

# Chapter 10

MODERN PRINCIPLES OF ECONOMICS  
Third Edition

## Externalities: When the Price Is Not Right



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# Outline

- External costs, external benefits, and efficiency
- Private solutions to externality problems
- Government solutions to externality problems

# Introduction

- Antibiotics are overused.
- Users get all the benefits but do not bear all the costs.
- Each use of an antibiotic
  - Creates a small increase in bacterial resistance.
  - Pollutes the environment with more resistant and stronger bacteria.
- Antibiotic users ignore these costs, non-users pay these external costs.

# Introduction

- Since the price of antibiotics does not include *all* the costs, the price signal is imperfect.
- The price is too low, and antibiotics are overused.

# Environmental Economics

- Are we running out of resources? (4:07 video)
- <https://www.youtube.com/watch?v=AcWkN4ngR2Y>
- Greatest resource on the planet is the human brain
- Innovation and resource availability
- Julian Simon – Paul Erhlich wager (article)
- <http://www.fhttp://www.forbes.com/sites/timworstall/2013/01/13/but-why-did-julian-simon-win-the-paul-ehrich-bet/>

# Externalities and Efficiency

- For some products, some of the costs or benefits fall on bystanders.
- External *costs* are called negative externalities.
- External *benefits* are called positive externalities.
- When we evaluate markets with externalities, we look at social surplus.

# Definition

## **Externalities:**

*external costs or benefits; costs or benefits that fall on bystanders.*

## **External Cost:**

*a cost paid by people other than the consumer or the producer.*

# Definition

## **Private Cost:**

*a cost paid by the consumer or the producer.*

## **Social Cost:**

*the cost to everyone; private cost plus external cost.*



# Definition

## **Social Surplus:**

*consumer surplus plus producer surplus  
plus everyone else's surplus.*

# Self-Check

You pay \$50 for a new jacket. This is an example of a(n):

- a. External cost.
- b. Social cost.
- c. Private cost.

**Answer: c** – *this is a private cost, because it is paid by you, the consumer.*

# Externalities and Efficiency

- A market equilibrium maximizes consumer surplus plus producer surplus (gains from trade).
- A market with externalities does not maximize social surplus (consumer + producer + everybody else's surplus).
- A market with externalities is therefore inefficient.

