

Microeconomics

## Chapter 9: Externalities and Public Goods

Acemoglu Laibson List

Modified by Joseph Tao-yi Wang

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

### Chapter Outline

- 9.1. Externalities
- 9.2. Private Solutions to Externalities
- 9.3. Government Solutions to Externalities
- 9.4. Public Goods
- 9.5. Common Pool Resource Goods

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

### Key Ideas

1. There are important cases in which free markets fail to maximize social surplus.
  - ▶ Market Failure?!
  - ▶ "Lack of Market" Failure!
2. This chapter discusses three such cases:
  1. Externalities,
  2. Public goods, and
  3. Common pool resources.

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

### Key Ideas

3. One common link between these three examples is that there is a difference
  - ▶ between the private benefits and costs
  - ▶ and the social benefits and costs.
4. Government can play a role in improving market outcomes in such cases.

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

### Evidence-Based Economics Example

How can Taiwan's President lower her commute time?

## 選通民讓路

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

### Externalities and Public Goods

Why aren't cows extinct?

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

Externalities: "Broken" Invisible Hand?  
Negative Externalities



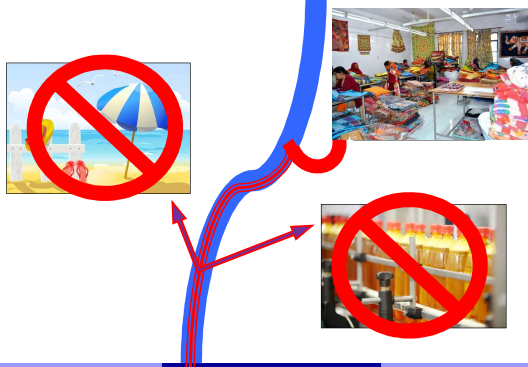
We Make Sweaters, Inc.

Externalities: "Broken" Invisible Hand?  
Negative Externalities



Free yarn?  
Free workers?  
Not free any more?

Externalities: "Broken" Invisible Hand?  
Negative Externalities



Externalities: "Broken" Invisible Hand?  
Negative Externalities

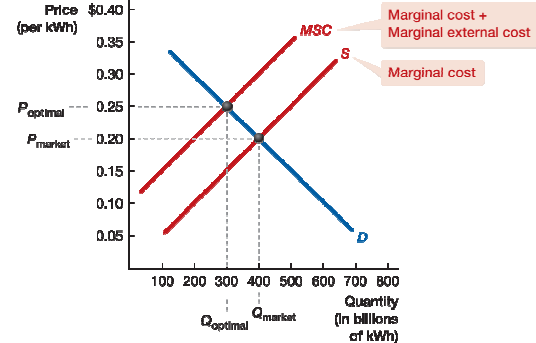


Exhibit 9.2 The Socially Optimal Quantity and Price of Electricity

Externalities: "Broken" Invisible Hand?  
Negative Externalities

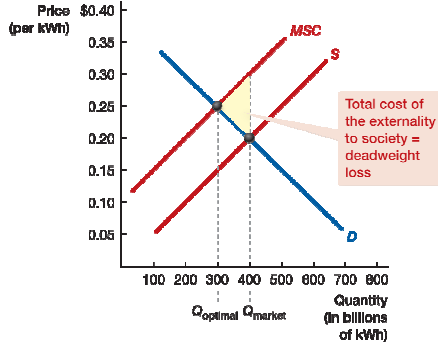


Exhibit 9.3 Deadweight Loss Due to a Negative Externality

Externalities: "Broken" Invisible Hand?  
Negative Externalities

- ▶ Negative Externality
- ▶ An economic activity that has a negative spillover effect

## Externalities: "Broken" Invisible Hand? Negative Externalities

- ▶ **Positive Externality**
- ▶ An economic activity that has a **positive** spillover effect

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Externalities: "Broken" Invisible Hand? Positive Externalities

- ▶ **Social Benefits of Education:**
  - ▶ Higher individual wages  
= more tax revenues
  - ▶ Less reliance on social programs
  - ▶ Decreased crime
  - ▶ More innovation
  - ▶ Better functioning society

