

Lecture 12: The optimal point of instrument application

- Purpose
 - ▶ show under what conditions various instruments are suitable (advantages and disadvantages with the instruments)
 - ▶ present a theoretical frame for choice of instruments (OPIA)

Eirik Romstad

School of Economics and Business
Norwegian University of Life Sciences
<http://www.nmbu.no/hh/>



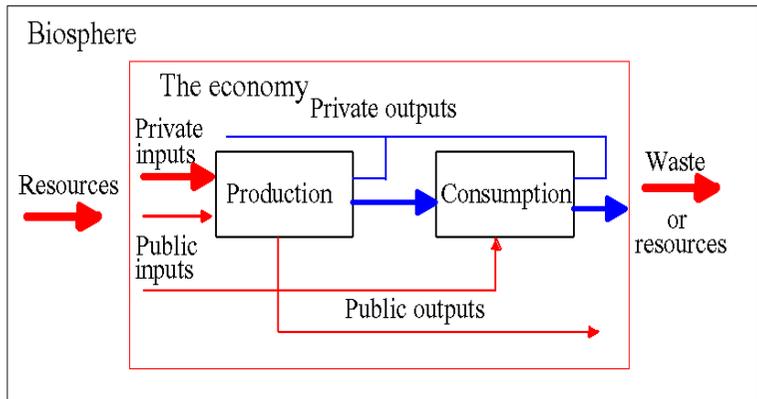
1:18

Outline

- Interactions the environment - the economy
- Tradeoff TC and overall instrument performance
- Evaluation of various instruments - principal dividing line
 - ▶ environmental performance based (ambient policies)
 - ▶ emission based
 - ▶ process based
 - ▶ input factor based
- Optimal Point of Instrument Application (OPIA)
 - ▶ a principal frame for the choice of instruments
- Linkages to contracts, monitoring and enforcement

2:18

Environment and economy linkages



Regulation can take place on resource extraction, (internal) processes (production and consumption) or on waste (emissions)

3:18

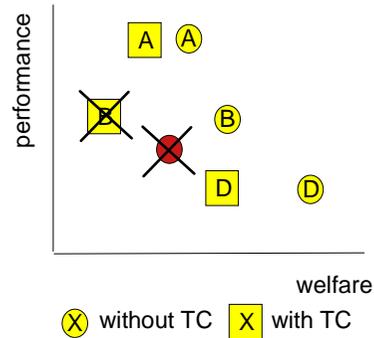
Instrument performance

- **Physical instr.perf.** : how well does it solve the environmental problem it is aimed at solving
- **Economic instr.perf.** : necessary RAM criteria
 - participation constraint
 - informational viability
 - incentive compatibility
- **Regulations directed to the problem preferred:**
 - technological progress ⇒ regulation aimed at mandating process control likely to become obsolete
 - incentives for solving the problem
 - match between objective of regulation and instrument used ⇒ easier to understand for all parties

4:18

Transaction costs and performance

- TC are real and hence to be included in the social costs associated with an instrument
 - ▶ TC \Rightarrow reduction in welfare estimates while env. performance unchanged
- social costs $\uparrow \Rightarrow$ welfare \downarrow
- must trade off net economic welfare with environmental performance



Policy candidates

- without TC: A, B and D
- with TC: A and D

5:18

TC and 4 regulation categories (1)

- Ambient regulations:
 - ▶ directed towards the state of the environment
 - ▶ example: the concentration of a chemical is not to exceed x parts pr. mill in a lake, i.e., the lake's self cleaning capacity is taken into account when formulating the regulation
- Emission regulations:
 - ▶ directed towards the rate of emissions or total emissions in a given time period
- Remark: the difference between ambient and emission regulations is somewhat subtle, spec. if focus is on optimal emission level

6:18

... TC and 4 regulation categories (2)

- Process based regulations
 - ▶ old/naive: certain technological processes are to be used to control emissions
 - ▶ modern: firms must document they have suitable control routines in place, i.e., parallel to the literature on quality controls
- Input based regulations
 - ▶ the use of production factors that are linked to the environment is regulated
 - quantity applied
 - timing of application and quantity applied
 - ▶ example: pesticides or fertilizer use in agriculture

7:18

Emission and ambient policies (1)

- Ambient regulations attractive from an environmental perspective as the focus is directly on environmental quality
- Issues with ambient regulations
 - ▶ polluters are held responsible/liable for factors that they may be unable to control ⇒ fairness issue?
 - ▶ example: the environmental impact of emissions in lakes and rivers may depend on the firm uncontrollable factors temperature, water flow, etc.
 - ▶ lack of control on ambient results ⇒ risk to firms
 - + firms forced to make risk calculations
 - what if firms' risk preferences deviate from those of society ?

