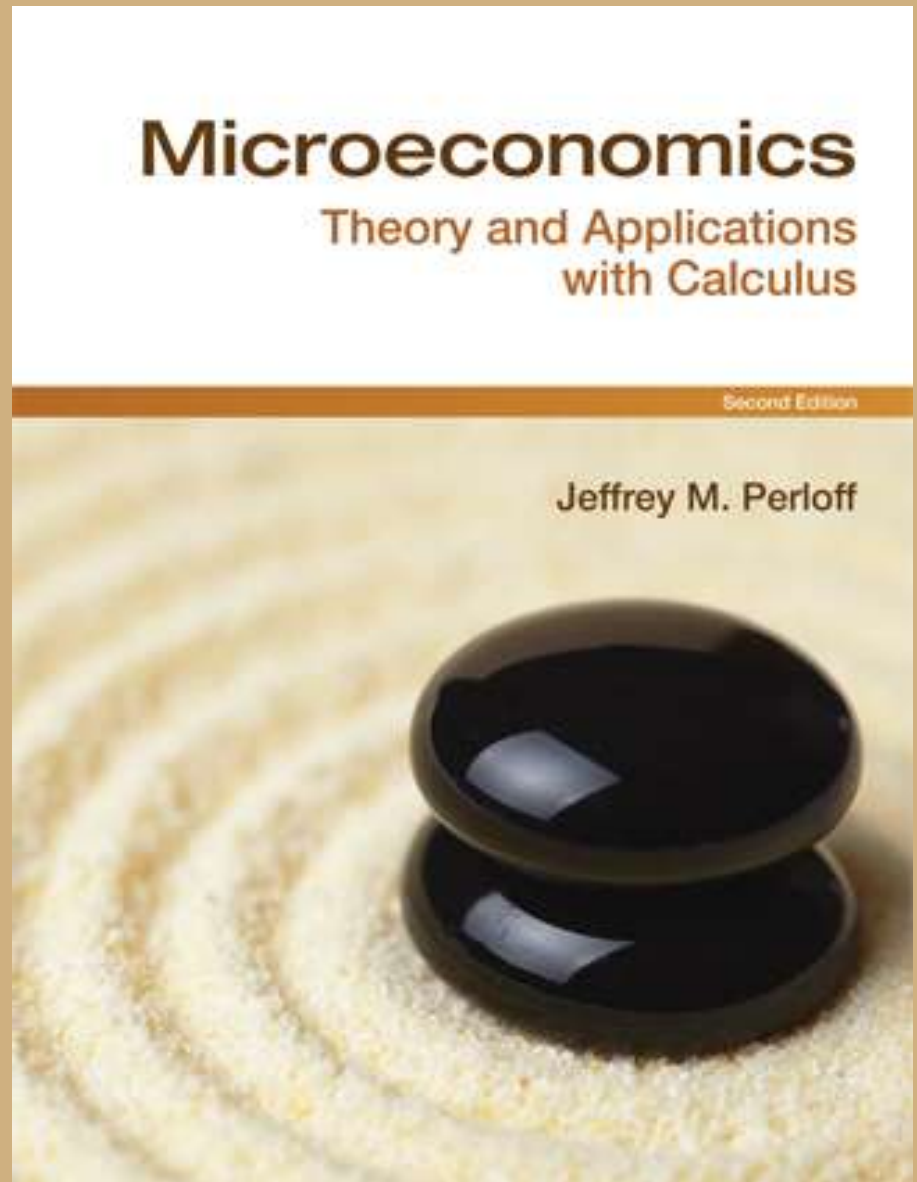


Chapter 17

Externalities, Open Access, and Public Goods

*There's so much pollution in the air now
that if it weren't for our lungs there'd be
no place to put it all.*

Robert Orben



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Chapter 17 Outline

- 17.1 Externalities
- 17.2 The Inefficiency of Competition with Externalities
- 17.3 Regulating Externalities
- 17.4 Market Structure and Externalities
- 17.5 Allocating Property Rights to Reduce Externalities
- 17.6 Open-Access Common Property
- 17.7 Public Goods

17.1 Externalities

- An ***externality*** occurs when a person's well-being or a firm's production capability is directly affected by the actions of other consumers or firms rather than indirectly through changes in prices.
- *Negative* externalities harm others
 - Example: a chemical plant pollutes and spoils a lake's beauty and safety for recreational use by others.
- *Positive* externalities help others
 - Example: a teacher gets a flu shot and reduces his students' probability of catching the flu.