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Externalities: "Broken" Invisible Hand? Positive Externalities

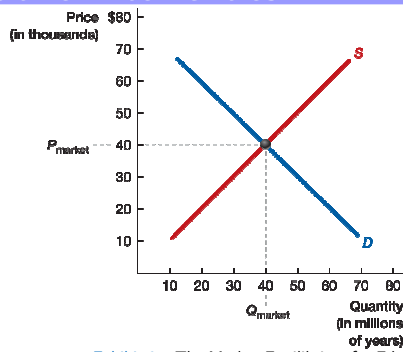


Exhibit 9.4 The Market Equilibrium for Education

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Externalities: "Broken" Invisible Hand? Positive Externalities

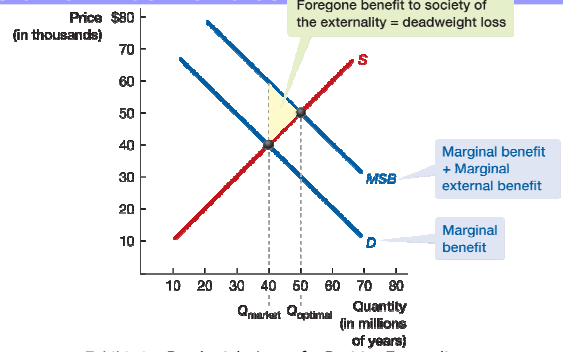


Exhibit 9.5 Deadweight Loss of a Positive Externality

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Externalities Pecuniary Externalities

- ▶ **Pecuniary Externality**
- ▶ When a market exchange affects other people **through market prices**

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Externalities

- ▶ How can we address inefficient outcomes?
  - ▶ **Private solutions**
  - ▶ **Government solutions**

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Private Solutions to Externalities

### Private Solution: Bargaining

Profits Per Day		
	Without Filter	With Filter
Fred	\$130	\$100
Anne	\$90	\$140

Can Fred and Anne come to an agreement?

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Private Solutions to Externalities

### Private Solution: Bargaining

- ▶ If Anne has rights of clean water
  - ▶ Will she agree to let go for  $<50$ ?
  - ▶ Will Fred agree to pay her  $>30$ ?
- ▶ Range of terms: none!
- ▶ Outcome: Filter added, no transfer
  - ▶ Fred:  $\$100 = \$100$
  - ▶ Anne:  $\$140 = \$140$ , Total:  $\$240$
- ▶ Total welfare maximized since
  - ▶  $\$130 + \$90 = \$220 < \$240$

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Private Solutions to Externalities

### Private Solution: Bargaining

- ▶ If Fred has rights to pollute
  - ▶ Will he agree to add a filter for  $<30$ ?
  - ▶ Will Anne agree to pay him  $>50$ ?
- ▶ Range of terms:  $\$30 < \$X < \$50$
- ▶ Possible Outcome: Filter added for  $\$40$ 
  - ▶ Fred:  $\$100 + \$40 = \$140$
  - ▶ Anne:  $\$140 - \$40 = \$100$ , Total:  $\$240$
- ▶ Total welfare still maximized!
  - ▶ Property rights affect wealth, but not efficiency

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Private Solutions to Externalities

### Private Solution: Bargaining

Profits Per Day		
	Without Filter	With Filter
Fred	\$130	\$100
Anne	\$90	<b>\$110</b>

What if the numbers change?

