

10

Externalities

PRINCIPLES OF

MICROECONOMICS

FOURTH CANADIAN EDITION

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PowerPoint® Slides

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Canadian adaptation by Marc Prud'Homme

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In this chapter, look for the answers to these questions:

- What is an externality?
- Why do externalities make market outcomes inefficient?
- How can people sometimes solve the problem of externalities on their own? Why do such private solutions not always work?
- What public policies aim to solve the problem of externalities?

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Introduction

- Recall one of the Ten Principles from Chap. 1:  
*Markets are usually a good way to organize economic activity.*
- Lesson from Chapter 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

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### Introduction

- 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.*



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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 gov't 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*
  - *better government*
  - *lower unemployment*
  - *better international competitiveness*
  - *improved economic efficiency and productivity*
- People do not consider these external benefits when deciding how much education to "purchase"
- Result: with the free market eq'm the consumption of education is too low
- How gov't may improve the market outcome?
  - By subsidizing the 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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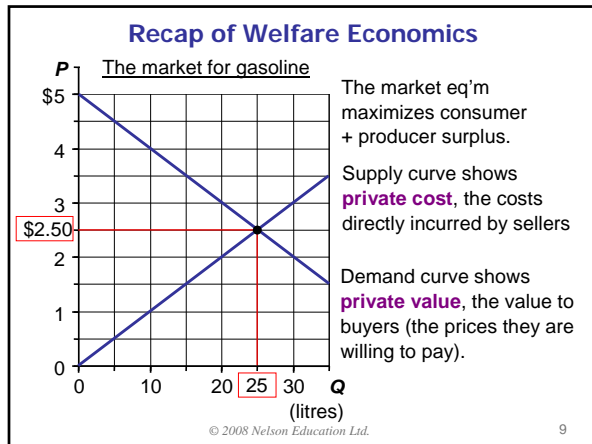
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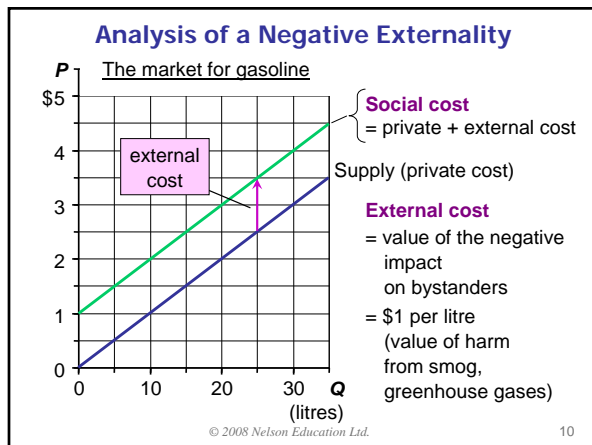
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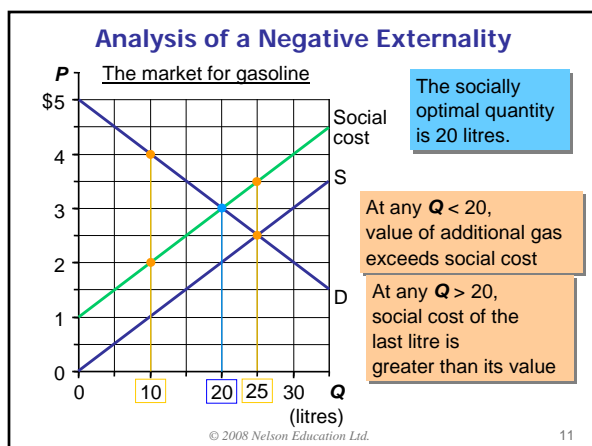
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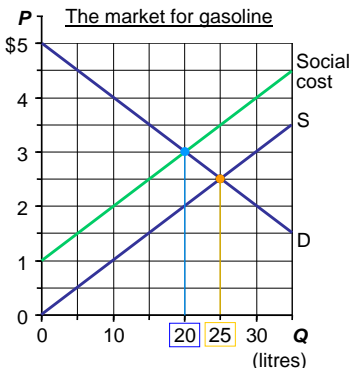
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### Analysis of a Negative Externality