# Definition

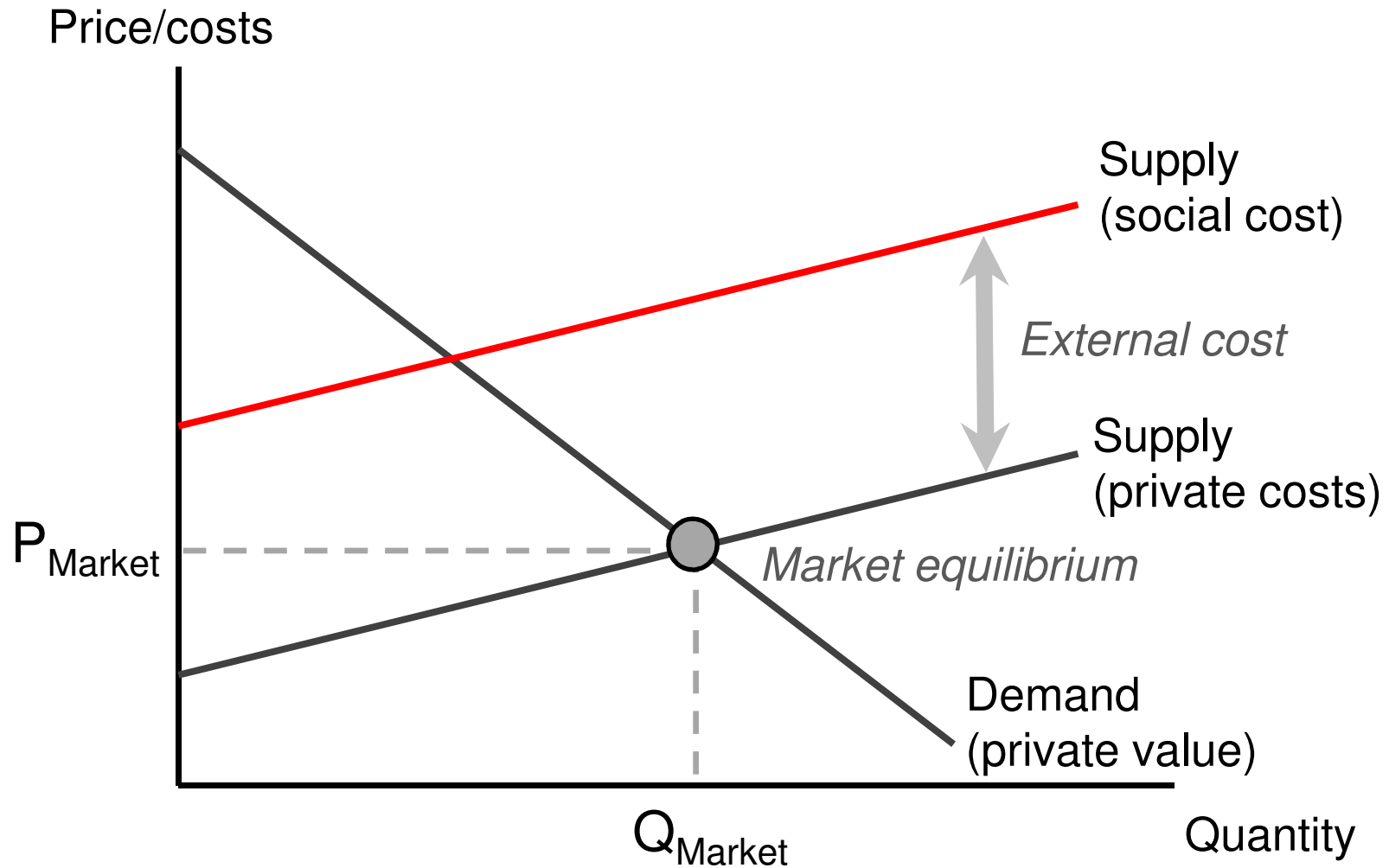
## **Efficient Equilibrium:**

*the price and quantity that maximizes social surplus.*

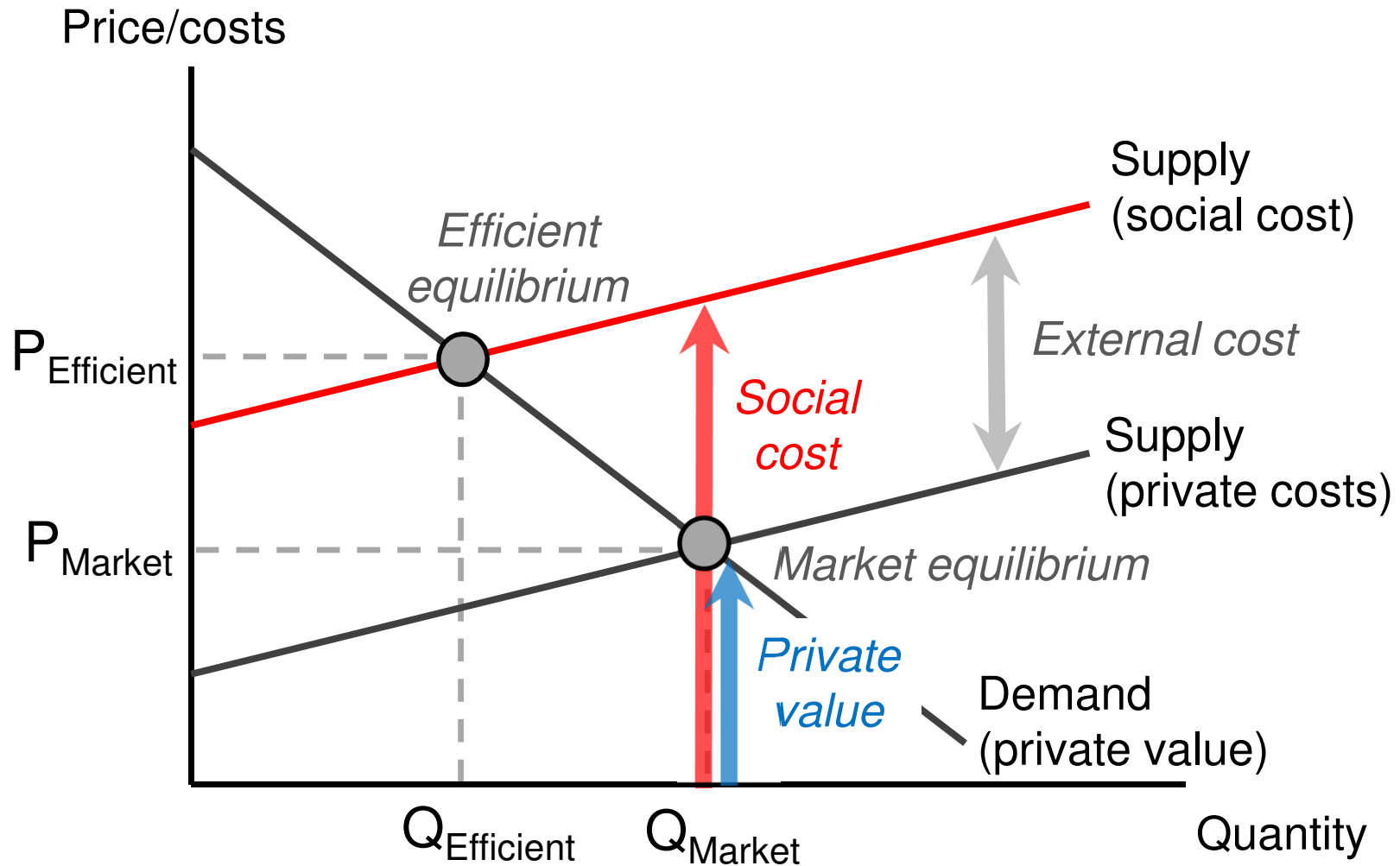
## **Efficient Quantity:**

*the quantity that maximizes social surplus.*

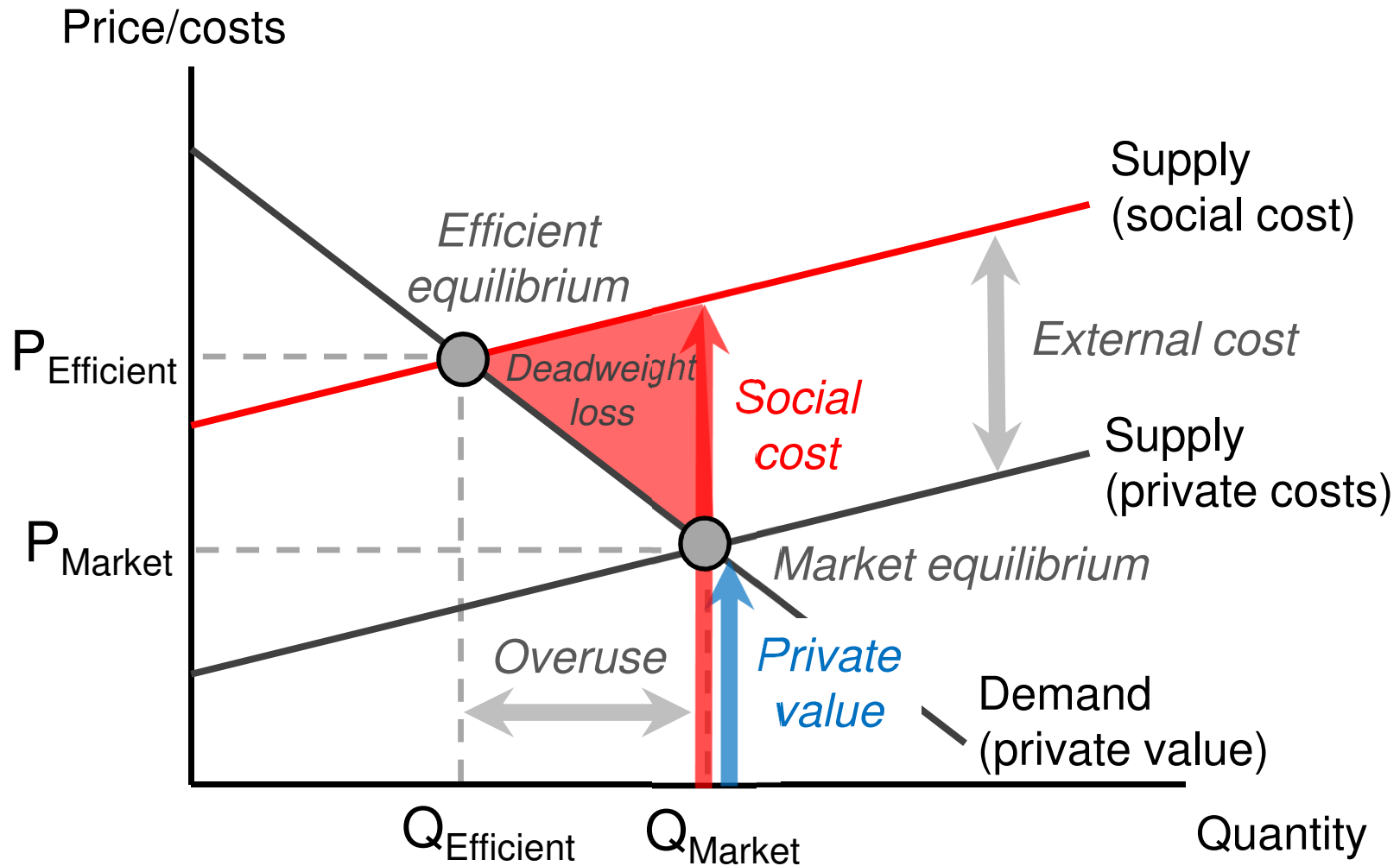
# External Costs



# External Costs



# External Costs



# External Costs

- A tax on an ordinary good increases deadweight loss (Chapter 6).
- A tax on a good with an external cost reduces deadweight loss and raises revenue.
- Economist Arthur C. Pigou first focused attention on externalities and how they might be corrected with taxes.



# Definition

## **Pigouvian tax:**

*a tax on a good with external costs.*

# Self-Check

When a tax is imposed on a good with significant external costs, deadweight loss is:

- a. Increased.
- b. Reduced.
- c. Unchanged.

