Business and International Environmental Treaties:

Ozone Depletion and Climate Change

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Ozone depletion and climate change are examples of global environmental problems that demand an international response. Both are "global commons" issues caused by the emission of specific gases into the atmosphere; ozone depletion is caused mainly by a class of chemicals called chlorofluorocarbons (CFCs), while climate change is caused by the buildup of atmospheric greenhouse gases (GHGs), particularly carbon dioxide (CO_2) and methane. A coordinated international response is required, since few countries are willing to bear the costs of controlling emissions if others do not commit to doing likewise. The situation is a classic "prisoners' dilemma."

Despite the widespread assumption that the climate change process would follow the model of ozone depletion, the experience in each case has been quite different. In the ozone case, the international community moved quite rapidly from the Vienna Framework Convention in 1985 to the Montreal Protocol on Substances that Deplete the Ozone Layer in 1987, which mandated cuts of 50% in production and consumption of CFCs by the year 1999. In 1990, the protocol was amended to require a full phaseout of most CFCs by 2000. By contrast, progress on a regime to control emissions of GHGs has been relatively slow. At the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, the Framework Convention on Climate Change (FCCC) called for countries to begin to monitor and report their emissions but did not mandate any emission curbs.[1] It did contain an expression of intent by industrialized countries to stabilize emissions at 1990 levels by the year 2000, though it was clear by the Second Conference of the Parties (COP-2) to the FCCC, held in Geneva in July 1996, that few countries would meet this target.[2] Even if a mandatory protocol is agreed by the target date of December 1997, it is likely to have very long timetables, to require only modest cuts in emissions, and to

exempt less developed countries (LDCs), which account for a large and growing proportion of emissions.[3]

Conventional explanations for the difference between the two cases point to the stronger scientific evidence concerning ozone depletion, the lack of coherent industry opposition to CFC controls, the availability of alternatives, and the distribution of costs and benefits in each case.[4] However, these factors are not in themselves fully convincing. It is clear that the science of climate change is much more complex than ozone depletion, thus giving rise to greater uncertainty about the severity of effects.[5] In the case of ozone depletion, empirical measurements have demonstrated that the problem is dramatically worse than models had predicted, whereas measurements of temperature changes have until recently shown increases of only half of the amount predicted by computer models. Nevertheless, since 1995 there has been a reasonable consensus among a large group of international scientists concerning the causes, mechanisms, and potential effects of climate change.[6] It should also be noted that the generation and interpretation of scientific evidence is not perfectly insulated from business pressure; fossil fuel interests have devoted considerable resources to challenging the science of climate change.[7]

It is true that agreement in the ozone case was facilitated by the lack of strong industry opposition and the availability of substitutes, while the opposite holds for climate change. This was not the situation, however, in the early 1980s, when CFC industry opposition was much stronger and substitutes were unavailable. Rather than take these factors as given, it is necessary to explain the extent of industry support or opposition and investment in substitutes. This requires an examination of the structures of related industries, corporate strategies, and the economics of substitute products and processes. Similarly, country negotiating positions must be analyzed in terms of national industrial structures and economic interests.

Oye and Maxwell have argued that agreement on CFCs was made easier because the costs were dispersed widely, while the benefits were concentrated in the hands of a few industry leaders, notably Dupont.[8] It is tempting to assert that agreement on climate change is much more difficult because the costs are concentrated in the powerful fossil fuel industry, while the benefits are widely dispersed. Reality is much more complex than this, however. One could make the case that for CFCs, the costs of regulation were relatively concentrated in a few producer companies and relatively few user sectors; only Dupont stood to gain significantly from CFC controls. For climate change, by contrast, one could argue that the costs of regulation are dispersed across many industrial sectors, countries, and consumers. A more complete account of the differences between the two cases requires an examination of the absolute magnitude of economic impact, the formation of inter-sectoral as well as international coalitions, and the diversity of interests affected.

These two cases demonstrate how business interests have substantial influence over the contours of international environmental treaties. Although

most businesses might prefer no controls at all, agreement requires at least the passive assent of major corporate players. The treaty to control ozone depleting gases accommodated the interests of the large CFC producers, avoided major market disruptions, and even offered market opportunities in substitute chemicals. Despite the diversity of business interests in the case of climate change, business has so far been successful in preventing mandatory controls on GHGs. Indeed, if an agreement cannot be crafted that gains the consent of major affected industries, there will likely be no agreement at all.

Macroeconomic Impact

A fundamental difference between these two environmental issues is the extent of their economic impact; efforts to control ozone-depleting substances cause significant effects at the sectoral level, but have little macroeconomic impact. By contrast, the impact of controlling emissions of greenhouse gases could be substantial; the long recession triggered by dramatic increases in energy prices in 1973 has not been forgotten, and LDCs fear that limits on fossil fuels will constrain their plans for industrialization and growth.

Prior to the Montreal Protocol, CFC-related industries did, of course, stress the magnitude of the economic impact of a ban on the chemicals. Thus, a Dupont spokesperson estimated in 1975 that industries related to CFCs, including user industries such as refrigeration, electronics, and aerosols, contributed more than $8 billion to the U.S. economy and employed more than 200,000 Americans. According to the Alliance for Responsible CFC Policy, an industry association that represented European as well as American manufacturers and users of CFCs, goods and services involving CFCs were worth $28 billion annually in 1986, and more than $128 billion of installed equipment relied on CFCs.[9] Despite the apparent magnitude of these numbers, CFCs were simply not a big business. In the early 1980s, U.S. companies sold about $700 million of CFCs annually, a minuscule fraction of the $1 billion worth of crude oil consumed *every day*. CFCs were not a major cost component in the price of final products. Moreover, CFCs represented less than 3% of the total sales of Dupont, the world's largest producer of the chemical; even a total loss of this product line would not have had a devastating impact on the company.

