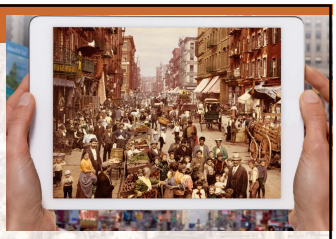
N. GREGORY MANKIW

PRINCIPLES OF

ECONOMICS

Eight Edition



CHAPTER

10

Externalities

Premium PowerPoint Slides by:
V. Andreea CHIRITESCU
Eastern Illinois University

Modified by Joseph Tao-yi Wang

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?

Externalities

- 'Markets are usually a good way to organize economy activity'
  - In absence of market failures, the competitive market outcome is efficient, maximizes total surplus
- Externality: one type of market failure
  - The uncompensated impact of one person's actions on the well-being of a bystander

Externalities

- Negative externality
  - Impact on the bystander is adverse
- Positive externality
  - Impact on the bystander is beneficial
- Self-interested buyers and sellers
  - Neglect the external costs or benefits of their actions
  - So the market outcome is not efficient

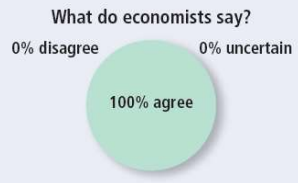
Externalities

- 'Government action can sometimes improve upon market outcomes'
  - Why markets sometimes fail to allocate resources efficiently
  - How government policies can potentially improve the market's allocation
  - What kinds of policies are likely to work best

ASK THE EXPERTS

Vaccines

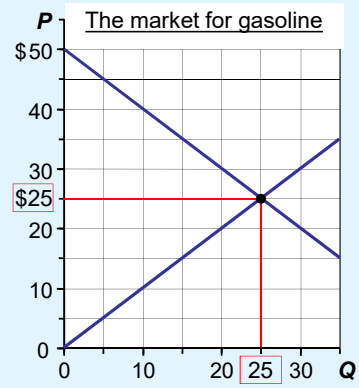
"Declining to be vaccinated against contagious diseases such as measles imposes costs on other people, which is a negative externality."



Negative Externalities

- 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

Recap of Welfare Economics

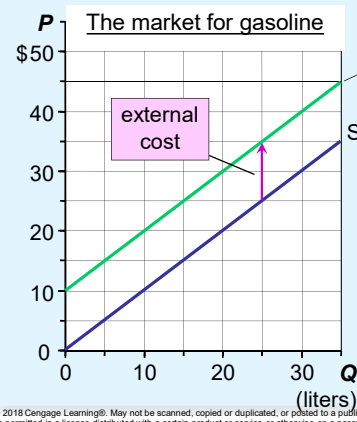


The market equilibrium maximizes consumer + producer surplus.

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

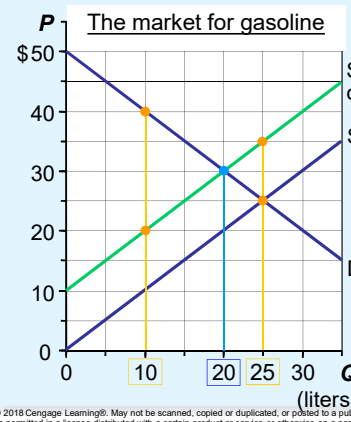


Social cost
= private + external cost

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 exceeds social cost.

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

Analysis of a Negative Externality

Market equilibrium ($Q = 25$) is greater than social optimum ($Q = 20$).

