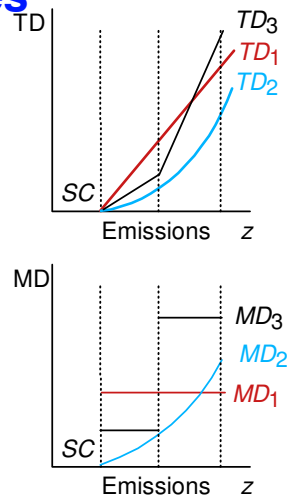
Lecture 2:
Market failures and env. damages

- Objectives
  - repeat some basic concepts
  - explain environmental damages
  - set market failures in a rival - non-rival / exclusive - non-exclusive framework
  - systemize basic concepts

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

Environmental damages

- Total damages: $TD(z)$
- Self cleaning capacity: SC
- Marginal damages: $MD(z)$
- Damage scenarios:
  1. Linear damages
  2. Convex (std.) damages
  3. Kinked damages
- Physical units $MD(z)$ → Monetary units $MEC(z)$
  a monotonic transformation



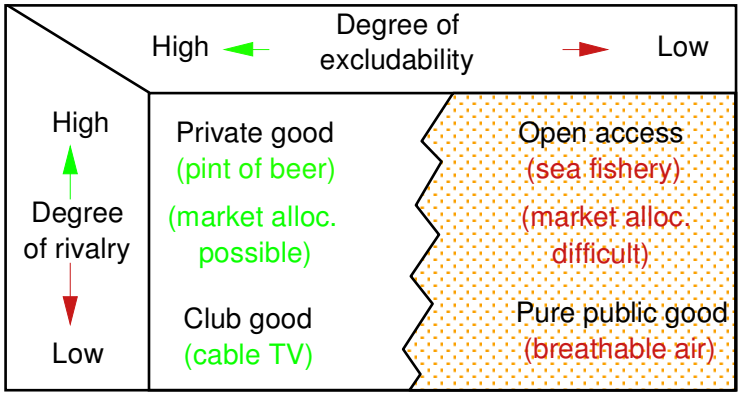
Public goods and bads (1)

- Excludability
  - To be able to use prices to allocate a good, it is necessary that consumers do not consume the good unless an appropriate price has been paid
  - Definition :
    A *good is excludable* if it is feasible and practical to selectively allow consumers to consume the good.
    A *bad is excludable* if it is feasible and practical to selectively allow consumers to avoid consumption of the bad.

... public goods and bads (2)

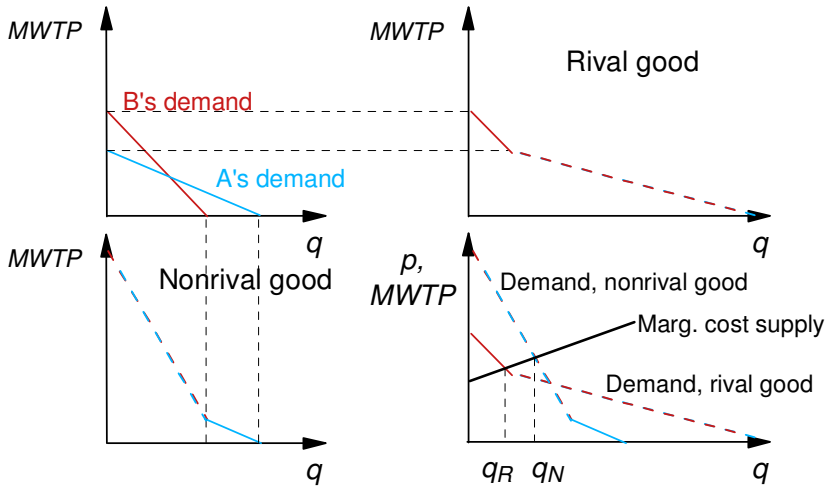
- Rivalry
  - a good is rival in consumption if the act of consumption reduces the amount of the good that is available to other
  - Definition :
    A *good* (*bad*) *is rival* if one person's consumption of a unit of the good (bad) reduces the amount of the good (bad) available to other consumers.
  - Corrolary :
    Rivalry of a good (bad) $\Rightarrow$ there is a positive (negative) social opportunity cost to others associated with consumption

... public goods and bads (3)

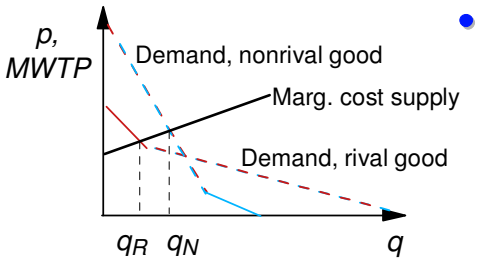


Note: other factors (like market power and cost structures) could also make allocation in the market difficult

Optimal public goods levels (1)



... optimal public goods levels (2)