Efforts to address climate change could, by comparison, prove very costly. According to *The Economist*, "One of the few certainties about global warming is that the costs of severely curbing emissions of greenhouse gases now would be huge."[10] Reducing CO_2 emissions would not only hurt the oil and coal industry, but would have a major impact on fossil-fuel dependent industries, particularly electric utilities and transportation, as well as other energy-intense sectors. A study by the U.S. Council of Economic Advisors estimated that the cost to the U.S. economy of reducing carbon emissions by 20% by 2100 would be between $800 billion and $3.6 trillion.[11] It should be noted that these numbers, widely cited by industry lobbying groups, are cumulative over more than a century.

More recent studies using macroeconomic and general equilibrium models suggest that a 20% reduction of emissions by 2010 might lower GDP by 2% to 2.5% annually, depending on the mechanism used, although the rate of economic growth would not necessarily be reduced; some models suggest that growth could be temporarily stimulated due to investment in alternative energy sources.[12]

These macroeconomic models do have a number of limitations. They assume that businesses and consumers are already exploiting every profitable opportunity available and do not consider the possibility that cost-effective opportunities to reduce emissions might exist due to organizational slack or market failures. They also ignore the potential for higher energy prices to stimulate R&D and accelerate technological change. These models are overly optimistic in one respect, however. They presume full employment, ignoring the possibility that a sharp rise in energy prices could trigger a recession.[13]

Other economic studies, based on a sectoral technological costing approach, suggest that large reductions in GHGs could be achieved at little cost, or even a net benefit, through the widespread implementation of energy efficiency measures and increased use of renewable energy sources.[14] These studies survey the potential for reducing emissions using specific technologies in each sector. The optimistic assumptions of these models also need to be viewed with caution, however. The potential for innovation and diffusion of new techniques does not guarantee that it will indeed occur, as there are still significant organizational and market barriers to be overcome.

Structure and Interests of Industries Affected

Measures to address climate change would affect far more industries in much more significant ways than the Montreal Protocol. CFCs had only four main industrial uses; as the cooling agent in refrigeration and air-conditioning, as a solvent to clean electronics equipment, as a propellant in aerosol sprays, and as a foaming agent in insulation and packaging materials. In addition, the global CFC industry was highly concentrated. Eighteen chemical companies accounted for most of the world's production of CFCs in the early 1980s, the bulk of which was concentrated in the U.S., U.K., France, and Japan. Dupont alone produced around one-quarter of world output and supplied about one-half of the U.S. market.[15] This concentration allowed Dupont to act as the industry leader at the negotiating table, through its dominance of the Alliance for Responsible CFC Policy. Once Dupont decided to support international controls on CFCs in September 1986, the path to the Montreal Protocol was cleared, and the limited number of user industries cooperated to develop CFC-free products and processes. The relative cohesion of business interests over the ozone issue, at least within the U.S., is reflected in the fact that only one industry organization was active in international negotiations.

By contrast, controls on emissions of CO_2 would affect not just the producers and refiners of oil and coal, but would dramatically raise costs for electric utilities, the transportation sector, and energy-intense industries downstream on the value chain, such as chemicals, glass, aluminum, cement, and paper.[16] The impact would extend to commercial and retail sectors that use large amounts of energy for heating and cooling. Some sectors might stand to gain from efforts to curb CO_2 emissions. Natural gas is a relatively low carbon fuel, so producers of gas, and gas-based power generation equipment, such as Enron, could well benefit. In a similar way, the renewable energy sector, based on wind, solar, and biomass, would be expected to thrive.[17] Manufacturers of insulation and sophisticated temperature control equipment, such as Honeywell, are also likely to benefit.

While the physical depletion of the ozone layer itself presented few business threats or opportunities, aside from the chance to sell more sunscreen and sun hats, climate change could have a major impact on a number of industries. Agriculture and forestry in some areas could be hurt by higher temperatures and more extreme weather patterns such as droughts and floods. Higher CO_2 levels and greater rainfall in other regions could enhance crop and tree growth. Companies in these industries have been studying the drought tolerance of various seeds, but have not yet entered the policy debates. Income in the agricultural sector in the U.S. could actually rise 1-2% due to higher prices and inelastic demand, though the outlook for the rest of the world, where people spend more of their incomes on food and are more dependent on local crops, is less optimistic.[18] The insurance sector has substantial exposure to claims for losses from rising sea levels, flooding, and the possibility of more frequent hurricanes. The banking industry also has assets at risk from climate change, but is in a more complex position as it holds large loans from sectors that would be hurt financially by measures to combat climate change.[19]

The diversity of business interests affected by climate change has given rise to a plethora of industry associations representing different perspectives; thirteen contributed to the joint Business and Industry Statement presented at the negotiations in Berlin in March 1995. The Global Climate Coalition (GCC), which represents more than 50 companies and trade associations in the oil, coal, utility, chemicals, and auto industries, is the largest industry group working on the issue and has spent nearly $1 million a year to convince policy makers that proposals to limit CO_2 emissions "are premature and are not justified by the state of scientific knowledge or the economic risks they create."[20] The Climate Council, which works closely with oil exporting countries such as Kuwait and Saudi Arabia as well as with oil and coal companies, has also been active in trying to forestall any international treaty with mandatory reductions in CO_2 emissions.[21]

The Business Council for a Sustainable Energy Future (BCSEF) represents businesses active in natural gas, electric power, energy efficiency, and renewable energy, sectors that stand to benefit from controls on carbon emissions. The

BCSEF has supported proposals to curb CO_2 emissions, especially measures that would offer financial incentives for low-carbon alternatives and for the transfer of new technologies to LDCs. Proponents of renewables point out that they are likely to generate much more employment per dollar of investment than in the oil and coal sectors.[22]

