

ON RECONCILING PARTICULARISTIC AND GENERAL INTERESTS:
MANAGING DISTRIBUTIONAL EFFECTS OF CPR REGULATION

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I. INTRODUCTION: SELF INTEREST AND CPR MANAGEMENT

This paper offers a moderately optimistic view on the management of Common Pool Resources (CPR). We argue that a central problem of CPR management is to bring about a convergence of narrow self interest and the common good. In what could be termed "Stiglerian" situations, that convergence is a natural byproduct of cartelization by regulation. The phenomenon of regulatory capture may advance the general interest in effective management of CPRs, albeit at the expense of would be entrants and/or consumers. In what could be termed "Olsonian" situations, that convergence must be created by buying off powerful potential losers that would otherwise undercut systems of regulation. In short, our optimism on CPR management derives from the perverse observation that general environmental concerns are being advanced through the particularistic pursuit of rents and subsidies.

Nevertheless, our optimism is tempered by significant qualifications. As the cases presented below illustrate, unholy alliances of the green and the greedy may yield inefficient and intrinsically unstable transitional solutions to CPR problems. Stiglerian regulatory rents can come at the expense of potential entrants, consumers and aggregate welfare and Olsonian systems of regulation without compensation are unstable. Furthermore, compensation schemes are difficult to establish and maintain, and when compensation schemes are established they may retard adjustment by blunting market incentives. Our analysis of the four primary cases and several minor cases that follow also suggests that consideration of elementary principles of fairness in establishing Stiglerian regulations and setting levels of Olsonian compensation may be necessary if self interested behavior is to yield stable solutions to CPRs.

II. STIGLERIAN REGULATION: CONCENTRATED BENEFITS AND DIFFUSE COSTS

In Stiglerian situations, regulatory benefits are concentrated on the few while regulatory costs are diffused across the many.² More precisely, producers will fight for regulations that provide: (1) direct

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²Stigler, G. 1971. "The Economic Theory of Regulation," *Bell Journal of Economics* 2: 3-21.

monetary subsidies; (2) constraints or subsidies on substitutes or complements of commodities produced; (3) price fixing; and (4) control over entry by new rivals. Environmental justifications for regulation may have the effect of fostering Stiglerian rent seeking by offering legitimating principles for regulation and by adding environmentalists to regulatory coalitions. Of course, regulations that advance the particularistic interests of existing producers and a general interest in effective management of CPR problems may also harm potential entrants and consumers. In Stiglerian situations, the central institutional design problem is to define and achieve an appropriate balance across managing the CPR and minimizing the unfairness and welfare losses associated with rent providing regulations.

Our review of the Montreal Protocol case stresses the economic consequences of the second and fourth of Stigler's benefits of regulation, the creation of markets for substitutes and the creation of barriers to entry by potential rivals. Specifically, long term economic interests in creating the market for CFC substitutes were one of the primary reasons that DuPont sought and ICI accepted international regulation.

Our review of the efforts of a small farming community in Kansas to manage local water resources stresses the fourth of Stigler's benefits of regulation, the creation of barriers to entry by potential rivals. The irrigators of Fowler, Kansas managed their common groundwater supplies in their local artesian valley first by excluding potential entrants and then by limiting their own drawing rights.

In both of these cases, narrow material interests interacted with broader environmental and political concerns. The international community successfully adopted the Montreal Protocol because of the concordance of political values, scientific knowledge, and economic incentives. And the farmers of Fowler established their barriers to entry to manage a very rapidly depleting common pool resource. In neither the Montreal nor Fowler cases would regulation and restriction have been possible if there were not a plausible and substantive connection to very real environmental concerns.

A. PROFITING FROM PRODUCT SUBSTITUTION: DUPONT, ICI AND THE MONTREAL PROTOCOL

The Dupont and ICI experience with restrictions on CFCs represents a classic Stiglerian case of producers benefiting from regulations that mandated product substitution.³ From the 1930s when they were invented, until the early 1970s, CFCs were considered to be one of the great success stories of the chemical industry. Because they did not react with other substances, the chemicals were nontoxic in either industrial or environmental settings. They were relatively easy and inexpensive to produce, and widely used in applications such as refrigeration, air conditioning, and in aerosols. The 1974 *Nature* paper by Rowland and Molina caught both the manufacturers and scientists by surprise⁴. They argued that CFCs might prove a significant source of chlorine in the stratosphere following decomposition by ultraviolet radiation, and that, over a long period of time, this free chlorine could lead to serious reductions in the stratospheric ozone layer.

Both US and British government responses to Rowland and Molina's hypothesis were swift. The National Academy of Sciences (NAS) reported in 1976 that the nonessential uses of CFCs would have to be drastically reduced if the science was borne out⁵. A far more cautious response came from the British Department of the Environment (DoE), which emphasized the uncertainties contained in the scientific analysis

³The material for this case is based upon the following: J. Maxwell and S. Weiner 1993. "Green Consciousness or Dollar Diplomacy: The British Response to Ozone Depletion." *International Environmental Affairs* v5 pp. 19-41, and S. Weiner and J. Maxwell 1992. "The Political Economy of the CFC Phaseout: Learning the Right Lessons," in *Dimensions of Managing Chlorine in the Environment*, Report of the MIT/Norwegian Chlorine Study, March 1993.

⁴Molina, M., and Rowland, F. S. 1974. "Stratospheric Sink for Chlorofluoromethanes: Chlorine Atom Catalyzed Destruction of Ozone". *Nature* Vol 249 No 5460. p 10-12.

⁵National Academy of Science Report. 1976. *Halocarbons, Environmental Effects of Chlorofluoromethane Release*. Committee on Impacts of Stratospheric Change. Assembly of Mathematical and Physical Sciences. Washington DC.

and dismissed the need for immediate regulatory action⁶.

In 1977, American regulatory authorities proposed banning the use of CFCs in aerosols. But this use had already fallen due to shifts to alternatives by consumer products companies. Confronting state bans and rising consumer concerns driven by environmental groups, Johnson Wax had announced in June 1975 its intention to phase-out CFCs; other consumer products companies in the US had followed its example⁷. Implementation of the proposed ban had thus been greatly facilitated by market forces acting in anticipation of regulation.

Despite strong American encouragement to eliminate an unnecessary "luxury," the British rejected the American approach, arguing that auto air conditioning systems in the U. S. were also luxuries. The weak scientific case as they perceived it discouraged the British from regulating its CFC industry, especially Imperial Chemical Industries, the nation's largest manufacturing company and one of the world's largest CFC producers. In 1974 UK consumption of CFCs remained heavily concentrated in aerosols (80% versus 50% in the U.S.)⁸. A ban on the use of CFCs as aerosol propellants would have imposed markedly different economic consequences for the United Kingdom than the United States. Thus Dupont, the largest American producer, lost half its CFC market because of domestic policies, while ICI was unimpeded.⁹

In 1979, the National Academy of Sciences estimated that a 16% ozone depletion would result eventually in several thousand more cases of melanoma per year, many fatal, several thousand more cases of nonmelanoma, and a likely reduction in crop yields.¹⁰ Following the publication of the NAS report, the Carter administration launched new regulatory initiatives. While seeking to further limit US production, the EPA pressed European governments to also ban CFCs in aerosols and other nonessential uses¹¹. The European Community responded with a compromise CFC regulation that was essentially symbolic. The main proponents (Germany, Denmark, and the Netherlands) faced opposition from the UK and France. The regulation required

⁶Department of the Environment, Central Unit on Environmental Pollution. 1976. Pollution Paper No 5. *Chlorofluorocarbons and their effect on Stratospheric Ozone*. p 16. (hereafter Pollution Paper #5).

⁷Dotto, L. and Schiff, H. 1978. *The Ozone War*. Doubleday. Garden City, New York, pp 165-166.

⁸Pollution Paper #5. p 6.

⁹By the time of the next UK DoE report on ozone depletion in 1979, the difference in the UK and US attitudes to the uncertainties involved had hardened. Noting that the amount of CFCs used in the UK was declining, the report concluded that "In the light of the many uncertainties still prevailing such a reduction appears to be adequate pending further research." (See Pollution Paper #15, p 10.) This conclusion stands in stark contrast to one from the NAS, which was published a few weeks later. (See National Academy of Sciences. 1979. *Protection Against Depletion of Stratospheric Ozone by Chlorofluorocarbons*. p 5. cited hereafter as NAS. 1979.) The NAS believed that the uncertainties had been overcome to the extent that a "wait-and-see" approach was no longer feasible, calling for an urgent global ban on the use of CFCs in aerosols. In addition, it emphasized the alarming growth in other uses such as air conditioning, refrigeration, and solvents.

The NAS and the DoE derived rather similar quantitative estimates of ozone depletion from their atmospheric models. The reports differed in their approach to the scientific uncertainties involved. (See Rivkin, Kenneth A. 1983. *Decision-Making Under Uncertainty: The International Response to Protect Stratospheric Ozone*. Thesis for Master of Science in Management, Massachusetts Institute of Technology. p 33. (Hereafter Rivkin, K. *Decision-Making under Uncertainty*)) The Americans believed that the possibility of significant new chemical processes being discovered was small enough to be ignored and the report actually attempted to quantify the uncertainties. The British had less faith in these modelling techniques, emphasizing that critical uncertainties remained, and that all of the estimates varied by as much as 100%. In addition, NAS scientists devoted far greater attention to potential health effects than their British colleagues.

¹⁰See NAS. 1979.

¹¹Rivkin, K. *Decision-making under Uncertainty*. p 33.

a 30% reduction in CFCs for aerosols by 1981 (from 1976) and limited overall production capacity¹². But even in Europe CFC use in aerosols had declined and the total production limit was set too high to constrain.

