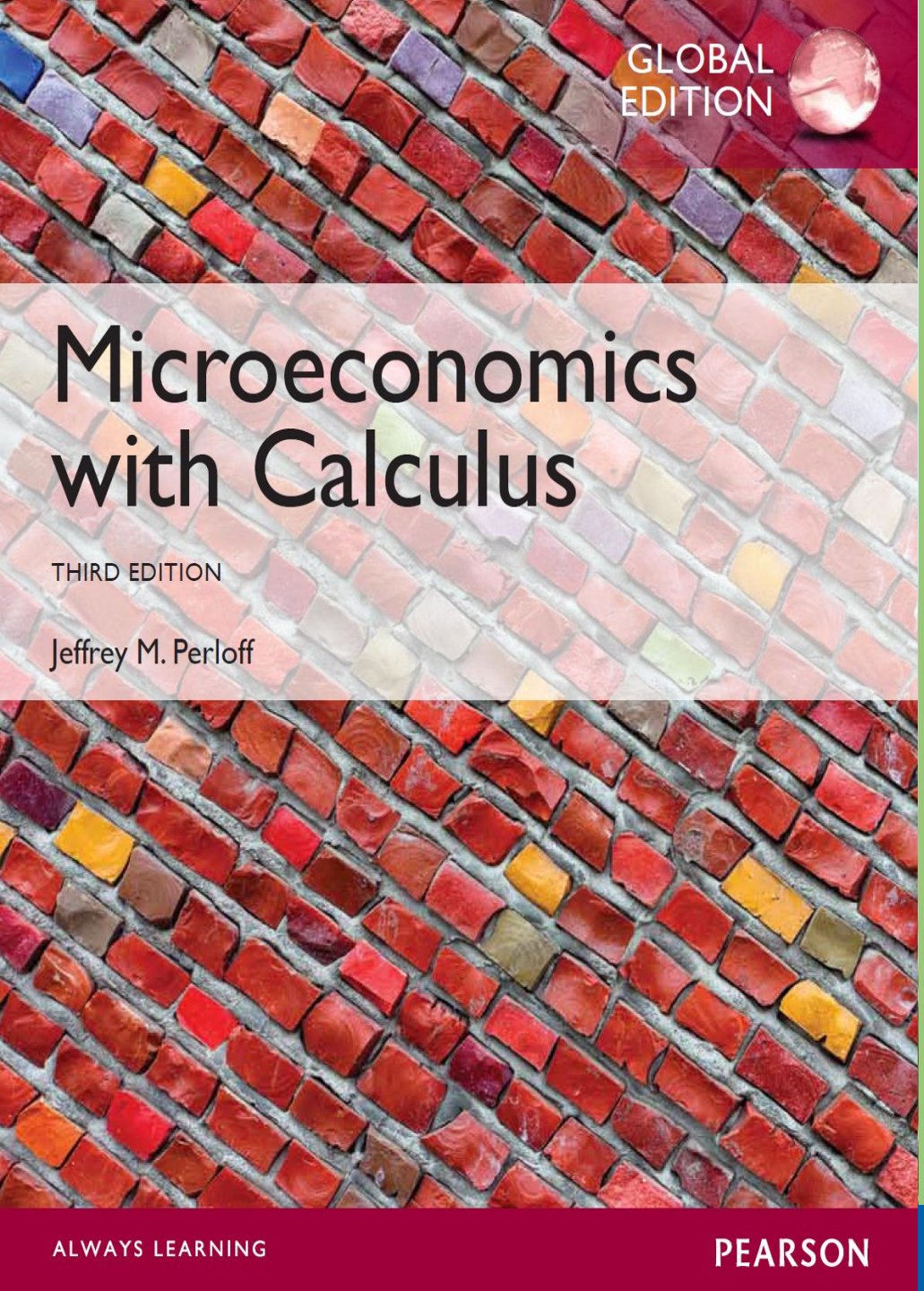


Lecture 3:

Externalities and Public Goods

PEARSON

Outline

1 Externalities

2 The Inefficiency of Competition with Externalities

3 Regulating Externalities

4 Market Structure and Externalities

5 Allocating Property Rights to Reduce Externalities

6 Rivalry, Exclusion and Public Goods

Readings: Perloff Chapter 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

2 The Inefficiency of Competition with Externalities

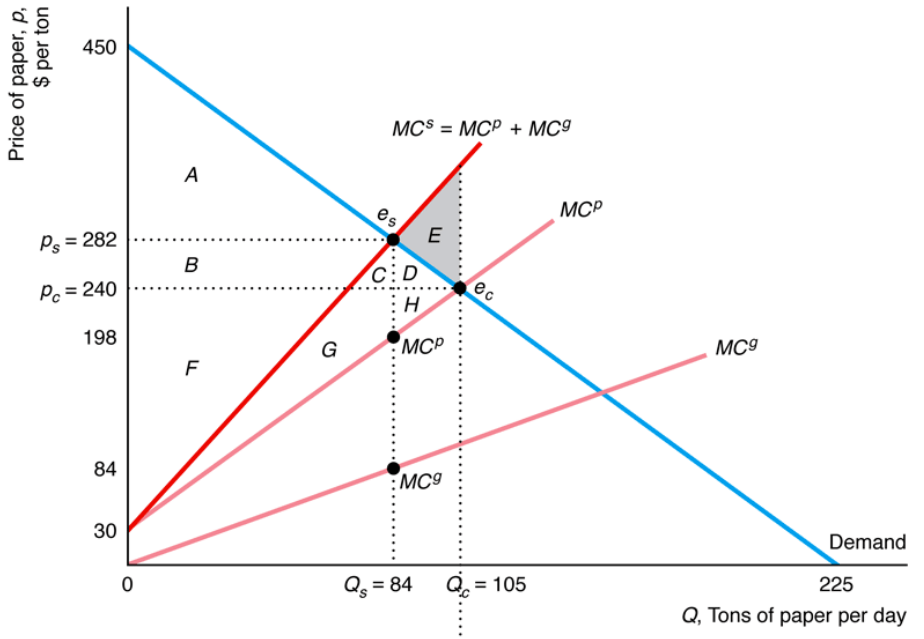
- Competitive firms and consumers do not have to pay for the harms of their negative externalities, so they create excessive amounts.
- Producers and individuals are not compensated for the benefits of a positive externality, so too little is produced.
- Nonoptimal production is the primary result of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

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.

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, $W = CS + PS_s$	$A + B + F$	$A + B + F - E$	$-E = DWL$

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***.
  - The government can also control pollution indirectly through quantity restrictions or taxes on outputs or inputs.

3 Emissions Fee

- How does the government achieve the social optimum using an **emissions standard**?

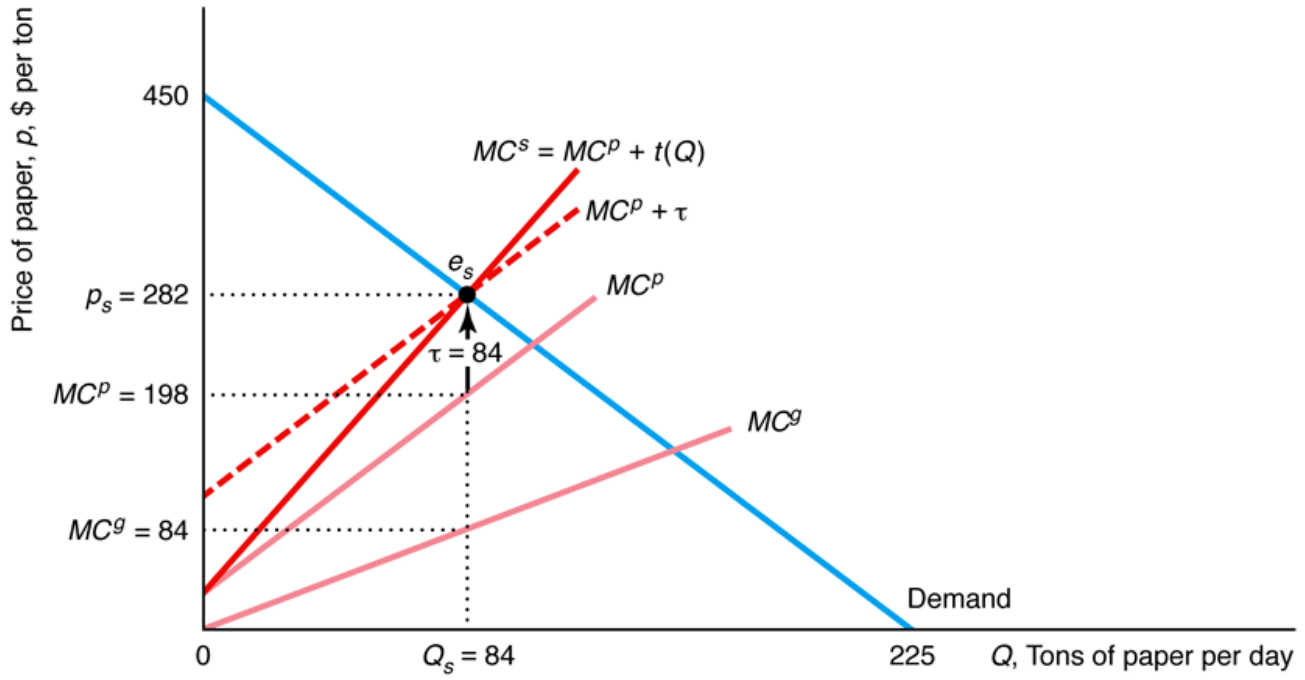
- How does the government achieve the social optimum using an **emissions fee**?