The International Climate Change Partnership (ICCP) was formed by a group of industrial companies that had been involved in the CFC issue and are now concerned that HFCs, some of which are potent greenhouse gases, would also be regulated in a climate change treaty.[23] Kevin Fay, the head of the ICCP and the former head of the Alliance for Responsible CFC Policy, has successfully expanded the organization to represent a broad range of manufacturing interests, including Dupont, General Electric, British Petroleum, AT&T, Enron, 3M, and Allied Signal. Some of these companies manufacture insulation and efficiency equipment and could benefit from higher fossil fuel prices. AT&T is promoting "tele-commuting" as an approach to reducing emissions from transportation. Enron has substantial interests in gas power generation and has recently invested in a joint venture with Amoco to produce photovoltaic panels. General Electric's gas turbine business could benefit from a switch away from coal, but its appliance and aircraft divisions could be hurt by emissions controls. Recognizing the sometimes conflicting interests of his members, Fay has attempted to position the ICCP as representing the "responsible middle ground" in the negotiations. The ICCP is most concerned with ensuring that any such treaty would be designed in consultation with key business players and would have a long timetable for implementation. This would allow his members the time and opportunity to develop and market new products and processes and would prevent premature obsolescence of existing capital.

Several industry associations have a more specific focus with regard to climate change. The World Business Council for Sustainable Development (WBCSD), for example, is an international coalition of more than 120 companies in a range of manufacturing industries that is active in setting up pilot "joint implementation" (JI) projects.[24] JI refers to a pilot scheme, discussed at the negotiations in Berlin in March 1995, whereby companies would be able to claim credit for activities performed in other countries that reduce carbon emissions. For example, the Canadian company Transalta has a project in India to reduce electric power transmission losses by more than 20%. While no credits have been agreed upon during the pilot stage—and these projects need to be profitable in a conventional manner—participating companies are hoping to be able to sell the carbon reductions in a future market for carbon emission permits.

The disunity of business interests has been evident in the international negotiation process. The structure of the U.N. process has forced business to attempt to speak with one voice, at least in the formal presentations, and this has led to bland, cautious statements that reflect the "lowest common denominator."[25] The International Chamber of Commerce, which has a Working Group

on Climate Change and is attempting to play a role in coordinating business responses, has had great difficulty finding common ground beyond advocating more research and industry participation in the process.[26]

One might expect that this disunity would weaken the power of business in the negotiation process relative to environmental non-governmental organizations (NGOs) and governmental agencies.[27] It is therefore somewhat surprising that a "rejectionist" coalition of industry interests, primarily the GCC and the Climate Council, has been relatively successful in deflecting calls for mandatory emission reductions. To some extent, this is because of opposition to controls from OPEC and the JUSCANZ group of countries (Japan, United States, Canada, Australia and New Zealand), who are the world's largest producers and consumers of fossil fuels and are home to large industrial sectors dependent on these fuels. A second reason is that the rejectionist coalition is well funded and represents large and concentrated industries. In comparison, business groups supporting emissions controls tend to include smaller companies in more fragmented industries.

A third potential explanation for the success so far of the rejectionist coalition is that business disunity itself conveys a certain type of veto power. The climate change case suggests a "divided we stand" hypothesis, in that the very diversity of corporate interests provides an effective veto against controls for which industry is generally unenthusiastic. Even though large sectors of industry, agriculture, insurance, and banking might favor some form of agreement, they prefer no agreement to one which is not tailored to their specific interests. Given the widespread perception among policy makers and even environmental groups that any agreement must have the support of key sectors of industry to be effective and politically feasible,[28] the diversity of business interests makes it difficult to reach any agreement at all. Those sectors opposing an agreement can strategically exploit these differences to delay and block an international system for limiting GHG emissions.

The "divided we stand" hypothesis can also explain the demise of the proposal for a European carbon tax in 1992, where different sectors of industry broadly accepted the science of global warming and the goal of reducing emissions, but presented conflicting sets of counter-proposals.[29] Although the coalition of business interests opposing any tax was relatively weak in this case, the difficulty in crafting a tax system that satisfied most of the major industry groups doomed the proposal.

Availability and Cost of Substitutes

An analysis of the availability and market structures for substitute products helps explain why leading CFC producers came round to supporting controls on CFCs, while major business players remain opposed to mandatory controls on GHG emissions. In the face of mounting concern over the ozone-depleting effects of CFCs and fears of regulation, the major CFC producers

initiated programs in the latter 1970s to develop substitutes for these chemicals. This research gathered pace in 1986 after the discovery of a large region of depleted ozone above Antarctica. Dupont alone devoted $5 million to this research in 1986, rising to $30 million in 1988.[30] By the time Dupont announced its support for international limits on CFCs in September 1986, CFCs had become commodity chemicals that were only marginally profitable. Demand was declining due to the unilateral U.S. ban on CFCs in aerosols, while European producers were gaining market share.[31] In contrast, the substitute chemicals (HCFCs and HFCs) were specialty products which required greater technological expertise to design and manufacture, and were expected to command premium prices. Major CFC producers therefore had every incentive by this stage to support an international regime requiring an orderly transition to the new chemicals.