As Figure 1 shows, the weak European regulation and the American ban on aerosols led to a long term shift in worldwide production of CFCs. From the mid 1970s, US production for CFC 11 and 12 fell rapidly in response to market pressures on aerosols, while it continued to expand in Britain and the EC. The fall in US demand led to manufacturing overcapacity and undermined producers ability to raise prices and improve profit margins. As Figure 2 demonstrates, the pressure on prices proved so great that prices in real terms for both CFC 11 and 12 would remain relatively constant for more than a decade. The British industry successfully overcame these adverse market conditions by expanding its production, an option which was unavailable to its US rivals because of the weakness of demand.

(Insert Figures 1 and 2 Here)

Political and scientific developments in the early 1980s reduced concerns over the ozone depletion issue. The new Reagan Administration was opposed to further environmental regulations. At the same time, scientific assessments seemed to confirm earlier British skepticism by lowering the estimates of the long term ozone depletion to be expected; the NAS estimates dropped from 16% (1979) to 2-4% (1984)¹³. Nevertheless, international negotiations began at low diplomatic levels, given that the stakes involved were perceived to be small. The Vienna Convention for the Protection of the Ozone Layer, signed in 1985, committed the international community to the eventual control of ozone depleting substances, but lacked any specific control measures.

The CFC industry felt reassured by these events. Research started in the mid-70s had identified about a dozen possible new replacement chemicals for applications in aerosols, refrigeration and foam-blowing, but in the early 1980s the entire ICI and Dupont CFC alternatives research programs were discontinued because of the lack of a market for the higher priced alternatives.

The policy stalemate was broken in 1985 when the science of ozone depletion was thrown into disarray by Farman's discovery of the destruction of stratospheric ozone in the Antarctic polar vortex, the infamous ozone hole¹⁴. Farman's observations caused turmoil in the scientific community because its members did not have a theory to explain the unexpectedly large depletions discovered at Antarctica. The discovery of the ozone hole dramatically transformed the politics of the international negotiations as well as the science. The image of a hole in the sky which was allowing dangerous levels of UV radiation to reach the earth's surface captured the public's imagination¹⁵. No longer did there seem to be uncertainty about prospects for an international agreement; the major question concerned the content. The United States position leading into the international negotiations was that substantial cuts should be enacted in CFC production with a total phase out within 10 years. Even if the link between chlorine and ozone depletion had not been definitively demonstrated, the EPA was concerned about the possible risks of inaction¹⁶.

Fearful of repeating the earlier experience with strict domestic regulation that had cost it a significant share of the global market for CFCs in the 1970s, DuPont proposed in September 1986 that international

¹²Council Decision 80/372/EEC. Official Journal of the European Communities L90. April 3 1980.

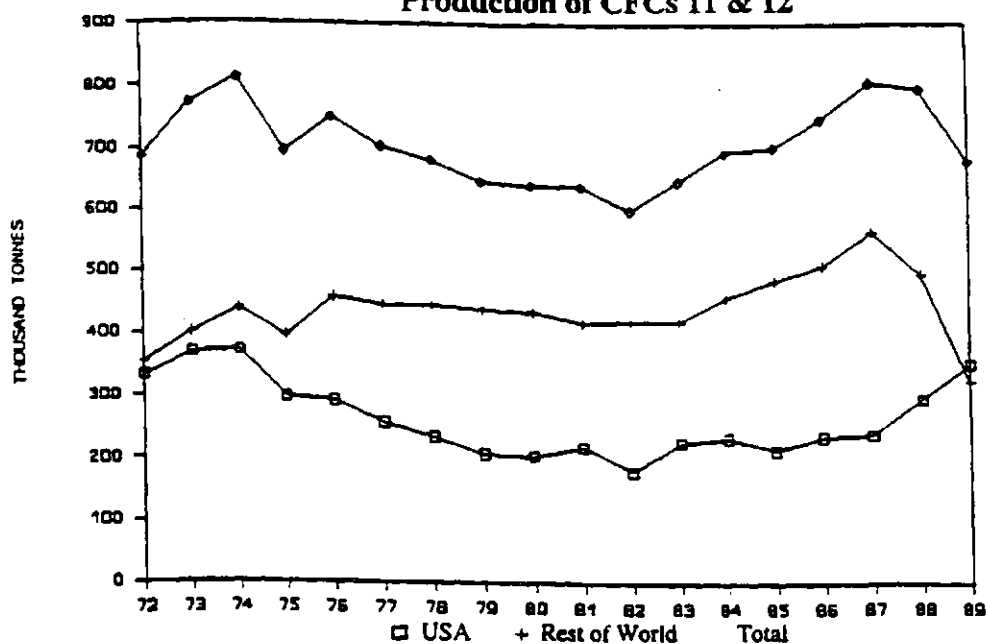
¹³National Academy of Sciences. *Causes and Effects of Stratospheric Ozone Reduction: An Update*. 1982 and 1983. National Academy Press, Washington D.C.

¹⁴Farman, J.C., Gardiner, B.G., and Shanklin, J.D. May 1985. "Large Losses of Total Ozone in Antarctica Reveal Seasonal ClO_x/NO_x Interaction". *Nature* 315. pp 207-210.

¹⁵Warr, K. 1990. "Ozone: the burden of proof". *New Scientist*, 27 Oct 1990. p 39.

¹⁶Lee Thomas, EPA Administrator. Cited in Paul Brodeur. 1986. "Annals of Chemistry in the Face of Doubt". *New Yorker*. June 9, 1986. p 86. The actual scientific rationale for the phaseout was found in old models even while the discovery of the antarctic ozone hole was proving them to be inadequate. The original models had assumed steady state production. By 1986, it was clear that worldwide production had begun to climb again and was approaching the 1974 peak. When 3% per year production increases were compounded indefinitely into the future, any model would eventually predict significant ozone losses.

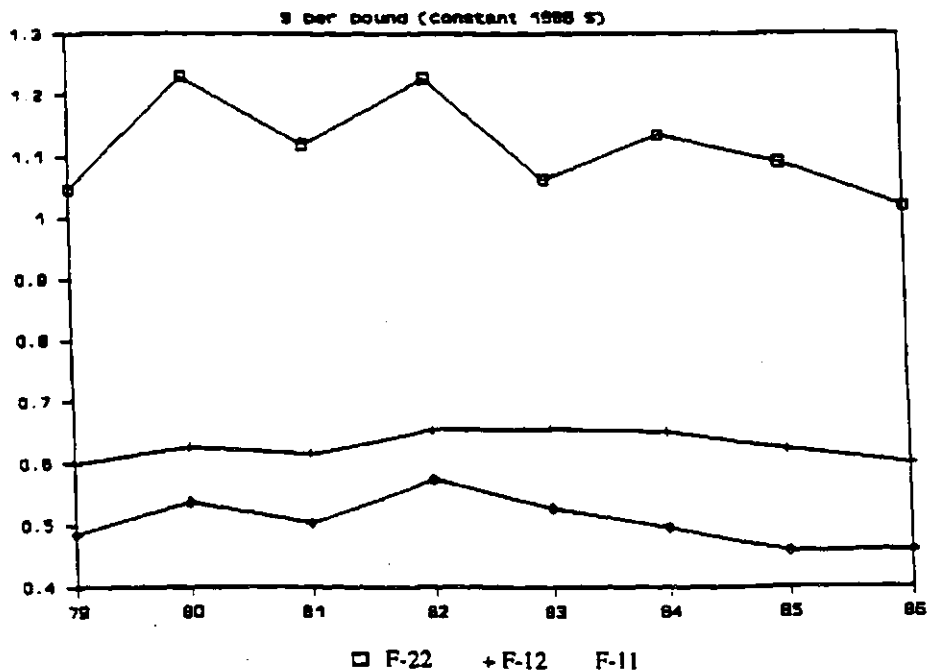
Figure 1
Production of CFCs 11 & 12



Note: Data for world production are taken from the Chemical Manufacturers' Association Fluorocarbon Program Panel, December 1990. 1989 Production and Sales of Fluorocarbons 11 & 12. US data were taken from the US International Trade Commission report Synthetic Organic Chemicals. Data for the rest of the world were estimated by subtracting the US data from the World Total.

Source: CMA, AFEAS and US ITC

Figure 2
Average Value of CFCs



Note: The data are for the US sales, taken from The US International Trade Commission publication Synthetic Organic Chemicals. The figures are the average unit values calculated from rounded figures. Prices have been deflated using the yearly average Producer Price Index.

Source: US int Trade Commission

regulation should limit worldwide production to the then existing levels¹⁷. This was the critical moment in the more than decade long ozone depletion controversy. An agreement to cap production demonstrated a willingness to shift its capacity to the manufacture of alternative chemicals. A cap, in turn, implied an eventual phaseout of ozone depleting chemicals. The British government rejected this in favor of freezing production capacity, arguing that the scientific models showed that any form of cap, including the European capacity ceiling applied globally, would be sufficient to safeguard the environment.

Divergence in the British and the US positions can be partially explained by differences in the short term economic positions of their respective industries. The British showed reluctance to harm ICI's CFC business, which because of its recent expansion was more profitable than that of its US competitors. The American CFC business continued to be characterized by overcapacity, low profit margins, and the impending threat of domestic regulation¹⁸. However, the long term term economic incentives facing both industries were similar. The transition to alternatives had the promise to expand profits even while eliminating a billion dollar a year business. Favorable economics made the ozone issue different from many other environmental problems that harmed the long term profitability of the industries involved.

The transition to alternatives was technically feasible because research in the late 1970s had identified a series of substitutes that could be used where some sort of CFC-like substance was needed. But in contrast to the CFC 11 and 12 which were relatively inexpensive to produce, the substitutes required sophisticated chemical engineering processes and capital investments of hundreds of millions of dollars. This meant that the new chemicals would be inherently more expensive to produce and would demand much higher prices. Rather than being sold as commodity chemicals on a world wide basis, they could be marketed as high-margin specialty chemicals where the leading international firms could foresee substantial competitive advantages.

