Masaryk University

Microeconomics 1

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Lecture

7

Externalities

Chapter 10

Lecture Today

- 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?

One of the Ten Principles from Chapter 1:

Markets are usually a good way to organize economic 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.

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 the efficiency.

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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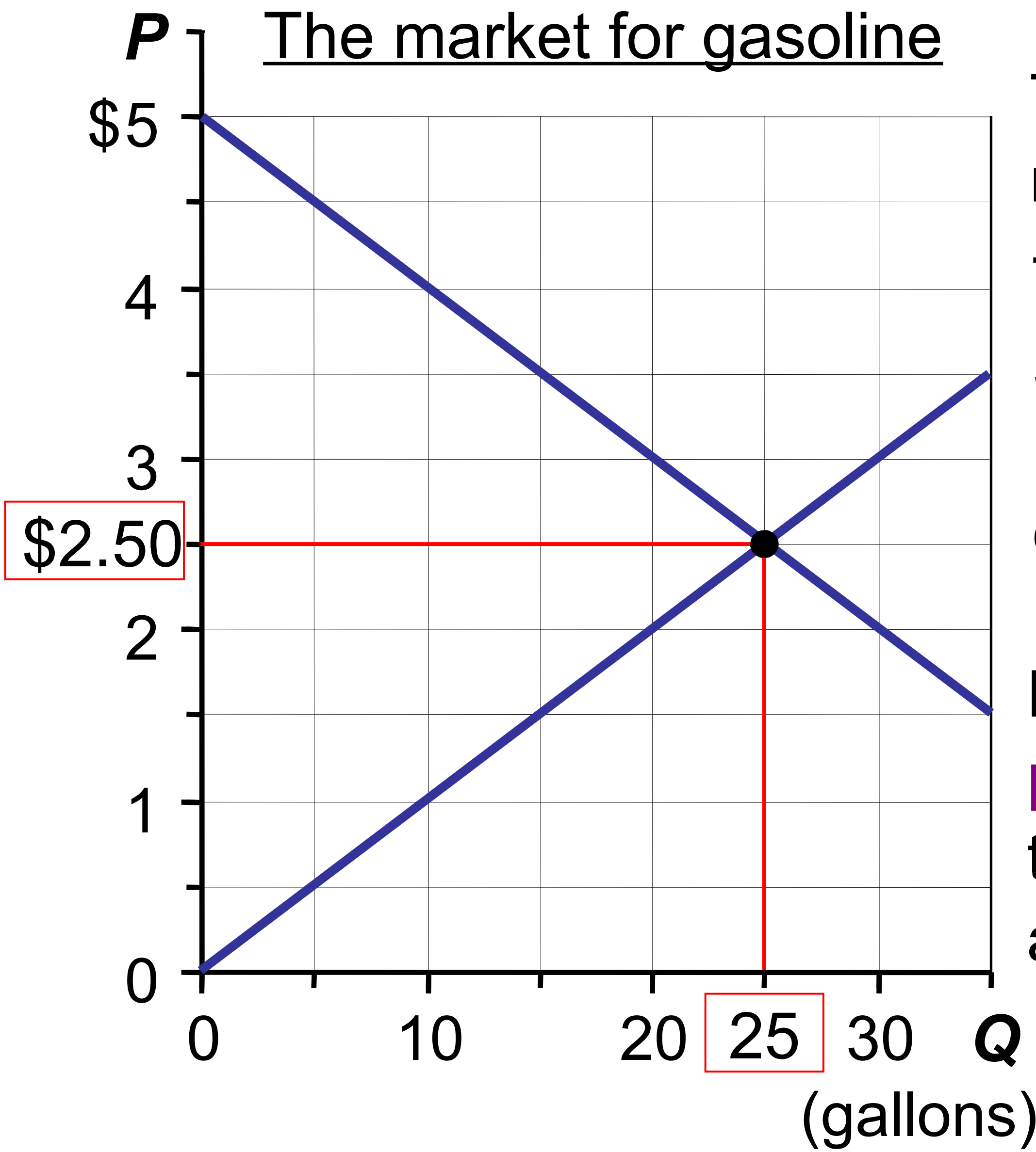
Recap of Welfare Economics

