Externality

Xi Wang

University of Georgia

# Lesson 1: Marginal Social Cost

Examples of Externalities

- **Externality**: Actions of one party impose costs or benefits on a second party. Externalities are sometimes called *spillovers* or *neighborhood effects*.
- Types: positive externality, negative externality.
- Example: Air pollution, noisy, traffic congestion [1], secondhand cigarette smoke.
- Property right.

---

[1]Each traveler in congestion raises others' costs and reduces their possibilities of using transport resources

Externalities

- In the perfect competition market, the firm chooses the optimal output based on the condition: $P = MC$.
- XYZ company is producing detergents in Athens. People found that the company dumps wastewater into the Oconee River.
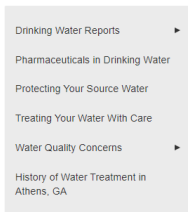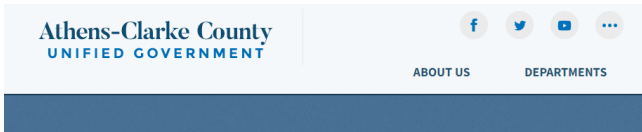
Externalities

- XYZ company's decision on producing 10000 detergents imposed a cost on residents in Athens. $\Rightarrow$ Negative externality.
- Marginal Social Cost: The total cost to society of producing an additional unit of a good or service.
  $MSC = MC$ + Marginal external cost
- Question: What would happen to the XYZ company if we made the firm responsible financially for the external costs they impose?

Externalities

a. A profit-maximizing firm: No externalities

The industry

A representative firm

b. A profit-maximizing firm: Externality

The industry

A representative firm
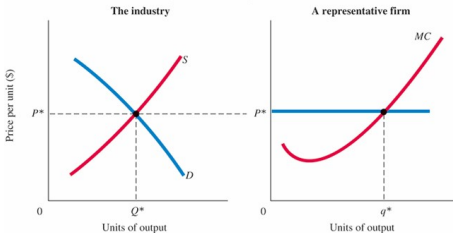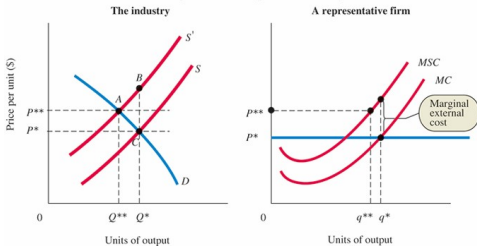
Externalities

- Answer: Making the firms responsible for their external costs increases the costs they see. This reduces firm and industry output, and textcolorbluereduces the quantity of pollution.
- Question: Is externality always negative?
- Example: Vaccinations. The more people who are vaccinated, and thus less likely to be ill, the less likely it is that a disease will spread.
- Health precautions taken by an individual have positive external benefits to the rest of the community.
- *Challenge*: For the positive externality, too few people have incentive to engage in these activities.
- Example: Too few people would vaccinate unless forced to do so.
- Question: It is very clear to see the marginal social costs that producing one additional detergents imposed (pollution), however, what is the marginal social benefits of pollution?

Externalities

- Marginal social benefit of pollution: The incremental benefit to society from producing one more unit of pollution.
- *Goal*: Decide the optimal amount of pollution in a society.
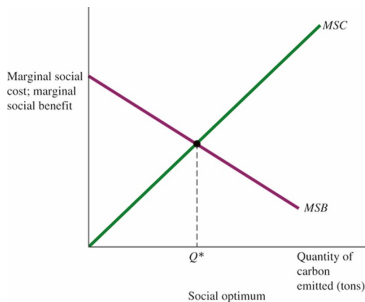
- *Challenge*: How do we move to the optimal level? Government policy and private actions. Costly!

Internalizing Externalities

- *Internalization*: A number of mechanisms are available to provide decision makers with incentives to weigh the external costs and benefits of their decisions.

- Four approaches have been taken to solving the problem of externalities:
  - Private bargaining and negotiation.
  - Environmental standards.
  - Government-imposed taxes and subsidies.
  - Selling or auctioning rights to impose externalities.

- *Coase Theorem*: Under certain conditions, when externalities are present, private parties can arrive at the efficient solution without government involvement.