8:18

... emission and ambient policies (2)

- Emission regulations can be tailored to capture many of the elements from ambient regulations
 - ▶ detailed specification of emission rates over time
 - ▶ problem: adds extra costs
 - easy to see in an emission TP framework where multiple detailed constraints at best adds costs
 - if costs don't increase, constraint not binding
- Transaction costs usually perceived to be higher for ambient regs than emission regs
 - ▶ ... but possibly lower for ambient regulations in some cases -- f.ex. small and multiple emission sources
 - ▶ ambient regs. problematic in terms of liability

9:18

Process and input based policies (1)

- High TC on emissions regulation \Rightarrow emission externalities may be Pareto irrelevant
 - ▶ Welfare gains by regulations with less TC?
- Process based policies
 - ▶ provide incentives (subsidies?) for firms to adopt the "best available technology" (BAT)
 - BAT firms have lower emissions than old tech. firms -- it suffices to check that BAT is operated properly (self reporting with random checks)
 - ▶ BAT works well if emissions are heterogenous or multi-compound
 - ▶ facilitates "zero emissions" \Rightarrow beneficial for toxic releases or in particularly sensitive areas

10:18

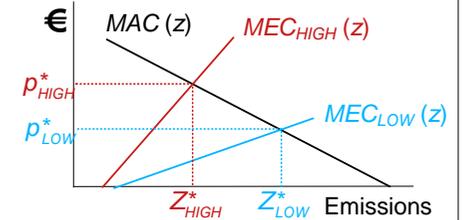
... process and input based policies (2)

- Input based policies (ex. fertilizer tax)
 - ▶ particularly beneficial if
 - there is a strong linkage between emissions and input factor use
 - emissions are homogenous
- Difficulties with process/input regs vis-a-vis emission based instruments
 - ▶ removes the direct incentives of reducing emissions that follows directly by emission based regs.
 - ▶ process based: may create technological lock-in
 - ▶ input based: black market/smuggling of the regulated (high value/low volume/weight) input

11:18

Heterogenous emissions

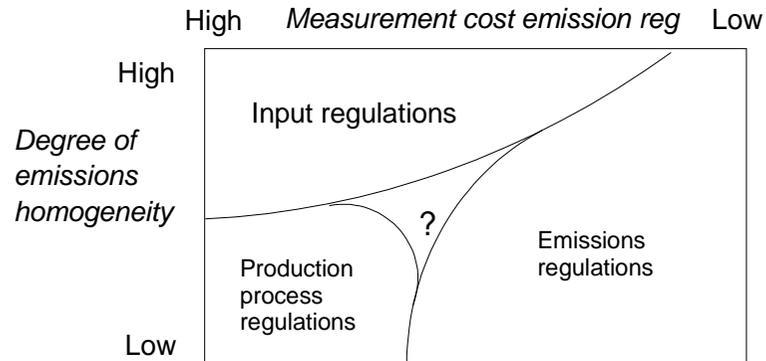
- Emissions with
 - ▶ multiple compounds
 - ▶ location specific MECs
- Input regulations
 - ▶ max "price" difference between locations is transport costs
- Process based regulations
 - ▶ may be difficult to use if one reducing emissions of one emission compound makes it very costly to reduce other compounds
 - ▶ ... but many modern processes are "zero emission"
 - ▶ payments for adopting BAT can be regionally differentiated



12:18

OPIA (1)

- **O**ptimal **p**oint of **i**nstrument **a**pplication (OPIA): a concept for what type of regulations to use under various settings



13:18

... OPIA (2)

- TC may change over time with technological progress \Rightarrow boundaries between types of regs do not stay fixed
 - ▶ ex. GIS in terms of management of issues that are linked to geographical location
- Severity of problem may mandate some types of regulations over others
 - ▶ Weitzman "Prices vs. Quantities" makes this distinction for emission based regulations
 - ▶ price instruments generally weaker than quantity or process based instruments

14:18

Contracts, monitoring & enforcement (1)

- TCs can be reduced
 - ▶ good design for monitoring & enforcement important
 - ▶ example: testing of well drinking water (Henken and Ready, AJAE 1999)
- General principle:
 - ▶ test where the marginal value of information equals the marginal cost of monitoring
 - in border line cases
 - in "high value locations"
 - for very toxic substances

15:18

... contracts, monitoring & enforcem. (2)

- Contracts (lecture 9)
 - ▶ contract terms and transaction costs
 - compare contract prices with varying degrees of "burden of proof"
- Monitoring and enforcement (lecture 8)
 - ▶ self reporting when monitoring individual polluters is costly
 - consistency individual self reports and aggregate measurements
 - false self reports more severely punished (fraud: action to conceal/hide violations)

16:18

Summary

- Much of the TCs related to monitoring and enforcement of regulations
 - ▶ expected marginal value of M&E = expected marginal costs of M&E
- TCs differ among types of regulations
 - ⇒ TC of various regulations may affect what is optimal to do
 - ▶ OPIA as a framing tool
- TCs may change over time
 - ▶ technological progress may reduce TCs of regulations substantially

17:18

Concept questions

- Applying OPIA
 - ▶ sea based aquaculture
 - ▶ land based aquaculture
 - ▶ moving sources (cars)
- Contracts and OPIA :: contract price vs. "burden of proof" - what to expect
 - ▶ general principles (policy guide)
 - ▶ examples
 - location fixed emission sites
 - moveable emission sources
 - location of emissions do not matter

18:18