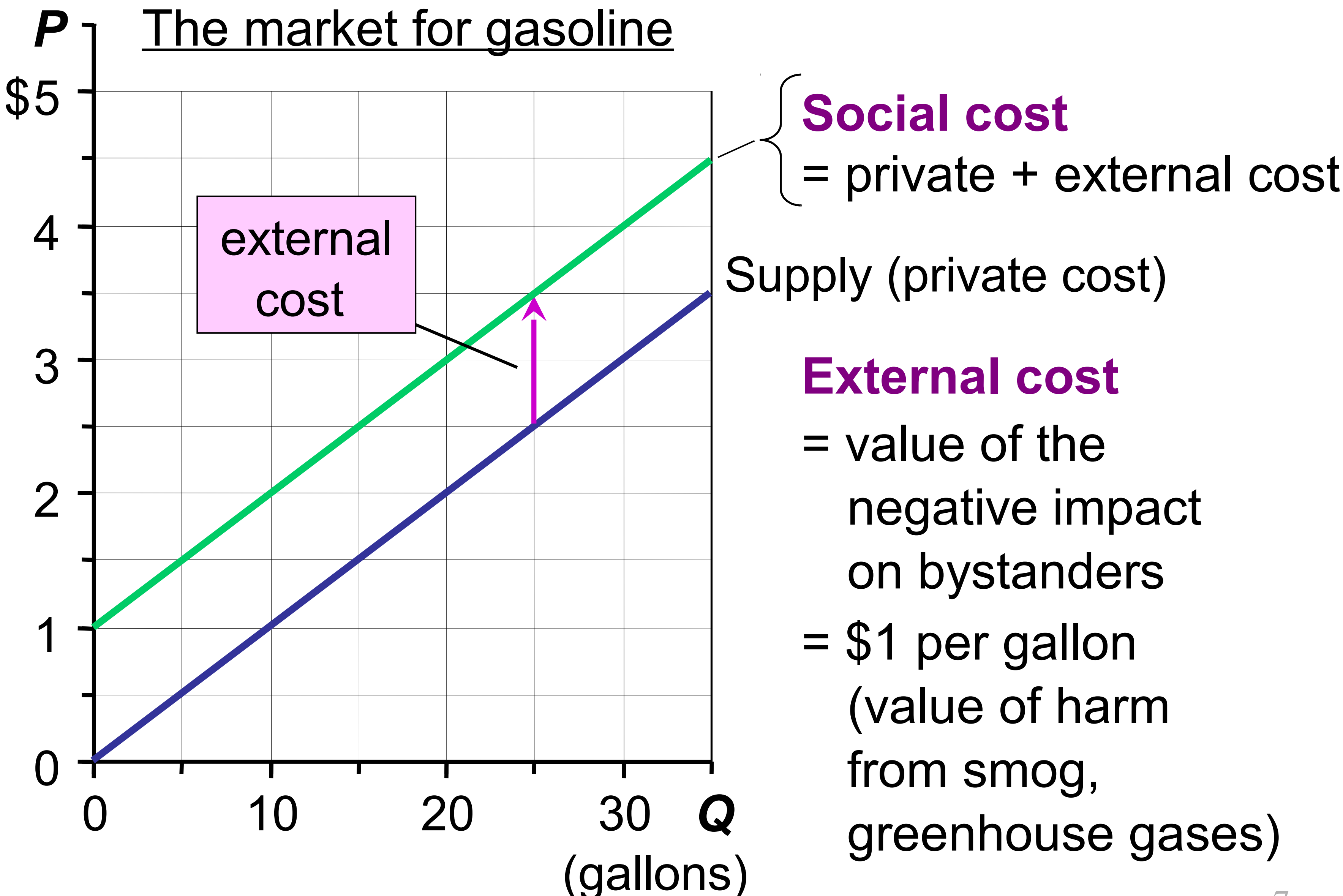


The market eq'm maximizes consumer + producer surplus.

