

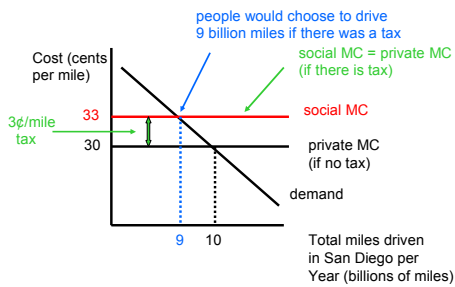
Rough grading scale for first exam:

- A: 85-100
- B: 72-84
- C: 55-71
- D: 40-54
- F: below 40
- average score on first exam: 67
- Next week's discussion sections (Oct 28 - Nov 2) will review Problem Set 3:
 - Chapter 10, pages 290-291: problems 1 and 2
 - Chapter 11, pages 320-322: problems 3, 4, 8, and 9

Chapter 11: Externalities and Property Rights

- A. External costs
- B. External benefits
- C. Negotiation and the Coase Theorem
- D. Using taxes to internalize negative externalities

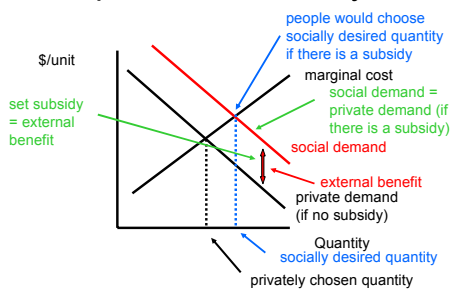
Using a tax to correct a negative externality



Chapter 11: Externalities and Property Rights

- A. External costs
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- E. Using subsidies to internalize positive externalities

Using a subsidy to correct a positive externality



Examples of potentially useful subsidies:

- (1) Recycling aluminum cans
- (2) Public transportation

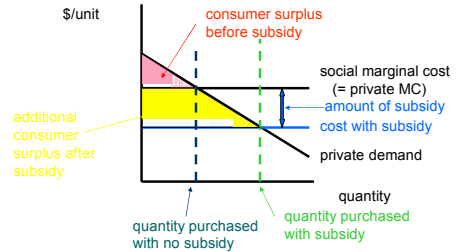
(3) Basic scientific research

private benefit: researcher may enjoy research, may obtain patent, university gains prestige and students

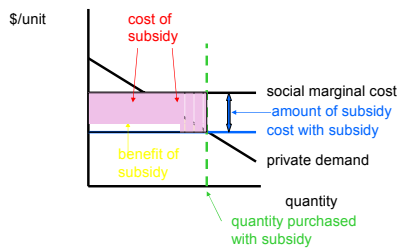
external benefit: research may inspire other discoveries for which others receive patent

public subsidy: increases private return to research

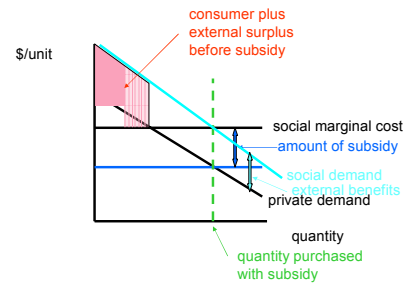
In absence of external benefits, a subsidy costs the taxpayers more than it benefits



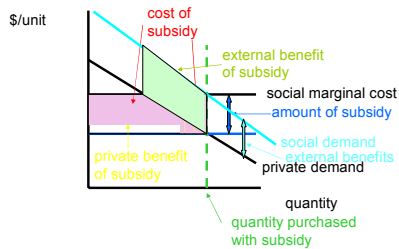
In absence of external benefits, a subsidy costs the taxpayers more than it benefits



In presence of external benefits, a subsidy costs the taxpayers less than it benefits



In presence of external benefits, a subsidy costs the taxpayers less than it benefits



Case study- ethanol for motor fuel

- U.S. produces 40% of world's corn
- About 1/3 of U.S. corn production is devoted to ethanol production
- current ethanol production is 500,000 barrels per day, which is 2.6% of total petroleum consumption



Why used?

- 51 cents tax credit for every gallon of ethanol blended with gasoline
- reduced taxes on blended product itself in many states
- tax credits and subsidies for biofuels infrastructure
- subsidized water, fuel, and other inputs for farmers
- use mandated by Energy Policy Act of 2005

- International Institute for Sustainable Development estimates total subsidies amount to \$1.05 to \$1.38 per gallon
- Implication: economic value of resources used up in producing ethanol is 33% greater than the value of the product to consumers
- 1 Btu of energy inputs required to get 1.25 Btu of ethanol from corn

U.S. ethanol program:

- (1) consumes 5% of world production of calories from corn, soybean, wheat and rice
- (2) raised the cost to world's poor of meeting minimal dietary requirements by 34.5%



Source: Roberts and Schlenker, "World Supply and Demand of Food Commodity Calories", 2008.