17.2 The Inefficiency of Competition with Externalities

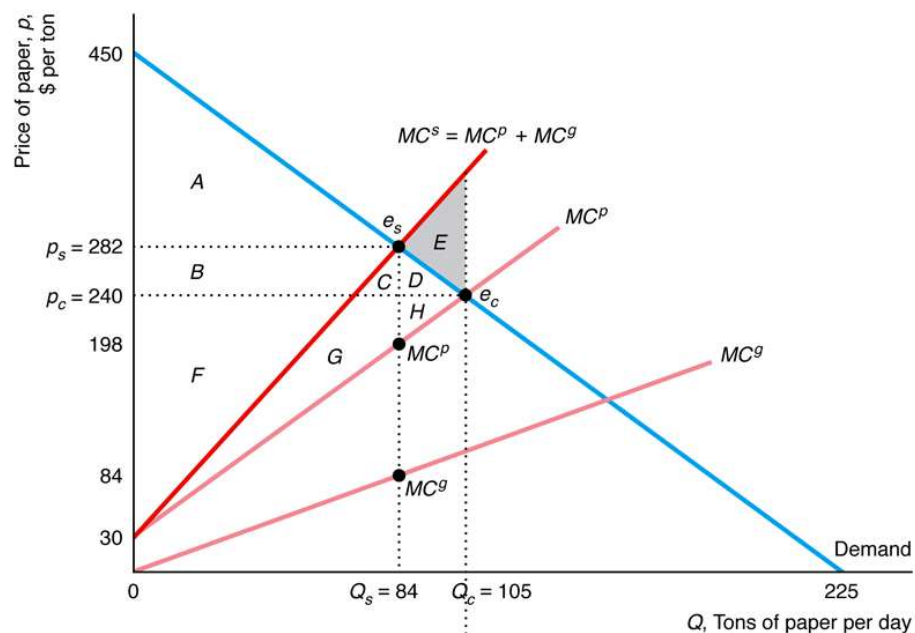
- Competitive firms and consumers do not have to pay for the harms of their negative externalities, so they create excessive amounts.
- Producers and individuals are not compensated for the benefits of a positive externality, so too little is produced.
- Nonoptimal production is the primary result of externalities.

17.2 The Inefficiency of Competition with Externalities

- Consider a paper mill that produces paper in a way that pollutes the air and water.
- The firm's **private cost** is the cost of production only (direct costs of labor, energy, and wood pulp), but not the indirect costs of the harm from pollution.
 - Intersection of private MC and market demand yields the competitive equilibrium.
- The firm's true **social cost** is the private cost **plus** the cost of harms from externalities.
 - Intersection of social MC and market demand yields the socially-optimal equilibrium.

17.2 The Inefficiency of Competition with Externalities

- The competitive equilibrium, e_c , excludes externalities and involves overproduction and DWL relative to the social optimum, e_s .



