

**International Environmental
Agreements and Global Public
Goods**

Economics of IEAs

Recall the
Prisoners'
Dilemma game:

[Pollute, pollute] is
a Nash
equilibrium. It is a
dominant
strategy for
country i to
pollute.

		Abate	Pollute
i	Abate	1,1	-1,2
	Pollute	2,-1	0,0

Neither player could do better by deviating from this strategy.

Economics of IEAs

- How do we achieve full cooperation?
- Fines – but no international court...The policy challenge is to design self-enforcing agreements.
- Side payments (but polluter pays principle?)
- Can sometimes transform a PD into a self-enforcing coordination game by trade sanctions, or by requiring countries to adopt technology standards.

If the game is repeated, then can obtain full cooperation from

-trigger strategy (non-cooperate forever if other pollutes)

-tit-for-tat strategy (non-cooperate for one period if other pollutes)

Can change the above PD by adding a payment of a fine of 2 to the other country if a country chooses “pollute” when the other country chooses “abate”. Nash equilibrium is now [abate, abate]. But it requires third-party enforcement.

Limited possibilities for side-payments: cannot make everyone gain, but can make free-riding costly.

In some cases, it is only a matter of coordination (symmetric, but multiple equilibria):

If the pure coordination game below was played sequentially then [abate,abate] is the only outcome.

2,2	-1,1
1,-1	0,0

Economics of IEAs

- Basically, IEAs transform the game by restructuring the choices:
 1. Sign or not.
 2. Signatory parties make a joint decision on whether to abate or pollute.
 3. Non-signatories make an independent choice of whether to abate or pollute.

One type of EIAs: Convention followed by protocols which specify binding emission reductions. Example:

United Nations' Convention on Long-Range Transboundary Air Pollution 1979

1985 Helsinki Protocol (30% club)

1988 Sofia Protocol (reduction objectives for NO_x emissions)

1994 Oslo Protocol (SO₂ emission reductions according to critical loads)

1998 Heavy metals and persistent organic pollutants

2001 Stockholm Convention on Persistent Organic Pollutants (wider coverage than in 1998)

Science and uncertainty: the example of the Montreal Protocol

- The ozone layer absorbs ultraviolet radiation in the upper part of the atmosphere (the stratosphere).
- The scientific evidence of a link between chlorofluorocarbons (CFCs) and ozone layer destruction stems from 1974.
- The WMO/UNEP assessment (published in 1986) : accumulations of CFCs in the atmosphere had nearly doubled from 1975 and 1985.

Molina and Rowland (Nobel Prize in chemistry, UC)

The economics of CFCs

- In 1985, the U.S. accounted for 30% of world output of CFCs 11 and 12. Home of DuPont (25% of world production).
- The EU accounted for 45%.
- Other producers: Japan (11-12%), the Soviet Union (9-10%), Canada, China, Australia, Venezuela and India.

The negotiation process

- The Vienna Convention for the Protection of the Ozone Layer (March 1985): signed by 20 countries plus the European Commission.
- Negotiations began in December 1986.
- The Montreal Protocol was agreed upon in September 1987. Significant revisions took place in 1990 (London amendments).

In 1977: UNEP convened an International Conference on the Ozone Layer.

London 1990: Second meeting of the Parties.

By the start of the London negotiations 65 countries had signed the MP.

London amendments made India and China sign (burden-sharing).

The amendments increased the number of controlled substances from 8 to 20 (ten additional CFCs, methyl chloroform, and carbon tetrachloride)

The London amendments came into force August 1992.

Copenhagen amendments of 1992 came into force 1994: CFCs were to be phased out by 1996; number of controlled substances increased from 20 to 94 (including HCFCs, to be capped and phased out by 2030).

Vienna 1995: methyl bromide phase-out.

Montreal 1997: methyl bromide phase-out brought forward to 2005.

Beijing 1999: phase-out of bromochloromethane (95 controlled substances).

Basis of the Protocol

- Definitions of regulated chemicals.
- Basis: production plus imports, less exports (easy to measure, a proxy to consumption).
- Original commitment: cut production and consumption of CFCs by half of their 1986 levels by 1999.
- Ratification requirement: 11 signatories, making up 2/3 of consumption (minimum participation clause).

ODS: not only CFCs but also halons, CT (carbon tetrachloride) and MT (methyl chloroform), HCFCs. A basket of chemicals, each weighted by its ozone-depleting potential.

The original MP encompassed 5 CFCs and 3 halons.

Stabilize the use of certain halons at their 1986 level.

Can adjust the levels of reductions by two-third majority vote.