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

Externalities

- Internalizing the externality:
  - Altering incentives so that people take into account the external effects of their actions
  - In our example, the $10/liter tax on sellers makes sellers' costs = social costs.
- If market participants pay social costs
  - Market equilibrium = social optimum

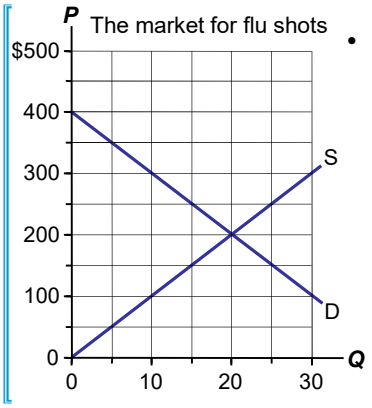
Positive Externalities

- 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
  - Research and development creates knowledge others can use
  - People going to college raise the population's education level, which reduces crime and improves government

Positive Externalities

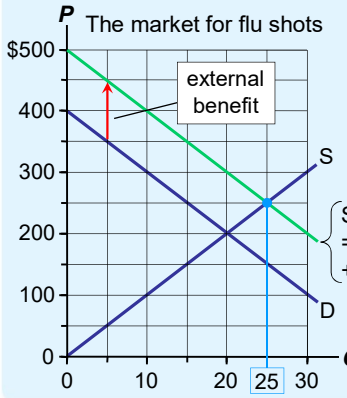
- With a positive externality
  - The social value of a good includes
    - Private value – the direct value to buyers
    - External benefit – the value of the positive impact on bystanders
- The socially optimal Q maximizes welfare:
  - At any lower Q, the social value of additional units exceeds their 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

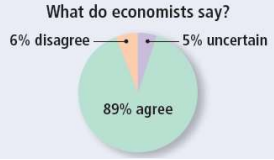
Effects of Externalities: Summary

- 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

ASK THE EXPERTS

Vaccines

"Considering the costs of restricting free choice, and the share of people in the US who choose not to vaccinate their children for measles, the social benefit of mandating measles vaccines for all Americans (except those with compelling medical reasons) would exceed the social cost."



Public Policies Toward Externalities

- Command-and-control policies
  - Regulate behavior directly
    - Limits on quantity of pollution emitted
    - Requirements that firms adopt a particular technology to reduce emissions
- Market-based policies
  - Incentives so that private decision makers will choose to solve the problem on their own
    - Corrective taxes and subsidies
    - Tradable pollution permits

Public Policies Toward Externalities

- Corrective taxes and subsidies
  - Corrective taxes (*Pigovian taxes*)
  - Induce private decision makers to take account of the social costs that arise from a negative externality
  - Places a price on the right to pollute
  - Reduce pollution at a lower cost to society
  - Raise revenue for the government
  - Enhance economic efficiency

Corrective Taxes vs. Regulations

- Different firms
  - Have different costs of pollution abatement
- Efficient outcome
  - Firms with the lowest abatement costs reduce pollution the most

Corrective Taxes vs. Regulations

- 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.
- Regulation requiring all firms to reduce pollution by a specific amount
  - Is 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

CASE STUDY Example of a Corrective Tax: The Gas Tax

The gas tax targets three negative externalities:

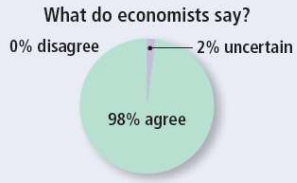
- Congestion
  The more you drive, the more you contribute to congestion.
- Accidents
  Larger vehicles cause more damage in an accident.
- Pollution
  Burning fossil fuels produces greenhouse gases.

ASK THE EXPERTS
Carbon Taxes

"The Brookings Institution recently described a U.S. carbon tax of $20 per ton, increasing at 4 percent per year, which would raise an estimated $150 billion per year in federal revenues over the next decade. Given the negative externalities created by carbon dioxide emissions, ...

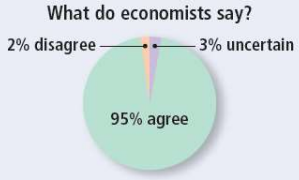
ASK THE EXPERTS
Carbon Taxes

...a federal carbon tax at this rate would involve fewer harmful net distortions to the U.S. economy than a tax increase that generated the same revenue by raising marginal tax rates on labor income across the board."



ASK THE EXPERTS
Carbon Taxes

"A tax on the carbon content of fuels would be a less expensive way to reduce carbon-dioxide emissions than would a collection of policies such as 'corporate average fuel economy' requirements for automobiles."