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

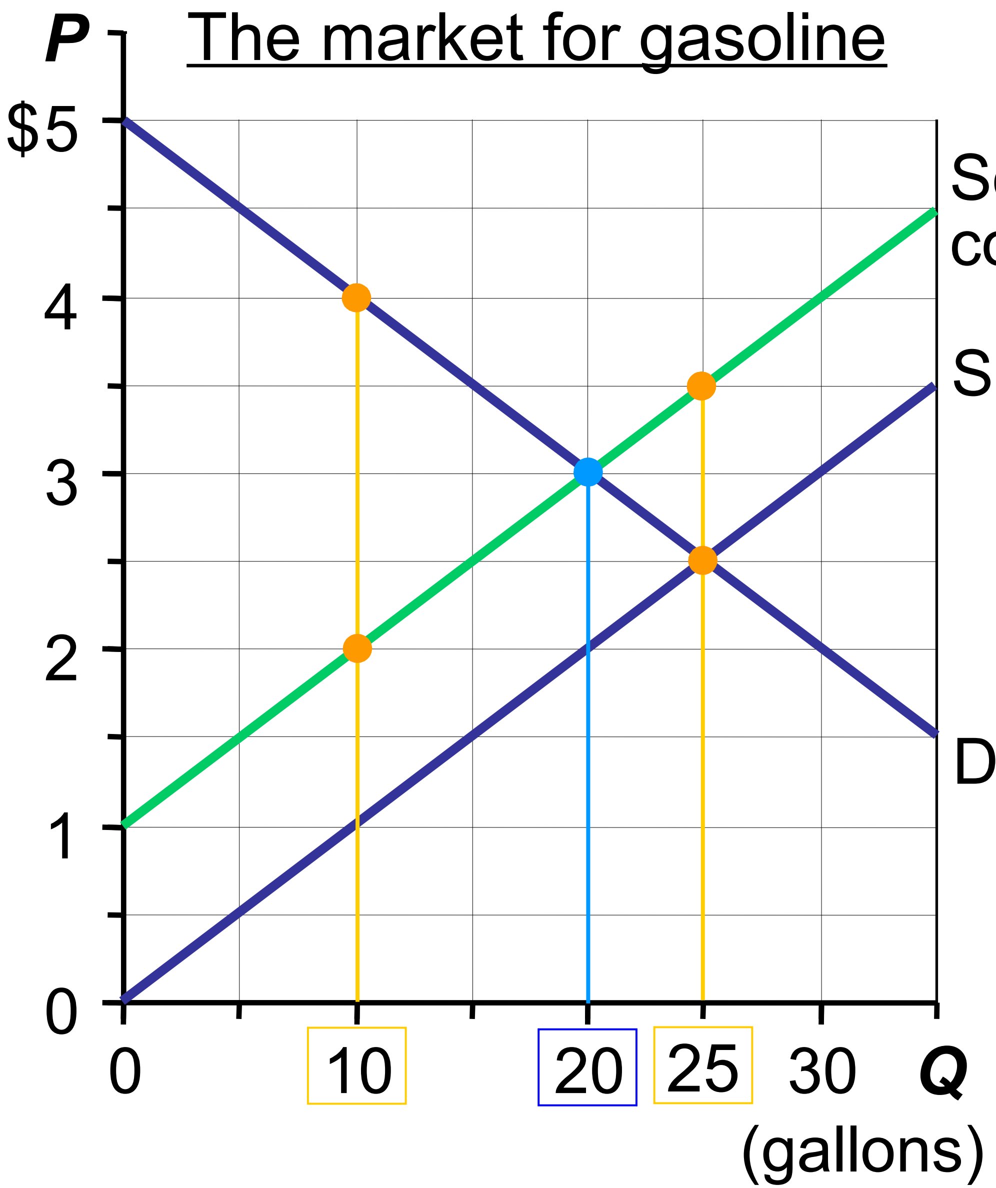
Demand curve shows **private value**, the value to buyers (the prices they are willing to pay).