Fossil fuel industries have been much more reluctant to invest resources on a large scale to develop substitute sources of energy that would reduce or eliminate GHG emissions. During the early 1990s, some oil and gas companies were beginning to make limited investments in renewable energy sources. Shell, BP, Amoco, and Enron all have subsidiaries active in photovoltaic (PV) technologies. Nevertheless, the scale of these investments is very limited compared to their exploration budgets for new oil and gas fields. The total peak power output of all the PV panels manufactured worldwide in 1996 was about 100 MW, which is less than 10% of the output of one conventional power station. The major energy companies still derive the vast majority of their revenues from business lines that would be hurt by emission controls, and they have not yet begun to make strategic resource allocation decisions based on an expectation of serious GHG emission controls. Currently, investments in renewable technologies tend to be regarded more as "foot-in-the-door" operations rather than significant efforts to diversify.[32]

The reluctance of major energy companies to commit substantial resources to renewables is attributable, in part at least, to the scale of financial commitment required, the long time frame, and the risks involved. Without any form of carbon tax, the cost of renewable energy sources needs to fall to around 5 cents/kWh to be competitive with fossil fuels. For example, although the cost of PV power is falling by about 15% per year, reflecting an 80% experience curve, PV is not expected to be competitive with fossil fuels till some time between 2010 and 2020 for general supply to the grid.[33]

The risks are compounded by uncertainty as to which renewable energy technologies will take off; there is currently activity regarding PV, solar thermal, wind, and biomass; even within PV there are multiple competing technologies. Meanwhile, industry observers estimate that the large U.S. oil and gas companies have lost nearly $1 billion over the last decade in investments in renewables, and that those remaining in the field are still not making much of a return.[34] Given the market failures associated with the high risks and long time horizons of these investments, one might expect governments to fund much of

the basic R&D in these technologies. Public funding through the U.S. federal budget, however, has been cut by around 50% from a level of $150 million in 1980.[35] This signal to private firms about the lack of public commitment has exacerbated their reluctance to invest.

More fundamentally, perhaps, energy substitutes present a difficult challenge to fossil fuel companies because they are so far removed from these companies' existing core businesses. Recent literature in the business strategy area has stressed the importance of firms building upon core competencies and capabilities that are firm-specific and enable a company to compete successfully in an industry.[36] Regarding CFCs, chemical companies could build on their capabilities in chemical engineering and production process technologies, while using existing distribution channels to dominate the markets for CFC substitutes. For traditional fossil fuel and utility companies, renewables represent a fundamentally different technology. Photovoltaics, for example, are based on technologies related to silicon semiconductors rather than hydrocarbon chemistry. It is not surprising, therefore, that Atlantic Richfield (ARCO), after losing considerable amounts of money, sold its PV business to Siemens, which is now the world's largest producer of PV panels. Similarly, the largest Japanese PV companies are Sanyo, Kyocera, and Sharp—all electronics companies. Mobil sold its solar business after incurring substantial losses. Amoco already had a number of electronics subsidiaries, which may have facilitated its PV joint venture with Enron.[37]

An analysis of user industries reinforces the argument that substitutes present a more complex challenge in the case of climate change than for ozone depletion. It is true that substitutes for CFCs were initially considered expensive and inadequate, particularly for refrigeration and cleaning of printed circuit boards. The American Electronics Association testified to Congress in March 1987 that "the electronics industry has a keen interest both in the continued availability of this indispensable solvent and in its safe use...the issue has profound and troubling implications for the U.S. high-tech industry's international competitiveness and for international trade."[38] Nevertheless, facing the prospect of imminent controls, the industry moved quickly to develop water-based cleaning techniques, and discovered that they were actually cheaper than using CFC solvents.[39] Northern Telecom committed to phase out all ozone-depleting substances within three years, and estimated that the switch would save the company $50 million over eight years. The automobile industry, somewhat more slowly and reluctantly, also developed air-conditioning equipment based on substitutes.[40]

Where there were only four major industrial uses for CFCs, and these chemicals typically constituted very little of the final price of a product, numerous industries are highly dependent, directly or indirectly, on fossil fuels. The only substitute for energy *per se* in many applications is efficiency, the scope for which is inherently limited in many industrial processes, and which offers little to fossil fuel companies except lower demand. In any event, some of the most energy-intense industries, such as glass and cement, are not particularly

technologically progressive, so are unlikely to pursue alternatives with the same zeal as did the electronics industry for CFCs.[41] Investments in power generation capacity are costly and long-lived; owners of these assets will not want to see them scrapped prematurely. The automobile industry is clearly much more committed to the internal combustion engine as the primary source of motive power than it was to the use of CFCs in the air-conditioning unit. For electric utilities, the largest consumers of coal, the distributed nature of the energy supplied by renewable technologies, particularly PV, could make their massive investments in grid transmission systems obsolete.

Country Negotiating Positions and Economic Interests

The evidence from these two environmental issues suggests that country negotiating positions can largely be understood in terms of geographic patterns of ownership, production, consumption, and trade in affected industries. This does not necessarily mean that business is directly dictating national policy in an "instrumentalist" manner; rather, national governments recognize their structural dependence on the economic health of key sectors.[42]

In the case of the negotiations over ozone depleting gases, the U.S. position largely followed the stance of Dupont and the Alliance for Responsible CFC Policy.[43] After Dupont and the Alliance announced their support for international controls on CFCs in August 1986, the U.S. proposed an almost total phaseout of CFC consumption. American producers feared stronger unilateral U.S. regulations that would unduly advantage foreign, primarily European, producers, and wanted global controls to ensure export markets for substitutes.

The Europeans were much more resistant to radical curbs and countered with a proposal for a production freeze.[44] A number of economic factors can explain the European position. The European producers were behind in developing substitutes for CFCs and feared Dupont's dominance of markets for these chemicals in the event of a rapid phaseout. In comparison to the U.S. producers, who were largely dependent on their stagnant, regulated home market, the European producers enjoyed a buoyant export market for one-third of their output and were not constrained by regulatory constraints on aerosols. The U.K. only abandoned its opposition to a binding protocol after ICI, the second largest producer of CFCs, changed its position, and Europe eventually compromised on a 50% cut in the 1987 Montreal Protocol. In subsequent amendments to the Montreal Protocol, the U.S. secured, over European objections, a very long phaseout period for HCFCs, protecting American producers' market positions in this substitute chemical.

