Chapter 5

The Economics of Environmental Quality

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Learning Objectives

1. Distinguish between positive and normative economics.
2. Define the marginal damage function and distinguish between four different shapes and what each means.
3. Distinguish between marginal and total damages and illustrate their derivation graphically.
4. Interpret the meaning of the marginal abatement curve and illustrate graphically the distinction between marginal and total costs of abatement.
5. Show graphically how to aggregate marginal abatement cost curves.
6. Explain the equimarginal principle and how it applies to marginal abatement costs.
7. Illustrate graphically the determination of a socially efficient level of pollution and how this equilibrium minimizes net social costs compared to no emission control.

Normative and Positive Statements

- A **normative statement** is one that expresses an option, what "ought to be"
- A **positive statement** is a study of facts, the actual events in the real world.

- The socially efficient level of emissions is a normative concept
- The actual target level of emissions and how much emissions need to be reduced to reach that target are positive concepts

LO1

Pollution Damages

- People have a WTP to avoid damages caused by pollution
- We examine the Marginal Damages – additional damage caused by additional units of pollution (or higher ambient concentrations)
- MD tend to rise exponentially
  - A little pollution causes little or no damage
  - A safe 'threshold' level of emissions without damages may exist
  - At higher concentrations, damages increase at an increasing rate
  - For some, highly toxic pollutants, any emissions may cause large damages

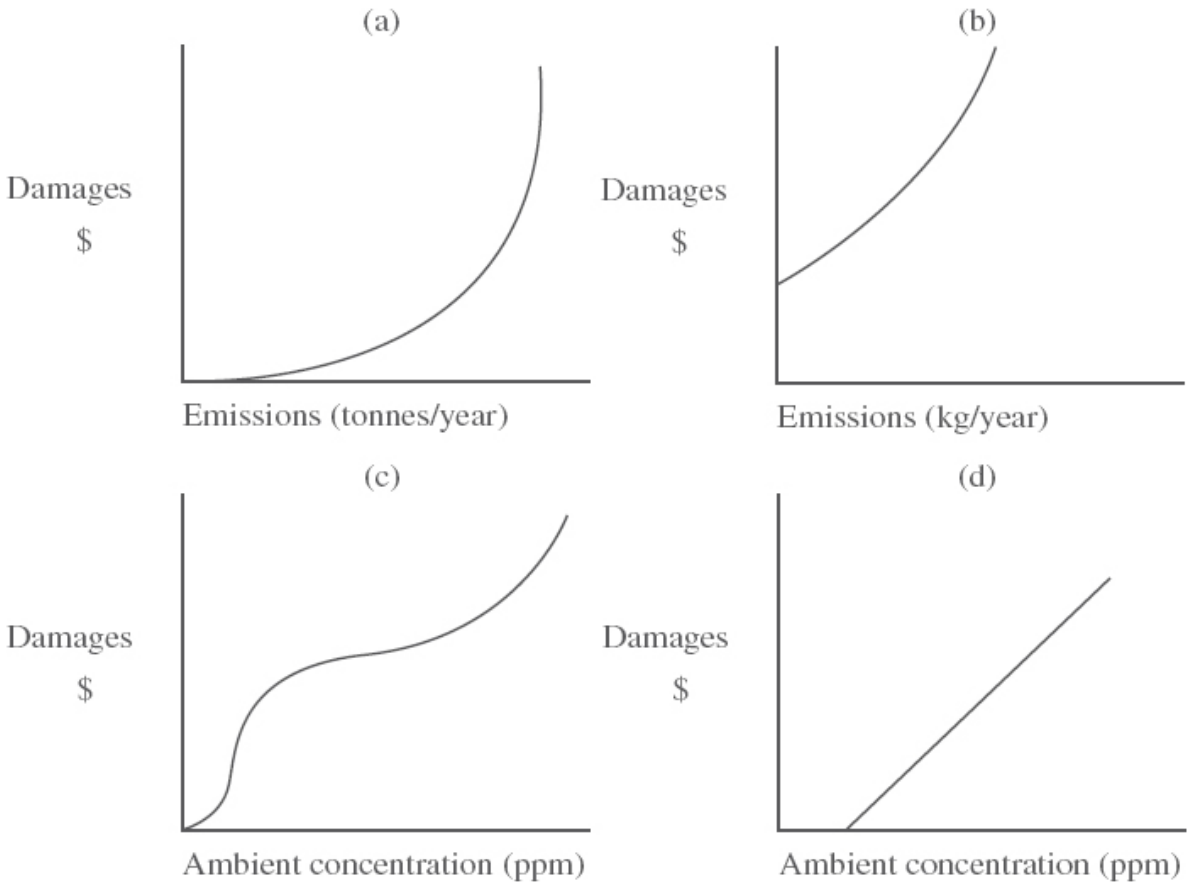
LO2

Marginal Damages: Explain Why?