Active Learning 2 — Reducing pollution

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 US Electric

Active Learning 2 — A. Regulation

- 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 US Electric.

- 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. Tradeable pollution permits

- 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 for 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

Active Learning 2 B. Answers

- Compute cost of achieving goal for 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.

Public Policies Toward Externalities

- 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

Public Policies Toward Externalities

- Reducing pollution using pollution permits or corrective taxes
  - Firms pay for their pollution
    - Corrective taxes: pay to the government
    - Pollution permits: pay to buy permits
  - Internalize the externality of pollution

Public Policies Toward Externalities

- Objections to the economic analysis of pollution
  - "We cannot give anyone the option of polluting for a fee." - by late Senator Edmund Muskie
- People face trade-offs
  - Eliminating all pollution is impossible
  - Clean water and clean air – opportunity cost: lower standard of living

Public Policies Toward Externalities

- Clean environment is a normal good
  - Positive income elasticity
    - Rich countries can afford a cleaner environment
    - More rigorous environmental protection
  - Clean air and clean water - law of demand
    - The lower the price of environmental protection
    - The more the public will want it

Private Solutions to Externalities

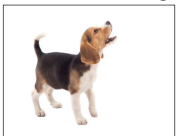
- The types of private solutions
  - Moral codes and social sanctions
  - Charities
  - Self-interest of the relevant parties
    - Integrating different types of businesses
  - Interested parties can enter into a contract

Private Solutions to Externalities

- The Coase theorem
  - If private parties can bargain without cost over the allocation of resources
    - They can solve the problem of externalities on their own
- Whatever the initial distribution of rights
  - Interested parties can reach a bargain:
    - Everyone is better off
    - Outcome is efficient

Private Solutions to Externalities

1. Dick has the legal right to keep a barking dog (Spot).
   - Dick gets a $5,000 benefit from the dog
   - Jane bears an $8,000 cost from the barking
   - Efficient outcome:
     - Jane can offer Dick $6,000 to get rid of the dog
     - Dick will gladly accept
     - Bye-bye Spot!
     - Both are better off



Private Solutions to Externalities

2. Dick has the legal right to keep a barking dog (Spot).
   - Dick gets a $10,000 benefit from the dog
   - Jane bears an $8,000 cost from the barking
   - Efficient outcome:
     - Dick turns down any offer below $10,000
     - Jane will not offer any amount above $8,000
     - Dick keeps the dog

Private Solutions to Externalities

3. Jane can legally compel Dick to get rid of the dog (Spot)
   - Dick gets a $8,000 benefit from the dog
   - Jane bears an $5,000 cost from the barking
   - Efficient outcome
     - Dick keeps Spot
     - Private outcome: Dick pays Jane $6,000 to put up with Spot's barking

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

Active Learning 3 — Applying Coase

Collectively, the 1000 residents of Chou Tribe value swimming in Sunny Moon 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?

Private Solutions to Externalities

Why private solutions do not always work

- High transaction costs
  - Costs that parties incur in the process of agreeing to and following through on a bargain
- Stubbornness: (最牛釘子戶)
  - bargaining simply breaks down
- Coordination problems
  - Large number of interested parties
  - Coordinating everyone is costly

Summary

- When a transaction between a buyer and seller directly affects a third party, the effect is called an externality.
  - If an activity yields negative externalities, such as pollution, the socially optimal quantity in a market is less than the equilibrium quantity.
  - If an activity yields positive externalities, such as technology spillovers, the socially optimal quantity is greater than the equilibrium quantity.

Summary

- Governments pursue various policies to remedy the inefficiencies caused by externalities.
  - Regulating behavior
  - Internalizes an externality using corrective taxes
  - Issue tradable permits (similar results to imposing corrective taxes on polluters)

Summary

- According to the Coase theorem, if people can bargain without cost, then they can always reach an agreement in which resources are allocated efficiently.
  - In many cases, however, reaching a bargain among the many interested parties is difficult, so the Coase theorem does not apply.