Japan agreed to sign on to the protocol when it was agreed to treat substances as a combined "basket" rather than individually, which gave countries some flexibility in deciding how to meet the targeted reductions. Japan had earlier opposed including CFC 113, a solvent widely used in the electronics industry, in the agreement. The larger developing countries, such as India,

China, Brazil, and Mexico did not initially ratify the agreement, however. Although the large LDCs produced only 5% of the world's CFCs, their output was rising by 7-10% annually; and Indian producers had plans to export half their CFC production to Asia and the Middle East.[45] These countries only agreed to sign on after the financial assistance fund for technology transfer was increased by $160 million.

The climate change issue also illustrates the predominance of business considerations in determining country negotiating positions. Compared to the ozone issue, many more countries would be directly affected by measures to reduce GHGs—as producers, exporters, and consumers of fossil fuel energy. Members of OPEC, led by Saudi Arabia and Kuwait, have, not surprisingly, been among the most vociferous opponents of any restriction. Much of the developing world, which already accounts for an estimated 45% of total GHG emissions, has been firmly opposed to any agreement on the grounds that climate change is a rich country problem and that cheap energy is needed to fuel growth. The current climate convention does not even require that LDCs target stabilization of emissions. China, with one-third of the world's proven reserves of coal, relies on coal for around 80% of its energy needs and in 1995 was already the world's third largest emitter of CO_2. China planned to expand its coal production five-fold to 3 billion tons a year by 2020, which would increase global CO_2 emissions nearly 50%.[46] Brazil, Indonesia, and Malaysia, which are home to much of the world's tropical rain forest, have expressed concern that a treaty might limit their ability to log and export timber, or to clear the land for agricultural use.

The divisions in Europe reflect different industrial structures, dependence on fossil fuels, and special circumstances. France has been relatively supportive of emission controls because it already obtains more than 60% of its electricity from nuclear plants and is perhaps hoping that controls on fossil fuels might spur exports of its nuclear technology. Although Germany, the strongest European advocate of controls, depended on coal for about one-third of its primary energy needs in 1990, this dependence was already being reduced due to concern about acid rain and the cost of coal subsidies, which exceeded $4 billion a year. Germany has been able to reduce emissions through the closure of inefficient plants in the former East Germany; moreover, it possesses a relatively strong renewable energy sector and is in the forefront of pollution prevention technologies.[47] The U.K., which was relatively inefficient in energy use and was quite dependent on coal, had followed the U.S. position against controls until the early 1990s. Margaret Thatcher reversed this position and, according to Sonja Boehmer-Christiansen, used the climate change issue to justify the wholesale closure of coal pits. This strategy entailed forging an alliance with U.N. environmental bureaucracies, the scientific community, and corporate gas and nuclear energy interests.[48] The poorer European countries, such as Greece, Spain, and Portugal, have opposed mandatory controls, sharing the concerns of other LDCs that emissions controls would choke off their growth.

The U.S., reversing its role as a lead state in the ozone case, has played a key role in blocking moves toward a binding agreement. The U.S. possesses substantial reserves of coal and oil, whose value would decline if demand were curbed or substitutes developed. The U.S. is home to five of the seven oil majors, representing a substantial stake in the value of global oil reserves, exploration, refining, and distribution. It is also the home to major multinationals in energy-intense user industries, such as automobiles, steel, and chemicals.[49] In terms of energy consumption, the U.S. is very dependent on fossil fuels; its carbon emissions, in total and in per capita terms, are the highest in the world, and its emissions grew by 4.4% from 1990 to 1994, a period in which emissions by most European countries were stable or dropping.[50] Emission control measures that would result in worldwide carbon taxes at approximately uniform rates across countries would cause much more serious adjustment effects in the U.S., where energy taxes are very low compared to Europe and Japan.

At the COP-2 session in Geneva in July 1996, the U.S. reversed its opposition to mandatory controls and announced support for modest mandatory cuts with long time frames combined with some commitment to stabilization from LDCs.[51] Though the announcement raised the ire of the GCC, the new U.S. policy reflects emerging common ground in the business community—particularly in moderate business associations such as the ICCP—concerning the shape of an eventual compromise agreement. The U.S. advocates a tradeable permit system, which has been promoted by several industry groups, and offers opportunities for companies to profit from innovations that cut emissions. Such a system, implemented over a long time period, would enable companies to redirect their investments accordingly and would lessen the threat of serious market disruptions. Indeed, the U.S. statement in July 1996 explicitly assured business that the U.S. would only accept measures that are not "economically disruptive" and that employ "the genius of the private sector" to find "market-based solutions that are flexible and cost-effective."

Conclusions and Implications

The study of business and industry interests adds an important dimension to our understanding of international environmental agreements and helps to explain why climate change is a much more difficult issue than ozone depletion for the international community to tackle. The macroeconomic impact of measures to address climate change is likely to be much greater than was the case for ozone depletion, and major industrial sectors, such as oil, coal, transportation and utilities, could be seriously harmed. CFCs were a relatively small business even for the industry leader, Dupont, but fossil fuels and cheap energy are at the heart of many large and powerful companies in a number of industrial sectors.

Although the costs of regulating GHG emissions are likely to be spread across a large number of firms and sectors, this has not inhibited those adversely affected from organizing in opposition to international controls. Some of the

industries anticipating harm are concentrated and powerful, but also important is the absolute magnitude of potential economic impacts and the strategic risks of investing in substitutes. Fossil fuel substitutes are costly and risky investments, and they often rely on technologies that are fundamentally different from existing corporate capabilities. The strength of opposition is also due to the formation of international and inter-sectoral industry associations that overcome some of the difficulties in organizing collective action against GHG controls. The CFC experience itself has given some companies valuable experience in coordinating broad efforts to influence international negotiations.