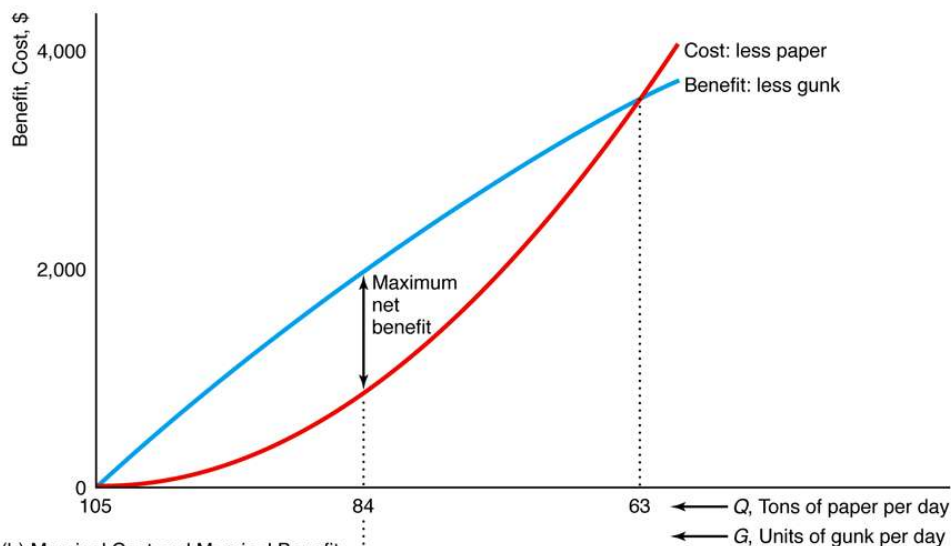
| | Social Optimum | Private | Change |
|---|----------------|-------------------|----------------|
| Consumer surplus, CS | A | A + B + C + D | B + C + D |
| Private producer surplus, PS_p | B + C + F + G | F + G + H | H - B - C |
| Externality cost, C_g | C + G | C + D + E + G + H | D + E + H |
| Social producer surplus, $PS_s = PS_p - C_g$ | B + F | F - C - D - E | -B - C - D - E |
| Welfare, $W = CS + PS_s$ | A + B + F | A + B + F - E | -E = DWL |

17.2 Cost-Benefit Analysis of Pollution

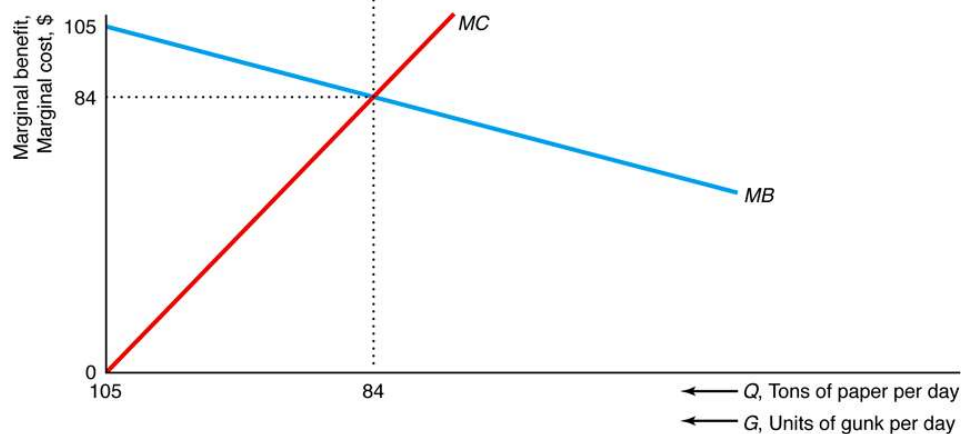
- If the amount of firm pollution, called gunk (G), can be reduced, what are the costs and benefits of this reduction?
 - H is the amount that gunk is reduced from the competitive level.
 - $B(H)$ is the benefit to society of reducing gunk by H
 - $C(H)$ is the cost to society of reducing gunk by H
 - Society wants to maximize welfare, $W = B(H) - C(H)$, by choosing H
- The socially optimal level of gunk is not zero; it is optimal for society to reduce pollution until the marginal benefit of further reduction is equal to the marginal cost.

17.2 Cost-Benefit Analysis of Pollution

(a) Cost and Benefit



(b) Marginal Cost and Marginal Benefit



17.3 Regulating Externalities

- Competitive markets produce too many negative externalities, so government intervention may provide social gain.
 - A governmental limit on the amount of pollution that may be released is called an ***emissions standard***.
 - A tax on air pollution is called an ***emissions fee***.
 - A tax on discharges into air or waterways is an ***effluent charge***.
 - The government can also control pollution indirectly through quantity restrictions or taxes on outputs or inputs.