  - The government may impose costs on polluters by taxing their output or the amount of pollution produced.

  - The tax causes a firm to ***internalize the externality*** or bear the cost of the harm inflicted on others.

3 Emissions Fee

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



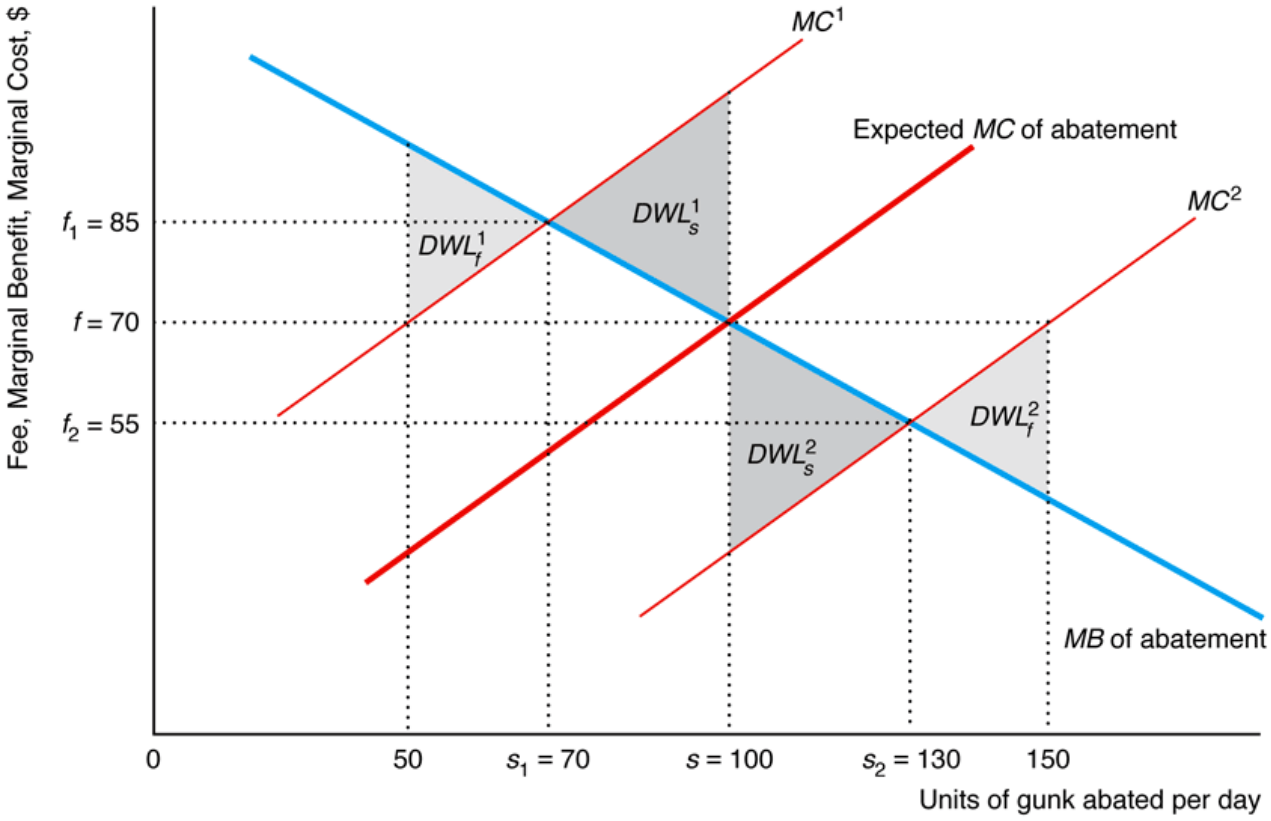
3 Regulating Externalities

- 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.

