



## Unit 12 : Externalities

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### Objectives

In this unit, 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?



## Introduction

- Recall one of the Ten Principles from unit 1:  
*Markets are usually a good way to organize economic activity.*
- Lesson from unit 7:  
In the absence of market failures, the competitive market outcome is efficient, maximizes total surplus.



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## Introduction

- One type of market failure: externalities.
- **Externality**: the uncompensated impact of one person's actions on the well-being of a bystander
  - **Negative externality**:  
the effect on bystanders is adverse
  - **Positive externality**:  
the effect on bystanders is beneficial
- Self-interested buyers and sellers neglect the external effects of their actions, so the market outcome is not efficient.
- Another principle from unit 1:  
Governments can sometimes improve market outcomes.



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## Pollution: A Negative Externality

- 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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## Other Examples of Negative Externalities

- the neighbor's barking dog
- late-night stereo blasting from the dorm room next to yours
- noise pollution from construction projects
- talking on cell phone while driving makes the roads less safe for others
- health risk to others from second-hand smoke
- ...

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## Positive Externalities from 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

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## Other 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
- Renovating your house increases neighboring property values



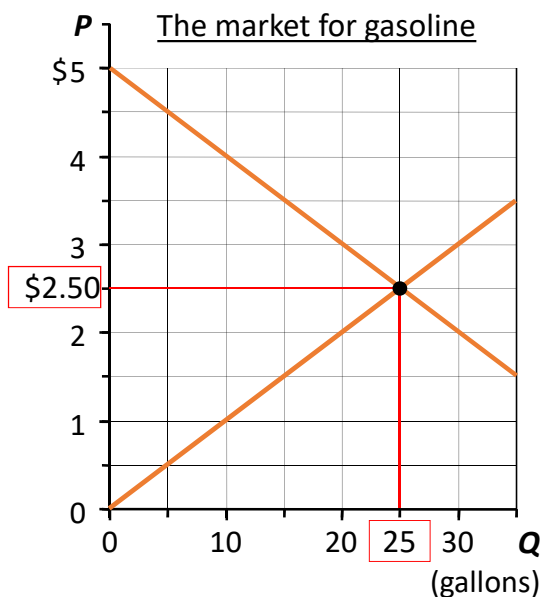
*Thank you for  
not contaminating  
the fruit supply!*

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## Recap of Welfare Economics



The market eq'm maximizes consumer + producer surplus.

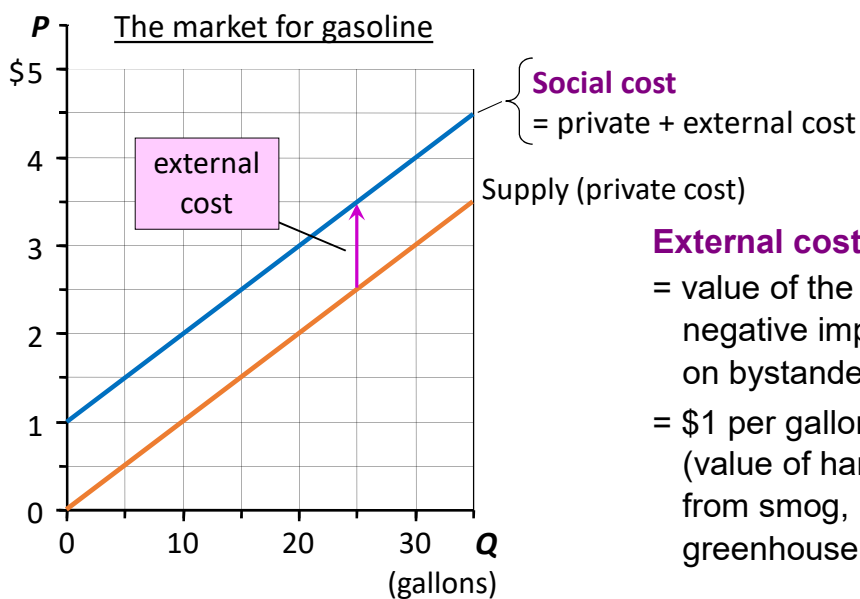
Supply curve shows **private cost**, the costs directly incurred by sellers