The market for gasoline



Market eq'm  
( $Q = 25$ )  
is greater than  
social optimum  
( $Q = 20$ )

One solution:  
tax sellers  
\$1/litre,  
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, a \$1/litre tax on producers would shift the supply curve for gasoline up by the size of the tax. The new supply curve now coincides with the social-cost curve and  $Q_{\text{market}} = Q_{\text{optimum}}$
- Taxes that internalize negative externalities are called **Pigovian taxes**, after economist Arthur Pigou (1877 - 1959).

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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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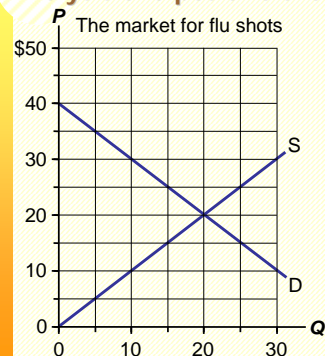
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### ACTIVE LEARNING 1: Analysis of a positive externality



External benefit  
= \$10/shot

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

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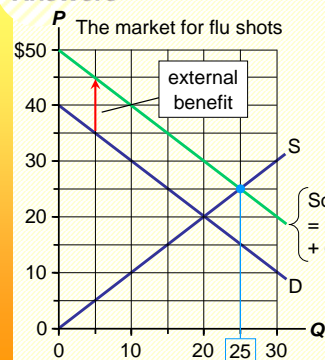
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### ACTIVE LEARNING 1: Answers



Socially optimal **Q**  
= 25 shots

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

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### Effects of Externalities: Summary

If negative externality

- market produces a larger quantity than is socially desirable

If positive externality

- market produces a smaller quantity than is socially desirable

To remedy the problem,  
"internalize the externality"

- tax goods with negative externalities
- subsidize goods with positive externalities

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### Private Solutions to Externalities

Types of private solutions:

- moral codes and social sanctions, e.g., the Golden Rule: *"Do unto others as you would have them do unto you."*
- charities, e.g., Greenpeace
- Relying on the self-interest of relevant parties.
- contracts between market participants and the affected bystanders

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### Private Solutions to Externalities

▪ **The Coase theorem:**

If private parties can bargain without cost over the allocation of resources, they can solve the externalities problem on their own.

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### The Coase Theorem: An Example

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.



See Spot bark.

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

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### The Coase Theorem: An Example

- 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:  
Spot goes bye-bye.
- Private outcome:  
Jane pays Dick \$600 to get rid of Spot,  
both Jane and Dick are better off.
- Private outcome = efficient outcome.

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### The Coase Theorem: An Example

- 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:  
See Spot stay.
- Private outcome:  
Jane not willing to pay more than \$800,  
Dick not willing to accept less than \$1000,  
so Spot stays.
- Private outcome = efficient outcome.

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### The Coase Theorem: An Example

- CASE 3:  
Benefit to Dick of having Spot = \$500  
Cost to Jane of Spot's barking = \$800  
But Jane has the legal right to peace & quiet.
- 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.***

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## ACTIVE LEARNING 2: Brainstorming

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?

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## 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.

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## Public Policies Toward Externalities

When an externality causes a market to reach an inefficient allocation of resources, the government can respond in one of two ways:

### Command-and-control policies

regulate behaviour 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.