3 Regulating Externalities

- With a relatively flat MB curve, using expected MC, an emissions fee (f=70) generates less DWL than an emissions standard (s=100).



3 Regulating Externalities

- With a relatively steep MB curve, using expected MC, an emissions fee (f=70) generates more DWL than an emissions standard (s=100).

- Whether it is optimal to use fees or standards depends on the shape of MB and MC curves.

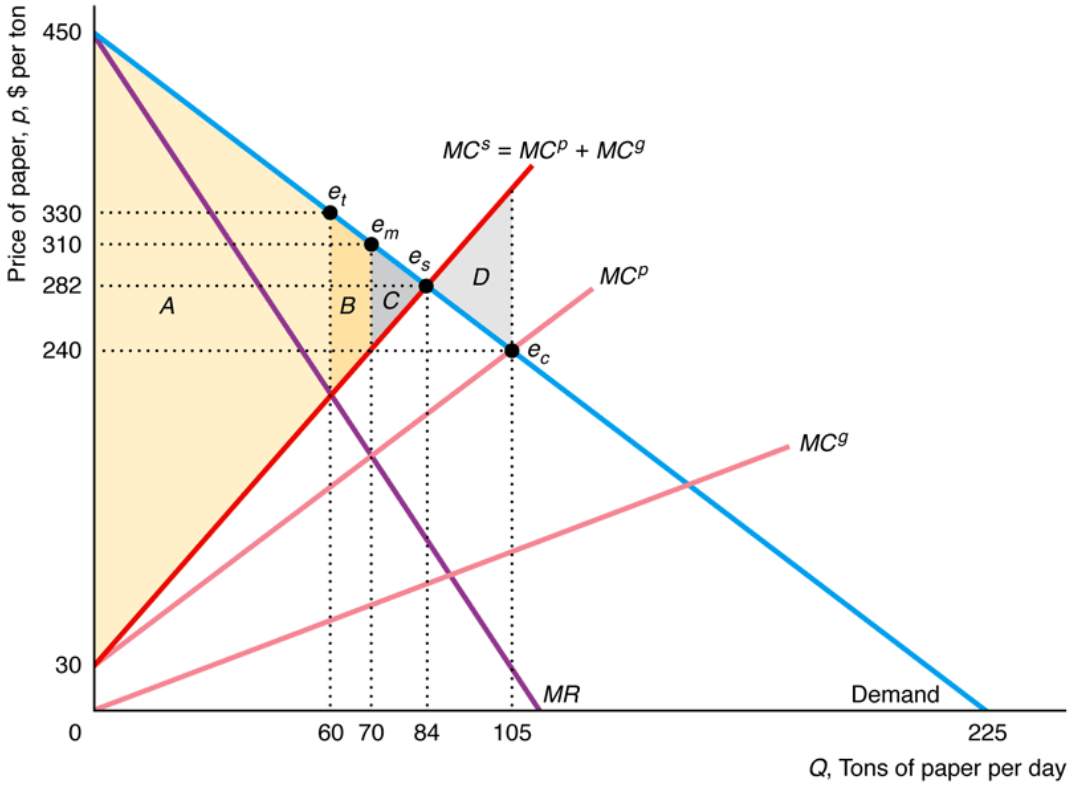
4 Market Structure and Externalities

- 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

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.
- Deadweight loss of competition (without emission fees): D
- Deadweight loss of monopoly (without emission fees): C
- DWL of monopoly with fees: B+C



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.

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:

To illustrate the Coase Theorem, we consider two adjacent firms, Alice's Auto Body Shop and Theodore's Tea House. The noise from the auto body shop hurts the tea house's business, as Table 17.2 illustrates. As the auto body shop works on more cars per hour, its profit increases, but the resulting extra noise reduces the tea house's profit. The last column shows the total profit of the two firms. Having the auto body shop work on one car at a time maximizes their joint profit: the socially optimal solution.