The concentrated nature of the CFC industry enabled Dupont to act as the industry leader in promoting an agreement favorable to its strategic interests. It is only half the story to say that the benefits of regulation were concentrated in the CFC industry; it was the industry structure and nature of the alternative products that provided incentives for industry leaders to invest in substitutes, transforming their stance from strong opposition to support for controls. Although the costs of CFC regulation were also concentrated in a limited number of user industries, this concentration facilitated cooperation in solving technical problems of adapting to substitutes.

The case studies suggest that international environmental treaties require the assent of major affected industries. The limited number of actors involved in the CFC case, whether potential winners or losers, made it easier to reach an agreement. It will likely prove much more difficult to forge an agreement that is acceptable to the broad range of industries affected by climate change. The multiplicity and diversity of interests that would be influenced by efforts to reduce GHG emissions, rather than weakening opposition, greatly complicates the task of establishing an international control mechanism, thus serving the strategic interests of those wishing to delay and block any agreement.

The discussion of country interests illustrates how country negotiating positions can largely be understood in terms of perceptions of national economic interest. The industry-based approach is not without limitations, of course. Some countries have mixed economic interests, making it difficult to predict their negotiating stance. Russia and Canada both have substantial coal and gas reserves, for example, but while emission controls would depress demand for the former, they would increase it for the latter. Countries also have interests that are more military and strategic than purely economic. Controls on emissions of GHGs would accelerate the development of renewables and reduce the strategic importance of oil in global politics, to the detriment of countries that control the production and refining of oil. It is also possible that the U.S. might see controls on GHGs as a means to constrain the ambitions of China, a rising power with huge coal reserves.

Non-business pressures can be significant in some countries. Germany is sensitive to public environmental concerns due to a well-organized "green" political movement, and public pressure in the U.S.—channeled through boycotts, the mass media, and environmental organizations—appears to have played

a role in the ozone case. The strongest support for firm action on climate change has come from a group of thirty-two countries known as the Association of Small Island States (AOSIS), which also includes countries such as Bangladesh with large populations in low-lying coastal areas. Despite their relatively weak bargaining position, these countries have been able to exert some moral suasion over the negotiations due to the threat from rising sea levels to their very existence.

This analysis of ozone depletion and climate change suggests that business does have substantial influence over the timing and shape of international environmental agreements, even when there is considerable disunity among the business ranks. This does not mean that industry can block an agreement indefinitely or dictate its terms. As in the case of ozone depletion, business will eventually be forced to accept a compromise agreement on climate change that includes some form of emission limitation. Such a compromise, however, will in all likelihood entail policy measures that provide market incentives for a gradual and long-term transition away from fossil fuels, thus guarding against severe, short-term market disruptions that would threaten the viability of major business players.

Notes

1. Details of the negotiations up to 1992 can be found in Ian H. Rowlands, *The Politics of Global Atmospheric Change* (Manchester: Manchester University Press, 1995); Gareth Porter and Janet W. Brown, *Global Environmental Politics* (Boulder, CO: Westview, 1991); Daniel Bodansky, "Prologue to the Climate Change Convention," in Irving M. Mintzer and J. Amber Leonard, eds., *Negotiating Climate Change: The Inside Story of the Rio Convention* (Cambridge: Cambridge University Press, 1994), pp. 45-74; Alan D. Hecht and Dennis Tirpak, "Framework Agreement on Climate Change: A Scientific and Policy History," *Climatic Change*, 29 (1995): 371-402. The best sources for the post-1992 negotiations, particularly the COP-1 and COP-2 rounds in Berlin and Geneva, are the Earth Negotiations Bulletin, published by the International Institute for Sustainable Development, at Web site http://www.iisd.ca/linkages, and the ECO newsletters published by the Climate Action Network, a coalition of environmental NGOs, available at Web site http://www.igc.apc.org/climate/eco.html.
2. See World Energy Council, *Climate Change Negotiations: COP-2 and Beyond*, Report No. 6, London, September 1996.
3. Various scientific studies estimate that cuts in GHG emissions of around 50% from 1990 levels are required to stabilize atmospheric concentrations at double the pre-industrial level. At the COP-2 negotiations in Geneva in July 1996, European countries favorable to mandatory controls were proposing cuts on the order of 10-15% by the year 2010.
4. On ozone depletion, see Kenneth A. Oye and James H. Maxwell, "Self-Interest and Environmental Management," *Journal of Theoretical Politics*, 6/4 (1994): 593-624; Edward A. Parson "Protecting the Ozone Layer," in Peter M. Haas, Robert O. Keohane, and Marc A. Levy, eds., *Institutions for the Earth* (Cambridge, MA: MIT Press, 1993). There have not yet been similar comprehensive analyses of climate change.