- Location Matters
  - Damages may be higher in urban areas than rural areas
- Knowledge Matters
  - The more you know about the impacts of pollution, the more you are WTP to avoid it
- Tastes and Preferences Matter
  - If my child has asthma, I may be WTP more to reduce pollution
- Ability to Pay Matters
  - Pollution damages may be lower in low income areas

Representative Marginal Damage Functions

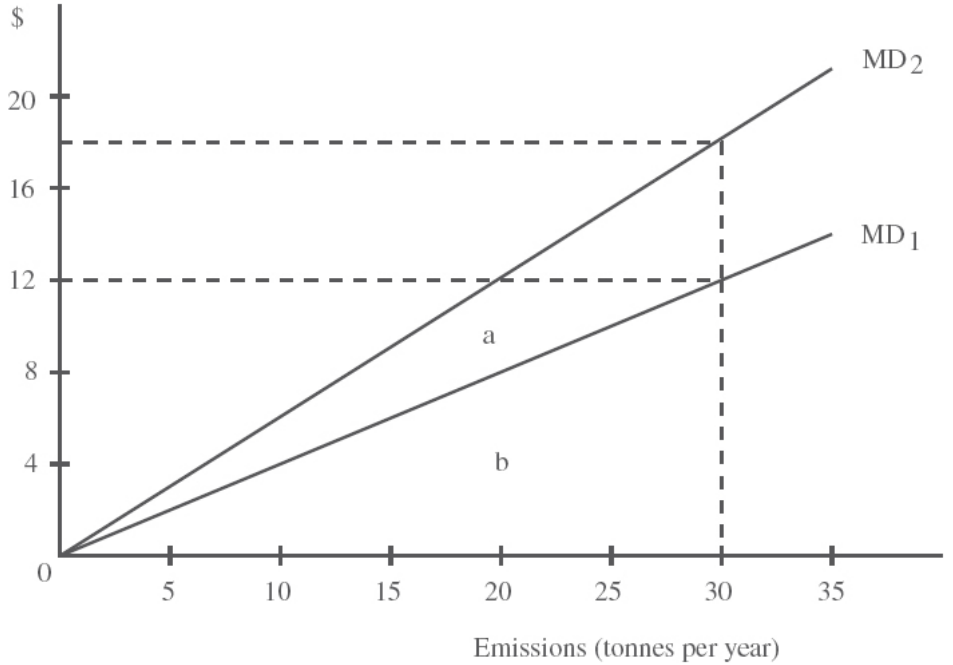
- Figure 5-1



LO2

Marginal versus Total Damages

- Figure 5-2

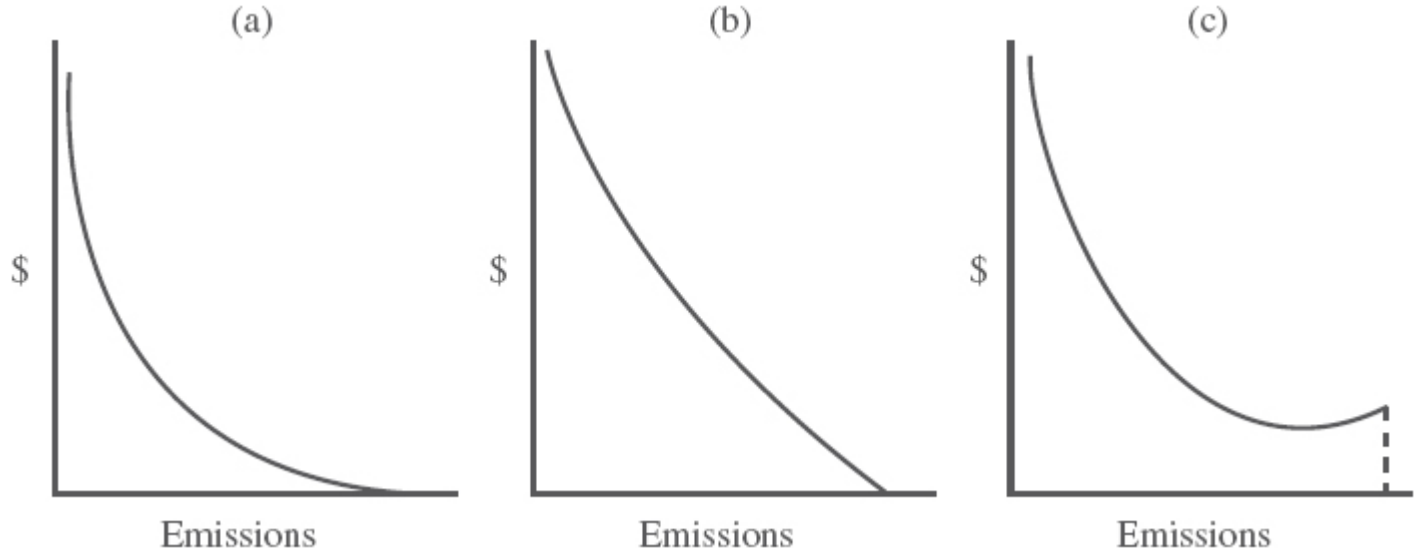


- Area b on the graph represents the Total Damages for curve MD1.