**Answer: b** – *a tax on a good with an external cost reduces deadweight loss.*

# Definition

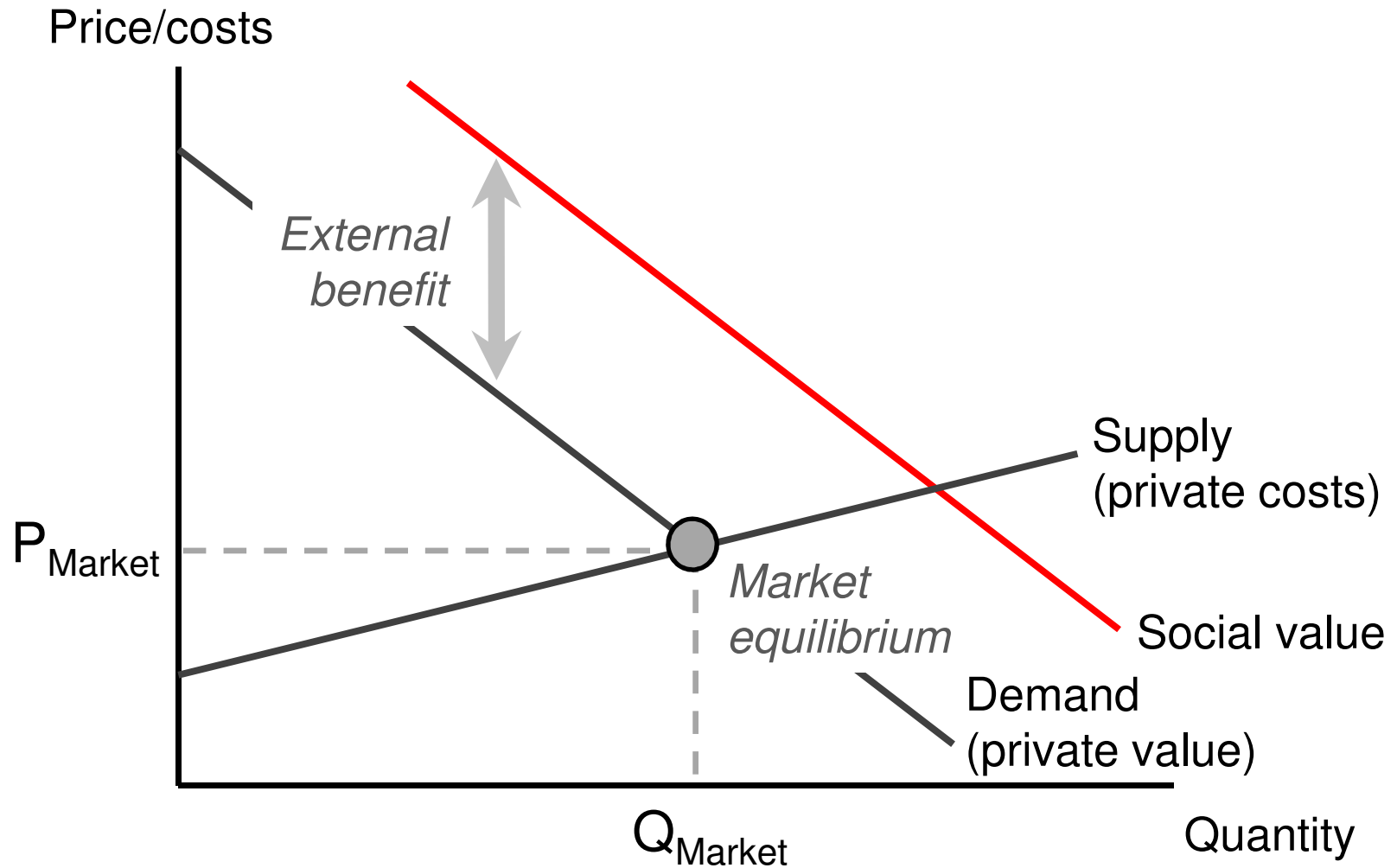
## **External benefit:**

*a benefit received by people other than the consumers or producers trading in the market.*

