ECN 275/375 Environmental and natural resource economics 4: Pollution control – physical targets (ch. 5, Perman *et al.*)

Reading guide

- Sections 5.1-5.5: get the main picture
  - remark: Note the difference between stock pollution (accumulation of a pollutant into a receptor, f.ex. a waterway) and a flow pollutant (how much pollution is added per time unit – Section 5.5)
- Section 5.5 – static model of flow pollution (the basic model – very important)
  - focus on the discussions surrounding fig. 5.2 → the emission flow (M) that maximizes net benefits
  - Benefits of emissions $B(M)$: economic benefits of being able to pollute (= optimized economic activity)
  - Damages of emissions $D(M)$: economic damages – think of this as the cumulative willingness to pay from reducing damages from the current level ($\bar{M}$ in fig. 5.2).
  - Conduct the analysis on the margin (optimal emission M^* : $B'(M^*) = D'(M^*) \rightarrow$ shadow price μ^* for emissions constrained at M^*). M^* = emissions that maximize the distance between the total benefits and damage curves in the top panel of the figure)
    - Benefit side: $\frac{\partial B(M)}{\partial M} = B'(M) = MB(M)$
    - Damage side: $\frac{\partial D(M)}{\partial M} = D'(M) = MD(M)$
  - Fig. 5.3 extends the analysis
- Read sections 5.6-5.8.
  - Understand meaning of spatial effects (in simple terms: downstream vs. upstream)
- Skip 5.9 Stock pollutants/intertemporal analysis.
- Read sections 5.10-5.14 to get an overview.
  - Know what is the double dividend (sec. 5.13: double benefit for a pollution policy that brings in revenues to the government, and hence allows for reducing other distortionary taxes). Daily language: green taxation, green shift in taxation or tax switching

Outline "stuff on the board"

Physical damages + monotonic damage functions → economic damages. Differentiable in M → *marginal damages* $MD(M)$

Total abatement cost function → marginal damage function $MAC(M)$.

Leads to same picture as fig. 5.3 (the "natural science perspective")

The *economics perspective* to get supply and demand parallels – flip 5.3 left/right → MD-curve becomes demand for cleaning services $D(q)$, $MAC(M)$ becomes supply of cleaning services $MC(q)$, where $q^* = \bar{M} - M^*$. Figure drawn in class. Remark: be able to switch between perspectives (depending upon what is helpful to get the message across)

Exercises

Go to the exercises section on the course web page.

Discussion topics

1. It costs something for emissions M to be reduced from the current emission level, M_0. Why? (Hint: think of emissions as a negative externality – what would then be the effect on the existence of emissions?)
2. Suppose marginal damages of emissions are underestimated. What happens then to the perceived optimal emission level and costs, and how would you correct for this?