5. Peter Haas has described the evolution of international "epistemic communities" that played a critical role in generating the momentum leading to the Montreal Protocol. Peter M. Haas, "Banning Chlorofluorocarbons: Epistemic Community Efforts to Protect Stratospheric Ozone," *International Organization*, 46/1 (Winter 1992): 193-215.
6. Intergovernmental Panel on Climate Change, *The IPCC Second Assessment Synthesis Report: Draft Summary for Policy Makers* (Geneva: United Nations, 1995, also Cambridge University Press, 1996). The report notes that recent models, which take account of the cooling effect of aerosol particles in the atmosphere, predict temperature changes that fit well with empirical observations.
7. See Ross Gelbspan, *The Heat is On* (Reading, MA: Addison-Wesley, 1997); Andrew Rowell, *Green Backlash* (London: Routledge, 1996), Chapters 3 and 5; Karen T. Litfin, *Ozone Discourses: Science and Politics in Global Environmental Cooperation* (New York, NY: Columbia University Press, 1994); Ozone Action, *Distorting the Debate: A Case Study of Corporate Greenwashing* (Washington: D.C.: Ozone Action, 1996). More generally, see Lynton K. Caldwell, *Between Two Worlds: Science, the Environmental Movement, and Policy Choice* (Cambridge: Cambridge University Press, 1990); Ernst B. Haas, *When Knowledge is Power: Three Models of Change in International Organizations* (Berkeley, CA: University of California Press, 1990).
8. Oye and Maxwell [op. cit.] argue that in a Stiglerian situation, where the costs of regulation are diffused and benefits are concentrated, those who benefit have a greater incentive to organize in support of the regulation. The opposite should hold in Olsonian situations, where the benefits of regulation are diffuse but the costs are concentrated. See George Stigler, "The Economic Theory of Regulation," *Bell Journal of Economics*, 2 (1971): 3-21; Mancur Olson, *The Logic of Collective Action: Public Goods and the Theory of Groups* (Cambridge, MA: Harvard University Press, 1965).
9. The Dupont estimate is cited in James H. Maxwell and Sanford L. Weiner, "The Political Economy of the CFC Phaseout: Industry's Role in the Establishment of the International Regulatory Regime," MIT Working Paper, September 1993. Kevin Fay's estimate is in his Statement to U.S. House of Representatives Subcommittee on Health and the Environment, *Ozone Layer Depletion Hearings*, March 9, 1987, p. 180. For other estimates, see The Department of Economic and Social Affairs, "Protection of the Ozone Layer—Some Economic and Social Implications of a Possible Ban on the Use of Fluorocarbons." in Asit K. Biswas, ed., *The Ozone Layer* (Oxford: Pergamon, 1983), pp. 141-67.
10. *The Economist*, April 1, 1995, p. 11.
11. U.S. Council of Economic Advisors, *Economic Report of the President* (Washington, D.C.: U.S. Government Printing Office, February 1990), pp. 214-223
12. The results from a range of models are summarized in the Statement of Marc Chupka, Acting Assistant Secretary for Policy and International Affairs, U.S. Department of Energy, to the Subcommittee on Energy and Power, Committee of Commerce, U.S. House of Representatives, *Hearings on Climate Change*, June 19, 1996.
13. For a discussion of these issues, see William R. Cline, *The Economics of Global Warming* (Washington, D.C.: Institute for International Economics, 1992)
14. The better known examples are U.S. Office of Technology Assessment, *Changing by Degrees: Steps to Reduce Greenhouse Gasses*, OTA-0-482 (Washington, D.C.: US Government Printing Office, 1991) and National Academy of Sciences, *Policy Implications of Greenhouse Warming* (Washington, D.C.: NAS Press, 1991).
15. For more background information on the industry, see Richard E. Benedick, *Ozone Diplomacy: New Directions in Safeguarding the Planet* (Cambridge, MA: Harvard University Press, 1991); Parson, op. cit.

16. A recent report by Mark Mansley/The Delphi Group concludes that the long-termfinancial risks from climate change to oil and coal related sectors are significant and not yet adequately anticipated or discounted by financial markets. Mark Mansley/The Delphi Group. *Long-Term Financial Risks to the Carbon Fuel Industry from Climate Change* (London: The Delphi Group, 1995)
17. The prospects for renewables are discussed in Joseph J. Romm and Charles B. Curtis "Mideast Oil Forever?" *The Atlantic Monthly* (April 1996), pp. 57-74; Shell International, *The Evolution of the World's Energy System 1860 - 2060* (London: Shell International, 1994); NRDC/Tellus Institute *America's Energy Choices* (Cambridge, MA: Union of Concerned Scientists, 1991).
18. These impacts are summarized in Kenneth M. Strzepek and Joel B. Smith, eds., *As Climate Changes: International Impacts and Implications*, on behalf of the U.S. Environmental Protection Agency (Cambridge: Cambridge University Press, 1994).
19. The impact on the banking and insurance industries is discussed in more detail in Jeremy Leggett, ed., *Climate Change and the Financial Sector* (Munich: Gerling Akademie Verlag, 1996) and in Mark Mansley/The Delphi Group, op. cit.
20. Global Climate Coalition press release, February 9, 1995.
21. The Climate Council is quite secretive about its activities and clients. This information is drawn from various issues of the ECO newsletter and from Gelbspan, op. cit.
22. Scott Sklar, Executive Director, Solar Energy Industries Association, address to the conference *Evolving Technologies, U.S. Business and the World Economy in the 21st Century*, Washington, D.C., June 18, 1996. Text published by Solar Energy Industries Association.
23. Information on the ICCP is based upon the author's interview with Kevin Fay, ICCP's publications and press releases, and Gelbspan, op. cit., pp. 102-106 (draft).
24. For information on the WBCSD and JI see Jim Leslie (Transalta Corporation), "Joint Implementation: Creating a New Market," presented to the Wall Street Journal/Handlesblatt Energy Congress on International Energy Markets, Vienna, September 13, 1995; Nazli Choucri (MIT), "Activities Implemented Jointly: A New Synthesis of Issues, Realities, and Contentions," prepared for UNEP, Earth Council Advisory Group, October, 1996; the WBCSD Web site at http://mcc29a5a.unige.ch/wbcsd/about/about.htm
25. See the "Business and Industry Statement to the First Meeting of the Conference of the Parties to the Framework Convention on Climate Change," Berlin, March 30, 1995.
26. See Statement by the ICC to the UNFCC COP-1, Berlin, March 1995. Author interview with Denise O'Brien, Director, Environmental Affairs, ICC, Paris.
27. The contentious debate over the power of business in society has turned on the extent of corporate unity and cohesiveness. Researchers from a Marxist and power-elite perspective emphasize the ability of business to act cohesively in the political arena. Examples include G. William Domhoff, *Who Rules America?* (Englewood Cliffs, NJ: Prentice Hall, 1976) and Charles Lindblom, *Politics and Markets* (New York, NY: Basic Books, 1977). The pluralist perspective, in contrast, stresses the conflicts and divisions among business sectors, so that business sectors compete among themselves and with other social groups for political influence. Examples include Edwin Epstein, *The Corporation in American Politics* (Englewood Cliffs, NJ: Prentice Hall, 1969) and Barry M. Mitnick, "Political Contestability," in B. M. Mitnick, ed., *Corporate Political Agency* (Newbury Park, CA: Sage, 1993), pp. 11-66. For a detailed review, see David J. Vogel, "The Study of Business and Politics." *California Management Review*, 38/3 (Spring 1996): 146-165.
28. Interviews with personnel in the U.S. Department of Energy, EPA, and White House staff clearly revealed the assumption that broad corporate assent would be

