Economics of Pollution Control:

Summary

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Adapted from:
Fundamentals of Environmental Economics and Policy
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Overview of instrument choices

Command and Control

-Mandated abatement technology

- Uniform (non tradable) performance standard

Market Based

Price based vs. Quantity based

-Taxes (Charges)

- Subsidies

-Tradable Permits

- Emissions Reductions Credits

Hybrid approach (e.g, "safety valve")

Voluntary Programs or Information Disclosure Programs

(not covered in detail in this course)

When are market based instruments **not** a good idea?

Benefit of market based instruments

- Benefits relate to cost-effectiveness
  - Should be able to describe and show this graphically
- Why MBI's are cost effective?
  - How do they achieve this?
- Require less information
- Dynamic benefits

The Double Dividend

- If the government uses taxes or auctions permits, the revenue can be used to
  - Offset other distortionary taxes (ie labor)
  - Reduce the deficit
- Provides an additional benefit beyond correcting for the externality
- Alternatively, revenue can be used to
  - Build political consensus
  - Achieve distributional equity goals
  - Invest in R&D that could lower the long run policy cost (?)

Comparing Taxes and Tradable Permits

- **Key distinction: Taxes lock in a marginal *price* of emissions; Permits lock in a *quantity* emissions**

- **When is that distinction important?**
  - **Uncertainty and Relative Efficiency**
    - Weitzman analysis – relative slopes rule
    - Only cost uncertainty matters
  - **Economic Growth**
    - Fixed Supply of permits: demand increases, price rises, emissions unchanged
    - Fixed Tax: increase in aggregate emissions

Comparing Taxes and Tradable Permits

- **Key distinction: Taxes lock in a marginal *price* of emissions; Permits lock in a *quantity* emissions**

- **When is that distinction important?**

  - **General Price Inflation**
    - Permits: higher nominal permit prices, constant real prices, no change in aggregate emissions or allocation.
    - Unit ($/ton) taxes (*not* ad valorem, % of price): real tax decreases, pollution levels increase.
  - **Technological Change**
    - Permits: marginal abatement costs decreases, permit price falls, but aggregate emissions unchanged.
    - Taxes: increase in control levels (decrease in aggregate emissions).

Comparing Taxes and Tradable Permits

Other important differences:

- **Distributional Effects**
  - Taxes: higher costs for sources, transfer to government, property rights to gov't (unless rebated).
  - Permits: if given away, lower costs for sources (unless auctioned)
- **Transaction Costs**
  - Permits: increase control costs directly and by reducing permit trades; also, for certain TC functions, costs are sensitive to initial allocation
  - Taxes: administrative costs may be non-trivial
- **Visibility to Public**
  - Taxes more transparent than permits, benefit-cost comparisons, lower public demand for regulation
  - But successful demonization of CO_2 cap-and-trade as "cap-and-tax" in 2009-2010

When are market based instruments NOT a good idea?

- When costs are homogenous across sources
  - For example if a single control technology is obviously ideal
  - What about dynamic efficiency?
- When monitoring is costly
  - Example: tailpipe emissions
  - If number of regulated entities is very high (autos, home heating, etc)
- When implementation involves costs that undermine the program
  - Remember the Coase Theorem! Cap and trade may not be cost effective when transaction costs are high and permits are not auctioned.

When the pollutant is highly localized (non-uniformly mixing)

- Efficient point: MB = MC
- MBI's achieve cost effectiveness by allowing some firms to pollute more than others
- If the pollutant is uniformly mixing, **it doesn't matter where it's emitted** (or which firms pollute)
  - Will also not be a problem if damages are linear (ie if MB is constant)
- Otherwise cost effective policy could come at the cost of efficiency
  - This is the "hot spot" problem
- Possible solutions:
  - Use trading ratios
  - Tie taxes to marginal damages

Hot Spot Example

- Consider two firm example from first lecture
  - MC1 = 6Q1 ; MC2 = 3Q2
- But now imagine that these two firms are in two different cities
- The pollutant is a **local** pollutant
  - i.e. non uniformly mixing
- Marginal benefit function same in both cities
  - MB1 = 28 – Q1 ; MB2 = 28 – Q2
- What is the *efficient* amount of Q1 and Q2?

Hot Spot Example

- What is the *efficient* amount of Q1 and Q2?
- MB1 = MC1 ; MB2 = MC2
  - 28-Q1=6Q1 → Q1* = 4
  - 28-Q2=3Q2 → Q2* = 7

- What happens if we use cap and trade with 11 permits?

Hot Spot Example

- What happens if we use cap and trade with 11 permits?
- Eq1 (Policy Constraint): Q1 + Q2 = 11
  - Q2 = 11 – Q1
- Eq2 (Cost effectiveness): MC1 = MC2
  - 2Q1 = Q2
- Solution:
  - Q1’ = 11/3
  - Q2’ = 33/3 – 11/3 = 22/3
- Too much pollution in city 1; too little in 2

When are hot spots not a problem?

