

# Microeconomic Theory: TA Session

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# Final exam

Final exam time: Dec 18th, 2-5pm

Place: Krieger 205

# Externality

**Externality:** the uncompensated impact of a person's actions on the well-being of others

Example of negative externality:

- ▶ Pollution: polluting is free for a factory, but it incurs costs on the environment and, ultimately, on the society

Example of positive externality:

- ▶ Vaccination: By getting vaccinated, you do not only protect yourself from the disease, but also protect others from getting the disease from you

# Externality

With negative externality:

- ▶ Marginal social cost = marginal private cost + marginal external cost

With positive externality:

- ▶ Marginal social benefit = marginal private benefit + marginal external benefit

What externality does is essentially to shift the demand or supply curve

- ▶ The government can make corrections (“internalize the externality”, in economics jargon) by imposing taxes, subsidies, or regulations

## Externality - exercise

Suppose the market for pesticide is perfectly competitive. The demand curve is  $P = 100 - 2Q$ , and the supply curve is  $P = 10 + Q$ . The cost of pollution when producing pesticide is \$30 per unit.

1. What is the marginal private cost of producing pesticide? What is the marginal social cost?
2. Calculate the equilibrium price and quantity without government intervention.
3. Calculate the socially optimal price and quantity. Is the actual production higher or lower than the socially optimal amount? Calculate the welfare loss.
4. Suppose the government levies a per-unit tax so that market production is socially optimal, what should the size of the tax be?
5. What is the amount of production when pollution is zero? Why is zero pollution not the socially optimal level?

## Externality exercise - answer

Answer:

1. Marginal private cost = private supply curve =  $10 + Q$ . Marginal social cost =  $10 + Q + 30 = 40 + Q$ .
2.  $P = 100 - 2Q = 10 + Q \implies P^* = 40, Q^* = 30$ .
3. Social optimum:  $P = 100 - 2Q = 40 + Q \implies P^S = 60, Q^S = 20$ .  
Actual production is higher than the socially optimal amount.  
Welfare loss =  $30 \times 10/2 = 150$ .
4. With a per-unit tax of size  $t$ , the private supply curve becomes  $P = 10 + t + Q$ . Then, in equilibrium,  $P = 100 - 2Q = 10 + t + Q$ . For  $Q = Q^S = 20$ , it must be that  $t = 30$ .
5. The amount of production is zero. Zero pollution is not socially optimal because the production and consumption of pesticide also yields benefits in the form of consumer and producer surplus.

# Coase Theorem

Without government intervention, can the private market by itself reach an efficient solution of externalities?

Consider a factory that dumps sewage into a river, creating health damages for a downstream community. The pollution costs the community \$7,000, and it would cost the factory \$5,000 to reduce pollution to safe levels.

Two solutions could be imagined:

1. If the community has a right to health, the factory incurs a cost of \$5,000 to reduce pollution
2. If the factory has a right to pollute, the community pays the factory somewhere between \$5,000 and \$7,000 for it to reduce pollution

Both outcomes are socially efficient!

# Coase Theorem

**Coase Theorem:** if private parties can bargain at low cost over the allocation of resources, they can always solve the problem of externalities on their own and achieve the socially optimal outcome

For the Coase Theorem to hold, we need two crucial conditions:

1. **Property rights are clearly defined** (In the pollution case: Does the factory have a right to pollute? Or does the downstream community have a right to health?)
2. **Transaction costs are low** (Suppose the factory and community need to hire lawyers to negotiate and the lawyers cost \$3,000, then negotiations won't take place)

# Coase Theorem and property rights

The essence of the market is not price, but property rights

- ▶ With clearly defined property rights, the market will naturally negotiate a reasonable price to solve the externality problem
- ▶ To achieve a socially efficient outcome, it only requires that property rights clearly belongs to *someone*; exactly whom does not matter
- ▶ A large body of economics research shows that clear property rights is crucial for economic development

What the Coase Theorem doesn't tell us:

- ▶ Who should own the property rights (which is a **normative** question)

## Coase Theorem - Exercise

A nightclub generates noise that affects two nearby residents A and B. If the club plays loud music, resident A suffers damage of \$40, resident B suffers damage of \$80, and the nightclub earns an additional profit of \$100.

1. What is the socially optimal outcome?
2. Suppose the residents have the right to quiet, and that the two residents coordinate in negotiations (i.e. they act as one). What is the outcome?
3. Following (2), suppose instead that the nightclub has the right to make noise. What is the outcome?
4. Following (3), suppose instead that the two resident must negotiate separately; they cannot coordinate. What outcomes are feasible?

# Coase Theorem - Answer

*Answer:*

1. The social surplus from noise is  $100 - 40 - 80 = -20 < 0$ . The socially optimal outcome is that the nightclub does not make noise.
2. This is equivalent to the scenario where there is only one resident who suffers \$120 damage from noise. Since this is bigger than the nightclub's willingness to pay (\$100), the residents will not negotiate, and the outcome is no noise.
3. The residents pay the nightclub anywhere between \$100 and \$120 in exchange for quiet.
4. Multiple outcomes are feasible.
  - (a) The residents pay, and the nightclub makes no noise. For example, resident A pays \$30 and B pays \$70. It can be shown that this is a Nash equilibrium. Any payments  $(x_A, x_B)$  satisfying  $x_A \leq 40$ ,  $x_B \leq 80$ , and  $x_A + x_B = 100$  is a Nash equilibrium.
  - (b) no resident pays, and the nightclub makes noise. This is also a Nash equilibrium: a resident will not pay if he knows that the other is not paying.