Chapter 10: Externalities

- Market Failure? Or, Lack of Market Failure!
  - Caused by lack of property rights!
- Social Cost/Benefit ≠ Private Cost/Benefit
- Market-based Public Policy:
  - Corrective Taxes
  - Tradable Pollution Permits
- Private Solutions: Coase Theorem

Chapter 10: Homework

- Mankiw, Ch.10, Problem 1, 4, 5, 8, 9
- Challenge Questions (Past Midterms)
  - 2007 - Essay Q6b
  - 2008 - Essay C5-9 (Multi-Choice Q12, Q13)
  - 2009 - Essay C1-4 (Multi-Choice Q13)
  - 2010 - Essay A (True/False Q10)
  - 2014 - Essay B
  - 2015 - Essay A4-5, B3
  - 2016 - Essay D
  - 2017 - Essay C
  - 2018 - Essay C, D

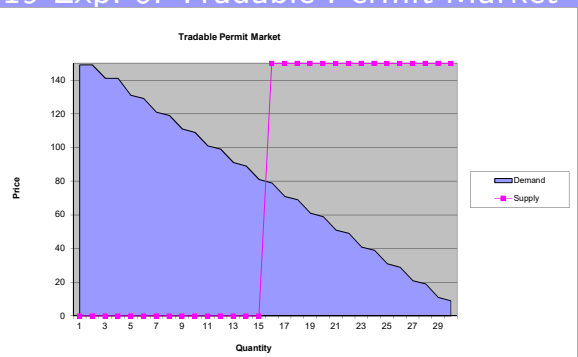
Experiment 6: Tradable Permit Market

- 3-4 per group; 1 market = 20 factory
  - 3-4人一組參與交易實驗，每組同學代表一家工廠，分屬兩個不同市場副本，每個市場有二十家工廠。
- Each group gets a card (J=11, Q=12, K=13, A=1, "Small" Joker = 14, "Big" Joker = 15)
  - 每組同學會拿到一張有數字的撲克牌(J=11，Q=12，K=13，但A=1，而大鬼=15, 小鬼=14)，
- # of your card multiplied by 10 and plus 1 = Cost to reduce 1 ton of carbon emission
  - 牌面數字乘以十再加上一代表您減少一噸碳排放所需的減碳成本(元)。請收好這張牌不讓人看到其花色數字。

Gov't issues permits (政府發放執照)

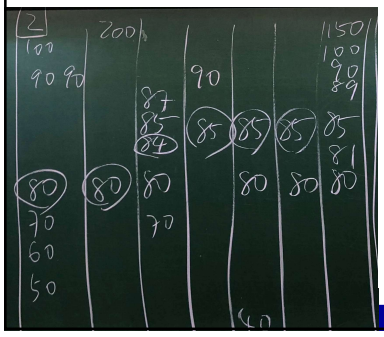
- Receive permit directly from gov't = obtain special technology to lower your cost by $2.
  - Cost: # of your card multiplied by 10 & minus 1
  - 政府直接給你執照的減碳成本 = 牌面數字 x 10 - 1
- After distribution, firms can trade permits:
  - 自由談判(Free Form Bargaining)
  - 看得見的手 (The Visible Hand)
  - 政府拍賣(Governmental Auctions):
  - English (Ascending Price) Auction, or
  - Dutch (Descending Price) Auction

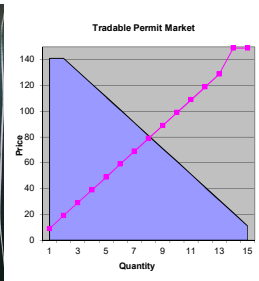
2019 Exp. 6: Tradable Permit Market



2019 Exp. 6: Tradable Permit Market

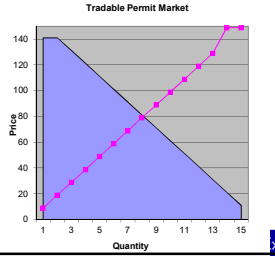
1. Random Distribution - Free-form Bargaining (omit)
2. Random Distribution - Visible Hand

