Seventh Edition

Principles of
Economics
N. Gregory Mankiw

CHAPTER
10

Externalities

Modified by Joseph Tao-yi Wang

In this chapter, look for the answers to these questions

- What is an externality?
- Why do externalities make market outcomes inefficient?
- What public policies aim to solve the problem of externalities?
- How can people sometimes solve the problem of externalities on their own? Why do such private solutions not always work?

Introduction

- One of the Ten Principles from Chapter 1:
  Markets are usually a good way to organize economy activity.
  In absence of market failures, the competitive market outcome is efficient, maximizes total surplus.
- One type of market failure:
  externality, the uncompensated impact of one person's actions on the well-being of a bystander.
- Externalities can be **negative** or **positive**, depending on whether impact on bystander is adverse or beneficial.

Introduction

- Self-interested buyers and sellers neglect the external costs or benefits of their actions, so the market outcome is not efficient.
- Another principle from Chapter 1:
  Governments can sometimes improve market outcomes.
  In presence of externalities, public policy can improve efficiency.

Examples of Negative Externalities

- Air pollution from a factory
- The neighbor's barking dog
- Late-night stereo blasting from the dorm room next to yours
- Noise pollution from construction projects
- Health risk to others from second-hand smoke
- Talking on cell phone while driving makes the roads less safe for others

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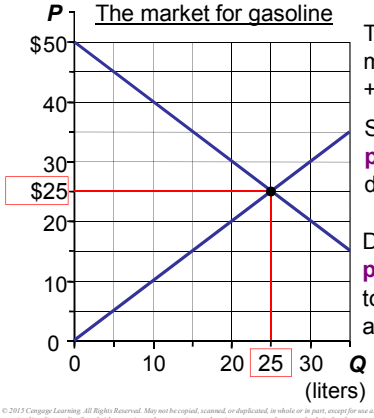
Recap of Welfare Economics

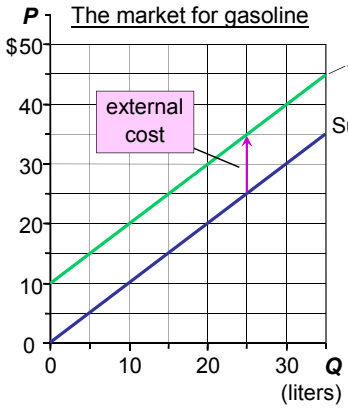


The market eq'm maximizes consumer + producer surplus.

Supply curve shows **private cost**, the costs directly incurred by sellers.

Demand curve shows **private value**, the value to buyers (the prices they are willing to pay).

Analysis of a Negative Externality



Social cost
= private + external cost

Supply (private cost)

External cost
= value of the negative impact on bystanders
= $10 per liter (value of harm from smog, greenhouse gases)

Analysis of a Negative Externality

The socially optimal quantity is 20 liters.

At any $Q < 20$, value of additional gas

At any $Q > 20$, social cost of the last liter is greater than its value to society.

Analysis of a Negative Externality

Market eq'm ($Q = 25$) is greater than social optimum ($Q = 20$).

One solution: tax sellers $10/liter, would shift ***S*** curve up $10.

"Internalizing the Externality"

- **Internalizing the externality**: altering incentives so that people take account of the external effects of their actions
- In our example, the $10/liter tax on sellers makes sellers' costs = social costs.
- When market participants must pay social costs, market eq'm = social optimum.

  (Imposing the tax on buyers would achieve the same outcome; market ***Q*** would equal optimal ***Q***.)

Examples of Positive Externalities

- Being vaccinated against contagious diseases protects not only you, but people who visit the salad bar or produce section after you.
- R&D creates knowledge others can use.
- People going to college raise the population's education level, which reduces crime and improves government.

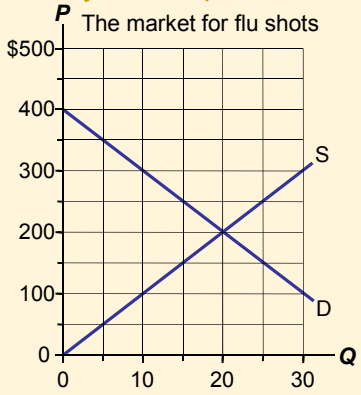
Thank you for not contaminating the fruit supply!