Auto Body Shop's Output, Cars per Hour	Profits, $		
	Auto Body Shop	Tea House	Total
0	0	400	400
1	300	200	500
2	400	0	400

Property Right to Be Free of Pollution. Now, suppose that the courts grant Theodore the right to silence. He can force Alice to shut down, so that he makes 400 and their joint profit is 400. However, if Alice works on one car, her gain is 300, while Theodore's loss is 200. They should be able to reach an agreement where he pays her between 200 and 300 for the right to work on one car. As a result, they maximize their joint profit at 500.

Why doesn't Alice buy the rights to work on two cars instead of one? Her gain of 100 from working on the second car is less than Theodore's loss of 200, so they cannot reach a deal to let her work on the second car.

Property Right to Pollute. Alternatively, suppose that the court says that Alice has the right to make as much noise as she wants. Unless Theodore pays her to reduce the noise, he has to shut down. The gain to Theodore of 200 from Alice working on one rather than two cars is greater than the 100 loss to Alice. They should be able to reach a deal in which Theodore pays Alice between 100 and 200, she works on only one car, and they maximize their joint profit at 500.

Table 17.2 Daily Profits Vary with Production and Noise

Auto Body Shop's Output, Cars per Hour	Profits, $		
	Auto Body Shop	Tea House	Total
0	0	400	400
1	300	200	500
2	400	0	400

6 Rivalry and Exclusion

- Until now, we have focused on *private goods*, which have the properties of rivalry and exclusion.
- A good is ***rival*** if only one person can consume the good.
- ***Exclusion*** means that others can be prevented from consuming the good.
- We classify goods by whether they exhibit rivalry or exclusion.

6 Rivalry and Exclusion

- Four categories: private good, open-access common property, club good, and public good

	Exclusion	*No Exclusion*
Rivalry	*Private good*: apple, pencil, computer, car	*Open-access common property*: fishery, freeway, park
No Rivalry	*Club good*: cable television, concert, tennis club	*Public good*: national defense, clean air, lighthouse

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
  - Roads
  - Common grazing areas for herd animals, fishing
  - Petroleum, water, other fluids and gases extracted from common pools

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.
   - E.g. first-come, first-served rewards access to those who arrive early
3. Government can assign private property rights.
   - Removes incentive to overuse resource

6 Club Goods

- A ***club good*** is a good that is nonrival but is subject to exclusion.

- Examples:
  - Swimming clubs
  - Golf clubs
  - Cable televison
  - Computer software

- Government intervention to regulate club goods is rare.

6 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.

6 Public Goods

- Markets do not exist for nonexclusive public goods (e.g. clean air).
  - These are typically government-provided, if provided at all.

- 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.

6 Public Goods

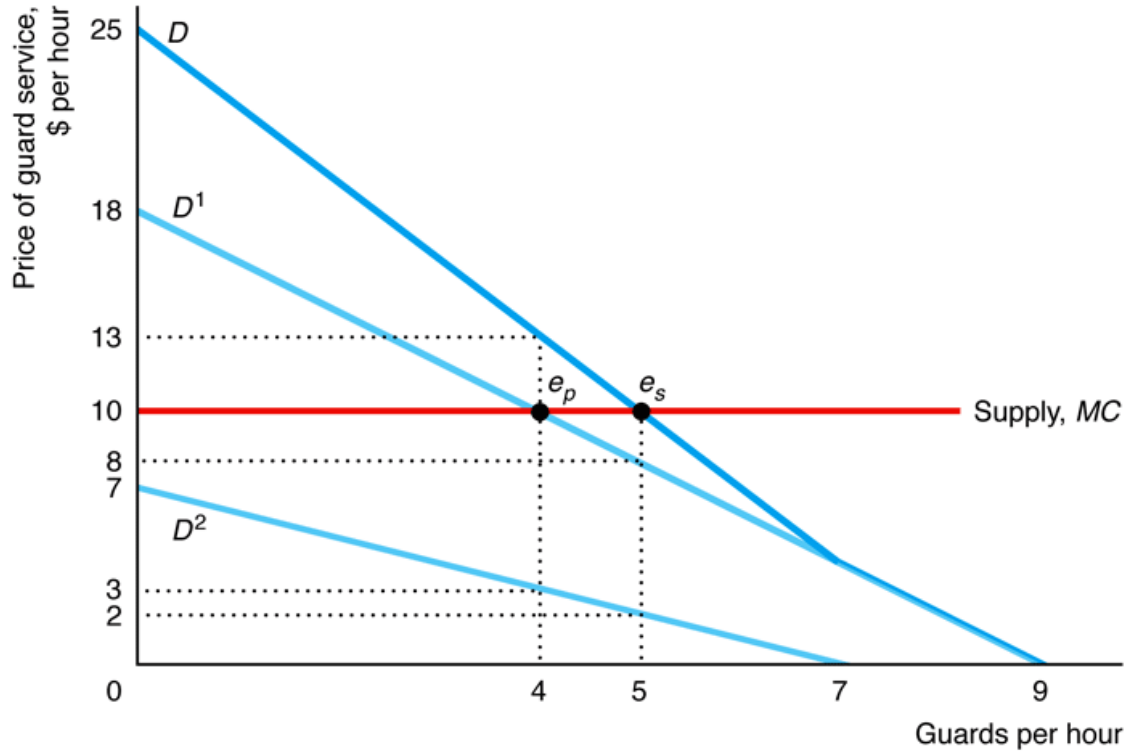
- Society can rarely get individuals to contribute the optimal amounts toward a public good.
  - Many people ***free ride*** – benefit from the actions of others who pay for the public good without paying for it themselves.
- Example: two stores deciding whether to hire a security guard
  - First assume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

