

## Externalities Examples

Second Midterm Exam

News

Externalities and Property Rights Redux

Examples of How Economics Contributes to  
Efficient Remedies for Third Party Effects

Should the U.S. use a carbon tax or a cap-  
and-trade system to lower CO<sub>2</sub> emissions?

What Have We Learned?

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## Midterm Examination

The exam is Tuesday, November 3 in class.

It comprises 30-35 multiple choice questions.

It covers material in lectures 10 and 12-18.

The exam is "closed books and notes" and the  
honor code will be strictly enforced.

Please bring a Scantron sheet and your UNC ID.

Late comers will be barred.

You may not leave the room during the exam.

Practice questions and the key for back-of-chapter  
problems are posted on the web page.

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## Exam Advice

Please fill out your Scantron accurately.

There is a one-course-point penalty for  
bubbling errors. There were about ten  
bubbling errors on the first midterm.

Please start studying now. Most students  
find the second midterm more difficult  
than the first.

## News

*The New York Times*

PRINTED PAPERLESS FOREVER  
IN THEATERS  
OCTOBER 30TH

September 28, 2009

GREEN INC.

**E.U. Alone and Lonely on Carbon**

By JAMES KANTER

BRUSSELS — Carbon trading put the European Union in the environmental vanguard.

Since 2005, the trade bloc has operated the world's only continentwide system that puts a cap on  
greenhouse gas emissions and that requires major polluters to hold tradable allowances.

But the system has also been the most "costly climate policy program in the world," according to Jürgen R.  
Thumann, the president of BusinessEurope, a powerful confederation of industry and employer groups.

## Review Externalities and Property Rights

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### What Are Externalities?

Externalities are the costs (and sometimes benefits) that are not experienced directly by producers and consumers of goods.

Externalities “spill over” onto third parties.

Externalities are generally negative...but sometimes positive.

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### Externalities Interfere with Efficient Allocation of Resources.

For most goods, the total social cost of production and consumption are reflected in the price of the good.

For goods with third party effects, the total social cost and benefit of production and consumption are not wholly reflected in the price of the good.

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### Externalities Interfere with Efficient Allocation of Resources.

When negative externalities are associated with production or consumption of a good, too much of the good is produced and consumed.

When positive externalities are associated with production or consumption of a good, too little of the good is produced and consumed.

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## Ronald Coase Explains The Connection between Externalities And Property Rights

If bargaining is not costly and  
 If property rights are secure  
 Then  
 Agents can bargain over externalities  
 and achieve an efficient outcome.

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Use Your Clickers To Answer  
 The Following  
 Graded Question.

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Pollution Decision	Value of the Mill	Value of the Fishery
High Discharge	\$5000	\$2000
Low Discharge	\$1000	\$3000

If the Fishery has the right to block the mill from a high rate of discharge of pollution then...

- A. The Fishery will prefer to exercise its right and keep pollution low.
- B. The Fishery will achieve the social optimum by keeping pollution low.
- C. The Mill will pay the Fishery over \$4000 for the right to pollute. Fishery will go out of business because of pollution.
- D. The Mill will achieve the social optimum by buying the right to pollute from the Fishery.

## Markets and Third Party Effects

Under the Clean Air Act Amendments of 1990, the U.S. Environmental Protection Agency (EPA) established the Acid-rain Abatement Program that authorized the creation of a sulfur dioxide (SO<sub>2</sub>) allowance trading system.

An air pollution allowance trading program introduces market forces into pollution control, harnessing the incentives of the free market to reduce pollution.

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The screenshot shows the EPA website's 'Clean Air Markets - Allowance Trading' page. At the top, it features the EPA logo and the text 'U.S. Environmental Protection Agency'. Below this is a navigation bar with links for 'Recent Additions', 'Contact Us', 'Print Version', and a search box with a 'GO' button. A breadcrumb trail reads 'EPA Home > Clean Air Markets > Allowance Trading'. A secondary navigation bar includes links for 'Home', 'Business', 'Programs', 'Progress', 'Trading', 'Reports', 'Data and Maps', 'Monitoring', and 'Issues'. On the left side, there is a vertical menu with categories: 'Trading Basics', 'Allowance Data', 'Allocations', and 'Auctions'. The main content area is titled 'Allowance Trading' and contains the following text: 'EPA's Clean Air Market Programs use cap and trade programs to address environmental issues. This section of the site focuses on trading concepts, program design considerations, and tracking of allowances in our programs:'. Below this text is a bulleted list of links:

