-seeker) special interests that Bruce Yandle argues must undergird domestic environmental regulation. See Bruce Yandle, "Bootleggers and Baptists in the Market for Regulation," in The Political Economy of Government *Regulation*, pp. 29-54 (Jason F. Shogren, ed., Boston: Kluwer Academic Publishers, 1989).

85. See Yandle, supra note 84 (bootleggers pursue their strategic interests under cover of Baptist slogans).

86. See Manne and Richels, supra note 41; Richels, Edmonds, Gruenspecht and Wigley, supra note 40, at p. 10.

87. See Schmalensee, supra note 17; Stiglitz, supra note 9.



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For helpful disucssion on the issues raised in this paper, Dr. Wiener is grateful to Scott Barrett, Ken Chilton, Dan Dudek, Joe Goffman, Howard Gruenspecht, Bob Hahn, Sally Kane, Bob Keohane, Jonathan Pershing, Annie Petsonk, Paul, Portney, John Reilly, Jay Shogren, Rob Stavins, Dick Stewart, Mike Toman, the participants at the NBER-Snowmass Workshop on International Emissions Trading Systems (August 13-14, 1997), and many others too numerous to mention. Dr. Wiener thanks Suzanne Alwan and Lisa Glover for excellent research assistance.

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