ECO2011 Basic Microeconomics

Mankiw Chapter 10 (Externality)

2025

Motivation

- One night before Zhang San's ECO2011 midterm exam, his roommate talks loudly on his phone for 2 hours in the dorm……

Externalities

- Externality: one type of market failure
  - The uncompensated impact of one person's actions on the well-being of a bystander
  - Negative externality
    - Impact on the bystander is adverse
  - Positive externality
    - Impact on the bystander is beneficial

Examples of Negative Externalities

- Air pollution from a factory
- The neighbor's barking dog

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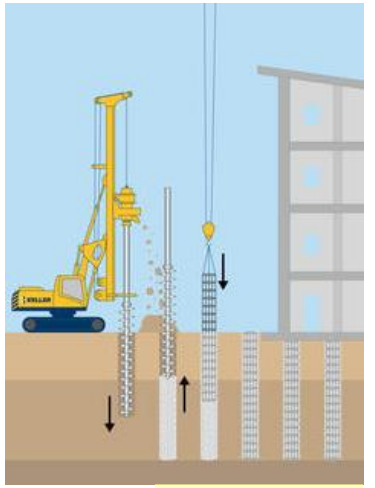
- Late-night stereo blasting from the dorm room next to yours
- Noise pollution from construction projects
- Health risk to others from second-hand smoke
- Talking on cell phone while driving makes the roads less safe for others



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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

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- People going to college raise the population's education level, which reduces crime and improves government

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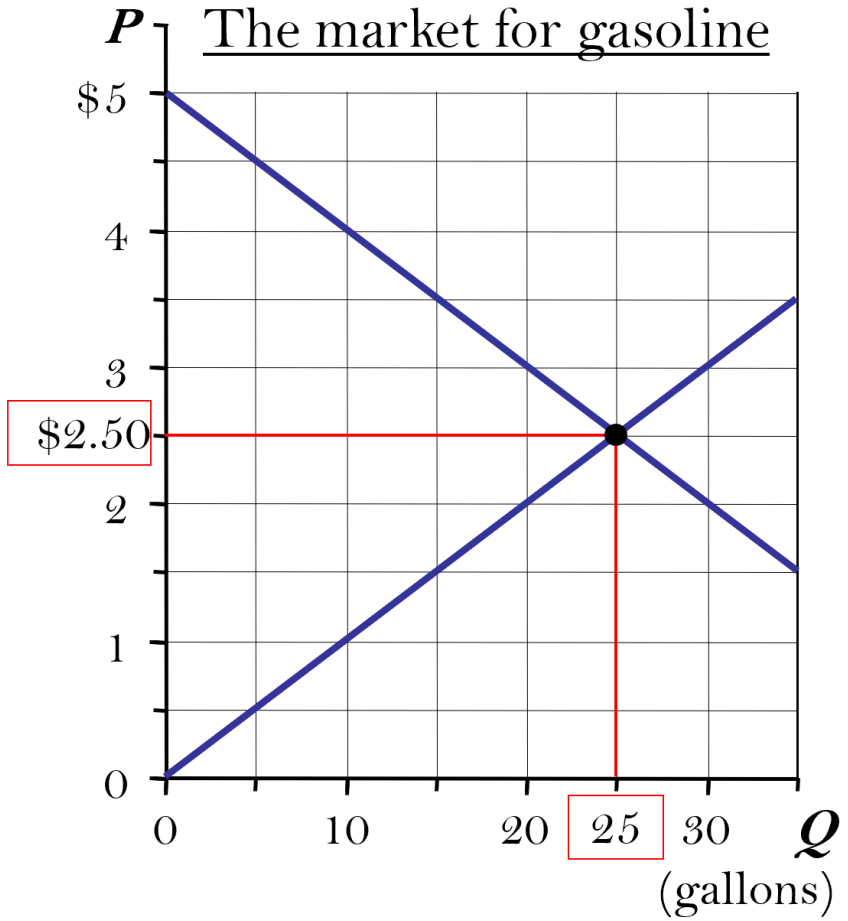
Externalities

- Self-interested buyers and sellers neglect the external effects of their actions, so the market outcome is not efficient.
- Another principle from Chapter 1: Governments can sometimes improve market outcomes.

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).



