ETH
Eidgenössische Technische Hochschule Zürich
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IED
Institut für Umweltentscheidungen
Institute for Environmental Decision

The Economics of Climate Change

Lecture 13: Repetition and mock exam

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1. Concepts

a) In economics, what do we mean by "externality"?

- "An externality is present whenever some individual's utility or production relationships include real. . . variables, whose values are chosen by others. . . without particular attention to the effects on that person's welfare." (Baumol and Oates, 1988)
- Costs/Benefits of externalities are not borne by decision makers so therefore not taken into account when decisions are made. (allocatively inefficient)

1. Concepts

b) What is a public good?

- A public good is:
  - **Non-Rivalrous:** when an agent's consumption of the good is at the expense of another's consumption
  - **Non-Excludable:** when agents can be prevented from consuming the good.

- Sum of individual distributions of the public good does not yield the social optimum

$$\underbrace{\max_{Q} \sum_{i=1}^{n} u(Q) - c(Q)}_{\text{Social Optimum over aggregate Q}} \neq \underbrace{\sum_{i=1}^{n} (\max_{q_i} [u_i(q_i + \sum_{k \neq i} (q_k^*)) - c_i(q_i)]}_{\text{Sum of individual net utilities from providing share } q_i}$$

$$\text{where } Q = \sum_i q_i$$

1. Concepts

c) Explain whether investment in greenhouse gas abatement is (or is not) a public good.

Solution in class

2. The economic incentives behind pollution abatement

a) Find the Nash equilibrium

A's payoff (first entry)	B's payoff (second entry)	
	Pollute	Abate
Pollute	(0,0)	(9,-1)
Abate	(4,4)	(5,1)

Solution concept:

What happens for each player if we assume the opponent's strategy to be at either «abate» or «pollute»?

You can identify «pollute» as the dominant strategy of player B and «abate» for A. The Nash equilibrium is «abate» for A and «pollute» for B.

2. The economic incentives behind pollution abatement

b) Find the Nash equilibrium

A's payoff (first entry)	B's payoff (second entry)	
	Pollute	Abate
Pollute	(3,3)	(12,2)
Abate	(2,12)	(11,11)

Solution concept:

Again, what happens for each player if we assume the opponent's strategy to be at either «abate» or «pollute»?

You can identify «pollute» as the dominant strategy of player B and «pollute» for A. The Nash equilibrium is hence «pollute» for A and «pollute» for B.

2. The economic incentives behind pollution abatement

c) Is this an example of a Prisoner's Dilemma? If so why?, if not, why not?

- Yes, this is a prisoners's dilemma. Both players' dominant strategies lead to an inefficient outcome, i.e. (3,3) instead of (11,11).
- Hence, the Nash equilibrium diverges from the social optimum

2. The economic incentives behind pollution abatement

d) In your view, which case (part (a) or (c)) represents the problem of climate change more accurately? Briefly state why.

- Solution in class

3. Optimal instrument choice

a) With relatively at marginal damages and steeper marginal abatement cost curves, is a price or a quantity regime preferable in the context of an environmental problem?

- If there is uncertainty about the marginal abatement costs (MAC) and the marginal damages (or marginal benefits from abatement, MB), price and quantity regulation is not equivalent any longer (see Weitzman, 1974).
- If MB curve is relatively flat and MAC curve is relatively steep: price instrument is more efficient. An error when fixing the price level will be less costly, than when fixing an emission level.
- If MB curve is relatively steep and MC curve is relatively flat: quantity instrument is more efficient. An error when fixing an emission level will be less costly, than when fixing a price level.

2. Optimal instrument choice

b) Would hence a harmonized global carbon tax be preferable to a global emissions trading system? Please, consider also issues of enforcement.

- According to Weitzman's theory, a global carbon tax should be preferred to a global emissions trading system. (Questioning a flat slope of the MD curve is another good answer.)
- However, states have sovereignty and therefore might undermine the effect of a global carbon tax by either
  - reducing fees that indirectly tax carbon (e.g. fuel levies) or by
  - subsidizing carbon intense production processes (e.g. coal subsidy).
- Undermining the effect of a global carbon tax by reducing the effective tax rate is known as ‘fiscal cushioning'.

3. Optimal instrument choice

b) Would hence a harmonized global carbon tax be preferable to a global emissions trading system? Please, consider also issues of enforcement. (ctd.)

- Fiscal cushioning hence reduces the environmental effectiveness of a global carbon tax.
- The enforcement of a quantity-based instrument such as a global emissions trading system is stricter than that of a global carbon tax.
- Given the problem of fiscal cushioning, a global emissions trading system would be more effective.

3. Optimal instrument choice

c) Now let us consider a country that has implemented an emissions trading system. What arguments can support the introduction of an additional subsidy on research and development (R&D) in the field of abatement technologies?

- One policy instrument for each policy objective is always better (Tinbergen rule).
- If there are multiple policy goals, multiple instruments can be justified
- In case of climate change mitigation, policy goals other than CO2 emissions abatement are, for example, enhancing energy efficiency, increasing energy security, spurring innovation in abatement technologies, promoting technology adoption.

3. Optimal instrument choice

c) Now let us consider a country that has implemented an emissions trading system. What arguments can support the introduction of an additional subsidy on research and development (R&D) in the field of abatement technologies?

- An additional subsidy on research and development in the field of abatement technologies can thus be useful to increase innovation beyond the incentives from the ETS (especially if there are knowledge-spillovers that lead to an underinvestment in R&D on the part of private investors).

4. Economics of the Clean Development Mechanism

Is Switzerland's decision to restrict the use of CDM certficates in the years to come economically sound? Discuss advantages and disadvantages from an economic perspective.

- Arguments in favor of a restriction:
  - Emission reductions within Switzerland incentivize technological innovation.
  - Emission reductions within Switzerland potentially create local employment and economic growth.
  - The local industry may gain from the so-called ‘first-mover advantage', if Swiss technologies are adopted in other countries.
  - Domestic Emission reductions can be verified and monitored more easily, compared to emission reductions abroad.

4. Economics of the Clean Development Mechanism

Is Switzerland's decision to restrict the use of CDM certficates in the years to come economically sound? Discuss advantages and disadvantages from an economic perspective.

- Arguments against a restriction:
  - Emission reductions abroad minimize the overall abatement costs as marginal abatement costs abroad might be lower (especially in developing countries and countries in transition).
  - Reduced opportunities for technology transfer to developing countries and countries in transition.
  - Reduced incentive for developing countries and countries in transition to engage in climate change abatement.

5. Voluntary approaches

a) **What are the two main motivations for companies to engage in voluntary measures for climate change mitigation?**

a) **Under what circumstances are voluntary measures of private companies preferable to mandatory regulation?**

a) **Why do economists still argue for mandatory regulation?**

Solution in class
Learnings from the previous lecture?

Questions about the exam?

- Closed-book, written exam
- Time limit 90 minutes
- Exam date:
  - Wednesday, 04.02.2015, 09:00-10:30
- Room to be determined