Analysis of a Negative Externality



External cost
= value of the negative impact on bystanders
= $1 per gallon (value of harm from smog, greenhouse gases)

Analysis of a Negative Externality

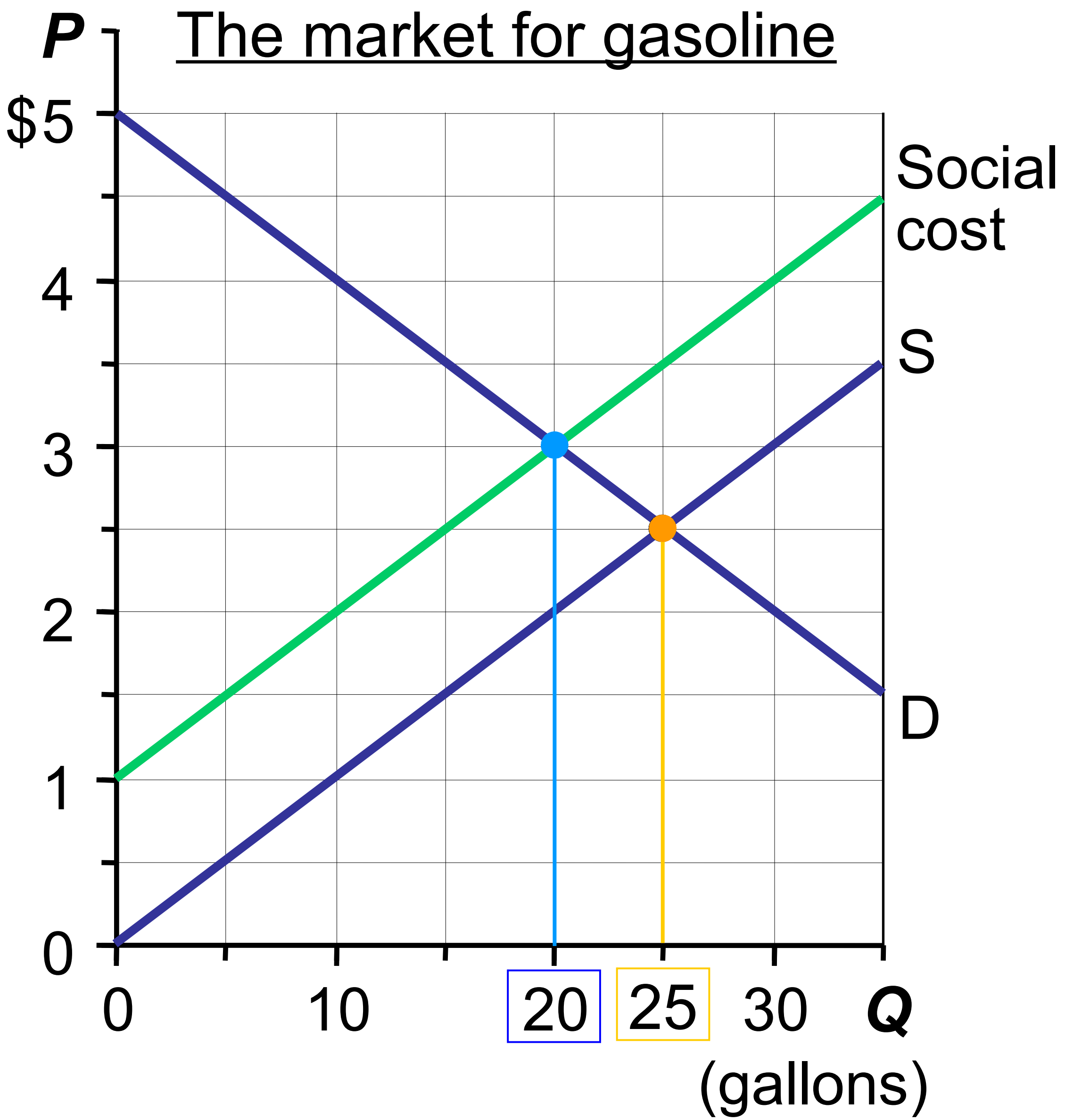


The socially optimal quantity is 20 gallons.