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Private Solutions to Externalities

### Private Solution: Bargaining

- ▶ If Fred has rights to pollute
  - ▶ Will he agree to add a filter for  $<30$ ?
  - ▶ Will Anne agree to pay him  $>20$ ?
- ▶ Range of terms: none!
- ▶ Outcome: Filter not added, no transfers
  - ▶ Fred:  $\$130$ , Anne:  $\$90$ , Total:  $\$220$
- ▶ Total welfare still maximized since
  - ▶  $\$100 + \$110 = \$210 < \$220$

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Private Solutions to Externalities

### Private Solution: Bargaining

- ▶ If Anne has rights of clean water
  - ▶ Will she agree to let go for  $<20$ ?
  - ▶ Will Fred agree to pay her  $>30$ ?
- ▶ Range of terms:  $\$20 < \$Y < \$30$
- ▶ Possible Outcome: Fred compensate  $\$25$ 
  - ▶ Fred:  $\$130 - \$25 = \$105$
  - ▶ Anne:  $\$90 + \$25 = \$115$ , Total:  $\$220 > \$210$
- ▶ Property rights affect wealth, not efficiency

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Private Solutions to Externalities

### The Coase Theorem

- ▶ **Coase Theorem**
- ▶ States that private bargaining will result in an efficient allocation of resources if
  - ▶ Property rights are clearly defined
  - ▶ Bargaining cost is small

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Private Solutions to Externalities

### The Coase Theorem

- ▶ Will the Coase Theorem hold if:
  - ▶ The **beach-goers** (instead of the brewery) try to come to an agreement with Fred?
  - ▶ Why or why not?

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Private Solutions to Externalities

### Private Solution: Doing the Right Thing



Why do you recycle?

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Government Solutions to Externalities

- ▶ What if private solutions do not work?
- ▶ Government solutions:
  - ▶ **Command-and-control**—direct regulation
  - ▶ **Market-based policies**—provide incentives

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Government Solutions to Externalities:

### Regulation: Command-and-Control Policies

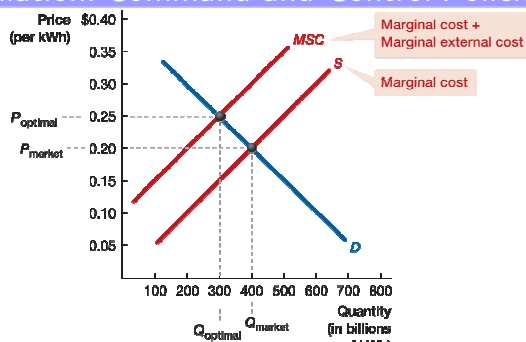


Exhibit 9.2 The Socially Optimal Quantity and Price of Electricity

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Government Solutions to Externalities:

### Regulation: Command-and-Control Policies



Would you put a **catalytic converter** on your car if it were optional?

2016/11/3 Externalities & Public Goods Joseph Tao-yi Wang

## Government Solutions to Externalities Corrective Taxes and Subsidies

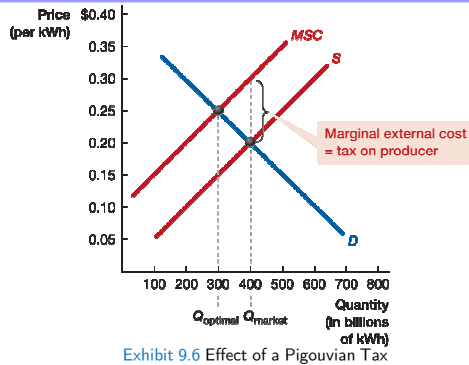


Exhibit 9.6 Effect of a Pigouvian Tax

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Government Solutions to Externalities Corrective Taxes and Subsidies

- ▶ Pigouvian Tax
- ▶ The tax necessary to incentivize a firm to produce the socially optimal level of output
  - ▶ Need to know MEC (marginal external cost)

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Government Solutions to Externalities Corrective Taxes and Subsidies



Pigouvian taxes also work on individuals

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Government Solutions to Externalities Corrective Taxes and Subsidies

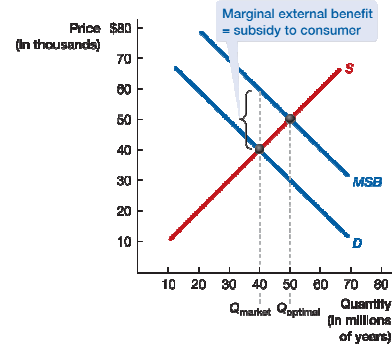


Exhibit 9.7 Effect of a Pigouvian Subsidy on the Education Market

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Government Solutions to Externalities Corrective Taxes and Subsidies

- ▶ Pigouvian Subsidy
- ▶ The subsidy necessary to make an economic agent increase consumption to the socially optimal level
  - ▶ Need to know MEB (marginal external benefit)

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods



So far, we have only been talking about private goods

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods



How many people can eat this apple?