Long term economic interests were one of the primary reasons that DuPont sought and ICI would ultimately accept international regulation that helped to create the market for substitute chemicals. The new chemicals were projected to sell for 5-10 times the costs of CFC 11 and 12 so that the major users would never voluntarily shift to these chemicals without government intervention. User industry resistance to the potential price increases would, however, be reduced by the fact that CFCs actually comprised only a small percentage of the total cost of any refrigerator or air conditioning unit (or the costs of manufacturing a circuit board). The major costs would be to adapt compressors and other technologies to the new chemicals, which again were manageable if phased in over time. So the transition would require government and industry working hand in hand. It was also to industry's advantage that the transition be staged in an orderly fashion so that existing customers could be shifted to the alternative chemicals as the new production came on line. The industry leader's incentives were clear.

The EC and the United States, the major governmental protagonists in the negotiations leading up to the Montreal protocol, faced different incentives. Once the US government and industry publicly announced their strong positions in favor of regulation, the British and the French had strong incentives from a tactical standpoint to hold out as long as possible for an agreement reflecting their desires to delay reductions in CFC production. The EC finally accepted the goal of a 50% cut in CFC production by the year 2000. This could easily be met by cutbacks in aerosol use alone. The US favored reductions measured in terms of national consumption; the EC argued forcefully for limits on production. DuPont feared that the national production limits could be easily met by European producers by restricting their use in aerosols, providing an opportunity for them to expand their sales either in other applications or in other markets. For their part, the Europeans expressed concern that DuPont would use the consumption limits to rationalize its production on a global scale and export into their home markets.

A related issue concerned whether the limits would be applied to individual countries or the entire EC. US industry feared that certain European producers would rationalize production at the community level, enhancing their position vis a vis American industry. Both the US and the EC wished to prevent the other's

¹⁷Environmental Data Services Report (hereafter ENDS Report). October 1986. *DuPont Leads Industry Shift on CFCs*. p 6. James Maxwell interviews with DuPont Officials. October 1991.

¹⁸Reinhardt, Forest. 1989. *DuPont Freon@ Products Division (B)*. Harvard Business School case prepared for the National Wildlife Federation, Washington DC.

environmental groups as subversives, calling them the enemy within. This marked the official "greening" of Mrs Thatcher. Ozone depletion and global warming were the two primary issues through which she demonstrated her new environmental commitment.

The roots of the transformation in British CFC policy can be found in these shifting commercial and political sands. At an EC meeting in March 1989, British officials expected to take the lead in pressing for the 85% cut in CFC production before 1999. Instead, according to the London Times:

...the British delegation...were upstaged by their more enthusiastic European counterparts, whose demands, first for 95% but then for the complete withdrawal of the chemicals, took them by surprise²⁵.

The resulting agreement marked the UK and the EC's official commitment to the eventual total phase-out of CFCs. The remaining obstacles to an international agreement on the total phaseout were predominantly issues of assistance to developing nations, and the control of non-CFC ozone depleting substances. Two of the major obstacles to an international agreement on the total phaseout were access to technology and financial aid for developing countries. Why did these issues arise in London and not Montreal? Under the Montreal agreement, signatories could have obtained the moderate 50 percent reductions in emissions through advanced industrial country actions alone. However, the the global bans at the heart of the London discussions required the cooperation of developing countries. The developing countries argued that the ozone depletion problem was not of their own making because industrialized countries consumed more than 80 percent of CFCs. Yet consumption was growing rapidly among the developing countries so that the Montreal treaty would be in jeopardy, if these countries refused to ratify it. Compensation was then a necessity for reducing the CFC build up in the atmosphere. The industrialized countries agreed to establish a multilateral fund to provide financial assistance to developing countries phase-out efforts. In response to strong demands for mandatory technology transfer, the industrialized countries promised to facilitate access to technology by developing countries and promote exchange of information and technical assistance. But the agreements lacked specificity as to how this technology transfer and licensing were to be accomplished. Nevertheless, the resolution of these difficulties enabled the London Revisions to the Protocol to be signed in June 1990, establishing a timetable leading to total phase-out of CFC production by the year 2000.

Our review of the U.S. and British experiences suggests that the international community successfully adopted the Montreal Protocol because of the concordance of political values, scientific knowledge, and economic incentives. All were necessary to create international change. By the mid 1980s, the production of CFC 11 and 12 was no longer as profitable a business as it once was. Renewed domestic environmental pressures created by the discovery of the ozone hole threatened to weaken an industry already characterized by overcapacity. International regulation mandating a switch to CFC substitutes offered major producers the Stiglerian solution of new and more profitable markets in the long term. Many consumer industries showed reluctance to give up CFCs but the costs of transferring to alternatives were widely dispersed, diminishing potential resistance. Despite the concordance of political and economic interests for phasing out CFCs, the industrialized countries had to agree to compensation for developing countries so that the treaty was not thwarted by politically influential countries, such as India and China.

B. PROFITING FROM BARRIERS TO ENTRY: FOWLER GROUNDWATER MANAGEMENT

Stiglerian regulation may benefit small farmers as well as large chemical companies. Fowler is a farming town of 500 residents in arid South West Kansas. Until recently, the farmers of Fowler grappled unsuccessfully with a classic common pool resources problem. The farms of Fowler rest above a local artesian valley that sits in turn above the Ogallala aquifer formation. Before irrigation, the water table in the local artesian valley was high and the farmers of Fowler enjoyed an advantage over those farming neighboring areas. Natural springs had filled the banks of Crooked Creek and spilled over into marshes.²⁶ The high local water table provided easy irrigation, as ground water and a system of shunts moistened the soil of low lying fields. To irrigate higher fields, Fowler's farmers drilled shallow wells and relied on natural water pressure. As the water table

²⁵"Total Ban on CFCs to Save Ozone Layer". *The Times*, London. 3 March 1989. p 1.

²⁶On geology of the local artesian valley and Crooked Creek, see Rex Buchanan, *Roadside Kansas: A Traveler's Guide to Its Geology and Landmarks* (Lawrence: University Press of Kansas, 1987).

industry from gaining a competitive advantage through the content of an international agreement that limited the usage of CFCs. So intense was the commercial jockeying that Mustafa Tolba, the executive director of the United Nations Environment Program, observed: "The difficulties in negotiating the Montreal Protocol had nothing to do with whether the environment was damaged or not. It was all who was going to gain an edge over who; whether DuPont would have an advantage over the European companies or not."¹⁹

In the year following the signing of the Montreal Protocol, a series of events lead the U.S and some of the European governments to renew their calls for a total CFC phaseout. This time, however, the British government and ICI, in a remarkable turnaround, accepted the proposals. During this year, scientific understanding increased to the extent that it was no longer possible to justify a policy of cautious inaction towards the ozone hole. At the same time, a variety of political and market factors added to the pressure on the British government and industry to revise their stand.

Two scientific reports contributed significantly to hardening public opinion against CFCs and in generating the political will required to negotiate more stringent controls. Only two weeks after the Protocol's signing, the first results became available from the US-led Antarctic Airborne Ozone Experiment (AAOE), which demonstrated definitively the link between chlorine and the hole, although it was the unique characteristics of Antarctica that enabled the critical chemical reactions to take place²⁰. The second key report was that of the NASA/WMO Ozone Trends Panel. Published in March 1988, it revealed unexpectedly large ozone depletions at middle/high northern latitudes during winter²¹. The traditional models had predicted ozone losses in the long term, but now it was clear that depletion was already occurring. Analogous to the earlier discovery of the Antarctic ozone hole the problem was unexplained and unbounded at this time.

Within ten days of the study's release, DuPont announced its plans to curtail production of CFCs, and to speed the transition to alternative chemicals, underlining the technical feasibility of a shift within the decade²². Referring to DuPont's announcement, Lee Thomas, the EPA administrator, stated that it "sends an unmistakable signal that alternatives and substitutes can be made readily available in the near future."²³

At the same time, ICI and Dupont both realized, even more strongly than before, the potential commercial opportunities as well as risks involved in shifting to substitute chemicals. Products and market share would accrue to the companies that developed process technology for making substitutes in the most cost effective and rapid manner possible. In August 1988, ICI announced its intention to join Dupont in an orderly phase-out of existing CFCs and in a rapid commercialization of substitutes.

A series of crises also began to focus British public attention on environmental issues. The death of seals in the North Atlantic, fears about the quality of drinking water, and concerns about global warming all fostered growth among environmental advocacy groups. In light of these mounting interests and pressures, the Tory Party began to reassess its positions and to raise the priority of environment issues on the policy agenda. Mrs Thatcher's speech to the Royal Society in September 1988 argued that the health of the economy and the environment were totally dependent on each other²⁴. Only several years before she had referred to

¹⁹Mustafa Tolba, cited in MacKenzie, Deborah 1988. "Now it Makes Business Sense to Save the Ozone Layer". *New Scientist*. October 29 1988. p 25.

²⁰October 9, 1987. "Winds, Pollutants Drive Ozone Hole". *Science* Vol 238. pp 156-158.

²¹Watson, R.T., Prather, M. and Kurylo, M.J. 15 March 1988. *Present State of Knowledge of the Upper Atmosphere 1988: An Assessment Report*.

²²"Du Pont Again Breaks Ranks on CFCs, Announces Phase-out Goal". March 1988. *ENDS Report* 158. p 6. DuPont Corporate News, External Affairs. 24 March, 1988. *Du Pont Policy Statement: CFCs*.

²³Lee Thomas cited in "How Long a Farewell to CFC Production?" 6 April 1988. *Chemical Week*. p 7.