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

At any **Q** > 20, social cost of the last gallon 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
$1/gallon,
would shift
S curve up $1.

Being vaccinated against coronavirus protects not only you, but other students at Masaryk university or at the dormitory where you stay

R&D creates knowledge others can use.

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

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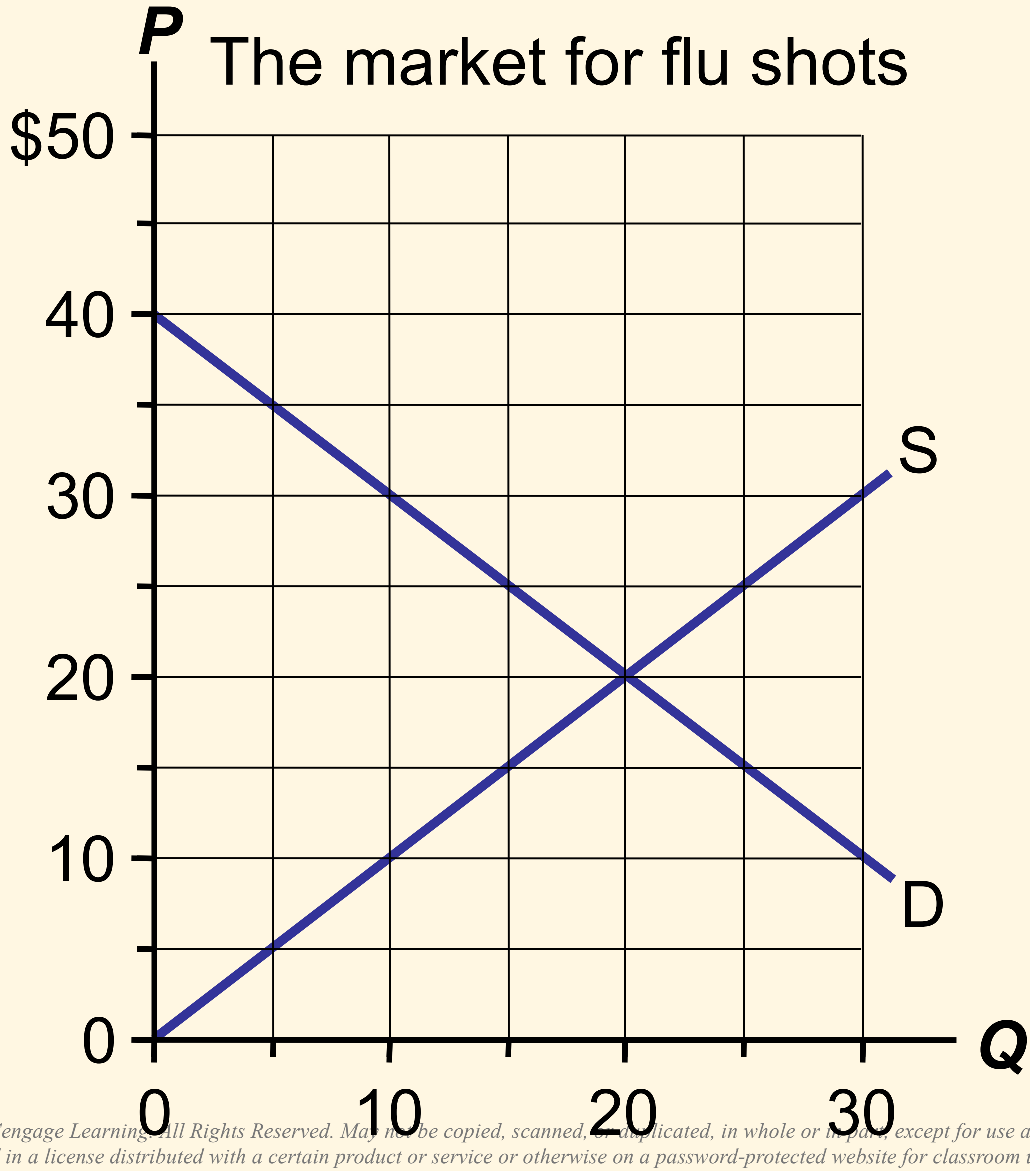
Positive Externalities