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

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## Analysis of a Negative Externality



**Social cost**

= private + external cost

Supply (private cost)

**External cost**

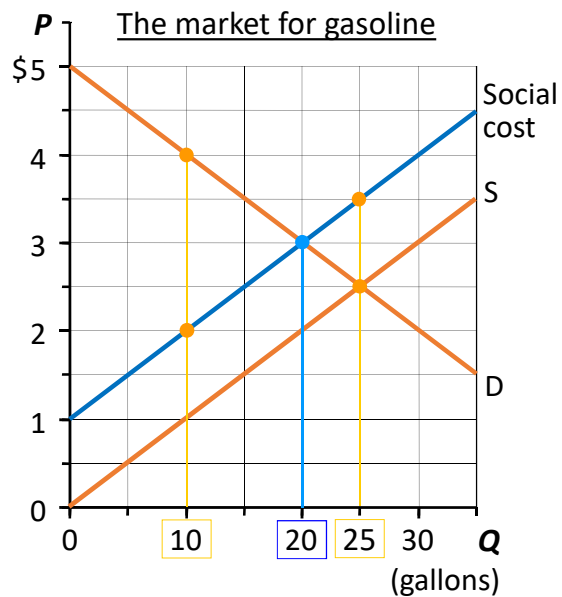
= value of the negative impact on bystanders

= \$1 per gallon (value of harm from smog, greenhouse gases)

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## Analysis of a Negative Externality



The socially optimal quantity is 20 gallons.

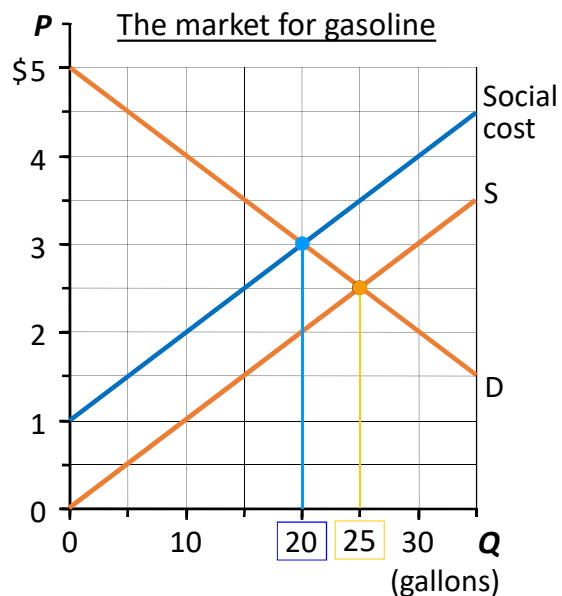
At any  $Q < 20$ , value of additional gas exceeds social cost

At any  $Q > 20$ , social cost of the last gallon is greater than its value

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## 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 supply curve up \$1.

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## “Internalizing the Externality”

- **Internalizing the externality**: altering incentives so that people take account of 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  $Q$ .)

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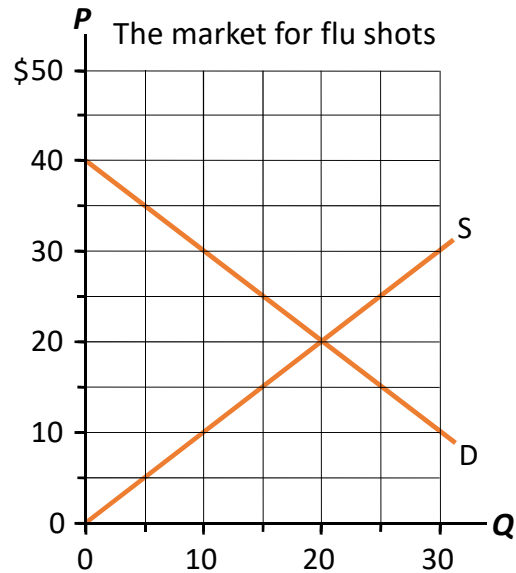
## Positive Externalities

- 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.