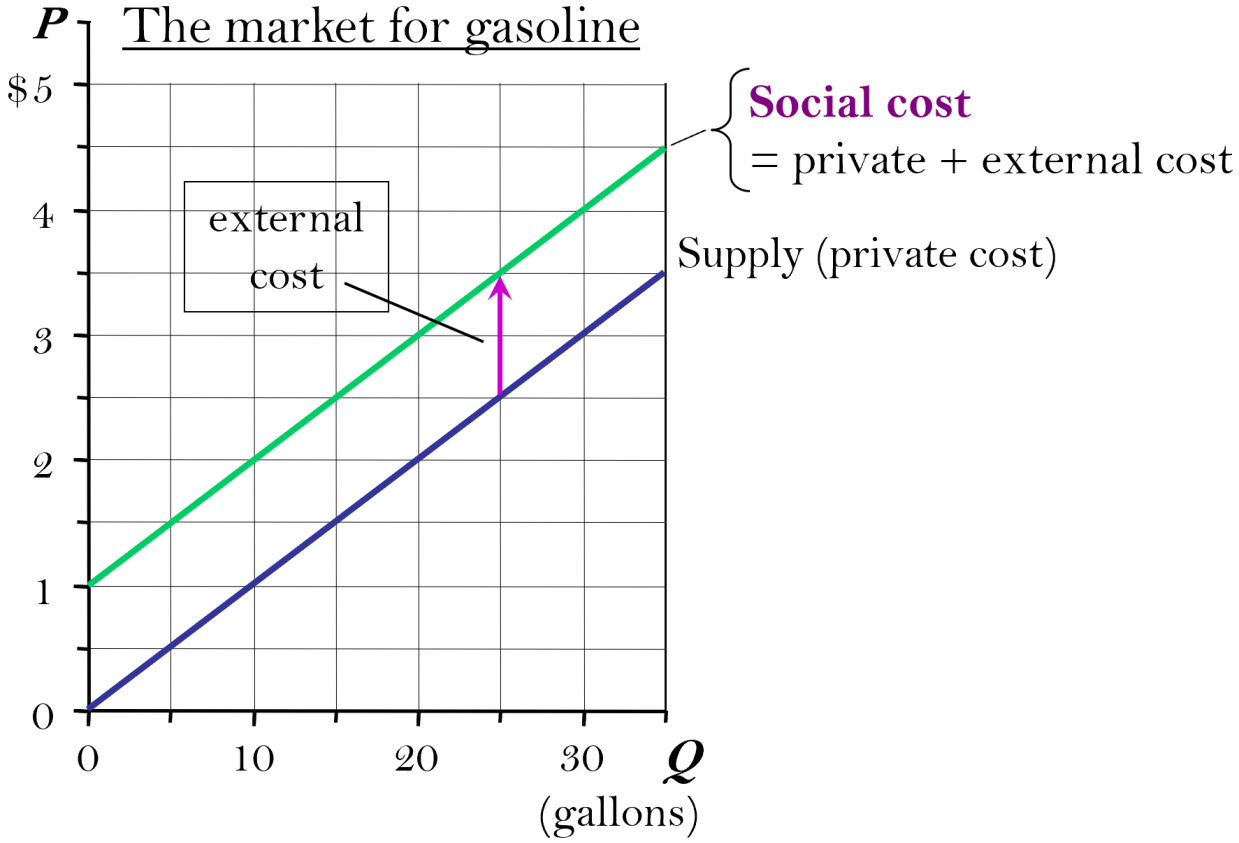
Analysis of a Negative Externality

- **External cost**

  = value of the negative impact on bystanders

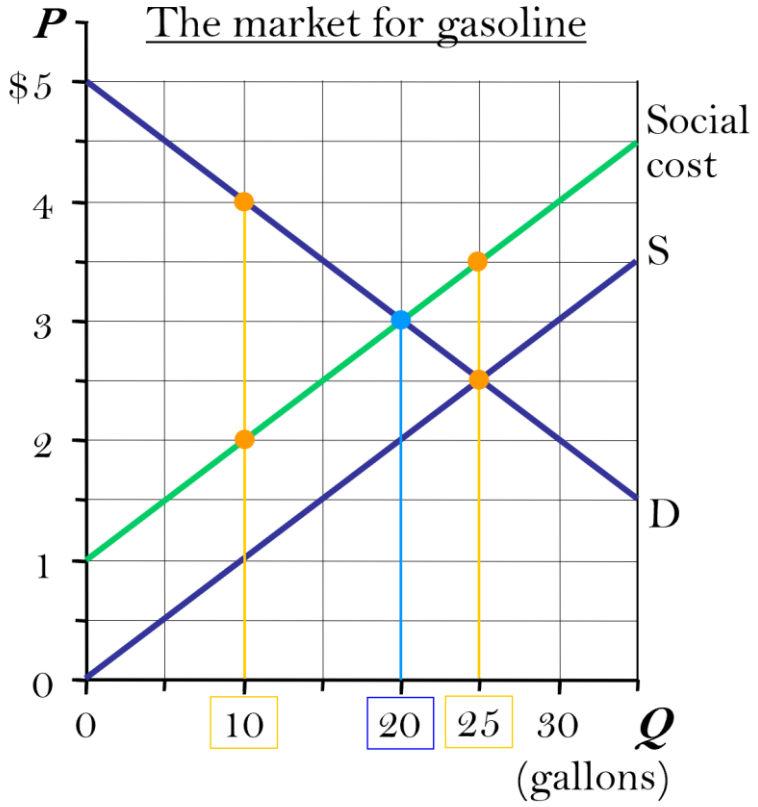
  = $1 per gallon

(value of harm from smog, greenhouse gases)



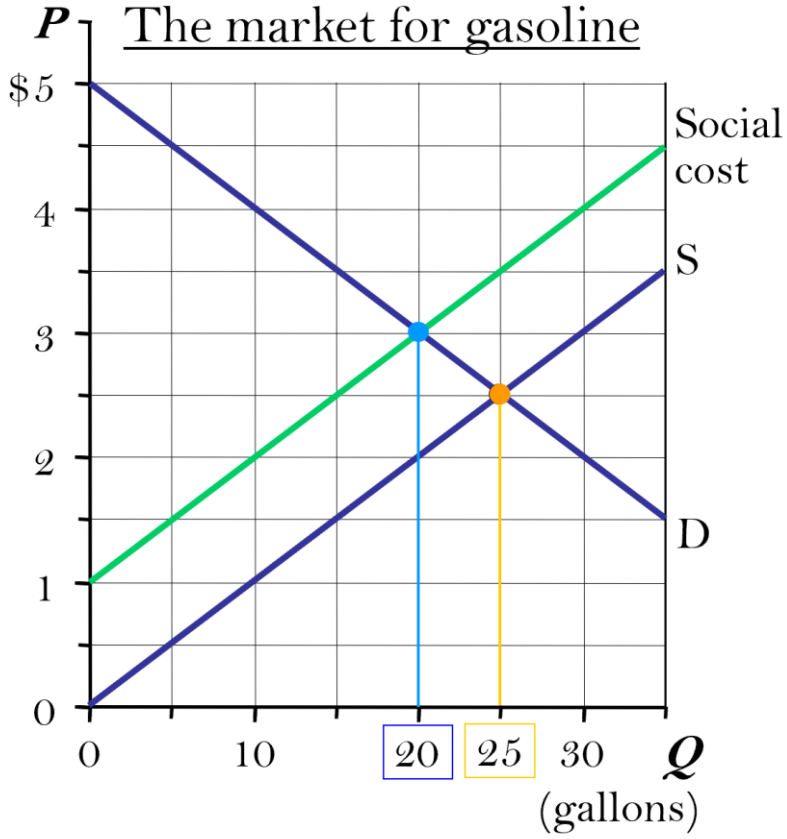
Analysis of a Negative Externality

- The socially optimal quantity is 20 gallons.
- At any $Q < 20$, value of additional gas exceeds social cost.
- At any $Q > 20$, social cost of the last gallon 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 \$1/gallon, would shift S curve up \$1.



Example: Pollution

- Example of negative externality: Air pollution from a factory.
  - The firm does not bear the full cost of its production, and so will produce more than the socially efficient quantity.
- How govt may improve the market outcome:
  - Impose a tax on the firm equal to the external cost of the pollution it generates

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"Internalizing the Externality"