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### Market-Based Policy #1: Pigovian Taxes & Subsidies

- Instead of regulating behaviour in response to an externality, the government can use market-based policies to align private incentives with social efficiency.
- **Pigovian tax**: a tax designed to induce private decision-makers to take account of the social costs that arise from a negative externality
- The ideal corrective tax = external cost
- For activities with positive externalities, ideal corrective subsidy = external benefit

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### Market-Based Policy #1: Pigovian Taxes & Subsidies

- Example:  
Two companies (firm A and firm B) run coal-burning power plants that each emit 40 tonnes of sulfur dioxide per month. SO<sub>2</sub> causes acid rain & other health issues.
- Policy goal: reducing SO<sub>2</sub> emissions.
- Policy options
  - regulation: requires each plant to cut emissions by a certain tonnage.
  - Pigovian tax:  
Make each plant pay a tax on each tonne of SO<sub>2</sub> emissions. Set tax at level that achieves goal.

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### Market-Based Policy #1: Pigovian Taxes & Subsidies

- The regulation dictates a level of pollution.
- The tax would give factory owners an economic incentive to reduce pollution.
- Most economists prefer the tax approach.
- Taxes reduce pollution more efficiently.

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### Market-Based Policy #1: Pigovian Taxes & Subsidies

- Suppose cost of reducing emissions is lower for firm A than for firm B.
- Socially efficient outcome: firm A reduces emissions more than firm B.
- The Pigovian 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 (firm B).

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### Market-Based Policy #1: Pigovian Taxes & Subsidies

- Under regulation, firms have no incentive to reduce emissions beyond the 5 tonne 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.

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### Market-Based Policy #1: Pigovian Taxes & Subsidies

- Other taxes distort incentives and move the allocation of resources away from the social optimum.
- When externalities are present however, society also cares about the well-being of its bystanders who are affected. Pigovian taxes therefore move the allocation of resources closer to the social optimum.
- Pigovian taxes raise revenue for the government and enhance economic efficiency.

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### Example of a Pigovian 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

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### ACTIVE LEARNING 3: 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?

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### Market-Based Policy #2: Tradeable Pollution Permits

- Recall: Firm A and firm B each emit 40 tonnes  $\text{SO}_2$ , total of 80 tonnes.
- Goal: reduce emissions to 60 tonnes/month.
- Suppose cost of reducing emissions is \$100/ton for firm A, \$200/ton for firm B.
- If regulation requires each firm to reduce 10 tonnes,  
cost to A: (10 tonnes) x (\$100/tonne) = \$1,000  
cost to B: (10 tonnes) x (\$200/tonne) = \$2,000  
total cost of achieving goal = **\$3,000**

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### Market-Based Policy #2: Tradeable Pollution Permits

- Alternative:
  - issue 60 permits, each allows its bearer one tonne of SO<sub>2</sub> emissions (so total emissions = 60 tonnes)
  - give 30 permits to each firm
  - establish market for trading permits
- Each firm can choose among these options:
  - emit 30 tonnes of SO<sub>2</sub>, using all its permits
  - emit < 30 tonnes, sell unused permits
  - buy additional permits so it can emit > 30 tonnes

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### Market-Based Policy #2: Tradeable Pollution Permits

Suppose market price of permit = \$150

One possible equilibrium:

Firm A

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

Firm B

- emissions remain at 400 tonnes
- buys 10 permits from firm A for \$1,500
- net cost to firm B: \$1,500

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

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### Market-Based Policy #2: Tradeable Pollution Permits

- A system of Tradeable 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.
- With a free market for pollution rights, the final allocation will be efficient whatever the initial allocation.

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### Pigovian Taxes vs. Tradeable 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 tradeable 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.

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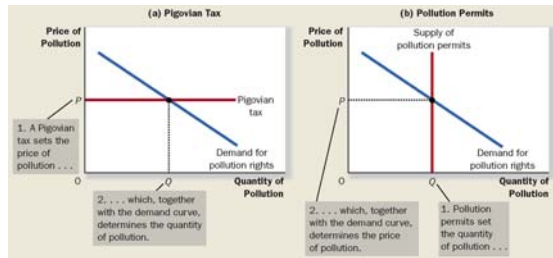
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### Pigovian Taxes vs. Tradeable Pollution Permits



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### 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.



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## CHAPTER 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.

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## CHAPTER 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.

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## CHAPTER 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.

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# End: Chapter 10

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