- Area a + b on the graph represents the Total Damages for curve MD2
- Which curve might represent an urban area and which might represent a rural area? Explain why.

LO3

Abatement Costs

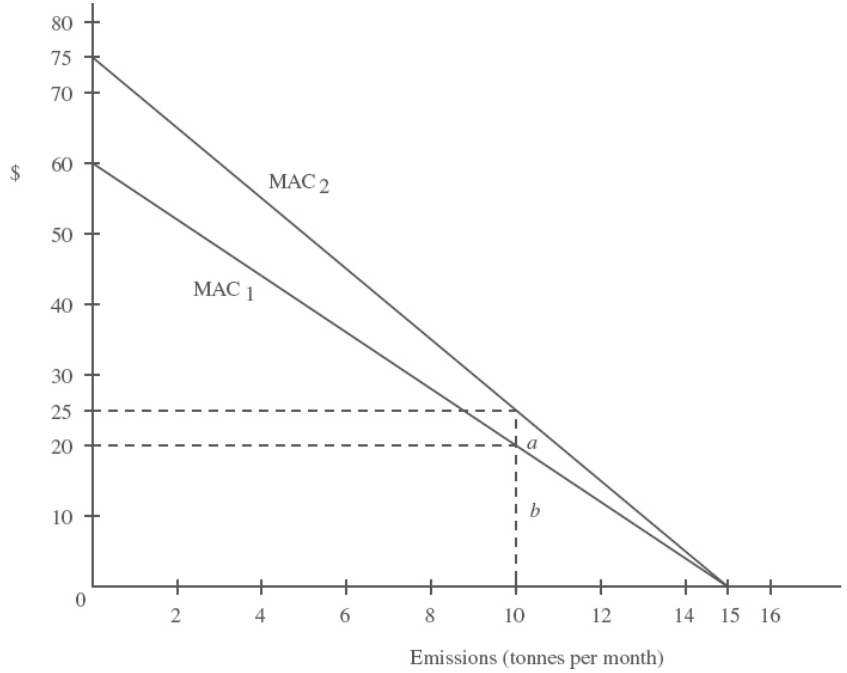
- The **Marginal Abatement Cost (MAC) Curve**
  - The cost of abating the next unit of emissions
  - Rises exponentially as the amount of emissions to be abated increases
  - The more pollution you abate, the higher the cost of abating the next unit of emissions because you have already abated the lowest cost units
  - Figure 5-3