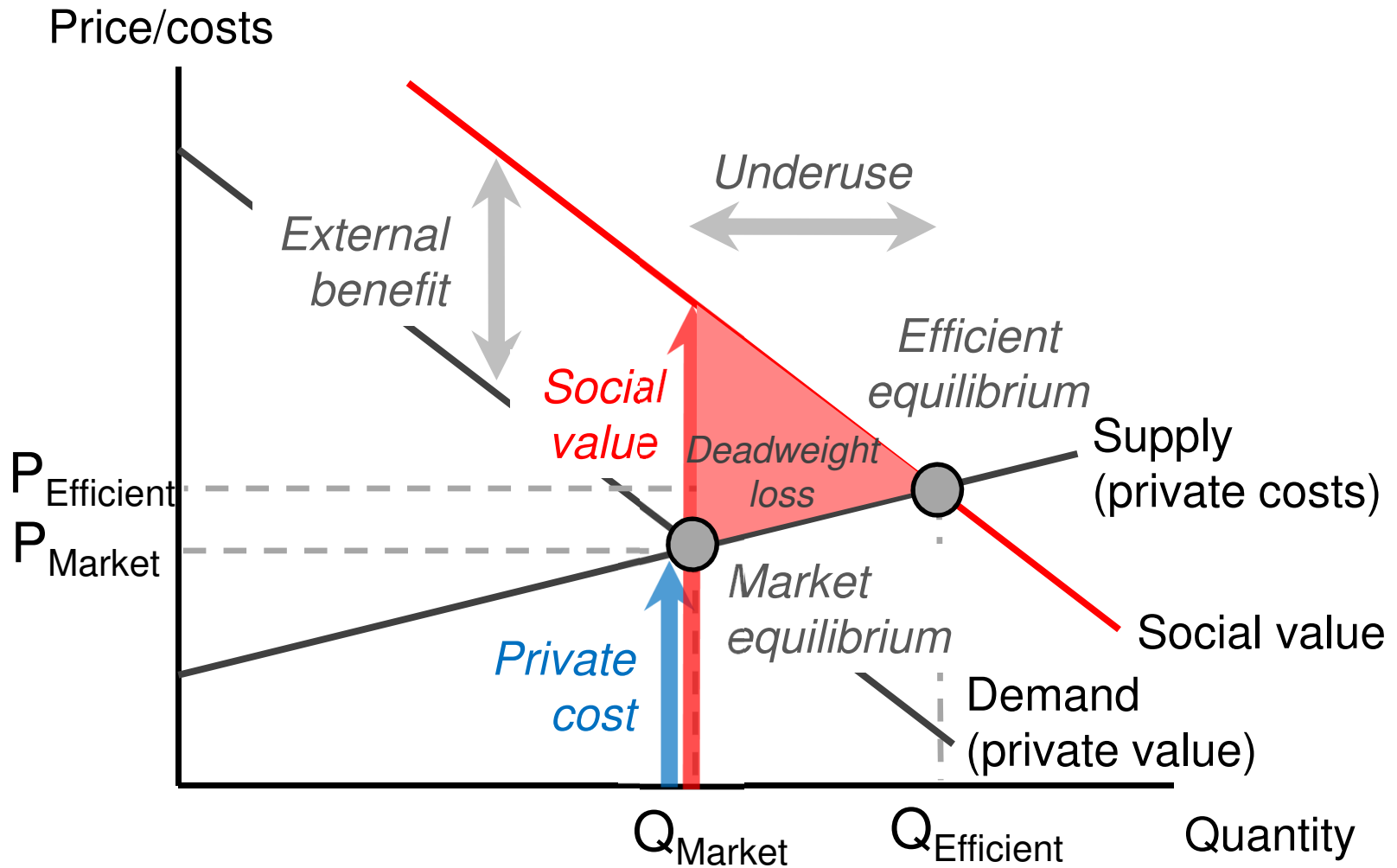
# External Benefits

- Vaccines benefit the person who is vaccinated but they also create an ***external benefit***.
- People who have been vaccinated are less likely to spread the disease.
- The person getting the shot bears all the costs: time, money, fever and ache.
- But the person being vaccinated doesn't receive all the benefits.
- As a result, fewer people get flu shots than is efficient.

# External Benefits



# External Benefits



# External Benefits

- When there are external benefits, market output is too low.
- A subsidy equal to the external benefit
  - Shifts the demand curve up
  - Makes market equilibrium = efficient equilibrium.
- A Pigouvian subsidy therefore
  - Reduces deadweight loss
  - Increases social surplus.

# Positive or Negative Externality?

- **Do car alarms do any good?**
- Since they frequently go off for no apparent reason, do they create any negative externalities? What are they?
  - *Police argue that they can “shatter the sense of civility that makes a community safe.” As one of the “signs that no one cares...” car alarms “invite both further disorder and serious crime.”-Police Strategy No. 5, New York Police Department, 1994*



# Definition

## **Pigouvian subsidy:**

a subsidy on a good with external benefits.

# Self-Check

When there are external benefits, market output is:

- a. Too low.
- b. Too high.
- c. Socially efficient.

**Answer: a** – *in a market with external benefits, output is too low.*

# Definition

## **Internalizing an Externality:**

adjusting incentives so that decision makers take into account all the costs and benefits of their actions, private and social.

# Solutions to Externalities

When externalities are significant, the market equilibrium is no longer efficient.

What can be done to resolve this problem?

- 1. Private Solutions***
- 2. Government Solutions***

# Private Solutions to Externalities

- Market equilibrium can be efficient even when there are externalities, *if* there is systematic trading in those externalities.
- The market can handle externalities when:
  - Transaction costs are low.
  - Property rights are clearly defined.
- These conditions are often not met.
- Markets alone will not solve all externality problems.