Minimum participation clause: necessary to reduce free-riding incentives (show prisoners' dilemma game).

Why did some countries sign the MP? What were the economic benefits and costs? Compare cooperative versus non-cooperative outcome.

Benefits: avoided deaths from increased incidence of skin cancer.

Costs: depends on available substitutes.

Turns out accession was a dominant strategy for US and European countries.

Burden-sharing

- Article 5 of the Montreal Protocol allowed a 10-year grace period for low-income countries.
- Developing countries demanded a multilateral trust fund to meet all incremental costs to developing countries (London revisions 1990).
- The Multilateral Fund for the Implementation of the Montreal Protocol (January 1993): finance investment to phase out ODS, promote the transfer of alternative technologies.

Countries with less than 0.3 kg/capita were allowed to continue use.

Currently, 129 out of 185 parties qualify for help under the Multilateral Fund which finances the incremental costs of developing technology.

Trade leakage

- Global emissions may not fall by as much as the actual emission reduction by the parties to the Protocol, if emissions are delocalized to non-parties (production relocation effect).
- Could envisage border tax adjustments (WTO compatibility?).
- Issue linkage can help prevent leakage:
 - cooperation on R&D
 - development assistance

Leakage is only a problem if participation is incomplete.

In theory, trade leakage could be either positive or (negative) –depends on whether pollution abatement is a strategic substitute or (complement).

The Montreal Protocol does not limit R&D transfers to non-parties, but the trade sanctions on import and exports of controlled substances have proven effective.

Compliance – trade sanctions

- Ban on imports of ODS from non-parties to the Montreal Protocol.
- No party should export any controlled substance to a non-party (Article 4 : Control of Trade with Non-parties).
- Parties should ban import of *products containing ODS*.
- If feasible, ban imports of *products produced with ODS* from non-parties.
- Article 8: Non-compliance measures to be developed.

Article 8: Non-compliance (not specified in Montreal), but trade sanctions were there from the start.

WTO: discriminates non-Parties versus Parties. (violates the Most Favored Nation Principle)

Border tax adjustments not allowed based on production processes or methods, although the GATT Article XX allowed restrictions of trade to protect human, animal or plant life. Recall dolphins versus tuna case.

Failure?

- Can argue that the Montreal Protocol did little compared to the non-cooperative outcome (Murdoch and Sandler, 1996)...
- ...but the Protocol has been revised continuously and now implies larger and faster reductions in ODS compared to the 1987 treaty.

Environmental effectiveness: ODSs in the atmosphere peaked in 1994 and is decreasing. By around 2050 the stratospheric concentration of ozone is expected to have returned to its “natural” pre-1980 level.

Multilateral cooperation catching up with unilateral initiatives?

By 1990, the 20% reduction in CFCs required by the Montreal Protocol for 1993 had already been met by virtually all industrialized countries. Some announced they would make further cuts unilaterally.

It was in the U.S. self-interest to sign the Montreal Protocol.

Political economy arguments: Dupont was ahead of its competitors in the development of CFC substitutes. Its announcement in March 1988 of a unilateral production stop accelerated the negotiations.

Learning over time.

One measure of success is that the Montreal Protocol was negotiated under scientific uncertainty (the ozone hole was considered a special case at the time).

Or Success?

- Problems:
 - Trade leakage
Definition: Production of ODS might shift to non-parties. (Article 4 of the Protocol intended to prevent this by controlling trade with non-parties.)
 - Assure participation of developing nations.
(London Amendments in 1990 created a multilateral fund to finance technology transfers.)

If leakage is severe enough, all the Protocol would do would be to shift production around and the environmental benefit would be insignificant. This is not an issue now since the Montreal Protocol basically has full participation.

The fear of trade leakage made the parties incorporate trade sanctions into the Protocol, and they have been proven effective to obtain virtually full participation in the Protocol.

Burden-sharing was dealt with in several ways: ten-year delay for developing nations in phasing out controlled substances. Funding of incremental costs of adoption of substitute technology. Ultimately, parties perceived the burden-sharing as fair after the London Amendments.

Bibliography

- Richard Benedick. *Ozone Diplomacy: New Directions in Safeguarding the Planet*. Harvard University Press: 1991, 1998.
- Scott Barrett. *Environment and Statecraft: The Strategy of Environmental Treaty-Making*. Oxford University Press: 2003.
- J. Murdoch and T. Sandler. "The Voluntary Provision of a Pure Public Good: The Case of Reduced CFC Emissions and the Montreal Protocol". *Journal of Public Economics*, 63: 331-349.