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## ACTIVE LEARNING 1: Analysis of a positive externality



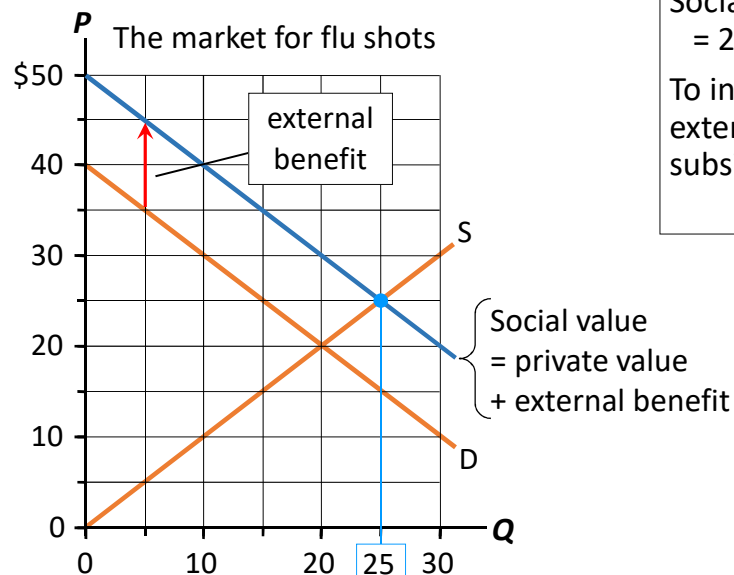
External benefit  
= \$10/shot

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

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## Answers



Socially optimal  $Q$   
= 25 shots

To internalize the  
externality, use  
subsidy = \$10/shot.

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## 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.

- Corrective taxes and subsidies;
- Tradable pollution permits

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## Market-Based Policy #1: Tradable Pollution Permits

- Recall: Acme, US Electric each emit 40 tons  $\text{SO}_2$ , total of 80 tons.
- Goal: reduce emissions 25% (to 60 tons/month)
- Suppose cost of reducing emissions is \$100/ton for Acme, \$200/ton for US Electric.
- If regulation requires each firm to reduce 10 tons,  
cost to Acme:  $(10 \text{ tons}) \times (\$100/\text{ton}) = \$1,000$   
cost to USE:  $(10 \text{ tons}) \times (\$200/\text{ton}) = \$2,000$   
total cost of achieving goal = **\$3,000**

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## Market-Based Policy #1: Tradable Pollution Permits

- Alternative:

- issue 60 permits, each allows its bearer one ton of  $\text{SO}_2$  emissions (so total emissions = 60 tons)
- give 30 permits to each firm
- establish market for trading permits

- Each firm can choose among these options:

- emit 30 tons of  $\text{SO}_2$ , using all its permits
- emit  $< 30$  tons, sell unused permits
- buy additional permits so it can emit  $> 30$  tons

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## Market-Based Policy #1: Tradable Pollution Permits

Suppose market price of permit = \$150

One possible equilibrium:

### Acme

- spends \$2,000 to cut emissions by 20 tons
- has 10 unused permits, sells them for \$1,500
- net cost to Acme: \$500

### US Electric

- emissions remain at 40 tons
- buys 10 permits from Acme for \$1,500
- net cost to USE: \$1,500

Total cost of achieving goal: **\$2,000**

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## Market-Based Policy #1: 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.



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## Tradable Pollution Permits in the Real World

- SO<sub>2</sub> 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.



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