(a) *Stores Decide Independently Whether to Hire a Guard*

		Television Store	
		Hire	*Do Not Hire*
Shoe Store	*Hire*	−2 −2	8 −2
	Do Not Hire	−2 8	0 0

6 Public Goods

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



6 Optimal Provision of a Public Good

- Two individuals, each pays for G_i of a public good; and consumes $P_i = Y_i - G_i$ of a private good and $G_1 + G_2$ of the public good.
- Use the Pareto concept to evaluate the social optimal:
  $\mathcal{L} = U_1(G_1 + G_2, Y_1 - G_1) + \lambda[U_2(G_1 + G_2, Y_2 - G_2) - \bar{U}_2].$
- The first-order conditions for this constrained maximization problem yield:

$$\frac{\partial U_1/\partial G}{\partial U_1/\partial P_1} + \frac{\partial U_2/\partial G}{\partial U_2/\partial P_2} = 1.$$

- Or:

$$MRS_1 + MRS_2 = 1.$$

6 Optimal Provision of a Public Good

$$\frac{\partial \mathcal{L}}{\partial G_1} = \frac{\partial U_1}{\partial G}\frac{dG}{dG_1} + \frac{\partial U_1}{\partial P_1}\frac{dP_1}{dG_1} + \lambda\frac{\partial U_2}{\partial G}\frac{dG}{dG_1} = \frac{\partial U_1}{\partial G} - \frac{\partial U_1}{\partial P_1} + \lambda\frac{\partial U_2}{\partial G} = 0, \quad (17.2)$$

and

$$\frac{\partial \mathcal{L}}{\partial G_2} = \frac{\partial U_1}{\partial G}\frac{dG}{dG_2} + \lambda\left(\frac{\partial U_2}{\partial G}\frac{dG}{dG_2} + \frac{\partial U_2}{\partial P_2}\frac{dP_2}{dG_2}\right)$$

$$= \frac{\partial U_1}{\partial G} + \lambda\left(\frac{\partial U_2}{\partial G} - \frac{\partial U_2}{\partial P_2}\right) = 0. \quad (17.3)$$

By subtracting Equation 17.3 from Equation 17.2, we learn that $\partial U_1/\partial P_1 = \lambda \partial U_2/\partial P_2$. Dividing Equation 17.2 by $\partial U_1/\partial P_1$ and substituting $\lambda \partial U_2/\partial P_2$ for $\partial U_1/\partial P_1$ in the second term, we find that

$$\frac{\partial U_1/\partial G}{\partial U_1/\partial P_1} + \frac{\partial U_2/\partial G}{\partial U_2/\partial P_2} = 1, \quad (17.4)$$

Or: MRS1+MRS2=1 (17.5)

6 Reducing Free Riding

- Free riding can be reduced in several ways:
  1. **Social pressure** to contribute reduces free riding and may result in 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.

Reference:

- Chapter 17:
- Microeconomics: Theory and Applications with Calculus, 3rd Edition. By Jeffrey M. Perloff. 2014 Pearson Education.