Private Bargaining and Negotiation

- Imagine: Abby and Zoe are roommates. Zoe likes calling her family members at the midnight. Abby usually sleeps at 10: 00 p.m.
- Negative externality.
- If you were Abby, what will you do to prevent Zoe's calling at the midnight?
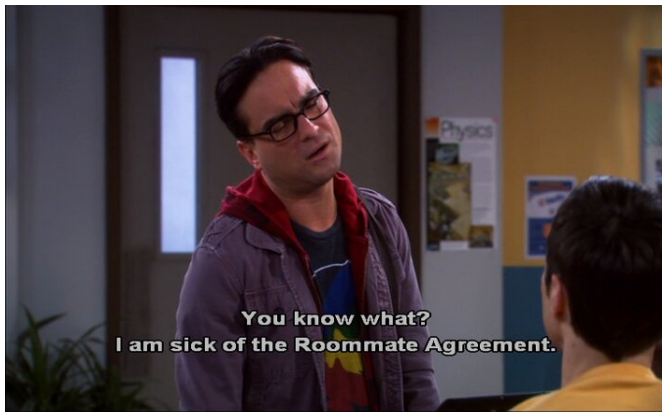
Private Bargaining and Negotiation

- If Abby wants, she could pay Zoe and let her stop calling. This payment is a compensation for Zoe of not calling.
- If Zoe wants, Zoe could pay Abby and continue calling at the midnight. This payment is a compensation for Abby of not having a good sleep.
- Liability rules: Laws that require A to compensate B for damages that A imposed on B.

Taxes and Subsidies

- Example: XYZ company dumps wastewater in the Oconee river. All of us went to negotiate with the company.
- We said: "The company could continue producing and dumping, but it has to pay us $1 million as a compensation."
- The company rejects the proposal.
- The local government asks the XYZ company to pay a per-unit tax.
- If the per-unit tax exactly equal to marginal external costs is imposed on a firm, then the firm will weigh the tax and marginal benefits from polluting.

Taxes and Subsidies
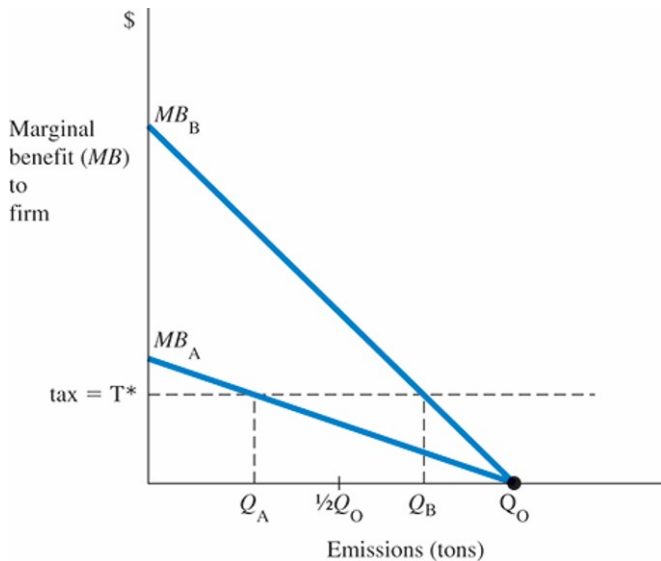
Tradeable Emissions Permits: Sell or Auction Pollution Rights

- The government[2] requires: Emissions from each plant are limited to a specific amount.
- The lower the level specified, the more air quality will improve.
- The plants is issued a permit allowing it to emit only at that level.
- The permit can be traded to another firm in what has developed into a large auction market.
- For a firm with low costs of abating pollution, it is in the firm's best interest to cut back below its permit levels and sell its unused permits to a firm with higher abatement costs.

---

[2]Cap-and-trade program

Selling or Auctioning Pollution Rights

- **Cap-and-trade program**: Selling the pollution rights to the highest bidder.
- Goal: The government tries to control the emissions.
- Actions: Emissions are capped at the plant level, that is, emissions from each plant are limited to a specific amount.
- The lower the level specified, the more air quality will improve.
- The plant is issued a permit allowing it to emit only at that level.
- This permit can be used or can be traded to another firm.
- For a firm with low costs of abating pollution, it is often in the firm's best interest to cut back below its permit levels, and sell its unused permits to a firm with higher abatement costs.

Selling or Auctioning Pollution Rights

- Assume each firm emits 5 units of pollution per period. The government wants to reduce the total amount of pollution from 10 to 4.
- $q_{pollution}^A$: is the reduction of pollution by firm A.
- Given that the government only allows each firm produce 2 units of pollution, firm A should reduce pollution from 5 to 3 units.
- If firm A reduce pollution from 5 to 4 units, then the marginal cost from reducing one additional pollution is \$12.
- Firm B's marginal cost of reducing the third unit of pollution is \$23.
- Firm B buys one unit pollution right from firm A, under the price $12 \leq P \leq 23$, both firms will be happy.