- [Buying allowances](#)  
Learn the options for anyone to buy and sell allowances, including the [Acid Rain Program allowance auctions](#).
- Sulfur Dioxide (SO<sub>2</sub>) and Nitrogen Oxides (NO<sub>x</sub>) allowance & market data
  - [Allowance Tracking Systems](#)  
EPA's database of SO<sub>2</sub> and NO<sub>x</sub> allowance accounts and transfers
  - [SO<sub>2</sub> market analysis](#)
  - [NO<sub>x</sub> market analysis](#)

At the bottom of the page, the text 'Econ 101 M. Salemi' is visible.

## Markets and Third Party Effects

The total amount of pollution to be allowed from certain similar sources within the designated area for a specified period is determined based on local clean air standards and the goals of the emission reduction program.

The total is divided into allowance units, which are auctioned off to the sources.

“Allowances” are in units of pollutant emitted, such that a polluter will use up its allowances as it pollutes.

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## Markets and Third Party Effects

The key to the system is that these allowances may be traded between sources, or may be banked.

At the end of the period, each source must have enough allowances to balance its emissions for that period, otherwise a (large) penalty on each excess unit of pollution is imposed.

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## Questions

What sort of company would want to sell pollution credits? Why?

What sort of company would want to buy pollution credits? Why?

Is it a good idea to allow companies to trade pollution credits? Why or why not?

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## An Example Helps Answer These Questions

Suppose three companies in the Ohio Valley each produce 1000 tons of SO<sub>2</sub> per year.

The EPA has decided to reduce emissions by 1200 tons per year—from 3000 to 1800 tons.

The following table gives the marginal cost per ton of reducing emissions.

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## Marginal Cost of Reducing Emissions

SO <sub>2</sub> Reduction	Marginal Cost per Ton of SO <sub>2</sub> Reduction		
	Firm A	Firm B	Firm C
0-200	\$100	\$100	\$50
200-400	\$100	\$150	\$100
400-600	\$100	\$200	\$150
600-800	\$150	\$250	\$300
800-1000	\$150	\$300	\$500

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## How To Read the Table

The total cost to firm B to reduce emissions by 700 tons is:

$$200 \times \$100 + 200 \times \$150 + 200 \times \$200 + 100 \times \$250 = \$115,000$$

SO <sub>2</sub> Reduction	Marginal Cost per Ton of SO <sub>2</sub> Reduction		
	Firm A	Firm B	Firm C
0-200	\$100	\$100	\$50
200-400	\$100	\$150	\$100
400-600	\$100	\$200	\$150
600-800	\$150	\$250	\$300
800-1000	\$150	\$300	\$500

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## Two Important Questions

What might account for the different Marginal Costs?

What is the most efficient way to lower pollution by 1200 tons?

SO <sub>2</sub> Reduction	Marginal Cost per Ton of SO <sub>2</sub> Reduction		
	Firm A	Firm B	Firm C
0-200	\$100	\$100	\$50
200-400	\$100	\$150	\$100
400-600	\$100	\$200	\$150
600-800	\$150	\$250	\$300
800-1000	\$150	\$300	\$500

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## Use Your Clickers To Answer The Following Non-Graded Question.

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The EPA wants to lower emissions by 1200 tons and do so at the lowest possible cost. How much pollution reduction should each firm undertake?

A. A(600), B(200), C(400)

B. A(400), B(400), C(400)

C. A(800), B(200), C(200)

D. A(600), B(200), C(200)

SO <sub>2</sub> Reduction	Marginal Cost per Ton of SO <sub>2</sub> Reduction		
	Firm A	Firm B	Firm C
0-200	\$100	\$100	\$50
200-400	\$100	\$150	\$100
400-600	\$100	\$200	\$150
600-800	\$150	\$250	\$300
800-1000	\$150	\$300	\$500

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## How Can a Trading System Help Lower Pollution in an Efficient Way?

Suppose the MC schedules are private information.

A trading system can reduce pollution by 1200 at the lowest possible cost.

What will be the market price of a right to discharge a ton of SO<sub>2</sub>?

SO <sub>2</sub> Reduction	Marginal Cost per Ton of SO <sub>2</sub> Reduction		
	Firm A	Firm B	Firm C
0-200	\$100	\$100	\$50
200-400	\$100	\$150	\$100
400-600	\$100	\$200	\$150
600-800	\$150	\$250	\$300
800-1000	\$150	\$300	\$500

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## If the Market Price of a Right to Discharge a Ton of SO<sub>2</sub> is \$101.00, How Much Pollution Will Each Firm Choose?