Positive Externalities

- In the presence of a positive externality, the **social value** of a good includes
  - **private value** – the direct value to buyers
  - **external benefit** – the value of the positive impact on bystanders
- The socially optimal ***Q*** maximizes welfare:
  - At any lower ***Q***, the social value of additional units exceeds their cost.
  - At any higher ***Q***, the cost of the last unit exceeds its social value.

ACTIVE LEARNING 1

Analysis of a positive externality

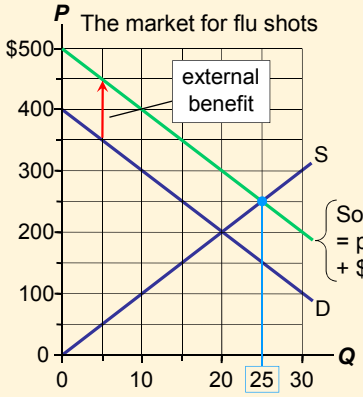


External benefit = $100/shot

- Draw the social value curve.
- Find the socially optimal ***Q***.
- What policy would internalize this externality?

ACTIVE LEARNING 1

Answers



Socially optimal ***Q*** = 25 shots.

To internalize the externality, use subsidy = $100/shot.

Social value = private value + $100 external benefit

Effects of Externalities: Summary

If negative externality
- market quantity larger than socially desirable

If positive externality
- market quantity smaller than socially desirable

To remedy the problem, "internalize the externality"
- tax goods with negative externalities
- subsidize goods with positive externalities

Public Policies Toward Externalities

Two approaches:

- **Command-and-control policies** regulate behavior directly. Examples:
  - limits on quantity of pollution emitted
  - requirements that firms adopt a particular technology to reduce emissions
- **Market-based policies** provide incentives so that private decision-makers will choose to solve the problem on their own. Examples:
  - corrective taxes and subsidies
  - tradable pollution permits

Corrective Taxes & Subsidies

- **Corrective tax**: a tax designed to induce private decision-makers to take account of the social costs that arise from a negative externality
- Also called **Pigouvian taxes** after Arthur Pigou (1877-1959).
- The ideal corrective tax = external cost.
- For activities with positive externalities, ideal corrective subsidy = external benefit.

Corrective Taxes & Subsidies

- Other taxes and subsidies distort incentives and move economy away from the social optimum.
- Corrective taxes & subsidies
  - align private incentives with society's interests
  - make private decision-makers take into account the external costs and benefits of their actions
  - move economy toward a more efficient allocation of resources

Corrective Taxes vs. Regulations

- Different firms have different costs of pollution abatement.
- Efficient outcome: Firms with the lowest abatement costs reduce pollution the most.
- A pollution tax is efficient:
  - Firms with low abatement costs will reduce pollution to reduce their tax burden.
  - Firms with high abatement costs have greater willingness to pay tax.
- In contrast, a regulation requiring all firms to reduce pollution by a specific amount not efficient.

Corrective Taxes vs. Regulations

Corrective taxes are better for the environment:

- The corrective tax gives firms incentive to continue reducing pollution as long as the cost of doing so is less than the tax.
- If a cleaner technology becomes available, the tax gives firms an incentive to adopt it.
- In contrast, firms have no incentive for further reduction beyond the level specified in a regulation.

Example of a Corrective Tax: The Gas Tax

The gas tax targets three negative externalities:

- Congestion
  The more you drive, the more you contribute to congestion.
- Accidents
  Larger vehicles cause more damage in an accident.
- Pollution
  Burning fossil fuels produces greenhouse gases.

ACTIVE LEARNING 2
A. Regulating lower SO_2 emissions

- Acme and US Electric run coal-burning power plants. Each emits 40 tons of sulfur dioxide per month, total emissions = 80 tons/month.
- Goal: Reduce SO_2 emissions 25%, to 60 tons/month
- Cost of reducing emissions:
  $1,000/ton for Acme, $2,000/ton for USE

Policy option 1: Regulation
Every firm must cut its emissions 25% (10 tons).