needed for an agreement to be "politically feasible." It was frequently argued that only large businesses possess the financial, technical, and organizational resources to address climate change. This discourse is analyzed and critiqued in David L. Levy, "Contesting the Terrain of Environmental Management: A Critical Examination of an Emerging Discipline," paper presented at Academy of Management, 1996 Annual Meeting, Cincinnati, Ohio.

29. The carbon tax proposal is discussed in detail in Tony Ikwue and James Skea "Business and the Genesis of the European Community Carbon Tax Proposal," *Business Strategy and the Environment*, 3/4 (1994): 1-10
30. Parson, op. cit., pp. 40-42; Rowlands, op. cit., pp. 110-111
31. Maxwell and Weiner, op. cit.; Oye and Maxwell, op. cit.
32. Information is from interviews with Scott Sklar, president of Solar Energy Industries Association and Paul Maycock, president of PV Energy Systems, Virginia. Also see Shell International, op. cit., and various issues of the Solar Industry Journal.
33. Sources are Shell International, op. cit., and data supplied by Paul Maycock, PV Energy Systems, Virginia. Nevertheless, interest is growing rapidly in PV, and four new plants to produce PV panels were announced in 1996 (Solar Energy Industries Association, Press Release, April 24 1996). PV is currently viable for niche markets, such as distributed locations, particularly in LDCs, where it saves the cost of transmission lines.
34. Interview with Scott Sklar, Solar Energy Industries Association.
35. Romm and Curtis, op. cit..
36. See C. K. Prahalad and Gary Hamel, "The Core Competence of the Corporation," *Harvard Business Review*, 68 (May/June 1990): 79-93; George Stalk, Philip Evans, and Lawrence E. Shulman, "Competing on Capabilities: The New Rules of Corporate Strategy," *Harvard Business Review*, 70/2 (March/April 1992): 57-69
37. Information supplied by Paul Maycock, PV Energy Systems.
38. Cited in Sandra Rothenberg and James Maxwell "Industrial Response to the Banning of CFCs," Working Paper, MIT Sloan School of Management, 1995.
39. Elizabeth Cook of the World Resources Institute has attributed the relatively smooth phase-out of CFCs in the U.S. to the combination of a stiff tax, a flexible permit trading system, and a firm phase-out date. See Elizabeth Cook, *Marking a Milestone in Ozone Protection: Learning from the CFC Phase-Out* (Washington, D.C.: World Resources Institute, 1996).
40. Rothenberg and Maxwell, op. cit., explain the difference between the rapid reaction of the electronics industry and the slower response of the auto industry in terms of the different industry cultures, attitudes toward regulation, and technological progressiveness.
41. NRDC/Tellus Institute, *America's Energy Choices*, 1991, pp. 62-64.
42. Examples of the instrumentalist perspective include G. William Domhoff, *The Power Elite and the State: How Policy is Made in America* (New York, NY: Aldine de Gruyter, 1990) and Ralph Milliband, *The State in Capitalist Society* (New York, NY: Basic Books, 1969). The structuralist position is elaborated in Lindblom, op. cit., and Nicholas Poulantzas, *Political Power and Social Classes* (London: Verso, 1978).
43. A more comprehensive discussion of country interests can be found in Benedick, op. cit., Biswas, op. cit., Markus Jachtenfuchs, "The European Community and the Protection of the Ozone Layer," *Journal of Common Market Studies*, 28/3 (March 1990); Parson, op. cit.; Rowlands, op. cit.; Maxwell and Weiner, op. cit. Primary sources include various editions of ECO and Earth Negotiations Bulletin.
44. For more details on the differences between the European and U.S. positions, see Jachtenfuchs, op. cit.; Oye and Maxwell, op. cit.; Rowlands, op. cit.
45. Porter and Brown, op. cit., p. 76.

46. Michael Grubb, "The Greenhouse Effect: Negotiating Targets," *International Affairs*, 66/1 (1990): 67-89. Also, see Michael Jefferson "Carbon Dioxide Emissions 1990-1995," *World Energy Council Journal* (July 1996).
47. Rowlands, op. cit., p. 130.
48. Sonja A. Boehmer-Christiansen, "Britain and the International Panel on Climate Change: The Impacts of Scientific Advice on Global Warming part II: The Domestic Story of the British Response to Climate Change," *Environmental Politics*, 4/2 (1995): 175-196.
49. These industries are concentrated and politically powerful. U.S. industry has sent the largest contingent of lobbyists and observers to the U.N. negotiations, numbering around 35 to 40 people at each major session.
50. Lester Brown et al., *State of the World 1996* (New York, NY: Norton/Worldwatch Institute, 1996), p. 30
51. Statement by Timothy E. Wirth, Undersecretary for Global Affairs, on behalf of the United States of America, at Convention on Climate Change, Second Conference of the Parties, July 17, 1996 (Geneva, Switzerland: United States Mission, Office of Public Affairs).