Firm A will buy 400 credits.

Firm B will buy 800 credits.

Firm C will buy 600 credits.

Total pollution will be 1800 tons instead of 3000 tons.

SO <sub>2</sub> Reduction	Marginal Cost per Ton of SO <sub>2</sub> Reduction		
	Firm A	Firm B	Firm C
0-200	\$100	\$100	\$50
200-400	\$100	\$150	\$100
400-600	\$100	\$200	\$150
600-800	\$150	\$250	\$300
800-1000	\$150	\$300	\$500

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## Lowering Carbon Emissions: Carbon Tax or Cap-and-Trade?

Carbon Dioxide CO<sub>2</sub> emissions are an important reason for global warming.

CO<sub>2</sub> is released into the atmosphere when fossil fuels are burned.

The Kyoto Protocol is an agreement among nations to reduce emissions of greenhouse gasses including CO<sub>2</sub>

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## Both A Tax on Carbon and Cap-and-Trade System Can Reduce Emissions

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If a Right to Emit One Ton of SO<sub>2</sub> Costs \$101, Firms will Lower Emissions by 1200 Tons

SO <sub>2</sub> Reduction	Marginal Cost per Ton of SO <sub>2</sub> Reduction		
	Firm A	Firm B	Firm C
0-200	\$100	\$100	\$50
200-400	\$100	\$150	\$100
400-600	\$100	\$200	\$150
600-800	\$150	\$250	\$300
800-1000	\$150	\$300	\$500

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A Tax of \$101 on Emitting A Ton of SO<sub>2</sub> will Cause Firms to Lower Emissions by 1200 Tons

SO <sub>2</sub> Reduction	Marginal Cost per Ton of SO <sub>2</sub> Reduction		
	Firm A	Firm B	Firm C
0-200	\$100	\$100	\$50
200-400	\$100	\$150	\$100
400-600	\$100	\$200	\$150
600-800	\$150	\$250	\$300
800-1000	\$150	\$300	\$500

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What Are  
The Tradeoffs  
Between  
The Two Systems?

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Use Your Clickers To Answer  
The Following  
Graded Questions.

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According to Parry and Pizer an advantage of a carbon tax system is that \_\_\_\_\_.

- A. A tax is better at hitting an emissions reduction target.
- B. It is easier to compensate hard hit industries with a tax system.
- C. It is politically easier to impose a carbon tax than a cap-and-trade system.
- D. A tax fixes the price of emitting CO<sub>2</sub>.

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According to Kanter, the Trouble with Markets for Carbon in Europe has been \_\_\_\_.

- A. The price of a permit to emit carbon has varied a lot.
- B. Initially, too many permits were issued and the price of a permit fell by a lot.
- C. There is ferocious lobbying by firms and nations seeking exceptions to the permit system.
- D. All of the above.

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## The Case for Carbon Taxes

The Price of CO<sub>2</sub> is fixed and widely known.  
Emissions of CO<sub>2</sub> vary from year to year as the costs of abatement vary.  
CO<sub>2</sub> taxes collect revenues that can be used to offset other taxes or can be spent on other programs.  
The benefits of CO<sub>2</sub> tax revenues can be widely distributed.  
All industries face the same price of emissions.

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## The Case for Cap-and-Trade

A cap-and-trade system can more precisely hit an emissions reduction target.  
It is difficult to know what the right price of CO<sub>2</sub> should be.  
Revenues from a CO<sub>2</sub> tax may be wasted.  
It is easier to make exceptions for hard hit industries with a cap-and-trade system.

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Use Your Clickers To Answer  
The Following  
Non-Graded Question.

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Which of the following best represents your position?

- A. The U.S. should use a cap-and-trade system to reduce CO<sub>2</sub> emissions.
- B. The U.S. should use a CO<sub>2</sub> tax to reduce emissions.
- C. The U.S. government should not regulate CO<sub>2</sub> emissions.

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What  
Have  
We Learned?

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## Externalities Examples

Externalities threaten the efficient allocation of resources.

A cap-and-trade system is currently in effect to reduce sulfur dioxide emissions.

Some favor a cap-and-trade system to regulate carbon dioxide emissions. Others favor a tax on carbon dioxide emissions.

There is an exam on October 28.

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