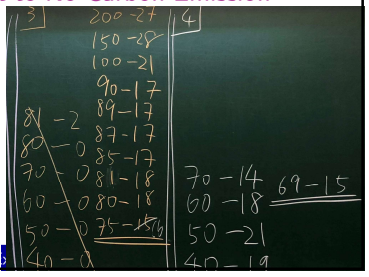




2019 Exp. 6: Tradable Permit Market

1. Random Distribution - Free-form Bargaining (omit)
2. Random Distribution - Visible Hand
3. Factories Have Right To Pollute
4. Residents Have Right to No Carbon Emission

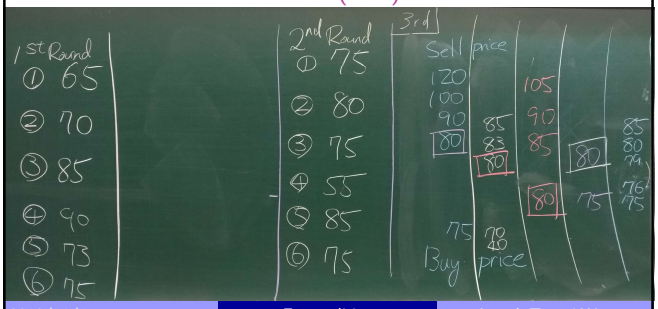




2018 Exp. 6: Tradable Permit Market

Random Allocation: Market 1 (R-side)

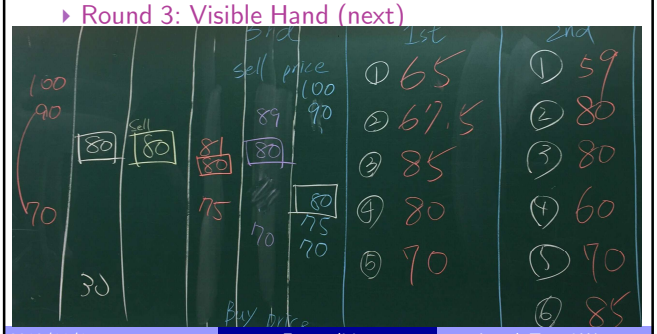
- Round 1-2: Free-form Bargaining (Simultaneous)
- Round 3: Visible Hand (first)



2018 Exp. 6: Tradable Permit Market

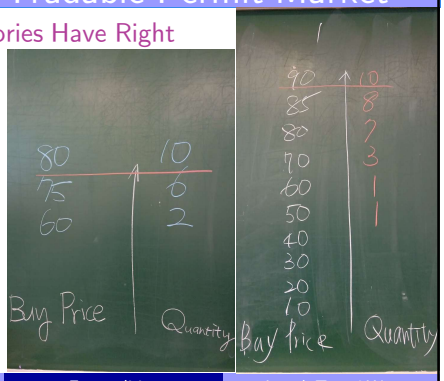
Random Allocation: Market 1 (L-side)

- Round 1-2: Free-form Bargaining (Simultaneous)
- Round 3: Visible Hand (next)



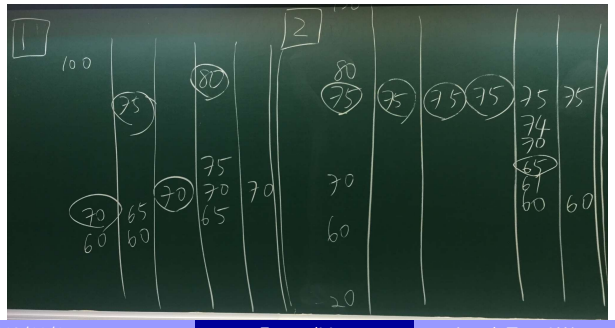
2018 Exp. 6: Tradable Permit Market

- Round 4: Factories Have Right To Pollute
- L-side first (P=90)
- R-side next (P=80)



2017 Exp 6: Tradable Permit Market

- Round 1 and 2: Random Allocation



2017 Exp 6: Tradable Permit Market

- Round 3:
- Factories Have Right To Pollute
- Round 4:
- Residents Have Right For Clean Water
- Round 5-6: N/A