LO4

Marginal versus Total Abatement Costs

- Figure 5-4

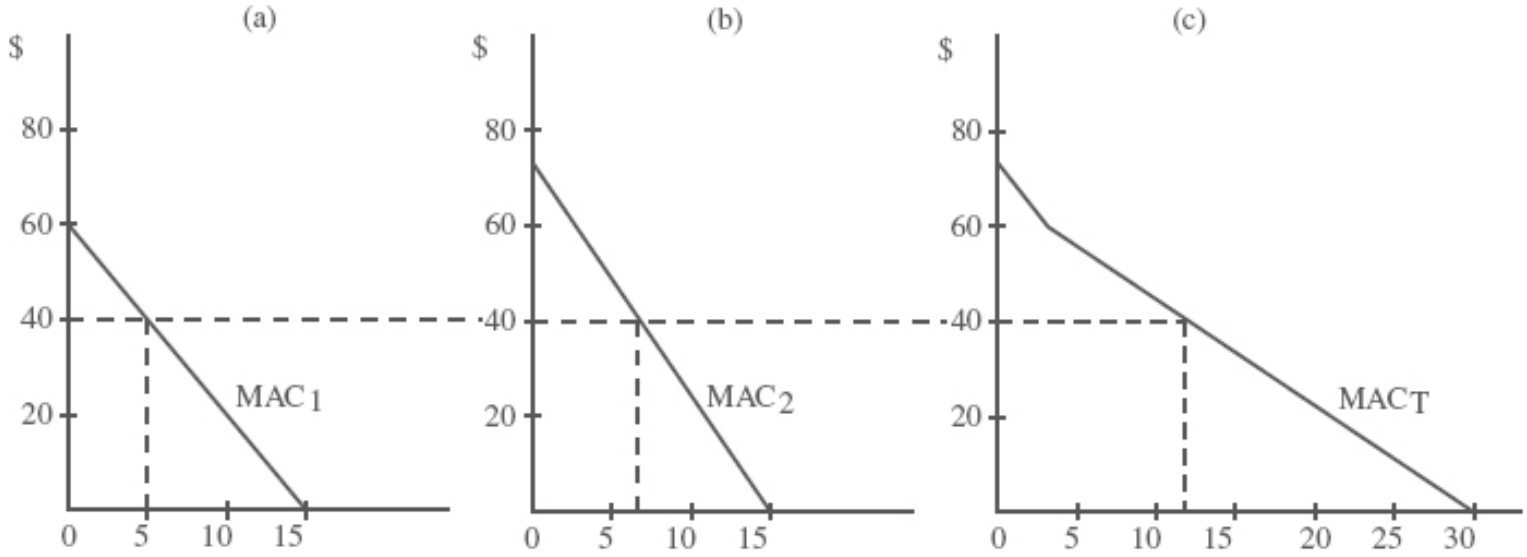


- The area under the Marginal Abatement Cost curve represents the Total Abatement Cost
- If technology to reduce abatement improves, the MAC curve will shift lower (MAC_1 versus MAC_2)

LO4

Aggregate Abatement Cost Functions

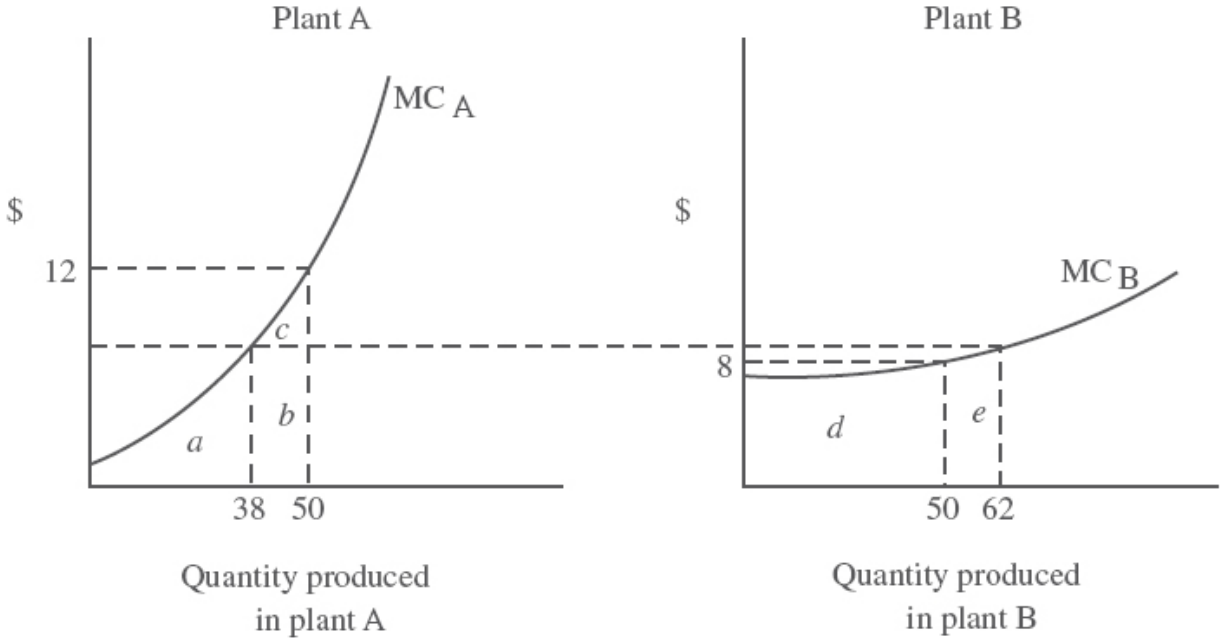
- To aggregate marginal abatement costs, individual functions must be added horizontally to yield the lowest possible aggregate abatement costs
- Figure 5-5



LO5

Equimarginal Principle

- Figure 5-6



- The equimarginal principle requires that the total production be distributed among sources so that their marginal cost of production are equalized