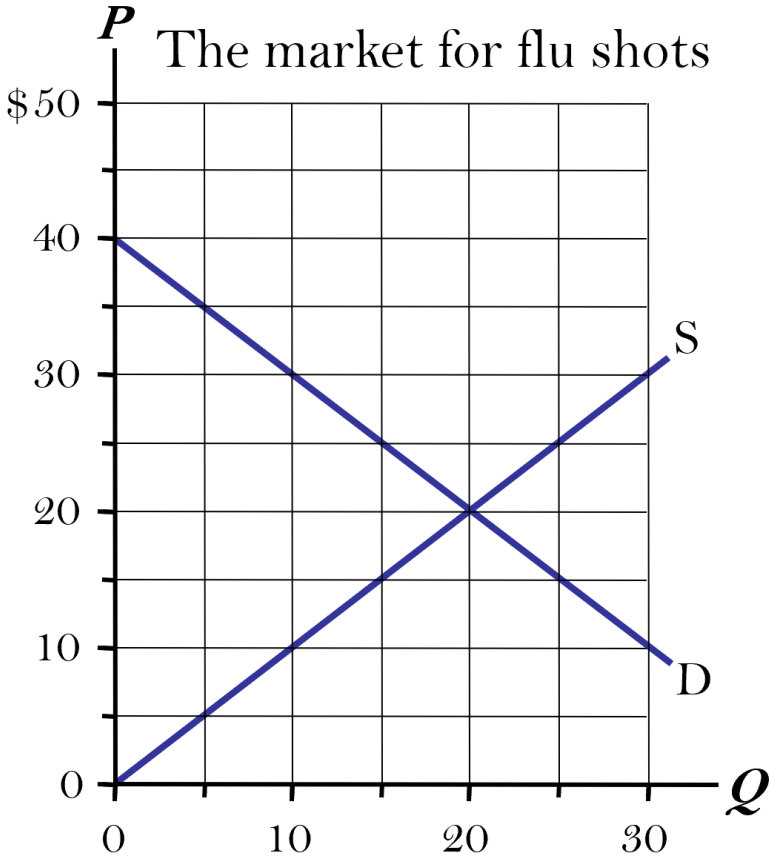
- Internalizing the externality: Altering incentives so that people take into account the external effects of their actions
- In the previous example, the $1/gallon tax on sellers makes sellers' costs equal to social costs.
- When market participants must pay social costs, the market eq'm matches the social optimum. (Imposing the tax on buyers would achieve the same outcome; market Q would equal optimal Q.)

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 = $10/shot
  - Draw the social value curve.
  - Find the socially optimal Q.
  - What policy would internalize this externality?



More Example: Education

- A more educated population benefits society:
  - lower crime rates: educated people have more opportunities, so less likely to rob and steal
  - better government: educated people make better-informed voters
- People do not consider these external benefits when deciding how much education to "purchase"
- Result: market eq'm quantity of education too low
- How govt may improve the market outcome:
  - subsidize cost of education

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

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 in which everyone is better off and the outcome is efficient.

Coase Theorem: An Example

1. Leonard has the legal right to keep a barking dog (Spot).
   - Leonard gets a $500 benefit from the dog
   - Sheldon bears an $800 cost from the barking
   - Efficient outcome:
     - Sheldon can offer Leonard $600 to get rid of the dog
     - Leonard will gladly accept
     - Bye-bye Spot!
     - Both are better off

Coase Theorem: An Example

2. Leonard has the legal right to keep a barking dog (Spot).
   - Leonard gets a $1,000 benefit from the dog
   - Sheldon bears an $800 cost from the barking
   - Efficient outcome:
     - Leonard turns down any offer below $1,000
     - Sheldon will not offer any amount above $800
     - Leonard keeps the dog

Coase Theorem: An Example

3. Sheldon can legally compel Leonard to get rid of the dog (Spot)
   - Leonard gets a $800 benefit from the dog
   - Sheldon bears an $500 cost from the barking
   - Efficient outcome
     - Leonard keeps Spot
     - Private outcome: Leonard pays Sheldon $600 to put up with Spot's barking

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

Active Learning Applying Coase

Collectively, the 1000 residents of Green Valley value swimming in Blue Lake at $100,000.

A nearby factory pollutes the lake water, and would have to pay $50,000 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?

- Transaction costs: the costs that parties incur in the process of agreeing to and following through on a bargain
- Sometimes when a beneficial agreement is possible, each party may hold out for a better deal.
- Coordination problems & costs when the number of parties is very large.

Public Policies Toward Externalities

- 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
  - Incentives so that private decision makers will choose to solve the problem on their own
    - Corrective taxes and subsidies
    - Tradable pollution permits

Market-Based Policy #1: 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

Market-Based Policy #1: Corrective Taxes & Subsidies

- Example: Acme, US Electric run coal-burning power plants. Each emits 40 tons of sulfur dioxide per month. SO2 causes acid rain & other health issues.
- Policy goal: reducing SO2 emissions 25%
- Policy options
  - regulation: require each plant to cut emissions by 25%
  - corrective tax: make each plant pay a tax on each ton of SO2 emissions. Set tax at level that achieves goal.