# Definition

## **Transaction costs:**

*all the costs necessary to reach an agreement; the costs of identifying and bringing buyers and sellers together, bargaining, and drawing up a contract are all transaction costs*

# Definition

## **Coase theorem:**

*if transaction costs are low and property rights are clearly defined, private bargains will ensure that the market equilibrium is efficient even when there are externalities.*

# Coase Theorem

The Coase Theorem suggests bargaining, with the right conditions, ensures that just the right amount of the externality is produced.

If there were either too little or too much of the externality, trading would push the quantity to the optimal level.

Thus, the free market equilibrium will maximize social surplus



# Coase Theorem

- The conditions of the Coase Theorem, however, are unlikely to be met.
  - Transaction costs for many externalities are high, and property rights are often not clearly defined.
  - When these conditions do not hold, markets alone will *not* internalize all externalities.

# Coase Theorem

- The Coase Theorem does suggest that if these conditions exist, a new market for externalities might develop that maximizes social surplus.
- Note that government can play a crucial role in defining property rights and reducing transaction costs.

# Coase Theorem – Example 1

- Suppose that a railroad runs along a wheat field.
- Steam locomotives using the railroad emit hot cinders from their smokestacks that can burn the neighboring crops.
- To avoid this danger, the wheat farmer does not plant crops within two hundred feet of the railroad incurring losses of \$3,000 per harvest.
- The railroad, thus, imposes an external cost on the farmer.

# Coase Theorem – Example 1

- If the farmer has a right to grow crops without them being burned, then the railroad must bear the costs to the farmer.
  - The railroad could pay the farmer \$3,000 to cover the losses each harvest and continue to use the rail line.
  - Or, the railroad could prevent the fires by installing spark arresters that cost \$2,000 to maintain each harvest.
  - In this situation all costs are now internalized, and the *railroad will install the spark arresters* (the least costly alternative).

# Coase Theorem – Example 1

- If the railroad has a right to use the rail line, then the farmer must bear the costs of the losses.
  - The farmer would be willing to pay the railroad up to \$3,000 per harvest to cease using the rail line.
  - Or, the farmer could purchase and maintain the spark arresters for the railroad at a cost of \$2,000 per harvest.
  - In this situation all costs are now internalized, and the *farmer will install the spark arresters* (the least costly alternative) for the railroad.

# Coase Theorem – Example 1

- If the railroad and the farmer can negotiate without incurring any additional costs, an efficient outcome will arise.
- Note that regardless of who is initially assigned the property right, the same solution occurs – the spark arrester is installed.

# Coase Theorem – Example 2

- 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 & quiet,  
the dog should stay.
- ***Coase theorem: The private market will  
reach the efficient outcome on its own...***

# Coase Theorem – Example 2

- Case 1:  
Dick has the right to keep Spot.  
Benefit to Dick of having Spot = \$500  
Cost to Jane of Spot's barking = \$800
- Socially efficient outcome:  
**Goodbye Spot.**
- Private outcome:  
Jane pays Dick \$600 to get rid of Spot,  
both Jane and Dick are better off.
- **Goodbye Spot.**
- Private outcome = efficient outcome.



# Coase Theorem – Example 2

- Case 2:  
Dick has the right to keep Spot.  
Benefit to Dick of having Spot = \$1000  
Cost to Jane of Spot's barking = \$800
- Socially efficient outcome:  
**Spot lives!**
- Private outcome:  
Jane not willing to pay more than \$800,  
Dick not willing to accept less than \$1000,  
**Spot lives!**
- Private outcome = efficient outcome

# Coase Theorem – Example 2

- Case 3:  
Jane has the legal right to peace & quiet.  
Benefit to Dick of having Spot = \$800  
Cost to Jane of Spot's barking = \$500
- Socially efficient outcome: Dick keeps Spot.
- Private outcome: Dick pays Jane \$600 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***

# Coase Theorem – Qs

- Q1) You want to hold a Saturday night party at your house but are worried that your elderly neighbors will complain to the police about the noise. Suggest a solution to this problem using what you know about the Coase Theorem.
- Q2) Consider a factory near you that pollutes. What are the transaction costs involved in you and your neighbors negotiating with the factory to reduce the pollution? Is a private solution possible?

# Government Solutions to Externalities

When private solutions are unavailable, the government can play a role in resolving externalities.

Some options available to government are:

- a. Taxes and Subsidies;**
- b. Command and Control;**
- c. Tradable Allowances.**

# Government Solutions to Externalities

## Taxes and Subsidies

- a. Governments often use **taxes and subsidies** to resolve externalities.
- If there are negative externalities, governments impose **Pigouvian taxes** to reduce the market quantity.
  - If there are positive externalities, governments offer **Pigouvian subsidies** to increase the market quantity.