17.3 Regulating Externalities with Emissions Standards

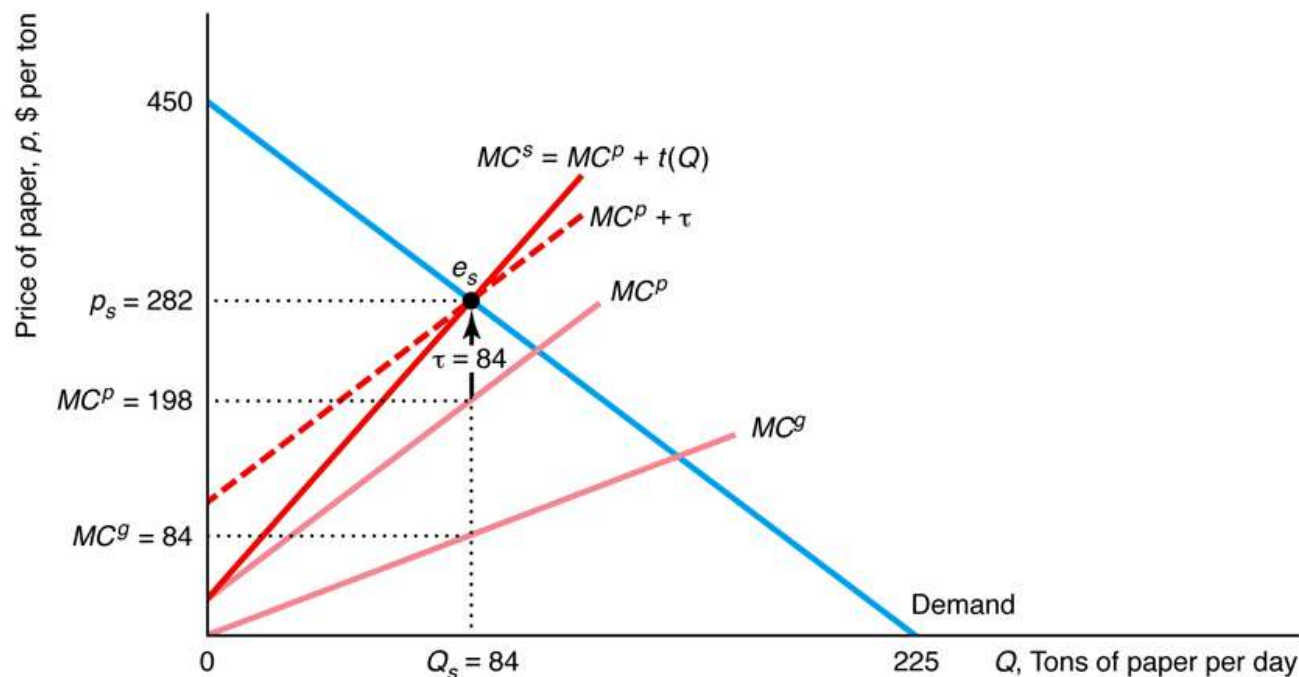
- How does the government achieve the social optimum using an **emissions standard**?
- The government doesn't usually know enough to set quantity restrictions on output optimally.
 - This would require knowledge of how marginal social cost, the demand for the product, and pollution vary with output.
- Even if the government knew enough to set optimal regulation, enforcement would still be difficult.

17.3 Regulating Externalities with Emissions Fees

- How does the government achieve the social optimum using an **emissions fee**?
- The government may impose costs on polluters by taxing their output or the amount of pollution produced.
- The output tax causes a firm to ***internalize the externality*** or bear the cost of the harm inflicted on others.

17.3 Regulating Externalities with Emissions Fees

- An emissions fee is a tax on output equal to MC of gunk so that after-tax MC induces socially-optimal behavior.