Market-Based Policy #1: Corrective Taxes & Subsidies

- Suppose cost of reducing emissions is lower for Acme than for US Electric.
- Socially efficient outcome: Acme reduces emissions more than US Electric.
- The corrective tax is a price on the right to pollute.
- Like other prices, the tax allocates this "good" to the firms who value it most highly (US Electric).

Market-Based Policy #1: Corrective Taxes & Subsidies

- Under regulation, firms have no incentive to reduce emissions beyond the 25% target.
- A tax on emissions gives firms incentive to continue reducing emissions 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.

Market-Based Policy #1: Corrective Taxes & Subsidies

- Other taxes distort incentives and move economy away from the social optimum.
- But corrective taxes enhance efficiency by aligning private with social incentives.

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.

Discussion Question

Policy goal: Reducing gasoline consumption

Two approaches:

A. Enact regulations requiring automakers to produce more fuel-efficient vehicles

B. Significantly raise the gas tax

Discuss the merits of each approach. Which do you think would achieve the goal at lower cost? Who do you think would support or oppose each approach?

Market-Based Policy #2: Tradable Pollution Permits

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 SO2 emissions 25%, to 60 tons/month
- Cost of reducing emissions:
  - $100/ton for Acme
  - $200/ton for US Electric

Active Learning 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 B. Tradeable pollution permits

- Policy option 2: Tradable pollution permits
  - Issue 60 permits, each allows one ton SO2 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 $150 each.

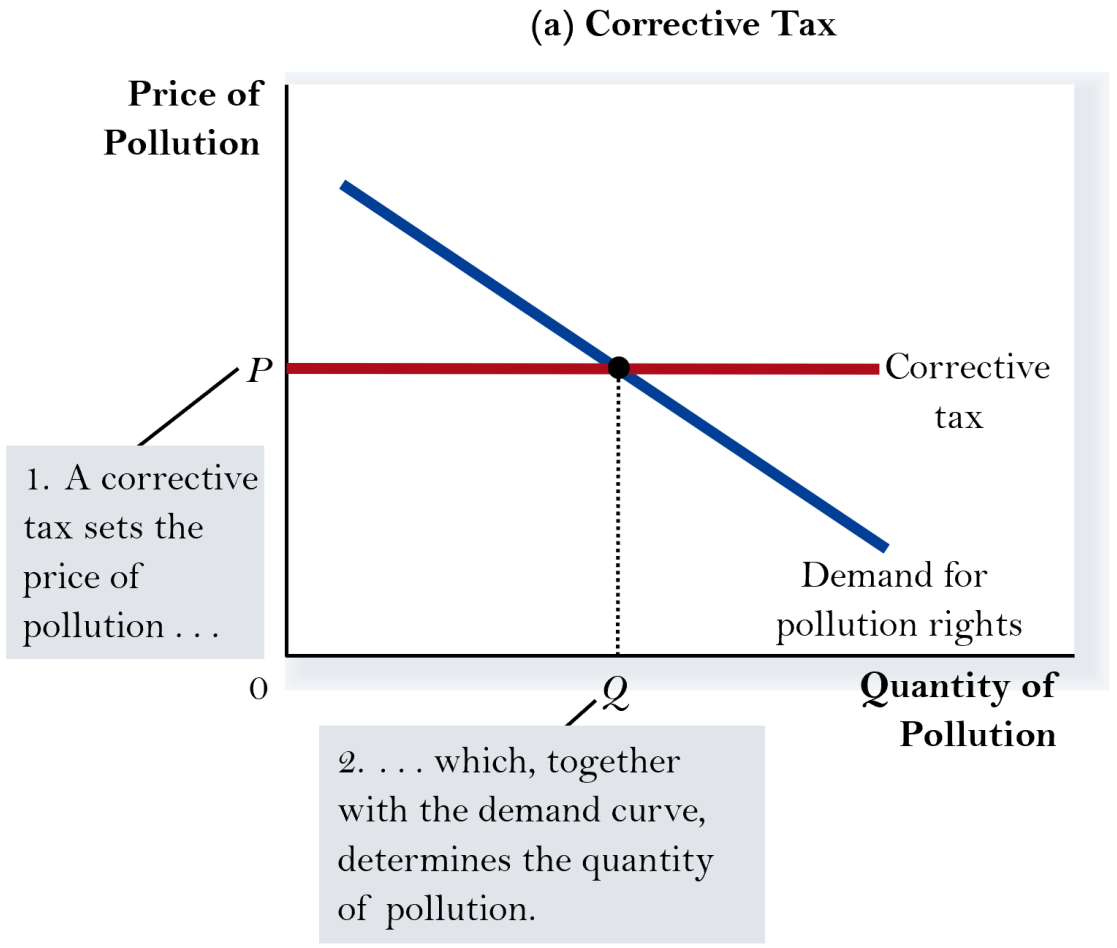
Market-Based Policy #2: Tradable Pollution Permits