# Government Solutions to Externalities

## Command and Control

b. The most direct approach for government to resolve externalities is to impose **command and control regulation.**

- If there are negative externalities, the government can **mandate a lower quantity than the market level.**
- If there are positive externalities, the government can **mandate a higher quantity than the market level.**

# Government Solutions to Externalities

## Command and Control Examples –

- CAFÉ gas mileage standards
- Auto emission controls
- Appliance/housing energy efficiency standards
- Recent Supreme Court ruling on EPA process
- Many, many others

# Government Solutions to Externalities

## Command and Control

However, command and control regulations **do not always bring about an efficient solution...**

**Governments may not possess enough information for good policy.**

Regulations do not provide buyers and sellers the flexibility to choose the least costly method of compliance.



# Government Solutions to Externalities

## Command and Control

- Example: clothes washer efficiency standards not most efficient method, much cheaper ways exist to reduce electricity use
- Since economic decisions are made at the margin, do such mandatory standards present consumers with the right price signal?
- CAFÉ standards – will double fuel efficiency by 2025 by raising average MPG to 54.5 MPG
  - at the margin, driving will be cheaper

# Government Solutions to Externalities

## Command and Control

- While command and control regulations fail to harness private information and individual preferences, there could exist some situations where such an approach would be preferable.
- Command and control can be effective under the following conditions:
  - The best approach to the problem is well known;
  - Success requires very strong compliance.
    - CEC – housing efficiency without inspections

# Self-Check

Under the command and control method, the government:

- a. Pays firms to produce less.
- b. Orders firms to produce less.
- c. Lets the market force firms to produce less.

**Answer: b** – *under command and control, the government orders firms to use (or make) less.*

# Government Solutions to Externalities

## Tradable Allowances

- Regulatory agencies set limits for the externality
- Pollution allowances are allocated (by auction?)
- Firms can trade or bank allowances for future use, choosing their least cost options (market forces).
  1. Buyers and sellers have much more **flexibility** about how to cut cost.
  2. Consumers and producers individually choose the best (least costly) approach to limit their quantity.
  3. There are **strong incentives** for buyers and sellers to **reduce quantity** since the allowances are tradable.

# Government Solutions to Externalities

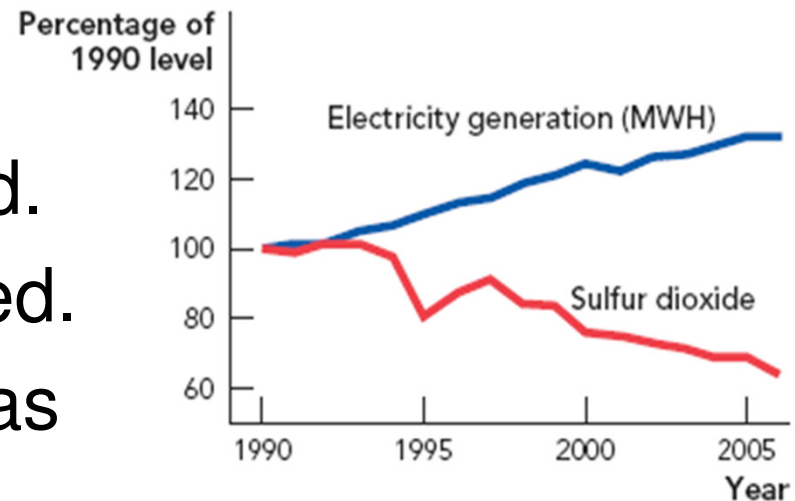
## Tradable Allowances

- Under the Clean Air Act of 1990, the EPA distributes pollution allowances to generators of electricity.
- Congress sets the total amount of allowances.
- The EPA monitors emissions so firms can't pollute beyond their allowances.
- Firms can trade or bank allowances for future use, choosing their least cost options (market forces).
  - California's carbon emission market as an example

# Government Solutions to Externalities

## Tradable Allowances

- The program has been very successful:
  - Emissions have been reduced.
  - Air quality has improved.
  - Illness has been reduced.
  - Electricity generation has increased.



# Government Solutions to Externalities

## Tradable Allowances

- EPA's system of tradable SO<sub>2</sub> allowance is a successful application of the Coase theorem
  - Rights to emit SO<sub>2</sub> were clearly defined
  - EPA reduced transaction costs via monitoring and tracking ownership
  - Trading process increased social welfare by minimizing cost of reducing pollution
- Incentivized green energy production since clean power did not require allowances
  - i.e. made dirty power costly, green energy less costly

# Government Solutions to Externalities

## Tradable Allowances

**California has had a CO<sub>2</sub>** market for a number of years.

- Since global warming is worldwide, tradable allowances would ideally be distributed and bought and sold worldwide.
- Problems with a common resource (to be covered in Chapter 19) – not enough cooperation exists worldwide to establish such a system



# Self-Check

Under tradable allowances, producers of electricity have:

- a. Reduced both output and emissions.
- b. Increased both output and emissions.
- c. Reduced emissions and increased output.