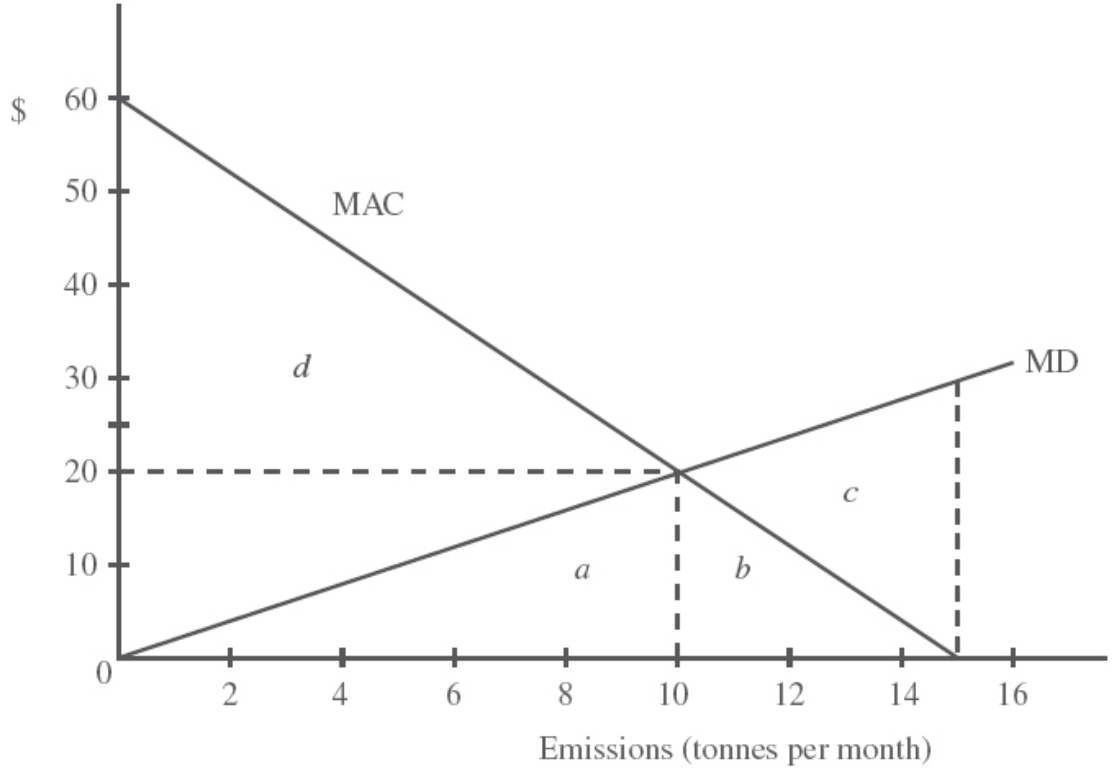
LO6

Equimarginal Principle

- An aggregate MAC function (such as for several firms or factories) will always represent the minimum MAC achievable
- The aggregate level of emissions will be distributed among different sources in a way that equalizes MAC
- Under the equimarginal principle, abate the cheapest unit of pollution first, no matter which factory emits it

The Socially Efficient Level of Emissions

- The socially efficient level of emissions is found where the MAC and the MD functions are equated
- Figure 5-7



LO6

Proving Social Efficiency yields the lowest social cost

- Total social costs (the total costs of damages (area b) plus the total costs of abatement (area a)) are minimized at the level of emissions where MAC=MD (At 10 units of emissions)
- If emissions levels are higher or lower than the efficient level, the sum of the total costs of damages plus the total costs of abatement is higher than at the efficient level
- For example, at 15 units of emission, total social costs equal total damages (a + b + c). There are no abatement costs at this point, but the damages to society are very high. Emissions that cause high damages can be abated at low cost, improving social welfare

LO6

Questions

- Explain why it is not in society's best interest to try to completely eliminate pollution.
- Many companies argue that money spent on pollution control costs jobs, which is bad for society. How would you counter this argument?
- Prove using a graph of MAC and MD that the efficient level of pollution has the lowest social costs of any level of pollution.

Chapter Overview

- This chapter focused on the trade off society faces between environmental damages and pollution abatement costs.
- Marginal damages are the harm caused by additional units of pollution, while marginal abatement costs are the cost of abating each unit of pollution.
- Total damages are and total abatement costs are represented by the areas under the marginal curves.
- Total social costs are the sum of total damages and total abatement costs for a given level of emissions.
- Total social costs are minimized when MD=MAC.