²⁴"Threat to Environment". *The Financial Times*. 28 September 1988. p 1. "Thatcher's Green Mantle Seems an Ill Fit". *The Financial Times*. 29 September 1988. p 7. "Testing the Ozone". *The Financial Times*. 30 September 1988. p 24. "Prime Minister's Discovery of Environment to Speed Greening of Political Landscape". *ENDS Report* 164. September 1988. p 21.

unregulated system but are more than the rate that can be sustained indefinitely. The planned depletion rates will determine the total amount of ground water that can be used by Fowler farmers, with the total amount of water to be drawn distributed evenly across existing wells. The new meters will permit effective monitoring and enforcement of the new plan.²⁹

What factors account for this tilt towards management of the common pool resource? One Fowler farmer offered an explanation along the following lines. Who are the winners and losers in this story? The winners are farmers with preexisting wells and irrigated land. The losers are farmers without preexisting wells and no prospect for irrigation. Under Western water law, prior use establishes property rights. As new wells were installed, the number of farmers that would benefit from a drilling freeze expanded and the number of farmers that would be adversely affected by a drilling freeze contracted. The critical factor in his explanation is coalition size, with coalition size driven by exploitation of the common pool resource. As the farmer explained, "When enough folks had drilled, we just got together and created a barrier to entry against the young and the poor."³⁰

C. EXTENSIONS AND IMPLICATIONS: DOING WELL BY DOING GOOD

In Stiglerian situations, local and global environmental regulations serve the interests of the regulated. New coalitions of the green and the greedy may result in management of common pool resources in a sustainable manner. The farmers of Fowler benefited from a freeze on new wells that preserved the common pool resource of the local aquifer by excluding potential entrants. The managers of Dupont and ICI benefited from a phase out of CFCs that preserved the common pool resource of atmospheric ozone and that also required a shift to substitutes that Dupont and ICI dominated even more than traditional CFCs. In the Fowler and the Dupont/ICI cases, those taking a possible short term hit had the capacity to identify and recognize their long term interests. Neither the farmers of Fowler nor the decisionmakers of Dupont were harmed by regulations that created substantial restraints on potential entrants or mandated shifts to substitutes. Neither the farmers of Fowler nor the decisionmakers of Dupont could advance their particularistic interests through regulation without framing the issue in terms of the public good.

Why did compensation played a significant role in only one Stiglerian regulation case, the London revisions to the Montreal Protocol? The Montreal Protocol and Fowler groundwater cases differ with respect to reliance on compensation. China and India demanded and received compensation and special provisions for technology transfer to offset the costs that they would bear in shifting to substitutes for CFCs. Their objections to the unfairness of Stiglerian regulation threatened to unravel the original Montreal Protocol. These sovereign nations received compensation for giving up their presumptive right to produce anything, including CFCs. By contrast, the potential entrants in Fowler neither demanded nor received compensation for losing the prospect of drilling wells, installing pumps, and irrigating their lands. Western water law does not establish a right for potential users of water to claim against existing users. And Western water law established the baseline that folks in Fowler used to assess the fairness and unfairness of outcomes. However, the most fundamental point follows from the basic observation that those bearing diffuse costs will must transcend dilemmas of collective action if they are to prevail against those that benefit from regulation. As a generalization, Stiglerian regulation is not packaged with compensation because opposition from those adversely affected by regulation do not represent a substantial threat to the fruits of regulation.

These two examples of Stiglerian management of CPRs provide a modest basis for optimism. In these cases, producers seeking to force substitution and/or to create barriers to entry did contribute directly to the adoption of regulations that fostered management of CPRs, albeit through regulations that were unfair and that may have decreased welfare. But how common are these Stiglerian situations?

1. The Montreal Protocol case is but one of many examples of "regulation of a substitute or complement." Dupont and ICI profited from regulations that forced consumers to switch from one set of products that they

²⁹This account of developments subsequent to 1991 is based on telephone interviews with Mark Rude, Kansas State Department of Water Resources, Garden City Field Office, September 24, 1993; and with John Hildebrand, in Fowler, Kansas August 1992 and in East Lansing, Michigan, September 24, 1993.

³⁰Telephone interview with John Hildebrand, Fowler, Kansas, August 1992.

fell, the farmers drilled deeper and deeper wells and installed natural gas powered pumps to bring the water to the surface. In the short term, each farmer benefited directly from these measures. Over the long term, the pumping depleted the local artesian valley on which they relied. By 1990, Crooked Creek was reduced to a trickle, the marshes were dry, and the water table in the artesian valley was dropping toward the level of the underlying Ogallala formation.²⁷

The failure of farmers in the small village of Fowler to address this obvious CPR problem is surprising. The geology of the local artesian valley placed clear limits on the number of individuals whose cooperation would have been required to reach an effective agreement on water usage. The farmers recognized that unregulated drilling and pumping was destroying the local artesian valley. Furthermore, Fowler is a tightly knit community with strong civic and religious institutions and longstanding patterns of association that should be conducive to cooperation. And yet local efforts to restrict shunts and to limit drilling and pumping failed. The poor farmers could not make their mortgage payments if they switched from wet to dry crops and the rich farmers would not subsidize the poor. Although virtually all members of the community could see where unrestricted pumping was leading, the farmers of Fowler did not limit their use of water from the local artesian valley. The water table continued to drop.²⁸

In 1991, effective new restraints on drilling and pumping came into force. The farmers of Fowler turned to two institutions of the state to manage their local artesian valley. In the Fowler area, groundwater is regulated by the local Garden City Water District and by the Kansas State Division of Water Resources. The governing board of the local water district consisted of farmers with wells and pumps in place -- the irrigators who were pumping the artesian valley dry and were alarmed at the falling water table that was a consequence of their individual actions. Potential drillers and irrigators were not represented at the table. The governing board of the Garden City Water District asked the Chief Engineer of the State Division of Water Resources to adopt a strict interpretation of regulations governing groundwater use in their local district. Under Kansas law, the State can prohibit new appropriations of groundwater where: (a) there is a forty percent drawdown in groundwater reserves over twenty five years; or (b) the depth of an aquifer is forty feet or less; or (c) where the depth of an aquifer is depleted by twenty percent or more since 1940. The State can refuse to grant permits for new well drilling if any of these conditions are violated. Under the old interpretation of these regulations, the State Office would draw a two mile radius around the site of a prospective well and determine whether these conditions were satisfied within the circle. The board of the Garden City Water District observed that wells within one circle affected groundwater supplies for wells in other circles. The board of the local water district asked the Chief Engineer to reject permits for new drilling if conditions were not satisfied within a two mile circle around a prospective well OR for the whole township containing the prospective well. This seemingly minor adjustment in interpretation of regulations -- the addition of a new township wide criteria to the preexisting two mile radius criterion -- had major consequences. In 1991, the Fowler area was effectively closed to all new well drilling.

The freeze on new drilling was not enough. The large number of existing wells with natural gas pumps were draining the local artesian valley. The board of the local Garden City Water District worked together with the State to tighten the regulations. The district and the state set up a schedule to phase in metering on existing wells, proceeding from quarter to quarter within each section. To spread costs over time, the plan began with wells in southeast quarters in January of 1993 and ended with all wells in all quarters metered by July of 1996. Under the new plan, the State and the local district established depletion rates for South West Kansas and for the Garden City Water District. These depletion rates are less than the rates that had prevailed under the old

²⁷The Fowler case may well be enlarged. The tale of the local artesian valley in Fowler appears to be paralleled by the emerging story of management of the Ogallala Formation that sits under most of Kansas. The Ogallala Task Force Committee Report, to be released on September 27, 1993, and the recommendations of the local Garden City Water District Board in 1991 may have similar content and rest on similar motivations. Kenneth Oye should be receiving the Ogallala Task Force Committee Report shortly before our Indiana meeting.

²⁸On changes in Crooked Creek and local responses, interviews with Don Hildebrand, Ed Hildebrand, Chris Hildebrand, and John Hildebrand, Fowler, Kansas, August 1991.

overturn or modify systems of regulation. Oil refiners and auto producers oppose emission control regulations, loggers oppose endangered species acts, and homeowners oppose sewage treatment facilities located upwind. Compensation payments from the many who benefit from regulation to the few who bear the concentrated costs of regulation may be a requisite of effective and stable regulation in Olsonian situations. We have emphasized two sets of major cases and augmented the cases with briefer illustrations and examples.

The American and Japanese Air Quality Cases presented below suggest that Olsonian regulation without compensation can be highly unstable. In the United States, those bearing the concentrated costs of air quality regulation have consistently forced revisions in bodies of regulation. Refiners and automobile producers have had an interest and the organizational strength to unravel systems of regulation. By contrast, in Japan, regulation has come with compensation payments that partially offset the costs of regulation. In the Air Quality area, the Japanese package of regulation and compensation has been far more stable than the American package of regulation without compensation.

The Canadian and American fisheries cases reveal a markedly different pattern. Fishermen in Newfoundland and Labrador currently face a total moratorium on cod fishing and currently receive massive compensation payments that offset regulatory losses. By contrast, American fishermen currently face severe regulations on the taking of black cod, salmon, sea urchins, and halibut and currently receive virtually no compensation. In the fisheries area, both compensated Canadian and uncompensated American fishermen have opposed regulations. Neither Canadian nor American fishermen succeeded in rolling back regulations in the cases presented below.³²

These Olsonian cases are far more complex than the Stiglerian cases treated in the last section. Our answers to the following questions are more hedged than our analysis of Stiglerian greed. To what extent can strategies of compensation even out the distributional consequences of environmental regulation and thereby reconcile particularistic and general interests? We examine the following practical concerns.