**Answer:** **c** – *reduced emissions and increased output.*

# Pigouvian Taxes vs Tradable Allowances

**There is a close relationship between using taxes and tradable allowances to internalize externalities.**

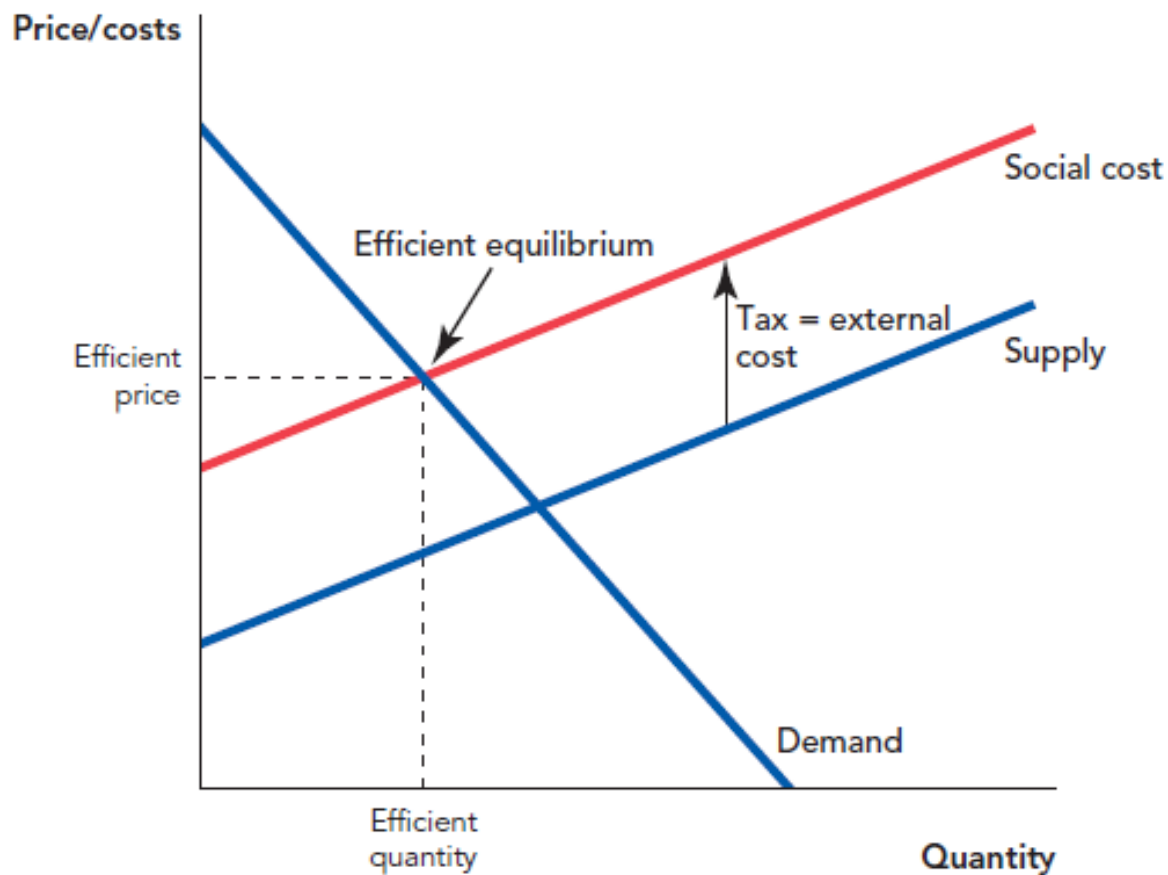
*A tax set equal to the level of the external cost **is equivalent** to tradable allowances when the number of allowances is set equal to the efficient quantity.*



# Pigouvian Taxes vs Tradable Allowances

- Are equivalent if:
  - The tax = the level of the external cost
  - The number of allowances = the efficient quantity.
- Are different if:
  - There is uncertainty.
  - There are political preferences for one or the other.

# Pigouvian Taxes vs Tradable Allowances



**Comparing Tradable Allowances and Pigouvian Taxes** If we knew the exact positions of the supply and demand curves, then we could always use tradable allowances to hit the efficient quantity or a tax to hit the efficient price and the equilibrium would be identical.

# Pigouvian Taxes vs Tradable Allowances

- Firms that are given tradable allowances get a big benefit compared with having to pay taxes.
- Critics say that pollution allowances equal corrective taxes plus corporate welfare.
- Allowances can be auctioned off, generating government revenue.
- Allowances are more likely to gain cooperation from large firms than taxes.

# Takeaway

- In a free market equilibrium quantity maximizes consumer surplus + producer surplus.
- With externalities, the market quantity is not the efficient quantity.
- There are three types of government solutions to externality problems:
  - Taxes and subsidies.
  - Command and control.
  - Tradable allowances.

# Takeaway

- Market prices do not correctly signal true costs and benefits when there externalities.
- Taxes and subsidies can adjust prices so that they do send the correct signals.
- Command and control solutions can work but are often high-cost and inflexible.
- If property rights are clearly defined and transaction costs are low, then markets in the externality will solve the problem.