- 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

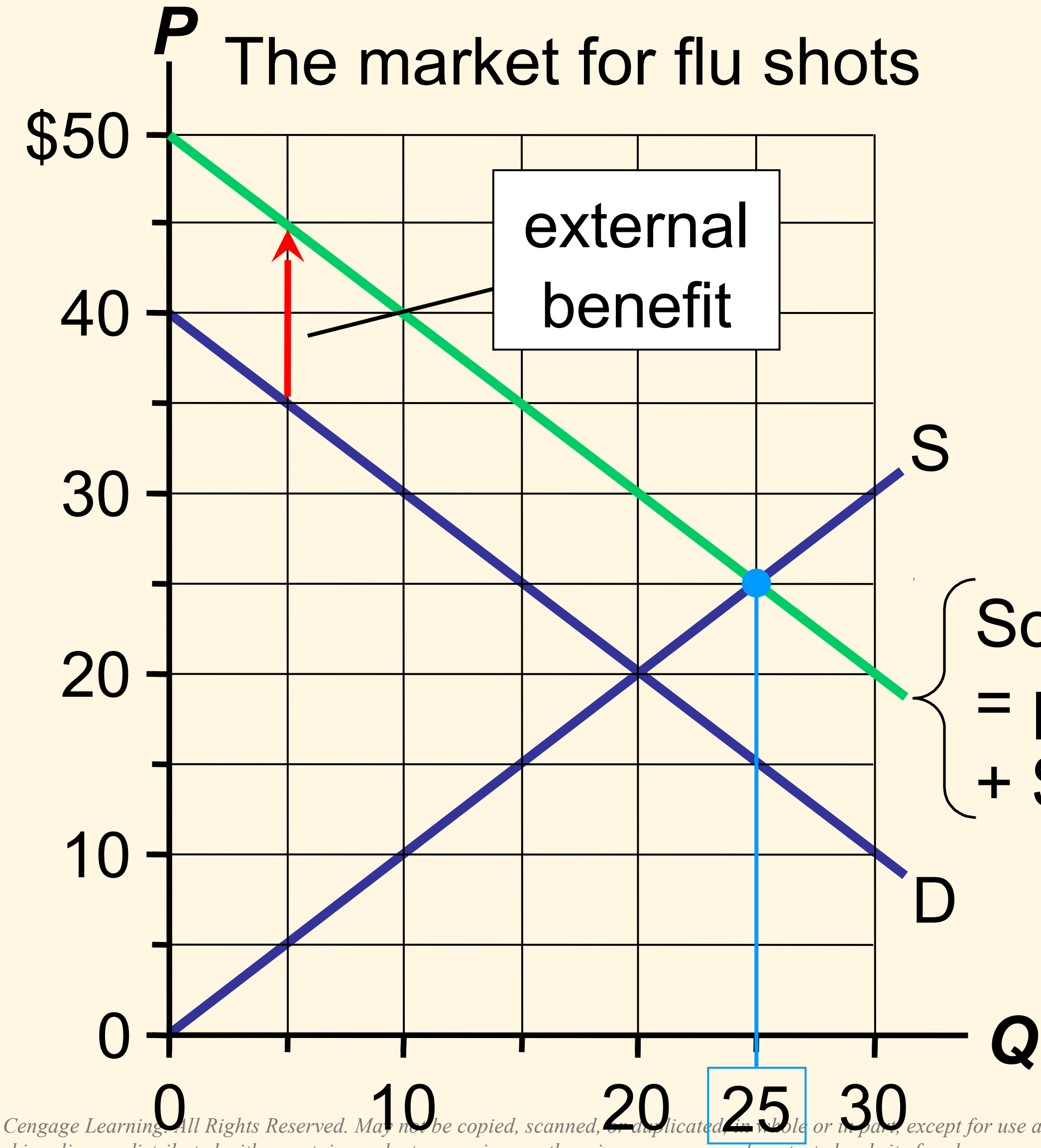


External benefit
= $10/shot

- 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 = $10/shot.