Your task: Compute the cost to each firm and total cost of achieving goal using this policy.

ACTIVE LEARNING 2
A. Answers

- Each firm must reduce emissions by 10 tons.
- Cost of reducing emissions:
  $1,000/ton for Acme, $2,000/ton for USE.
- Compute cost of achieving goal with this policy:

  Cost to Acme: (10 tons) x ($1,000/ton) = $10,000

  Cost to USE: (10 tons) x ($2,000/ton) = $20,000

  Total cost of achieving goal = **$30,000**

ACTIVE LEARNING 2
B. Tradable pollution permits

- Initially, Acme and USE each emit 40 tons SO_2/month.
- Goal: reduce SO_2 emissions to 60 tons/month total.

Policy option 2: Tradable pollution permits

- Issue 60 permits, each allows one ton SO_2 emissions. Give 30 permits to each firm. Establish market for trading permits.
- Each firm may use all its permits to emit 30 tons, may emit < 30 tons and sell leftover permits, or may purchase extra permits to emit > 30 tons.

Your task: Compute cost of achieving goal if Acme uses 20 permits and sells 10 to USE for $1,500 each.

ACTIVE LEARNING 2

B. Answers

- Goal: reduce emissions from 80 to 60 tons
- Cost of reducing emissions:
  $1,000/ton for Acme, $2,000/ton for USE.

Compute cost of achieving goal:

Acme

- sells 10 permits to USE for $1,500 each, gets $15,000
- uses 20 permits, emits 20 tons SO_2
- spends $20,000 to reduce emissions by 20 tons
- net cost to Acme: $20,000 − $15,000 = **$5,000**

continued…

ACTIVE LEARNING 2

B. Answers, *continued*

- Goal: reduce emissions from 80 to 60 tons
- Cost of reducing emissions:
  $1,000/ton for Acme, $2,000/ton for USE.

USE

- buys 10 permits from Acme, spends $15,000
- uses these 10 plus original 30 permits, emits 40 tons
- spends nothing on abatement
- net cost to USE = **$15,000**

Total cost of achieving goal = $5,000 + 15,000 = **$20,000**

Using tradable permits, goal is achieved at lower total cost and lower cost to each firm than using regulation.

Tradable Pollution Permits

- A tradable pollution permits system reduces pollution at lower cost than regulation.
  - Firms with low cost of reducing pollution do so and sell their unused permits.
  - Firms with high cost of reducing pollution buy permits.
- Result: Pollution reduction is concentrated among those firms with lowest costs.

Tradable Pollution Permits in the Real World

- SO_2 permits traded in the U.S. since 1995.
- Nitrogen oxide permits traded in the northeastern U.S. since 1999.
- Carbon emissions permits traded in Europe since January 1, 2005.

Corrective Taxes vs. Tradable Pollution Permits

- Like most demand curves, firms' demand for the ability to pollute is a downward-sloping function of the "price" of polluting.
  - A corrective tax raises this price and thus reduces the quantity of pollution firms demand.
  - A tradable permits system restricts the supply of pollution rights, has the same effect as the tax.
- When policymakers do not know the position of this demand curve, the permits system achieves pollution reduction targets more precisely.

Objections to the Economic Analysis of Pollution

- Some politicians, many environmentalists argue that no one should be able to "buy" the right to pollute, cannot put a price on the environment.
- However, people face tradeoffs. The value of clean air and water must be compared to their cost.
- The market-based approach reduces the cost of environmental protection, so it should increase the public's demand for a clean environment.

Private Solutions to Externalities

Types of private solutions:

- Moral codes and social sanctions, e.g., the "Golden Rule"
- Charities, e.g., the Sierra Club
- Contracts between market participants and the affected bystanders

Private Solutions to Externalities

- **The Coase theorem**:
  If private parties can costlessly bargain over the allocation of resources, they can solve the externalities problem on their own.

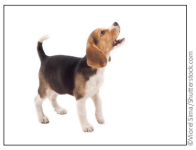
The Coase Theorem: An Example

Dick owns a dog named Spot.