- 86% of Americans support (reason: reduce dependence on foreign oil)
- Presumed justification: there are big geopolitical costs for imported oil (economic translation: external cost)
- Economic solution: tax the imported oil

Chapter 11: Externalities and Property Rights

- A. External costs
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- E. Using subsidies to internalize positive externalities
- F. Regulation versus market-based solutions

Government regulation can sometimes be interpreted as response to externalities

- Speed limits and traffic laws
- Tort liability system
- Laws and regulations on disposal of chemicals, batteries, oil, computers, ...
- Zoning laws
- Regulation of air and water pollution

Combining regulation with market-based incentives

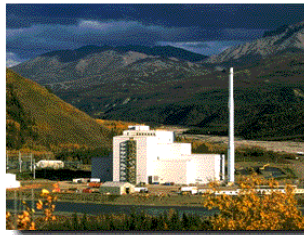
Example:
controlling air pollution from coal-fired power plants



Mt. Storm, W. Virginia

What can plant do to reduce SO₂ emissions?

- 1) Use low-sulfur coal
 - abundant supplies in Wyoming and Alaska
 - many power plants in northeast
 - big differences in transportation costs across facilities



Healy, Alaska

What can plant do to reduce SO₂ emissions?

- 2) Use coal "scrubbers"
 - differ in cost and effectiveness



- Conclusion: some plants can reduce SO₂ emissions at much lower cost than others
- Economic efficiency calls for equalizing marginal cost of reducing SO₂ emissions across all sources



Mt. Storm, W. Virginia

How to do this?

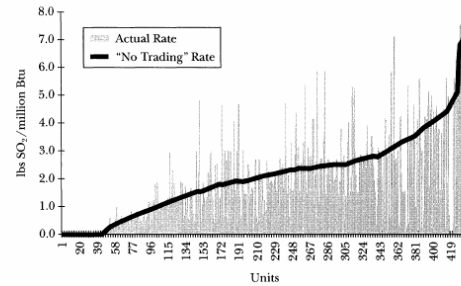
- (1) detailed regulation, separate requirements for each facility
- (2) market-based solution

Example: Clean Air Act Amendments of 1990

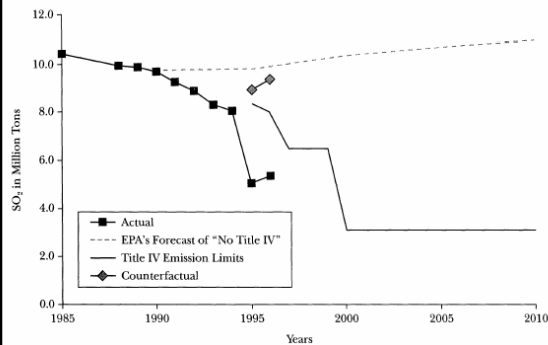
Approach:

- Companies issued permits to emit SO₂
- One permit allows to emit one ton of SO₂ per year
- Total permits issued achieves policy goal
- Companies could buy or sell permits from each other

Effect of Trading: 1996



SO₂ Emissions, Caps and Forecasts for Phase I Units



Results:

- pollution reduced well below goal
- Cost was 30% lower than original EPA plan

Conclusion: allowing tradable permits allowed U.S. to achieve target level of overall reduction at minimum total cost

Separate questions:

(1) Was this the right target level, that is, does marginal benefit of reducing SO₂ this much equal the marginal cost?

(2) Did this succeed in reducing pollution where it mattered the most?

Potential benefits of reducing SO₂ emissions:

- increased life expectancy
 - reduced illness
 - improved crop and timber yields
 - aesthetic value of visibility
- (first two account for 94% of estimated benefits)

Muller and Mendelsohn, *American Economic Review*, Dec 2009 sought to measure economic benefits of reducing SO₂ (and other pollutants) on a county-by-county basis

Figure 8: Marginal Benefits of Abatement for Ground Level Emissions of Sulfur Dioxide (SO₂)



Source: Muller and Mendelsohn, AER, Dec 2009

Muller and Mendelsohn concluded: by reducing SO₂ in areas where it's most important we would generate an additional \$310-\$940 million in social surplus annually