Social value = private value + $10 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

The demand curve for fire extinguishers slopes downward and the supply curve for fire extinguishers slopes upward. The production of the 500th fire extinguisher entails the following:

a private cost of $10;

an external cost of $0;

a private value of $9;

an external benefit of $3.

a) Does the production of fire extinguishers convey a positive externality, a negative externality, or neither?
b) What are social value and social cost of the 500th fire extinguisher.
c) Is the market-equilibrium quantity of fire extinguishers less than, equal to, or greater than 500? Explain

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 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.

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

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 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.

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 SO2 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 SO2 emissions 25%, to 60 tons/month
- Cost of reducing emissions:
  $100/ton for Acme, $200/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:
  $100/ton for Acme, $200/ton for USE.
- Compute cost of achieving goal with this policy:

Cost to Acme: (10 tons) x ($100/ton) = $1000

Cost to USE: (10 tons) x ($200/ton) = $2000

Total cost of achieving goal = **$3000**

ACTIVE LEARNING 2

B. Tradable pollution permits

- Initially, Acme and USE each emit 40 tons of $SO2$/month.
- Goal: reduce $SO2$ emissions to 60 tons/month total.
- Cost of reducing emissions:
  $100/ton for Acme, $200/ton for USE.

<u>Policy option 2: Tradable pollution permits</u>

- 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.

B. Answers

- Goal: reduce emissions from 80 to 60 tons
- Cost of reducing emissions:
  $100/ton for Acme, $200/ton for USE.

Compute cost of achieving goal:

<u>Acme</u>

- sells 10 permits to USE for $150 each, gets $1500
- uses 20 permits, emits 20 tons SO2
- spends $2000 to reduce emissions by 20 tons
- net cost to Acme: $2000 − $1500 = **$500**

continued…

ACTIVE LEARNING 2

B. Answers, *continued*

- Goal: reduce emissions from 80 to 60 tons
- Cost of reducing emissions:
  $100/ton for Acme, $200/ton for USE.

<u>USE</u>

- buys 10 permits from Acme, spends $1500
- uses these 10 plus original 30 permits, emits 40 tons
- spends nothing on abatement
- net cost to USE = **$1500**

Total cost of achieving goal = $500 + $1500 = **$2000**

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

SO2 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.

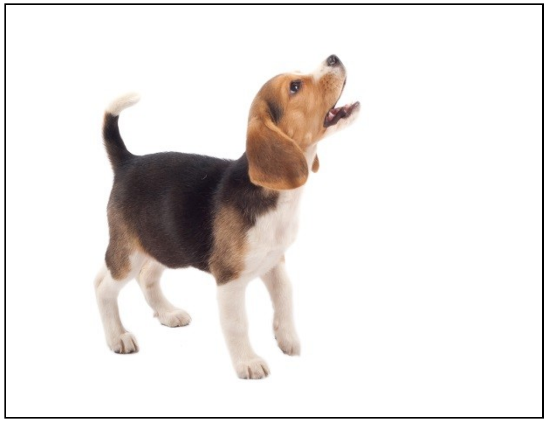
The Coase Theorem: An Example

Monika owns a dog named Spot.

Negative externality:
Spot's barking disturbs Barbora, Monika's neighbor.

The socially efficient outcome maximizes Monika's + Barbora's well-being.

If Monika values having Spot more than Barbora values peace and quiet, the dog should stay.



See Spot bark.

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

The Coase Theorem: An Example

CASE 1:
Monika has the right to keep Spot.
Benefit to Monika of having Spot = 5,000CZK
Cost to Barbora of Spot’s barking = 8,000CZK

Socially efficient outcome:
Spot goes bye-bye.