- **Effectiveness in Mitigating Opposition to Regulation:** Is compensation a requisite of stable management of Olsonian CPRs? When will compensation be unnecessary? When will compensation fail to mitigate opposition? What factors determine appropriate levels and forms of compensation? Does compensation function best in eliminating Olsonian challenges to regulations in relatively closed political systems like Japan or relatively open political systems like the United States? Our comparisons between Japan and the United States on Clean Air bear on these questions.

- **Efficiency:** How can compensation schemes be structured to minimize efficiency losses? Compensation payments can reduce efficiency over the long term by reducing market incentives to shift away from economically or environmentally unproductive activities. Can short term bribery be reconciled with long term adjustment? Our comparisons of Canada and the United States on fisheries bear on these questions.³³

- **Extractive and Allocative Capacity:** What institutional arrangements are required in order to extract resources from the many and distribute to the few? Specifically, what mechanisms and structures are needed to provide for financing and disbursing compensation? In order for compensation offers to succeed in reducing opposition, the offer must be credible. Extractive and allocative capacities will affect the credibility of offers and the stability of Olsonian packages of regulation and compensation. Our comparisons of difficulties establishing and maintaining compensation in domestic relative to international situations bear on these questions.

³²This is not to suggest that American fisheries regulations are never relaxed in the face of objections from fishermen. Salmon fishermen in the Washington State and cod and halibut fishermen on Georges Bank did succeed in lobbying for expanding quotas.

³³This analysis assumes that our examples of "compensation" represent forms of exchange or bribery. For an extended discussion of the welfare implications and the incidence of extortion or blackmail and of explanation or bracketing, see Kenneth A. Oye, *Economic Discrimination and Political Exchange*, Chapter Three, "The Logic of Contingent Action: Exchange, Extortion, and Explanation," (Princeton: Princeton University Press, 1992).

produced to another set of products that they had the potential to dominate. Other examples of Stiglerian "profiting from product substitution" may include the following.

- Consider regulations barring leaded gasoline, regulations that created a market for unleaded gasoline. These regulations surely served the common interest in reducing emissions of lead into the air, water and soil. These regulations also served the interests of refiners by forcing a shift toward higher profit unleaded gasoline.
- Consider regulations barring DDT, regulations that created the market for a variety of higher priced pesticides. The banning of DDT surely served a common interest in eliminating an unusually persistent, biocumulative and toxic substance that presented substantial health risks to humans and that was clearly threatening many animals that were high on the food chain. The ban on DDT also forced a move from a cheap easy to produce commodity chemical toward far more difficult to produce specialized substitutes. These major chemical producers enjoyed a substantial advantage in the market for DDT substitutes relative to the market for DDT.

2. The Fowler water regulation case is a classic example of producers securing an advantage through creation of barriers to entry. There are many other examples of CPR regulation that have the effect of benefiting existing producers at the expense of potential entrants.

- Consider regulations governing development of land in towns from Lincoln, Massachusetts to Petaluma, California. Restrictions on development, ranging from strict zoning through difficult percolation tests to stringent environmental impact assessment, surely advance a common interest in preserving the quality of the local environment in such areas. These restrictions also raising the rents that accrue to owners of previously developed properties at the expense of would be developers and owners.
- Consider regulations governing salmon farming in Norway. Regulations limiting new aquaculture and requiring the installation of advanced equipment for managing wastes from aquaculture surely advance a common local interest in preserving water quality in the fiords. These restrictions also raise the rents that accrue to owners of existing salmon farms at the expense of would be developers and owners.
- Consider the example of the German recycling law. Regulations requiring packaging that permits ready recycling surely advances a common interest in reducing use of nonrenewable resources. These restrictions also create a barrier to entry by non-German firms interested in exporting to the German market. Canadian beer bottle recycling requirements operate similarly by excluding American beer producing companies and others interested in exporting to the Canadian market.
- Consider the example of American regulations barring the sale of lobsters under one pound within the United States. These regulations surely advance a common interest in preventing unsustainable takings of lobsters by prohibiting the sale of immature American lobsters. Because lobsters in colder Canadian waters attain sexual maturity at a smaller size, the American size regulations also have the effect of creating a barrier to entry by excluding mature Canadian lobsters.
- Consider the example of proposed regulations on carbon use to limit global warming. Although these proposed regulations surely advance a common interest in preventing accretion of greenhouse gases that may contribute to global warming, the nations of the developing South and East regard such proposed regulations as having the effect of creating substantial barriers to entry into the world of developed nations.

III. OLSONIAN REGULATION: DIFFUSE BENEFITS AND CONCENTRATED COSTS

In Olsonian situations, regulatory benefits are diffused while regulatory costs are concentrated.³¹ Regulation commonly engenders opposition that blocks reforms or the expectation of opposition commonly results in anticipatory weakening of reforms. The benefits of cleaner air, biodiversity, or cleaner water are spread across large numbers of people over long periods of time. The costs of regulating emissions, limiting habitat destruction, or siting sewage treatment facilities are concentrated on smaller numbers of people over shorter periods of time. This sets up a classic problem, as collective action problems will result in underrepresentation of long term diffuse benefits relative to short term concentrated costs. Unlike our Stiglerian cases, no natural coincidence of particularistic and general interests exists.

In the absence of compensation, those adversely affected by regulation will organize and mobilize to

³¹Mancur Olson, *The Logic of Collective Action*.

Table 1: Federal Exhaust Emissions Standards (grams/mile)^a

Model Year	HC	CO	NO _x
Average unregulated 1967 car	8.7	87.0	4.0
1968-69	5.9	50.8	no requirement
1970-71	3.9	33.3	no requirement
1972	3.0	28.0	no requirement
1973	3.0	28.0	3.1
1975-76 ^b	1.5	15.0	3.1
1977-79 ^b	1.5	15.0	2.0
1980 ^c	0.41 ^c	7.0	2.0
1981-1982 ^c	0.41	3.4 ^{d,e}	1.0 ^f
1983 ^c	0.41	3.4	0.4 ^{g,h}

a As measured by the Federal constant-volume sampling, cold- and hot-start test.

b Interim standards established in 1973 and subsequent years.

c Levels established by 1977 Amendments to the Clean Air Act.

d Original 1975 requirements of the Clean Air Act of 1970.

e Subject to waiver by the Administrator of the EPA.

f Subject to waiver for diesels and small manufacturers.

g Original 1976 requirements of the Clean Air Act of 1970.

h To be established only if public health requires it; otherwise, standard is 1.0.

Source: White, Lawrence, "American Automobile Emissions Control Policy —Success or Wrongheaded Regulation," paper presented at the Harvard Symposium on Technology, Government, and the Automotive Future. Cambridge, October 19, 1978.

A. AMERICAN AND JAPANESE AIR QUALITY REGULATIONS

The predominant focus of U.S. environmental policy toward the automobile industry has been on regulating mobile source emissions in new automobiles. The first major emissions control initiative occurred in the state of California in 1960 with the passage of the California Motor Vehicle Pollution Control Act. The California program, which regulated CO, HC and NO_x in new vehicles, has since served as a prototype and testing ground for later federal initiatives. The history of federal involvement in the regulation of automobile emissions began with the passage of the 1965 Motor Vehicle Pollution Control Act. This Act required the Secretary of Health, Education and Welfare to promulgate standards for any level of pollution found to endanger human health and welfare and specifically mandated that the auto industry meet the 1967 California standards in the 1968 model year. Since the first federal standards were both technical feasible and very modest in cost, little controversy was aroused.

The next major step in the regulation of emissions was the passage of the 1970 Clean Air Act Amendments, a watershed in U.S. environmental policy.

(Insert Table 1 Here)

This act was adopted amidst the then rich political fervor and activism of the environmental movement. The political debate over the Clean Air Act Amendments was unique in that proposed versions of the Act became increasingly protective of public health during the course of the legislative process. Typically, decision-makers refine existing policy by determining what is technically and administratively feasible, as well as what is acceptable to those being regulated.³⁴ The political atmosphere in 1970, however, demanded stronger action and resulted in a law which may have been beyond then-existing technical capabilities. The act which finally emerged mandated a 90 percent reduction in three primary pollutants by 1975-1976.

The Clean Air Act Amendments represented a radical departure from past approaches to environmental policy.³⁵ First, the Clean Air Act was an experiment in technology-forcing which established goals admittedly inachievable with existing technology. The underlying belief among members of Congress and the supporters of the Clean Air Act was that industry would not develop the requisite control technology unless it was forced to do so. Nevertheless, the Congress did provide an escape hatch, allowing for a one-year delay in the standards if the industry could prove to the EPA Administrator that they were technically infeasible. Passage of the Clean Air Act amendments marked a significant shift from traditional regulatory approaches, which had been based upon economic feasibility, to a health-based standards approach. Emissions standards for automobiles were to be designed to protect those most susceptible to the health effects of air pollution in the most highly polluted areas, regardless of costs. The EPA was statutorily prohibited from relying on costs and economic efficiency as primary considerations in regulatory decision-making. Finally, the Clean Air Act also differed from past emissions and safety statutes in that Congress had itself established specific targets and timetables for industry to meet. In prior legislation, Congress had typically given administrative agencies greater discretion along with a less forceful legislative mandate.

The Clean Air Act Amendments proved far easier to adopt than to implement. Immediately following their adoption, the political atmosphere remained highly charged and polarized. On the one hand, the auto industry exerted great pressure on the EPA and the Congress to modify or delay the standards, claiming that they were technically infeasible. They also pressured the EPA to adopt the most flexible implementation procedures possible. On the other hand, the environmentalists' lobbying efforts were designed to protect the original standards and timetables and prevent compromises on this issue.

Debate over the emissions standards and timetables continued in a variety of forums. In 1972 and 1973, the National Academy of Sciences (NAS), a quasi-governmental organization that performs technical studies for the U.S. Congress, issued two reports that examined the technical and economic feasibility of the U.S. emissions standards and timetables. Broadly construed, the NAS reports concluded that the technology was not then available in adequate production volumes to meet the 1975 standards and that the benefits of the amendments were most likely exceeded by their costs.