Firm A	A	A	Firm B	B	B
$q_{pollution}^A$	MC	TC	$q_{pollution}^B$	MC	TC
1	5	5	1	8	8
2	7	12	2	14	22
3	9	21	3	23	45
4	12	33	4	35	80
5	17	50	5	50	130

The Cap-and-Trade program

- The cap-and-trade program in Europe resulted in a price for carbon and thus higher costs for carbon-producing firms, like electricity firms.
- Economists found that electricity prices in Spain rose 0.86 euro for a 1-euro cost increase. This implies a quite inelastic aggregate demand for electricity.
- Question: What do you think would have happened to pass through if the largest of the electricity providers had been heavily invested in solar power, which does not produce carbon?

Lesson 2: Public Goods and Common Resources

Public Goods

- Public goods are: 1. Non-rival in consumption; and 2. Benefits are non-excludable.
- *Non-rival* in consumption: One person's enjoyment of the benefits of a public good does not interfere with another's consumption of it.
  - I watch the "Friends" at my home, and you watch it at your home. My enjoyment does not interfere yours.
- *Non-excludable*: Once a good is produced, no one can be excluded from enjoying its benefits. (ex: National defense system)

Public Goods

- Question: During the game day, the university/local government usually builds temporary public restrooms around the gym. Are the restrooms public goods? Why or why not?

Features of Public Goods

1. Goods are either public or private by virtue of their characteristics and NOT by virtue of whether they are produced by the public sector.

2. For the same public good, different users have different marginal use value on it.

3. Because of the second feature, it is common to have price discrimination on selling public goods.
   - Example: TV show "Friends" is a public good. For watching "Friends", I am willing to pay $2 to watch it; and you are willing to pay $3. Our total willingness to pay for watching it is $2 + $3 = $5.

   a. NBC (TV show's owner) could charge each of us $2, so it gains $4 totally;
   b. NBC could charge each of us $3 and gains $3 totally;
   c. NBC could charge me $2, and charge you $3, and gains $5 totally.

Features of Public Goods

4. It is difficult to charge fees on public goods.

- Example: Consider an entrepreneur who decides to offer better police protection to Athens.
- Careful market survey reveals that the citizens in Athens want high-quality protection and are willing to pay for it.
- However, not everyone is willing to pay the same amount. Some can afford more, others less.
- Since the company is private, so it could not force everyone to pay the same amount.

Features of Public Goods

- Two problems happen:
  - If the goods are produced, the crime rate falls and all residents benefit. You get that benefits whether or not you pay for it. You get a free ride.
    - **Free-rider**: Because people can enjoy benefits of public goods whether or not they pay for them, they are usually unwilling to pay for them.
  - Your payment is small relative to the amount that must be collected to provide the service.
    - **Drop-in-the-bucket**: The good or service is usually so costly that its provision generally does not depend on whether any single person pays.

Features of Public Goods

- Example: Lighthouse is a public good.
- A private operator would have difficulty collecting payment from passing ships that use the light as a navigational aid.
- A lighthouse cannot pick and choose which ships view its light.
- Thus, a privately owned lighthouse would raise no revenue. If government didn't provide them through taxation, then no one would.
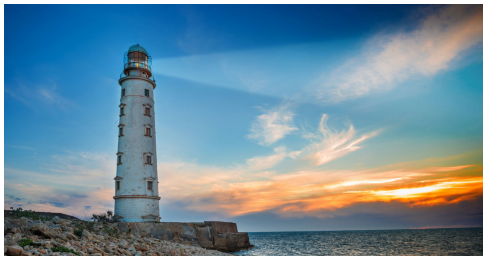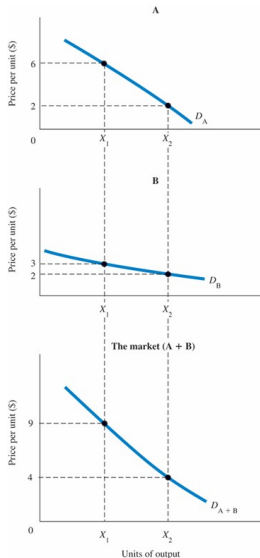
Optimal Provision of Public Goods