Negative externality:
Spot's barking disturbs Jane, Dick's neighbor.

The socially efficient outcome maximizes Dick's + Jane's well-being.

- If Dick values having Spot more than Jane values peace and quiet, the dog should stay.



See Spot bark.

Coase theorem: The private market will reach the efficient outcome on its own…

The Coase Theorem: An Example

- CASE 1:
  Dick has the right to keep Spot.
  Benefit to Dick of having Spot = $5,000
  Cost to Jane of Spot's barking = $8,000
- Socially efficient outcome:
  Spot goes bye-bye.
- Private outcome:
  Jane pays Dick $6,000 to get rid of Spot, both Jane and Dick are better off.
- Private outcome = efficient outcome.

The Coase Theorem: An Example

- CASE 2:
  Dick has the right to keep Spot.
  Benefit to Dick of having Spot = $10,000
  Cost to Jane of Spot's barking = $8,000
- Socially efficient outcome:
  See Spot stay.
- Private outcome:
  Jane not willing to pay more than $8,000,
  Dick not willing to accept less than $10,000,
  so Spot stays.
- Private outcome = efficient outcome.

The Coase Theorem: An Example

- CASE 3:
  Jane has the legal right to peace and quiet.
  Benefit to Dick of having Spot = $8,000
  Cost to Jane of Spot's barking = $5,000
- Socially efficient outcome: Dick keeps Spot.
- Private outcome: Dick pays Jane $6,000 to put up with Spot's barking.
- Private outcome = efficient outcome.

The private market achieves the efficient outcome regardless of the initial distribution of rights.

ACTIVE LEARNING 3

Applying Coase

Collectively, the 1000 residents of Green Valley value swimming in Blue Lake at $1,000,000.

A nearby factory pollutes the lake water, and would have to pay $500,000 for non-polluting equipment.

A. Describe a Coase-like private solution.

B. Can you think of any reasons why this solution might not work in the real world?

Why Private Solutions Do Not Always Work

1. **Transaction costs**:
   The costs parties incur in the process of agreeing to and following through on a bargain.
   These costs may make it impossible to reach a mutually beneficial agreement.
2. Stubbornness: (最牛釘子戶)
   Even if a beneficial agreement is possible, each party may hold out for a better deal.
3. Coordination problems:
   If # of parties is very large, coordinating them may be costly, difficult, or impossible.

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Summary

- An externality occurs when a market transaction affects a third party.
- If the transaction yields negative externalities (e.g., pollution), the market quantity exceeds the socially optimal quantity.
- If the externality is positive (e.g., technology spillovers), the market quantity falls short of the social optimum.

Summary

- Sometimes, people can solve externalities on their own.
- The Coase theorem states that the private market can reach the socially optimal allocation of resources as long as people can bargain without cost.
- In practice, bargaining is often costly or difficult, and the Coase theorem does not apply.

Summary

- The government can attempt to remedy the problem.
- It can internalize the externality using corrective taxes.
- It can issue permits to polluters and establish a market where permits can be traded.
- Such policies often protect the environment at a lower cost to society than direct regulation.

Externalities

- Market Failure? Or, Failure to Have a Market!
  - Problem is non-existence of market
- Social Cost / Benefit ≠ Private Cost / Benefit
- Market-based Public Policy:
  - Corrective Taxes
  - Tradable Pollution Permits
- Private Solutions: Coase Theorem

- Homework: Mankiw, Ch.10,
  Problem 1, 3, 6, 9, 10.

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Additional Homework Questions

- **True or False.** If universities were made liable to their students for the effects of assaults that occurred on campus, the number of such assaults might go up.
- **True or False.** If a new law states that married men have the duty to do at least half the housework (or, wives have the right to make such a request), then a lot of men will have to do more housework than they do today.

Additional Homework Questions

- **True or False.** If the courts enforce a negligence standard in determining liability for auto accidents, then people will take too many car trips.
- **Definition:** "Under a negligence rule, injurers are responsible for the damages they cause to their victims **only if they have not met the applicable standard of care**. If injurers meet that standard of care, then they are not liable and victim bears the full cost of their injuries."
  - Bajtelsmit and Thistle (2007)