³⁴Charles O. Jones, *The Policies and Politics of Pollution Control*, Pittsburgh: The University of Pittsburgh Press, 1975.

³⁵James Krier and Edmund Ursim, *Pollution and Policy*, Berkeley: University of California Press, 1977.

Pressure on EPA Administrator William Ruckelshaus to delay the standards increased with publication of the NAS reports. At first he rejected industry's application for a suspension, ruling that the 1975 standards could be achieved with existing engine technology.³⁶ The domestic industry promptly challenged the Administrator's decision and in a celebrated 1972 case, the Court of Appeals for the District of Columbia refused to uphold it. The court balanced the potential costs to the nation's economy against the risks posed by a suspension, implicitly defining limits on the costs industry should bear by suggesting that the adverse consequences of delaying the standards were less severe than the economic disruption that would be caused through their implementation. Ruckelshaus subsequently granted a one-year delay despite evidence from Honda and several other foreign producers that they would be able to meet the standards.³⁷

Initial postponement in implementing the Clean Air amendments was just the first in a long series of delays. The 1973 energy crisis with its resulting economic havoc further undercut Congress's and the President's commitment to reducing automobile pollution.³⁸ The auto industry used the energy crisis and the need to make improvements in automobile fuel economy as a new basis from which to attack the emissions standards and timetables. In a political and media blitz, the auto industry argued that the available emissions control technology in the early 1970s had seriously hampered the fuel economy performance of automobiles. Congress acquiesced to the industry's position and authorized two additional exceptions to the timetables for the HC and CO standards and one for the NO_x standard, delaying the deadlines for meeting all three standards until September 1978.³⁹

The 1977 Clean Air Act Amendments represented an additional step toward the abandonment of the health-based and technology-forcing approach contained in the 1970 statute. By 1977, the issues of energy, unemployment, and inflation were clearly more politically salient than that of air pollution. When faced with the choice between a tough environmental policy and significant economic consequences for the domestic industry, Congress continually compromised its health-related regulatory objectives. Given the altered political climate which was less favorable to environmental regulation, Congress relaxed the NO_x standard from .4 to 1.0 grams per mile, delayed the timetables for the NO_x standard for three additional years, permitted the EPA to delay the CO standard for an additional five years, and delayed the HC standard for two additional years.⁴⁰

For more than a decade following the passage of the 1977 amendments, the control of emissions from motor vehicles remained a source of political controversy. In 1981, the Reagan administration as part of a sweeping regulatory reform initiative promoted legislation that would have dramatically relaxed emissions standards for motor vehicles. The bill was resisted effectively by environmental groups and key Congressmen. Two years later with William Ruckelshaus back at the helm of the EPA, the momentum had shifted toward greater regulation. Proposals to reduce NO_x emissions and hazardous air pollutants were subsequently introduced in the Congress.

In 1989, Congress outlined an aggressive program to control motor vehicle emissions, which caused industry to respond that it was too costly and "simply not feasible."⁴¹ Industry feared the proposed controls would add hundreds of dollars to the costs of new vehicles. Reminiscent of the 1970 Clean Air Act, the 1990 amendments went considerably beyond earlier proposals, enacting controls that were not even on the table in earlier Congresses. Among other things, the 1990 amendments tightened tailpipe emissions standards for NO_x

³⁶Frank Grad et al., *The Automobile and the Regulation of its Impact on the Environment*, Norman: The University of Oklahoma Press, 1975, pp. 340-344.

³⁷*Ibid.*, p. 347.

³⁸*Environment Reporter*, Vol. 4 No. 40 (February 1, 1974), p. 1607.

³⁹Alan Altshuler, James Womack, and John R. Pucher, *The Urban Transportation System*, Cambridge: MIT Press, 1979, pp. 185-189.

⁴⁰*Ibid.* pp. 195-199.

⁴¹Henry A. Waxman, Gregory S. Wetstone, and Phillip S. Barnett 1991. "Cars, Fuels, and Clean Air: A Review of Title II of the Clean Air Act Amendments of 1990," *Environmental Law Journal* 21: 1947-2019.

and hydrocarbons, extended durability requirements so that equipment would have to last 10 years, and required the smoggiest cities to use reformulated gasoline.⁴² Despite substantial costs imposed on the automobile industry, the 1990 amendments had been embraced by Congress and signed by Republican President George Bush. Yet, the most aggressive provisions of the Act once again had an escape hatch, allowing EPA to delay the implementation of the tailpipe standards if they were economically or technically infeasible.

A month before the enactment of the 1990 Clean Air Act amendments, the California Air Resources Board adopted even more stringent standards to regulate emissions from motor vehicles.⁴³ The Air Resources Board established increasingly technology forcing standards for emissions reduction that would be phased in during the 1990s. The most ambitious and controversial part of the regulatory package involved standards requiring the development and sale of electric vehicles which would not emit any pollutants to the environment. Beginning in 1998, automobile manufacturers will be required to sell a specific percentage of electric vehicles. The standards for low emissions and zero emissions vehicles cannot be met by existing technologies, necessitating large research and development expenditures by the automobile and petroleum industries. Because of the technology forcing nature of the California standards, they were bitterly resisted by industrial interests. Political opposition when combined with the magnitude of the costs and technological challenges may lead the California Air Resources Board to back off from its most ambitious standards.

The history of motor vehicle emissions control reveals the instability and inefficiency of U.S. policymaking under Olsonian conditions. Over the last two decades, a bitter debate has raged among environmentalists, key Congressmen, and major automobile companies about the costs and benefits of clean air. In the early 1970s and the early 1990s, Congress (led by California) adopted very specific standards and timetables that mandated significant reductions in motor vehicle pollution that went beyond existing technical capabilities. But industry marshalled its political resources in variety of fora -- courts, regulatory agencies, and Congress --- to modify or delay implementation of the 1970 Clean Air Amendments. This enduring political struggle has led to less pollution reduction and at higher cost than might otherwise be the case.

In Japan, the regulation of chemical pollutants from automobiles has been conducted very differently from regulation in the United States. While regulations typically result from a closed and bureaucratically-dominated technical process, Japanese policy toward emissions has been characterized by a high degree of partisan political activity, public activism, and media attention. The strong degree of public concern coupled with a high level of political participation led to the adoption of stringent emissions control standards and timetables. In fact, the Japanese were able to implement the strict standards contained in the 1970 Clean Air Act, unlike the U.S. Several factors combined to explain this unique pattern of policy formulation: first, public opinion was aroused by a series of severe pollution episodes that were widely covered in the press; second, a well-organized environmental movement exerted pressure on the Japanese parliament, bureaucracy, and media; third, policy-making was strongly influenced by events abroad, particularly the passage of the 1970 Clean Air Act Amendments; and fourth, effective use of compensation to offset regulatory costs.

While the first steps in regulating emissions occurred in 1966, the major progress in emissions regulation occurred in the period 1970 - 1978.

(Insert Table 2 Here.)

In 1972, the Central Council on Environmental Pollution Control, and advisory body to the Japanese Environment Agency, proposed the adoption of the standard contained in the 1970 U.S. Clean Air Act Amendments.⁴⁴ The Council also proposed applying the same timetable contained in the U.S. act (standards

⁴² "A Decade's Acrimony Lifted in the Glow of Clean Air." 1990. Congressional Quarterly Weekly Report (October 27): 3587-3592.

⁴³ See Gregory P. Nowell. 1991. "California Initiatives on Air Quality and Alternative Fuels." Working Paper, Center for Technology Policy and Industrial Development, MIT for a description of the California clean air initiative and their political implications.

⁴⁴ Amelia Porges, *Car Wars: Automobile Regulation, Policy and Strategy in Japan*. Center for Policy Alternatives, MIT, April 1980.

Table 2: Japanese New Automobile Exhaust Emissions Control History

Year	Pollutant Standard ¹			Measurement Unit	Test Cycle
	CO	HC	NO _x		
1966	3	-	-	%	4 mode
1969	2.5	-	-		
1973	26.0	3.8	3.0	g/km	10 mode
1975	2.7(2.1) ²	0.39(0.25)	1.6 (1.2)	g/km	10 mode
	85.0(60)	9.5 (7.0)	11.0 (9.0)	g/test	11 mode
1976	2.7(2.1)	0.39 (0.25)	1.2 (0.85)	g/km	10 mode
	85.0(60)	9.5 (7.9)	9.0 (7.0)	g/test	11 mode
1978	2.7(2.1)	0.39 (0.25)	0.48 (0.25)	g/km	10 mode
	85.0(60)	9.5 (7.0)	6.0 (4.4)	g/test	11 mode

¹ Applicable to all new model vehicles that are greater than 1000 kg equivalent inertia weight. Later compliance dates are applied to all Japanese manufactured and imported vehicles.

² The figures show the maximum permissible limits of the standards while the figures in the parentheses show the average control value.

All standards applicable at 30,000 km durability and apply to new model vehicles only.

Source: Organization for Economic Cooperation and Development. *The Cost and Effectiveness of Automotive Exhaust Emission Control Regulations*. Paris, 1979, p. 15.

to be met by 1975 - 1976). Following vitriolic debate between environmentalists and the auto industry, the Environment Agency adopted the standards proposed by the Central council for 1975. However, under mounting pressure from the auto industry and its political allies in the bureaucracy, the Environment Agency was forced to postpone the .25 NO_x standard until 1978, adopting a less stringent interim standard for 1976.⁴⁵

What is remarkable about the Japanese bureaucracy, particularly in contrast to the U.S., was its ability to adopt and implement stringent regulations in a highly unfavorable economic climate. Emissions requirements were adopted in the middle of the 1973 Arab oil embargo, which increased the costs of energy to the Japanese auto industry by nearly 60 percent. In spite of the increased costs of energy and pollution control, the position of the Japanese industry in international commerce remained unscathed.