Private outcome:
Barbora pays Monika 6,000CZK to get rid of Spot, both Barbora and Monika are better off.

Private outcome = efficient outcome.

The Coase Theorem: An Example

CASE 2:
Monika has the right to keep Spot.
Benefit to Monika of having Spot = 10,000CZK
Cost to Barbora of Spot's barking = 8,000CZK

Socially efficient outcome:
See Spot stay.

Private outcome:
Barbora not willing to pay more than 8,000CZK,
Monika not willing to accept less than 10,000CZK,
so Spot stays.

Private outcome = efficient outcome.

The Coase Theorem: An Example

CASE 3:

Barbora has the legal right to peace and quiet.

Benefit to Monika of having Spot = 8,000CZK

Cost to Barbora of Spot's barking = 5,000CZK

Socially efficient outcome: Monika keeps Spot.

Private outcome: Monika pays Barbora 6,000CZK 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 $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?

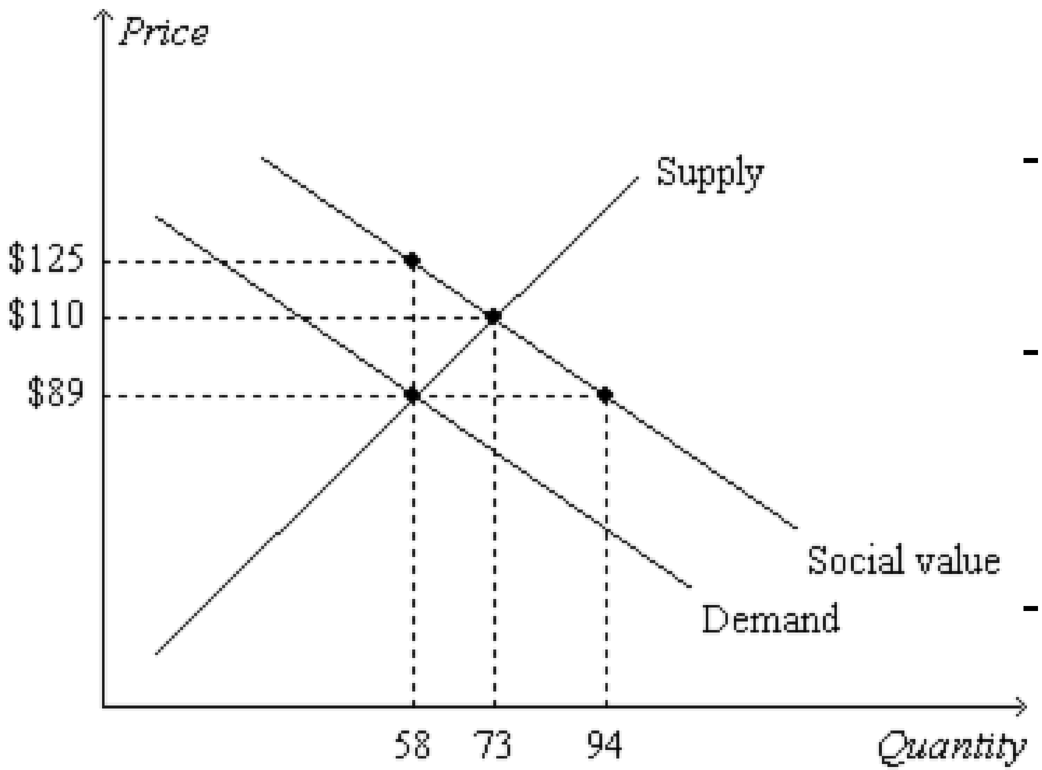
Why Private Solutions Do Not Always Work

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:
   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.

Problem 1



Refer to the graph on the left.

- Does the graph represent positive or negative externality?
- What is an external cost (benefit) that each additional unit of good is producing?
- How many units of the good are produced in a market equilibrium and what is the socially optimal quantity?
- Suppose the government implements a subsidy. How much should the subsidy be to achieve the social optimum?

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.