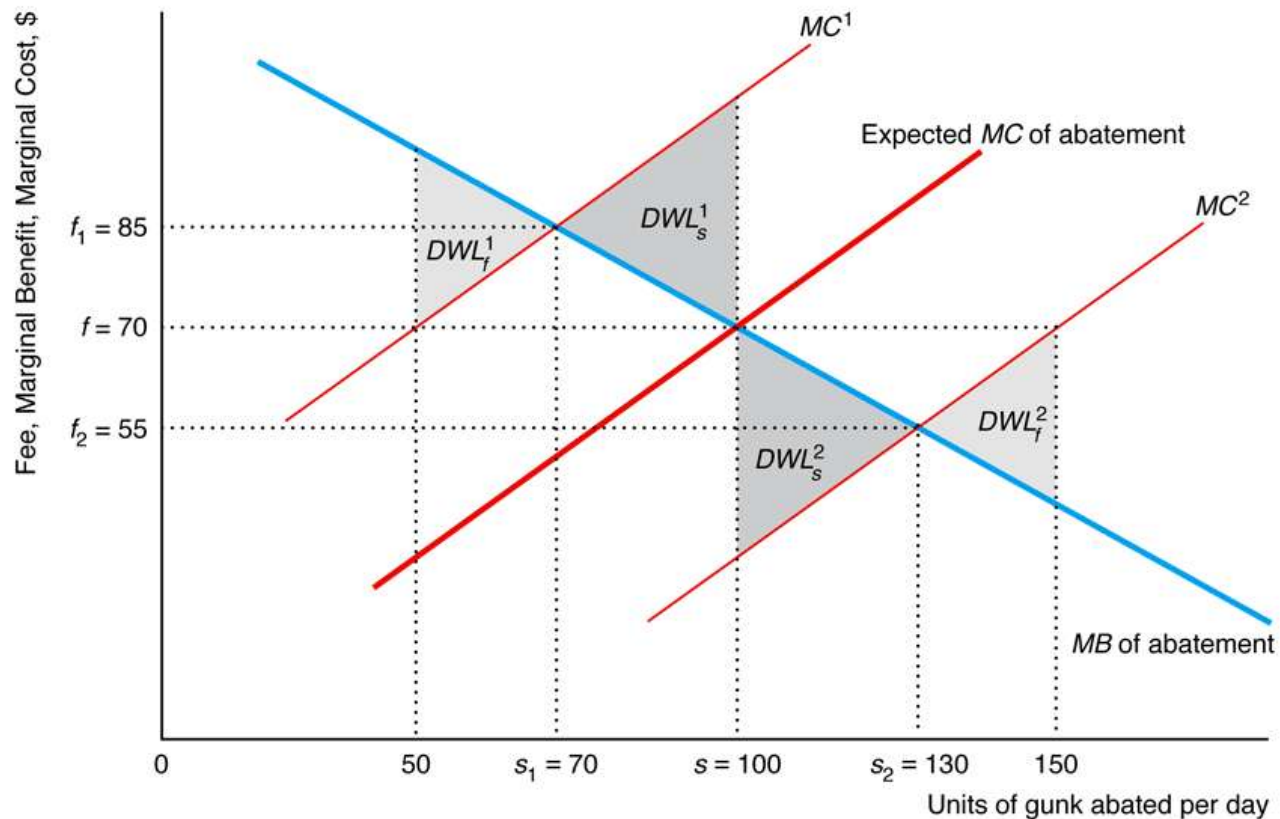


17.3 Regulating Externalities

- Is it better to tax emissions or set emissions standards?
 - Either has the power to induce socially-optimal behavior.
- If the government is uncertain about the cost of pollution abatement, welfare gains from government intervention depend on the shape of the *MB* and *MC* curves for abating pollution.
 - We assume the government knows the *MB* curve.

17.3 Regulating Externalities

- Using expected MC, an emissions fee generates less DWL than an emissions standard.