The Japanese government undertook a number of actions to soften the economic consequences for industry, particularly in international markets. In this as in other areas, compensation was a central element of Japanese regulatory policy. For example, the Ministry of Finance used tax incentives to ease the transition to less-polluting vehicles, reducing the high commodity and motor vehicle acquisition tax for passenger cars meeting the 1975, 1976, and 1978 emissions standards and making further reductions in ownership taxes for passenger cars meeting the emissions standards.⁴⁶ In addition, the Ministry of Transport (MOT) practiced a flexible implementation policy and viewed emissions standards as targets, not as inflexible legal requirements. Instead of applying its standards uniformly across the industry, MOT modeled its implementation procedures to an individual assessment of company capacity. Another example of Japanese implementation flexibility is shown in the MOT's adoption of its own test procedures. Less demanding than those in the U.S., the Japanese tests also apply to model averages, not to every vehicle.⁴⁷ These features provide Japanese companies with greater flexibility in certifying vehicles and reduce the stringency of the standards. The Japanese government use of compensation helped foster the development of less polluting vehicles and helped avoid the costly and politically divisive struggles that characterized U.S. policy. The contrast between Japanese and American traditions in combining compensation with regulation could not be more striking.

B. CANADIAN AND AMERICAN FISHERIES MANAGEMENT

The Canadian and American fisheries cases presented below share two features: first, restrictions on yield are necessary if depleted stocks of fish are to be restored; and second, no individual fisherman will voluntarily restrict his or her yield to advance the common good. Although the problem is "common" in at least two senses of the word, the solutions and outcomes in these cases are varied. In Canada, stringent moratoria are paired with substantial compensation, including extended unemployment benefits and targeted income maintenance. This combination has the effect of mitigating opposition to regulation but has also reduced incentives for individuals to adjust. By contrast, the United States has shrunk fishing seasons without setting up substantial compensation. This had the effect of encouraging market oriented adjustment out of sectors with surplus capacity but also does little to offset the burdens of regulation on the regulated. However, unlike the Clean Air case, the United States did not overregulate and then cut back as opposition to regulations materialized in the fisheries cases.

Canadian Regulation with Compensation: The 1991 Northern Cod Moratorium

For centuries, local fishermen in Newfoundland and Labrador have lived off of the northern cod. Between 1990 and 1992, stocks of northern cod and yields of northern cod fell sharply. According to the *Newfoundland Telegram*, in only two years the total cod stock was reduced by 50% and the spawning stock

⁴⁵The discussion of emissions regulation in Japan draws heavily on the following three sources: Porges, pp. 39-56; Julian Gresser, Koichina Fujikura and Akio Morishima, *Environmental Law in Japan*, Cambridge, MIT Press, 1981, pp. 268-275; and James Maxwell, George Heaton and Janet McCleary Jones, *Environmental Regulation of the Automobile*, CPA, MIT, October 1980, pp. 48-72.

⁴⁶Porges, p. 272.

⁴⁷Maxwell and Heaton p. 57.

was reduced by 75%.⁴⁸ The decline in stocks is attributed variously to advances in fishfinding technology, changes in breeding patterns, and ecological factors. Neither individual self restraint by fishermen nor provincial regulation of fishing nor limited federal moratoria on cod fishing succeeded in restoring badly depleted stocks of cod.

In June of 1992, Canadian Fisheries Minister John Crosbie announced a total moratorium on the taking of northern cod.⁴⁹ The moratorium affected Newfoundland's northeast coast and Labrador. Many communities in these areas depend heavily on the cod industry. The direct costs of the moratorium were substantial, including the loss of over six percent of the total output of the two provinces and the elimination of 10,000 to 12,000 fishing jobs and 8,000 to 10,000 fish processing jobs. The indirect costs included the loss of thousands of positions for truckers, equipment manufacturers, and others. The total losses that Newfoundland and Labrador suffered from the moratorium, including multiplier effects reflecting the losses of those who serviced the needs of those formerly employed by the fishing industry, were staggering.⁵⁰

The moratorium generated bitter complaints from fishermen about the loss of their livelihoods. However, lobbying by fishermen did not result in the relaxation of regulatory restraints. Complaints by fishermen resulted in substantial provisions for compensation and the subsequent moderation of demands for relaxation of the moratorium. Initially, Fisheries Minister Crosbie announced a compensation package of a maximum of \$225 per person per week, with the individual amount tied to prior individual earnings. One month later after fishermen had lodged vehement objections to the package, he raised the amount to a maximum of \$406 per week.⁵¹ Fishermen are required to sign up for retraining courses or to opt for early retirement to qualify for compensation.⁵² Furthermore, to improve enforcement, fishermen may qualify for forgiveness of interest payments on boat loans if they take their boats out of the water. Although the costs of dislocation associated with the two year moratorium remain severe, the package of compensation has softened opposition to the moratorium.⁵³

Why do we observe extensive reliance on compensation in the Canadian Northern cod case? In this case, the fishermen of Newfoundland and Labrador are at once long term beneficiaries of the moratorium and short term bearers of the costs of the moratorium. Compensation effectively transfers a portion of the costs from the shoulders of fishermen in the Maritimes onto the shoulders of Canadians who are neither beneficiaries nor bearers of burdens in this case. Why then do we find compensation playing so prominent a role in this case?

First, the principle of providing compensation in fisheries cases is relatively well established in Canada. Earlier partial moratoria on fishing in the Maritime provinces had been coupled with limited income maintenance schemes, specifically extended unemployment benefits. The length of the fishing season shrunk, but so long as fishermen spent some time each year fishing they qualified for substantial unemployment

⁴⁸"Fishery Closure and Compensation," *Telegram*, July 3, 1992.

⁴⁹The Canadian national moratorium was matched by a European Community Moratorium on cod fishing in the area.

⁵⁰"No Fishing" and "Canada Asks Spain to Extend Its Moratorium on Cod Fishing," *Telegram*, July 3.

⁵¹Pat Doyle, "Fishermen Receive Emergency Help," *Telegram*, October 5, 1991. By tying the amount of compensation to prior income, the designers of the program sought to minimize distortions created by the program by limiting the program to existing fishermen.

⁵²The retraining requirement for fisherman centered on preparation for the construction trades. The prospects for fishermen securing employment in the construction trades seem very limited. At the time that the retraining program was announced, only 17 percent of Newfoundland Construction Trades Council Union Members were employed. And not surprisingly, the retraining program was opposed by the Provincial Construction Trades Councils. See "No Room at Sites for Fishermen," *Newfoundland Telegram*, July 17, 1992.

⁵³Telephone interview with Ryan Cleary, *Newfoundland Evening Telegram*, 709-364-6300, by Tamar Gutner, March 1993.

benefits. By eliminating all fishing employment for a period of two years, the moratorium necessitated a search for alternative means of achieving the traditional goal of income maintenance.

Second, the level of compensation provided in this example may have been elevated by the coincidental constitutional crisis. The Maritime Provinces weighed heavily in Canadian national politics during the period of Canadian constitutional reform. Newfoundland and Labrador appear to have extracted an exceptionally generous compensation package by tacitly linking the standard of compensation on the Northern Cod moratorium to support for the package of constitutional reforms.

Even if the Canadian compensation program may be reckoned as a success in mitigating opposition to the moratorium by buying off those most severely affected by the moratorium, it must be reckoned a failure in terms of perpetuating conditions that contributed to overexploitation of Northern cod. By discouraging movement out of fishing and out of the region, traditional extended unemployment benefits and the moratorium compensation schemes may well have inadvertently contributed to maintaining excess capacity in the industry and to prolonging overfishing.

American Regulation without Compensation: Shrinking Seasons and Quotas

By contrast with Canada, the United States has inclined toward fisheries regulation with little or no compensation. The United States has relied on "shrinking seasons" and "shrinking quotas" without offsetting payments as a primary approach to fisheries management. For example, the Alaska halibut fishery has been reduced to a twenty-four hour halibut season. In some areas of the North Pacific, the herring season lasts 20 minutes. The black cod season which used to run for 200 days is now down to 15-18 days.⁵⁴ In recent years, Pacific salmon stocks have been badly depleted by factors including migration blocking dams, drought and water diversion, El Nino, and overfishing. Salmon fishing on the West Coast is now banned from Point Rena in southern Mendocino County to north of Coos Bay Oregon, and fishing in other areas is limited to two months with severe quotas.⁵⁵ As stocks of sea urchins in California were depleted, the California Department of Fish and Game announced that the sea urchin season would be limited to six days in July.⁵⁶ These examples are typical of the American approach to fisheries regulation without compensation.

The American use of limits on the length of season rather than restrictions on entry appears on first inspection to be puzzling. In general, American fishermen regulate themselves to a degree uncommon in the allocation of other public resources. In Alaska, for example, the fishing industry has seven of the eleven seats on the North Pacific Fishery Management Council with the other four seats drawn from government. Recommendations from the Council go to the U.S. Secretary of Commerce who typically signs them into regulation. Why did existing fishermen not simply exclude others before turning to the bizarre expedient of twenty minute seasons? They could not simply turn to Stiglerian barriers to entry because the heightened exploitation of fish stocks was as much a product of enhanced technology and efficiency by existing fisherman as by competition from new entrants.

C. IMPLICATIONS OF OLSONIAN REGULATION

In the Clean Air cases, regulation without compensation proved to be highly unstable. In the American cases, producers whose interests were compromised by regulations succeeded in delaying or modifying regulations. In the Japanese cases, producers whose interests were partially offset by compensation neither sought nor received substantial regulatory relief. By contrast, in the Canadian and American fisheries cases, regulation without compensation has been reasonably stable. With very limited exceptions, the complaints of fishermen, whether compensated or not, have not resulted in substantial unravelling of regulations governing fisheries.