- A system of tradable pollution permits achieves goal at lower cost than regulation.
  - Firms with low cost of reducing pollution sell whatever permits they can.
  - Firms with high cost of reducing pollution buy permits.
- Result: Pollution reduction is concentrated among those firms with lowest costs.

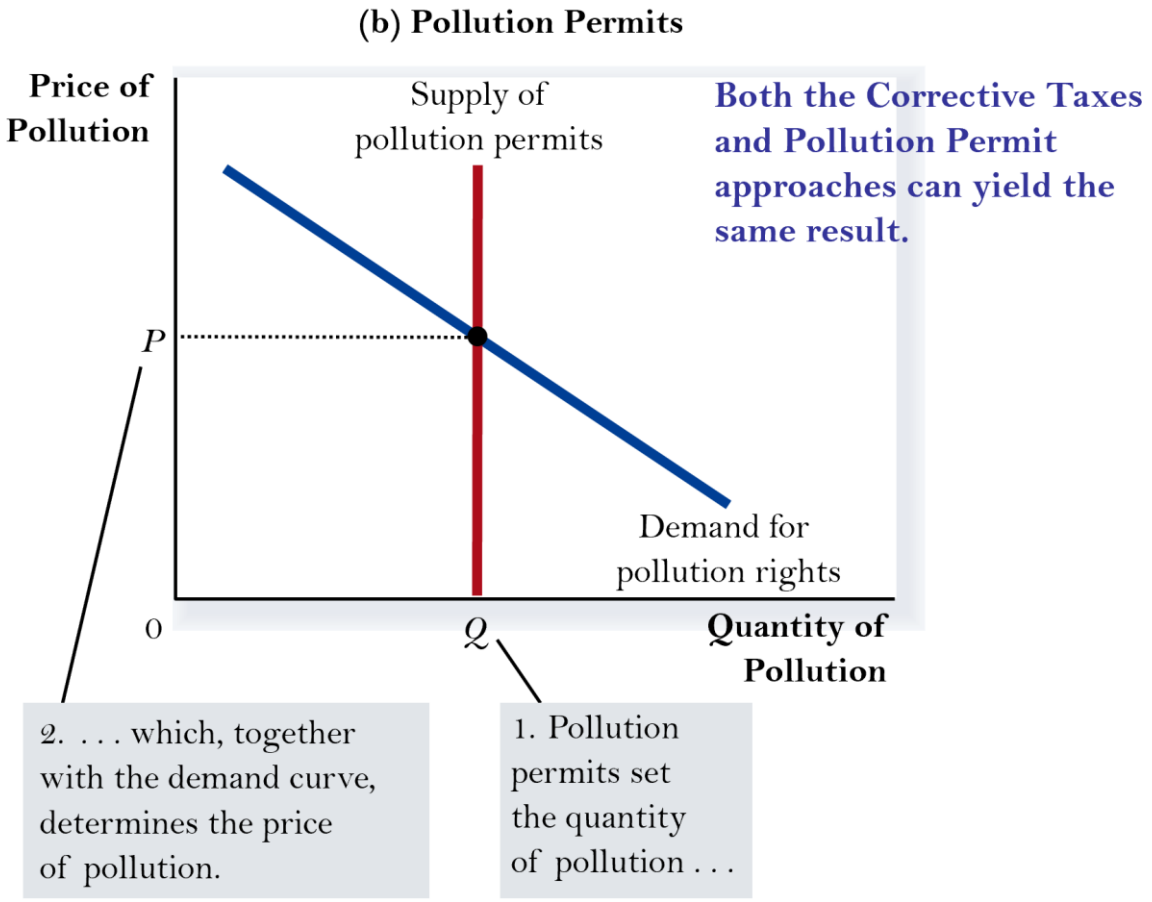
Tradable Pollution Permits in the Real World

- 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.

The Equivalence of Corrective Taxes and Pollution Permits



The Equivalence of Corrective Taxes and Pollution Permits



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 & 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.

Can You Answer the Following 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?

End