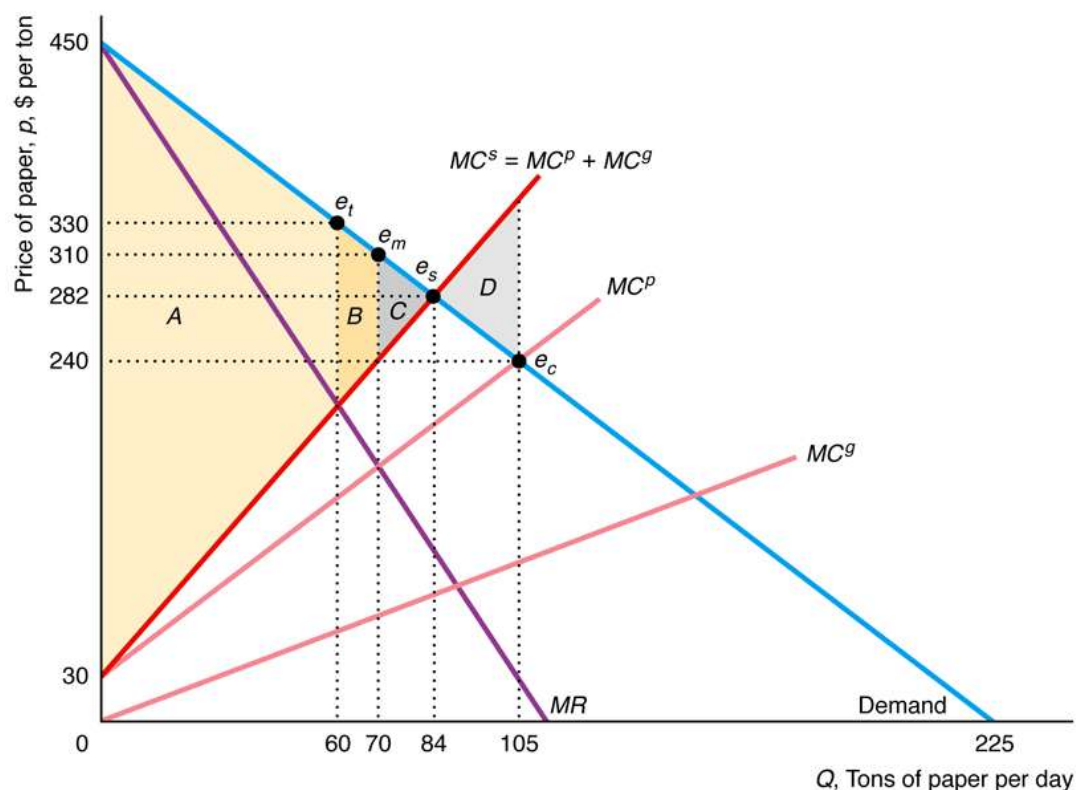


17.4 Market Structure and Externalities

- Although a tax can be set such that the competitive market produces the social optimum, this is not the case in a noncompetitive market.
- A monopoly produces at the intersection of *MR* and private *MC*.
 - It is possible that the monopoly quantity, even with the externality, is *less than* the socially optimal quantity.
 - This occurs because of competing effects:
 - Monopoly produces too little output because it sets $p > MC$
 - Monopoly produces too much output because of negative externality

17.4 Market Structure and Externalities

- Although the competitive quantity always exceeds the social optimum, the monopoly quantity may be less, equal to, or more than the social optimum.
- With monopoly, however, welfare is always lower.



17.5 Allocating Property Rights to Reduce Externalities

- A ***property right*** is an exclusive privilege to use an asset.
- Instead of emissions fees and standards, an indirect approach to dealing with externalities is for the government to assign a property right.
- If nobody holds a property right for a good or bad, the good or bad is unlikely to have a price.
 - Nobody has property rights to the air we breathe and pollution, a bad, has no price.

17.5 Allocating Property Rights to Reduce Externalities

- The ***Coase Theorem*** states that the optimal levels of pollution and output can result from bargaining between polluters and their victims if property rights are clearly defined.
- Example:
 - Chemical plant and boat rental company share a small lake
 - Chemical firm dumps by-products that only smell bad, but are otherwise harmless, into the lake
 - Boat rental firm's business is hurt because peoples' dislike for the smell means they are only willing to rent if the price is low.

17.5 Allocating Property Rights to Reduce Externalities

- With no defined property rights for the lake, the chemical firm and the boat rental firm won't negotiate.