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

- ▶ **Rival** Goods
  - ▶ Only one person can consume at a time
- ▶ **Non-rival** Goods
  - ▶ More than one person at a time can consume

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods



Can you eat this apple without paying for it?

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

- ▶ **Excludable** Goods
  - ▶ Must be paid for in order to consume them
- ▶ **Non-excludable** Goods
  - ▶ Can be consumed, even if they are not paid for

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

Key: Cannot exclude (property rights unclear)!

		Excludability	
		High	Low
Rival	High	Ordinary Private Goods (clothes, food, furniture)	Common Pool Resource Goods (fish, water, natural forests, food at a picnic)
	Low	Club Goods (cable TV, pay-per-view TV, Wi-Fi, music downloads)	Public Goods (national defense, early warning systems, earth protection programs)

Exhibit 9.8 Four Types of Goods

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods



How much are you willing to pay for national defense?

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

北京軍事專家：如果解放軍真要攻台，主要針對「台獨分子」

2015/09/11 09:03:00 檢舉 加入好友 3,896 19 A- A A+

國際中心 / 綜合報導

國軍昨(10)日在新竹、台中兩地進行漢光演習，身為三軍統帥的總統馬英九也到場檢視反舟波黨彈濟濟。大陸軍事專家卻認為，台灣舉行以解放軍攻台為背景的演習根本「完全沒有必要」，只是窮民傷財，因為解放軍如果真要對台發動武，主要也是針對「台獨分子」。



What if you didn't contribute?

2016/11/3

## Public Goods

### Government Provision of Public Goods

- ▶ Free rider problem
  - ▶ When an individual does not pay for a good because it is non-excludable
- ▶ Solution
  - ▶ The government makes paying for it mandatory

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

### Government Provision of Public Goods

- ▶ What's the "right" amount of a public good?

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

### Government Provision of Public Goods

$$\text{Market } Q^d = \text{Your } Q^d + \text{Jim's } Q^d + \dots$$

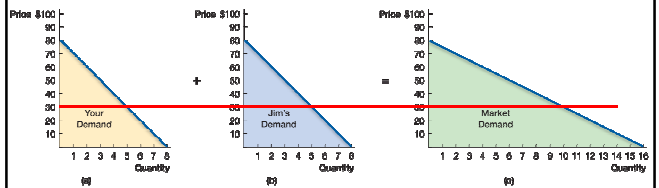


Exhibit 9.9 Constructing a Market Demand Curve for a Private Good

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

### Government Provision of Public Goods

Socially Benefit  
= Your WTP  
+ Jim's WTP  
+ ...

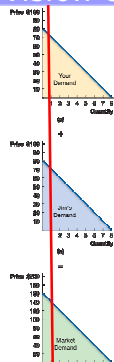


Exhibit 9.10 Constructing a Market Demand Curve for a Public Good

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

### Government Provision of Public Goods

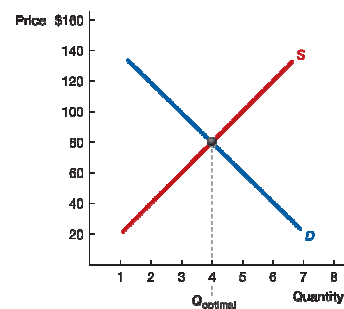


Exhibit 9.11 The Equilibrium Point for Providing a Public Good

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang



## Public Goods

### Private Provision of Public Goods

Did you pay for Cookie Monster's salary?