- Before, when we calculate the market demands for private goods:
- Assume there are only two persons: Alice and Bob.
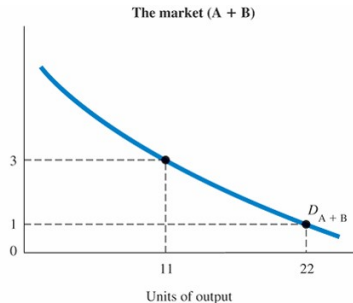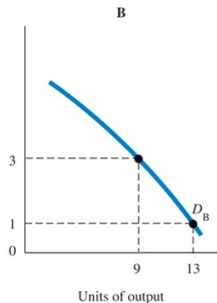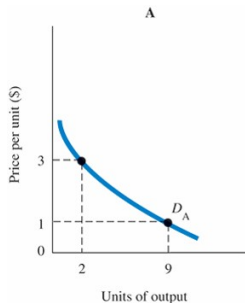
Optimal Provision of Public Goods

- Samuelson: To arrive at market demand for public goods, we do not sum quantities. Instead, we add the amounts that individual households are willing to pay for each potential level of output.

- Now, when we calculate the market demands for public goods:

Optimal Provision of Public Goods

- Challenge: To produce optimal amount of each public good, the government must know something that it cannot possibly know: Everyone's preferences. (Each person's willingness to pay).

- *Tiebout hypothesis*: An efficient mix of public goods is produced when local housing prices and taxes come to reflect consumer preferences just as they do in the market for private goods.

Optimal Provision of Public Goods

2021
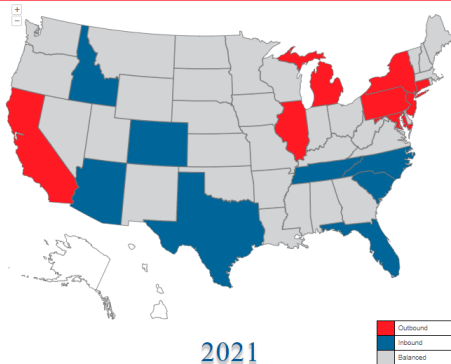
Top inbound states	
South Carolina	66%
Idaho	65%
Tennessee	65%
North Carolina	62%
Florida	59%

| Top outbound states	
Illinois	69%
California	66%
New Jersey	64%
Michigan	61%
New York	61%

Common Resources

- **Common Resources**: A resource that is nonexcludeable but rival in consumption.
- Example: Grazing sheep on common grasses.
- Problem: Overuse
    - Where a common resource is shared by many, and technology is well developed, overuse is more likely.
- Solution: Privatization the resource. If a common area is turned into a private resource, the owner will have incentives for using that resource efficiently.

Review: Externalities

- Without regulations, a profit-maximized firm should produce q^* amount of output because, at q^*, $MC = P^*$.
- With regulations, a firm has to pay a tax (T = Marginal external costs), so its marginal cost curve is now MSC = MC+ marginal external costs = MC+T.

a. A profit-maximizing firm: No externalities

b. A profit-maximizing firm: Externality
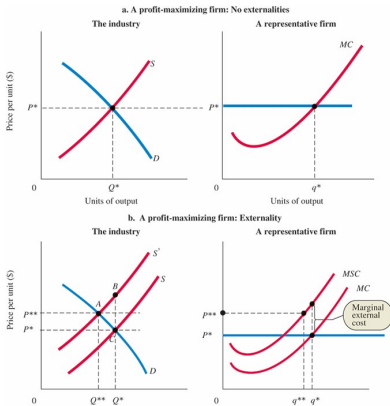
Review: Externalities

- Two firms A and B have different demands of pollution.
- If there is no regulations on dumping wastewater, A and B are facing MC of emission = 0. $\Rightarrow$ Each will produce Q_0 amount of pollution. $\Rightarrow$ Total pollution = $2Q_0$
- However, if the government asks each firm to pay a per-unit tax T^*, then A and B are facing MC of emission = T^*.
- A will produce Q_A, and B will produce Q_B. Total pollution = $Q_A + Q_B < Q_0 + Q_0$
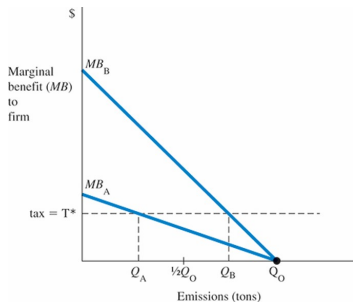
In-Class Quiz for fun

1. Use your electronic devices to search this website: `www.kahoot.it`
2. Pin code
3. Create a nickname for yourself
4. Answer the question