Several obvious factors may account for this pattern. The fishermen hit hard by moratoria and season limitations are at once the principal long term beneficiaries of regulation and the principal bearers of short term

⁵⁴John Balzar, "A Catch as Catch Can Fish Plan," *Los Angeles Times*, June 28, 1992, pp A1, A24, A25.

⁵⁵*Los Angeles Times*, April 1992.

⁵⁶*Los Angeles Times*, July 1992.

regulatory costs. The producers adversely affected by air quality regulations do not stand out as principal beneficiaries of air quality control regulations. And the political power of fishermen is markedly less than that of automobile manufacturers or oil companies. It is reasonable, indeed trivial, to postulate that compensation will be most useful in cases where regulation imposes substantial short term costs on powerful actors that do not derive substantial long term benefits from regulation.⁵⁷

In domestic cases of compensation, we find substantial differences in national practice. The Air Quality cases noted above appear to be typical of differences between Japan and the United States and the fisheries cases noted above appear to be typical of differences between Canada and the United States. Japan relies on compensation payments far more than does the United States. In general, the government of Japan takes greater care to offset costs associated with regulatory change than does the government of the United States. Consider several examples. Compensation payments to neighbors are the second largest item in the Japanese nuclear power plant budget.⁵⁸ Adjustments in tobacco price supports totally offset the effects of tariff reductions on Japanese tobacco growers. Central government payments to provincial governments offset the effects of beef liberalization on beef producing regions of Japan.⁵⁹ Japanese highway construction entails payments to those suffering from the noise and inconvenience of highway construction in addition to those whose real property is taken for construction. In Japan, compensation is the rule rather than the exception.⁶⁰

The principle of providing compensation in a variety of Olsonian situations is relatively well established in Canada, at least relative to the United States cases discussed below. This distinction carries over from fisheries to facilities siting.⁶¹ By contrast, compensation payments within the United States is the exception rather than the rule. Compensation appears in a far more restrictive set of situations, primarily situations where the clear expectation of opposition provides an immediate justification for strategies to buy off opposition. For example, Carter administration consumer product safety regulations required some manufacturers to drop whole lines of products without compensation to offset the costs of these regulations. In the face of substantial opposition from manufacturers, the Reagan administration kept the regulations but added provisions for payment of offsetting compensation to manufacturers. The Reagan administration's legislation (PL 97-395, December 30, 1982) compensated manufacturers of children's sleepware for the stocks of Tris they had on hand in 1977 when Tris was banned under the Federal Hazardous Substances Act. In an earlier case, the Federal Insecticide, Fungicide, and Rodenticide Act of 1971 called for compensation of manufacturers for product

⁵⁷Possible inferential problems limit the confidence with which we advance our findings on the association between compensation and regulatory effectiveness. First, our American cases are marked by extraordinary penetration of the American state by groups with veto power over regulations. The instability of regulations in the American case and the relative paucity of compensation may both be affected by the extraordinary degree of penetration; simply put, why bother to compensate if it is hopeless? Second, we also found that Japan offered compensation and that Japan addressed Olsonian situations with greater success than did other nations. However, it is possible that common largely cultural factors may account for both the greater tendency to offer compensation and to overcome dilemmas of collective action. If cultural factors affect both, then the association between compensation and successful management of collective action may be spurious.

⁵⁸Kenneth Oye interview with Saburo Kikuchi of the Power Reactor and Nuclear Fuel Development Corporation of Japan, Tokyo, July 5, 1993.

⁵⁹Kenneth Oye interview with A. Sawa, Ministry of International Trade and Investment, Tokyo July 6, 1993; and S. Kojima, *Nihon Keizei Shimbun*, Tokyo, July 9, 1993.

⁶⁰I will add other examples when I secure permission to quote from S. Hayden Lesbirel, *Externalities, Bargaining and Compensation: Managing Environmental Conflict in Japan*, Department of Japanese Studies, National University of Singapore, 1993.

⁶¹For examples of effective uses of compensation in Canada, see Barry G. Rabe, "When Siting Works, Canada Style," *Journal of Health Politics, Policy and Law* 1992; 17:1, pp 119-142.

suspensions after EPA testing showed that herbicides 2,4,5-T and Silvex were environmentally harmful.⁶² In other areas, requirements for compensation may be added through judicial rather than legislative or executive action. Coastal land use regulations greatly decrease the value of coastal property. In 1991, the U.S. Supreme Court ruled that restrictive coastal land use regulations constituted a taking and, under the principle of eminent domain, mandated fair compensation for the taking. In these varied domestic cases, property rights and institutional capacity to extract and distribute are present.

In international relations, the costs of engaging in actions that serve general international or regional interests can at least in theory be offset by compensation payments. International examples do exist. Under the US-Mexico Rio Grande agreement, the United States finances the construction of sewage treatment plants by Mexico. In debt for nature swaps, northern countries are forgiving or writing down debt in exchange for restrictions on development of rainforests. However, the international institutional and normative settings for Olsonian packages of regulation and compensation are thin. The simple Mexican-American Rio Grande case presents the best developed example of international compensation payments and the management of CPRs, in part because established bodies of riparian law assign property rights with clarity, waste water treatment technologies are well understood, and the geography of the river basin bounds the problem as a simple bilateral problem.⁶³ In multilateral cases in emerging areas of environmental conflict, guidelines for assessing appropriate levels of compensation are unclear, property rights and veto powers are imprecisely defined, mechanisms for extracting resources from the many and making payments to those with the power to block are weak, and the relevant technologies are not well understood. These problems reduce the likely stability of packages of Olsonian regulation and compensation in international multilateral CPR cases.⁶⁴

IV. CONCLUSIONS: INSTITUTIONS, FAIRNESS AND CPR MANAGEMENT

Institutions and norms can play a central role in promoting management of CPRs and in overcoming free riding. Where benefits are diffuse and long term and costs are concentrated and short term, institutions may define regulations on behalf of the common good and may provide compensation to buy off opposition to regulations. But as this paper has shown, neither strong institutions nor strong norms are requisites of cooperation where benefits are concentrated and costs are diffuse. In fact, some have argued that institutions in Stiglerian situations exist precisely in order to be captured. This view may be too cynical. Institutionalized conceptions of fairness may be requisites of stable long term management of CPRs.

While unconstrained Stiglerian capture can yield regulations that are consistent with management of CPRs, the role of environmental institutions and organizations in the Dupont and Fowler cases is considerable. International regulations barring CFCs and compensating China and India were shaped by a combination of commercial interest, environmental knowledge, and international organization. Regulations freezing new wells and requiring metering of pumps were drafted and implemented by the Kansas Division of Water Resources. And over the long term, as the interests of the regulated will tend to coincide with proper management of CPRs, institutions and norms may play a critical role in imposing a degree of homogeneity over diverse actors and in permitting actors to engage in self binding.

Institutions and norms may also play a critical role in stabilizing Olsonian regulation with compensation. Consider domestic examples of regulation with compensation. The costs of sewage treatment plants, prisons, toxic waste processing, and nuclear power plants are concentrated on those with the misfortune to live near

⁶²See Donald E. Agthe, "Indemnity for Companies Adversely Affected by Environmental Regulation Changes," *Policy Studies Review*, August 1986, Vol 6, No 1, p 11 and 12.

⁶³These examples assume that the distribution of externalities is fixed. For analysis of externalities that may be diverted from actor to actor, as distinct from stable concentrated private or diffuse public externalities, see Kenneth A. Oye, *Economic Discrimination and Political Exchange*, Chapter Two, "The Management of Spillover Effects: Public, Private and Divertable Externalities."

⁶⁴We are considering adding discussions of Swedish offers to compensate the Soviets for reducing emissions from nickel smelters on the Koala Peninsula and are also seeking to identify other examples of compensation payments across actions with heterogeneous preferences.

(or down wind from) these facilities. Yet the benefits of cleaner water, safer streets, effective waste management, and power generation without carbon emissions are spread over the many. Olsonian regulation with compensation may be complicated by several issues.⁶⁵

- Perceived unfairness and arbitrariness can undercut the effectiveness of compensation. The idea of providing compensation from the many to the few may be derived from a principled belief in fairness or a pragmatic interest in buying off resistance. If society is to derive (plausible) net benefits in both "Not In My Back Yard" and CPR cases, then compensation is both desirable and necessary. However, it is difficult to devise standards for determining fair and appropriate levels of compensation for those adversely affected by regulations.⁶⁶

- Agency and representation problems greatly complicate the effective utilization of compensation. Simply put, those receiving compensation may or may not represent those adversely affected by a state action in the common interest. These problems are most acute in situations involving polities without formal mechanisms for representation, but are also pronounced in cases involving neighborhoods within municipalities. It is difficult to devise credible and reliable institutional arrangements to extract resources from the many beneficiaries to distribute such resources to the concentrated few who are harmed. And these agency problems multiply when you move to the international arena.⁶⁷

⁶⁵We may be adding examples of compensation payments within the European Community.

⁶⁶For examples of failures in the use of compensation within the United States, see Paul Craig, "Siting a Liquid Hazardous Waste Incinerator: Experience with California's Tanner Act," *Environmental Impact Assessment Review* 1992; 12: 363-386; and Michael O'Hare and Debra Sanderson, "Facility Siting and Compensation: Lessons from the Massachusetts Experience," *Journal of Policy Analysis and Management*, 1993, 12:2, 364-376.

⁶⁷We do not address another form of compensation in this paper. Many have written on the payment of compensation from polluters to victims rather than from beneficiaries of regulation to those bearing the costs of regulation. Coasian compensation has of course been castigated by many in the environmental movement as offering licenses to pollute.