(a) No Property Rights

Boat Rental Firm: Boats Rented per Day

| | 0 | 1 | 2 |
|---|------------|-------------|-------------|
| 0 | \$0 / \$0 | \$0 / \$14 | \$0 / \$15 |
| 1 | \$10 / \$0 | \$10 / \$10 | \$10 / \$5 |
| 2 | \$15 / \$0 | \$15 / \$2 | \$15 / -\$3 |

Chemical Firm:
Tons per Day

17.5 Allocating Property Rights to Reduce Externalities

- If boat rental firm is granted property right to be free of pollution, the firm can prevent the chemical company from dumping at all.

(b) Boat Rental Firm Has Property Right: Chemical company pays the boat rental firm \$7 per ton for the right to dump

| | | Boat Rental Firm: Boats Rented per Day | | |
|--------------------------------|---|--|------|------|
| | | 0 | 1 | 2 |
| Chemical Firm: Tons per Day | 0 | \$0 | \$14 | \$15 |
| | 1 | \$7 | \$17 | \$12 |
| | 2 | \$14 | \$16 | \$11 |

17.5 Allocating Property Rights to Reduce Externalities

- If chemical company is granted property right to pollute, the boat rental firm could pay the chemical company not to pollute.

(c) Chemical Company Has Property Right: Boat rental firm pays the chemical company \$6 for each ton by which it reduces its production below 2 tons

| | | Boat Rental Firm: Boats Rented per Day | | |
|--------------------------------|---|--|-------|------|
| | | 0 | 1 | 2 |
| Chemical Firm: Tons per Day | 0 | \$12 | -\$12 | \$2 |
| | 1 | \$16 | -\$6 | \$4 |
| | 2 | \$15 | \$0 | -\$2 |

17.6 Open-Access Common Property

- Another important externality arises with ***open-access common property***, resources to which everyone has free access and an equal right to exploit.
- Because people do not have to pay to use open-access common property resources, they are overused.
- Examples:
 - Parks or pools with free entry
 - The Internet, roads
 - Common grazing areas for herd animals, fishing
 - Petroleum, water, other fluids and gases extracted from common pools

17.6 Open-Access Common Property

- Approaches to fixing the open-access commons problem:
 1. Government can apply a tax or fee for use to force people to internalize the externality.
 - If fee is less than the marginal externality harm, the externality problem is reduced but not eliminated.
 2. Government can restrict access to the common resource.
 - First-come, first-served rewards access to those who arrive early rather than those who value resource most.
 3. Government can assign private property rights.
 - Removes incentive to overuse resource.

17.7 Public Goods

- A **public good** is a commodity or service whose consumption by one person does not preclude others from also consuming it.
 - By contrast, private goods are rival in consumption.
- Too little production may occur when producers can't restrict access to a public good.
- A public good produces a positive externality, and excluding anyone from consuming a public good is inefficient.

17.7 Public Goods

- All public goods lack rivalry, but only some lack exclusion.