2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

### Private Provision of Public Goods

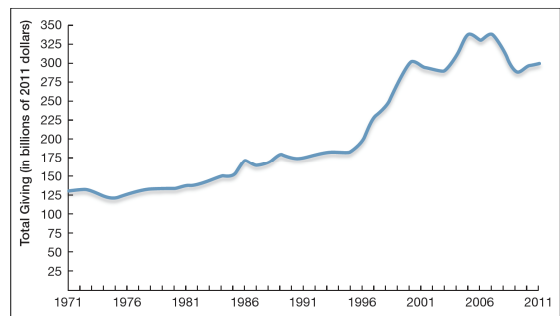


Exhibit 9.12 Total Giving in the United States Over Time

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Public Goods

### Private Provision of Public Goods

- ▶ What's wrong with charity?
  - ▶ Money may not go to areas of most critical need
  - ▶ Too variable
  - ▶ When economy is in downturn, giving decreases (but needed the most!)

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Common Pool Resource Goods



Why would people who fish be in favor of limits on how many fish they can catch?

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Common Pool Resource Goods

- ▶ **Tragedy of the Commons**
- ▶ When common pool resources are overused

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Common Pool Resource Goods

Why aren't cows extinct?



2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Externalities and Public Goods

▶ Solutions to tragedy of the commons:

1. Private ownership
  - ▶ (defined by the government)
2. Government regulation
  - ▶ (fishing limits, for example)
3. Tax on use

2016/11/3

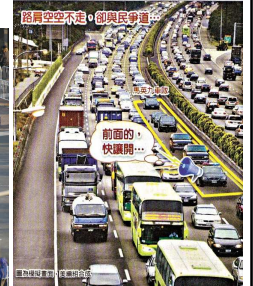
Externalities & Public Goods

Joseph Tao-yi Wang

## Evidence-Based Economics Example

How can Taiwan's President lower her commute time?

選逼民讓路



2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Externalities and Public Goods

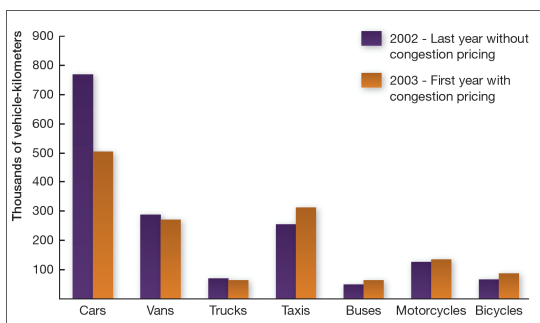


Exhibit 9.14 Results of the Congestion Charge

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Conclusion

- ▶ Problem of Externalities
  - ▶ Markets ignore External Cost/Benefit
  - ▶ Coase theorem works if assign property rights
- ▶ Public Goods and Common Resources
  - ▶ Cannot exclude free-riders
  - ▶ Property rights are not well-defined
- ▶ Just define property rights and trade!?
  - ▶ "Lack of Market" Failure
  - ▶ Caused by lack of property rights!

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Homework

- ▶ ALL Chap.9, Problem 2, 5, 6, 8, 10
- ▶ Challenge Questions (from Past Midterms)
  - ▶ 2007 - Essay Q6, Q7
  - ▶ 2008 - Essay C (Multi-Choice Q12, Q13)
  - ▶ 2009 - Essay C1, C8 (Multi-Choice Q11, Q13, Q14)
  - ▶ 2010 - Essay A (True/False Q10)
  - ▶ 2012 - True/False Q10
  - ▶ 2013 - True/False Q10
  - ▶ 2014 - Essay A4-A5, B, C-2:6
  - ▶ 2015 - Essay B16-B18

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang

## Experiment 7: Public Goods Game

- ▶ Round 1:  $m=2, c=1$       Round 2:  $m=4, c=1$
- ▶ Round 3:  $m=4, c=0.5$



$$\begin{aligned}
 1. (x^2) \frac{18}{26} &= 0.69 \\
 2. (x^4) \frac{48}{26} &= 1.85 \\
 3. (x^4 / 0.5) \frac{52}{26} &= 2
 \end{aligned}$$

2016/11/3

Externalities & Public Goods

Joseph Tao-yi Wang