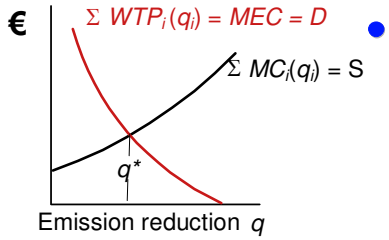


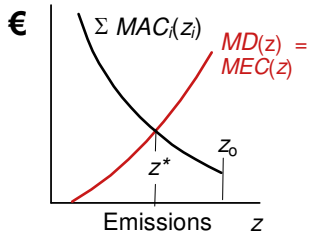
- Optimal emissions: $MEC(q) = \Sigma\ MAC_i(q_i)$
  - horizontal sum of ind. agents marg. abatement costs
  - vertical sum of ind. agents marg. damages
- Implications:
  - opt. amt. of nonrival goods could be non-zero for such high costs that the rival opt. amt. equal zero
  - opt. amt. of rival goods is generally higher at low costs than for nonrival goods

... optimal public goods levels (3)

- Private goods: have public prices
- Public goods: have private prices
  - private prices arise because of no-excludability
  - problems: free-riding, finding the demand for public goods
    - − valuation methods: contingent valuation / hedonic pricing method / travel cost method
  - Lindahl prices = everybody pays according to their marginal value
    - \+ produces right prices in theory
    - − no incentives to participate (best not to take part)

... optimal public goods levels (4)

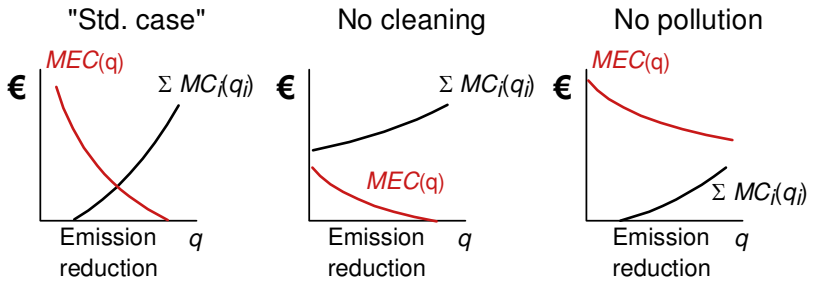




- Two perspectives:
  - "talk to economists": demand for environmental goods (like reduction in emiss, q)
  - "talk to natural scientists": marginal damages of emissions

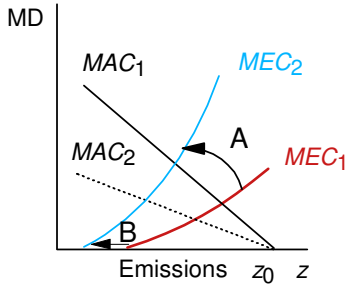
NOTE: $z_0 - z^* = q^*$

... optimal public goods levels (5)



The externality is pareto irellevant

... optimal public goods levels (6)



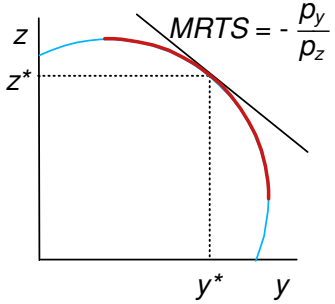
- Stock effects
  - A. MEC (MD) rotates counter clockwise
  - B. reduction in self cleaning capacity
- Importance of low marginal abatement costs, *MAC*
  - lower MAC leads to lower social opt. emission levels

It costs to produce pub.goods

- Assume no environmental regulations
  - the observed public good level would the be what maximizes firms' expected profits
  - suppose this public good level socially sub-optimal
- Constrained / unconstrained optimization
  - why firms/consumers oppose environmental regulations
- Emissions reductions can be viewed as a public good ⇒ emissions reductions below observed levels ⇒ costs ↑ / profits ↓

The tradeoffs (1)

- Standard profit function
  - $\pi = p_y y - C(y)$ (where y is the "good" output)
  - for any output, y, there is an adjoint level of a public good, z, in the absence of technology change
  - Let p_z be the unit price (payment) for the public good
- Revised profit function
  - $\pi = p_y y + p_z z - C(y,z)$



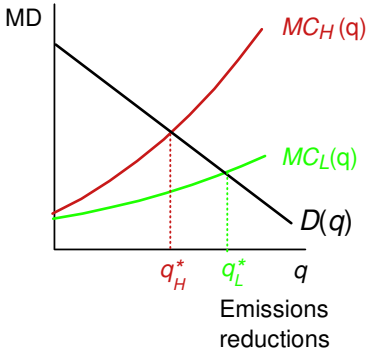
For a given level of costs there is a relationship between possible amounts of y and z, given by the production possibility set

... tradeoffs - simplified (2)

- For a given technology, a functional relationship (red segment) between y and $z \Rightarrow y(z)$
- Revised profit function (for given technology)
  - $\pi = p_y y + p_z z - C(y,z) = p_y y(z) + p_z z - C(y(z),z)$
  - containing one choice variable, z
- Simplifies the problem in terms of graphical analysis ⇒ gives tradeoff profits & provision level of the "public good" = opportunity cost of providing the public good

Low costs matter

- Suppose two cleaning technologies
  - High cost
  - Low cost
- Optimal emissions reductions are higher for the low cost than high cost technology
  - what are total costs
  - what are the marginal costs of cleaning at the two optima?



Summary

- The relationship total vs. marginal curves
- Framing environmental problems
  - to economists - supplying a cleaner environment: MEC as demand, MAC as supply
  - to nat.sci. - reducing emissions from a starting level (Zo)
- The optimal emission level
  - stock impacts
  - impact of choosing policies that give low MACs
- Public goods vs. private goods
  - excludability and rivalry in consumption
- Constrained optimization / opportunity costs