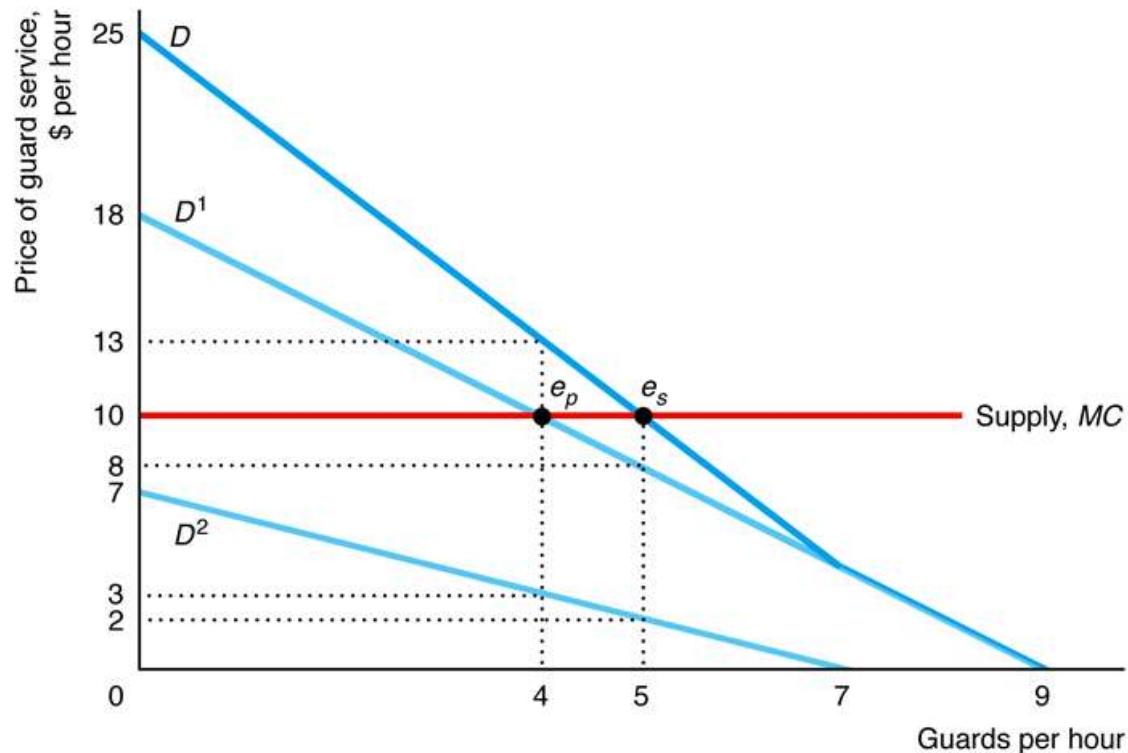
| | <i>Exclusion</i> | <i>No Exclusion</i> |
|-------------------|---|---|
| <i>Rivalry</i> | <i>Private good: candy bar, pencil, aluminum foil</i> | <i>Open-access common property: fishery, hunting, highway</i> |
| <i>No Rivalry</i> | <i>Public good with exclusion: cable television, club good (concert, tennis club)</i> | <i>Public good without exclusion: national defense, aerial spraying of pesticide, clean air</i> |

17.7 Public Goods

- Markets do not exist for nonexclusive public goods (e.g. clean air).
 - These are typically government-provided, if provided at all.
- Markets do exist for public goods if nonpurchasers can be excluded from consuming them (e.g. cable TV, computer software)
- The social demand curve for a public good is the *vertical*, as opposed to horizontal, sum of individual demands.
 - This difference from demand for a private good stems from the lack of rivalry in public good consumption.

17.7 Public Goods

- Demand for mall security guard services by two mall tenants.



17.7 Public Goods

- Society can rarely get individuals to contribute the optimal amounts toward a public good.
 - Many people **free ride** – benefit from the actions of others who pay for the public good without paying for it themselves.
- Example: two stores deciding whether to hire a security guard
 - First assume the stores act independently.

(a) Stores Decide Independently Whether to Hire a Guard

| | | Electronics Store | |
|--------------|-------------|-------------------|-------------|
| | | Hire | Do Not Hire |
| Stereo Store | Hire | -\$2 | -\$2 |
| | Do Not Hire | -\$2 | -\$2 |
| | | Hire | Do Not Hire |
| | | -\$2 | -\$2 |
| | | \$8 | \$0 |

17.7 Public Goods

- Example: two stores deciding whether to hire a security guard
 - Next assume the stores split the cost of a guard if one is hired.

(b) Stores Voting to Hire a Guard Split the Cost

| | | Electronics Store | |
|--------------|-------------|-------------------|-------------|
| | | Hire | Do Not Hire |
| Stereo Store | Hire | \$3, \$3 | -\$2, \$8 |
| | Do Not Hire | \$8, -\$2 | \$0, \$0 |

- In both games, the Nash equilibrium is for neither store to hire a guard because of free riding.

17.7 Public Goods

- Free riding can be reduced in several ways:
 - 1.Social pressure** to contribute reduces free riding and may result in minimal provision of some public goods.
 - 2.Firms can **merge** into a single firm and thereby internalize the positive externality.
 - 3.Privatization** (exclusion) also eliminates free riding because access to the good is restricted.
 - 4.Compulsion** to avoid free riding may come in the form of contracts and taxes.