- Constant MB
- Uniformly mixing
  - So MB1 = F(Q1,Q2)

Muller & Mendelsohn (2009) estimate considerable heterogeneity in MB for SO2 and PM

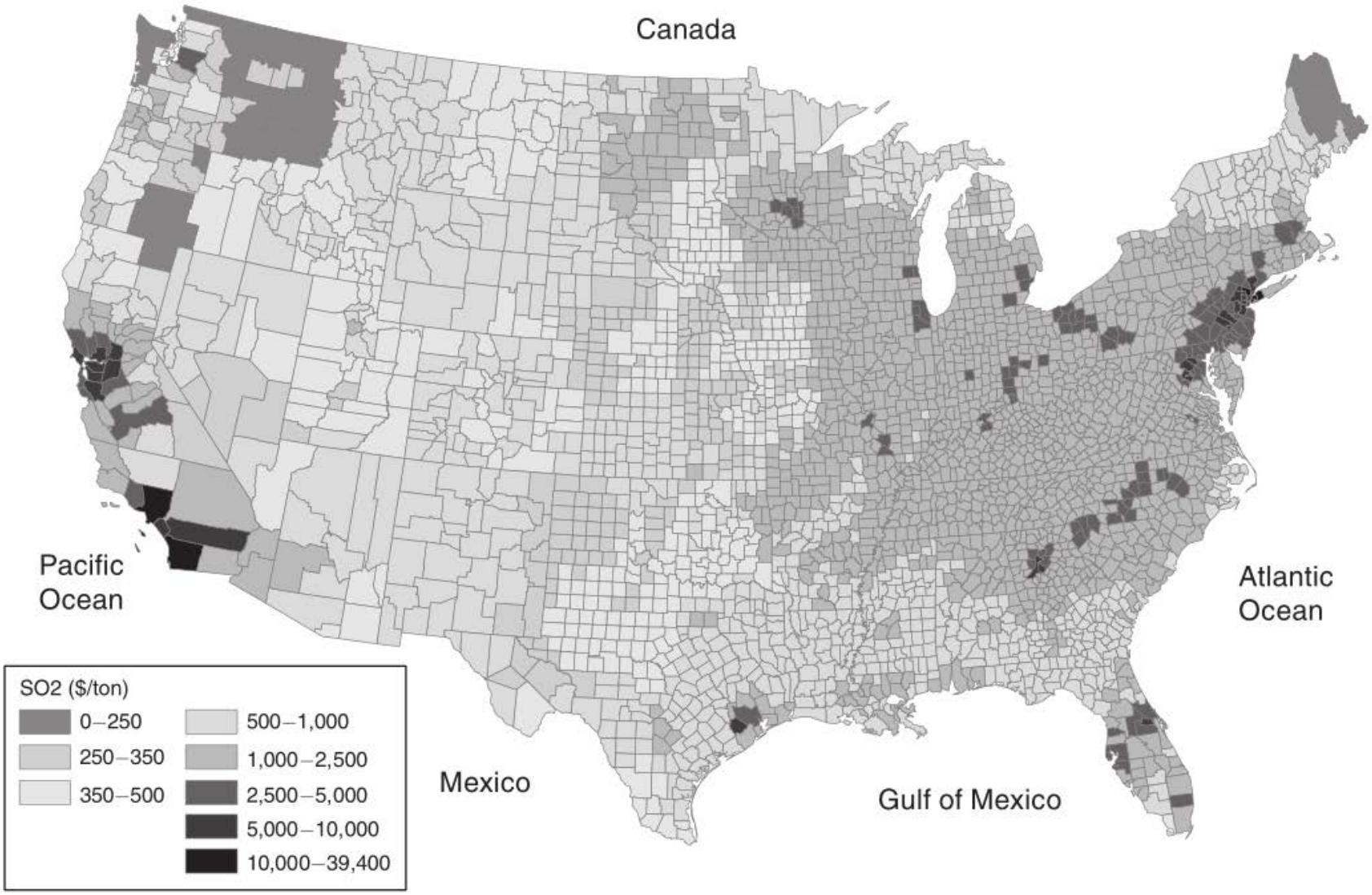

FIGURE 2. MARGINAL DAMAGE OF EMISSIONS FOR GROUND LEVEL SOURCES OF SO_2 ($/TON/YEAR)

Some experience with MBIs

- Not much experience with taxes
  - Australia CO2 tax (2012-2014)
- Tradable quotas (fishing)
- Cap and trade
  - Leaded gasoline phasedown (1980's)
  - Acid Rain program (SO2)
    - Next week
  - Water quality trading
  - Regional Greenhouse Gas Initiative (RGGI)
  - California AB32
  - EU Emissions Trading Scheme

For a good overview of this experience, see Keohane and Olmstead Ch. 10

BACKUP

Why do we care about permit price uncertainty?

- Uncertain prices make it very difficult for firms to make investment decisions
- This may cause them to delay investments
- If risk averse, could reduce investments
- Carbon tax eliminates price risk…
- Which type of pollutants does it make sense to smooth prices over time for?

Alternative Solutions to Environmental Externalities

PROBLEM	SOLUTION	POLICY MECHANISM	CONCERNS
Incomplete property rights	Assign Property Rights-Markets Arise	Eliminating Market Barriers, e.g., water transfers	Transaction costs Equity issues Public goods problems Political feasibility
Incomplete/ Missing Markets	Create a Market	Tradable Permits	Transaction costs Specifying endowments Imperfect markets
Inadequate Prices	Tax or subsidy - Trade	Pollution Charges Deposit-Refund System Eliminating Gov't Subsidies	Uncertain response Equity: tax can't go to injured party if free entry
Non-enforced Property Rights	Use courts to enforce prop. Rights... Internalize externalities	Law suits and related legal action	Transaction costs Intergenerational problem Multi-jurisdictional problem
Inadequate Regulation	Set regulation	Conventional command-and-control regulation	Allocative inefficiency No dynamic incentives for technological change Equity issues