PUBLIC POLICIES: IMPLEMENTATION

LESSON OBJECTIVES

01

Compare taxes and tradable Permits

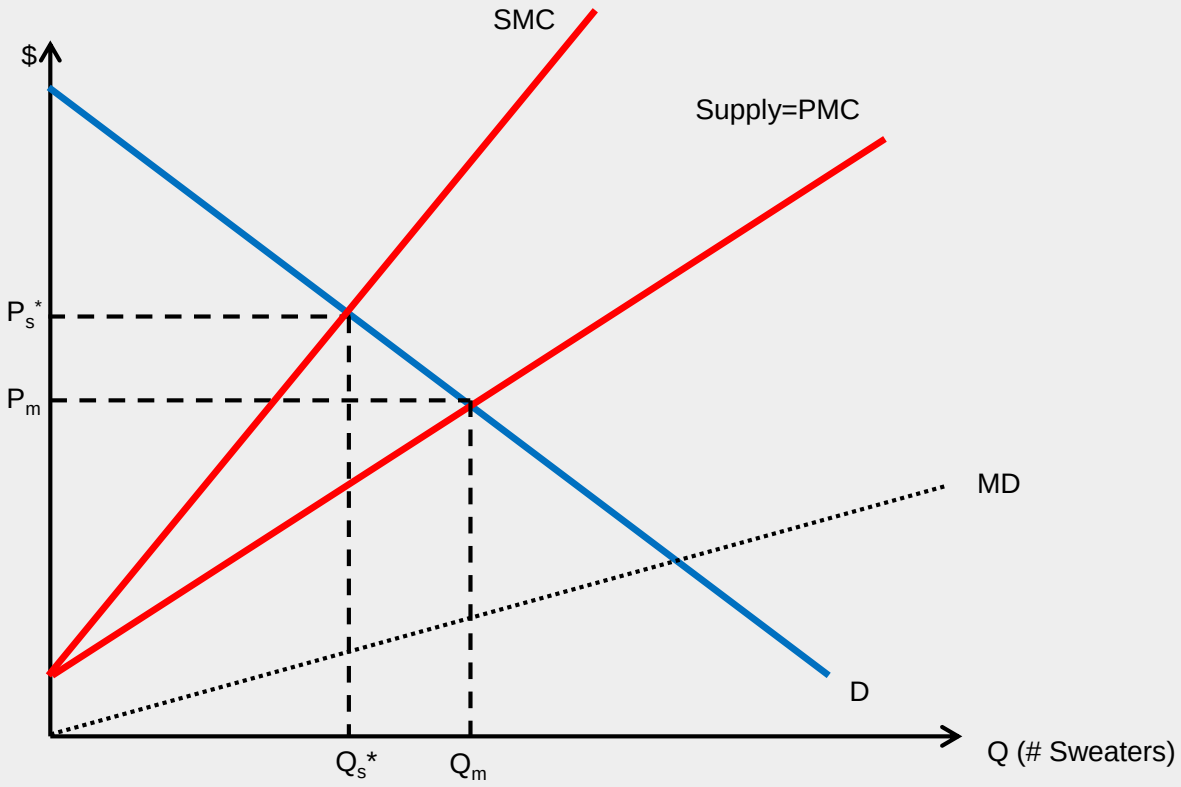
02

Compare standards with market-based policies

03

Analyze public policies for managing natural resources

EFFICIENT VS MARKET EQUILIBRIUM



HOW CAN WE ADDRESS INEFFICIENT OUTCOMES FROM EXTERNALITIES?

Private solutions:

- Coase Theorem
- Social Pressure

Public solutions:

- Standards
- Taxes
- Permits

PUBLIC SOLUTIONS:

STANDARDS

TAXES

PERMITS

We will formally analyze each of the three major policy approaches to address externalities

Each policy is evaluated on its **efficiency** and on **implementation strengths and weaknesses**.

Today we will focus on the **implementation strengths and weaknesses** of each policy alternative.

01

TAXES VS. PERMITS

Consider the social marginal cost and social marginal benefit of abatement.

- Can think of MC as the supply and MB as the demand for abatement.

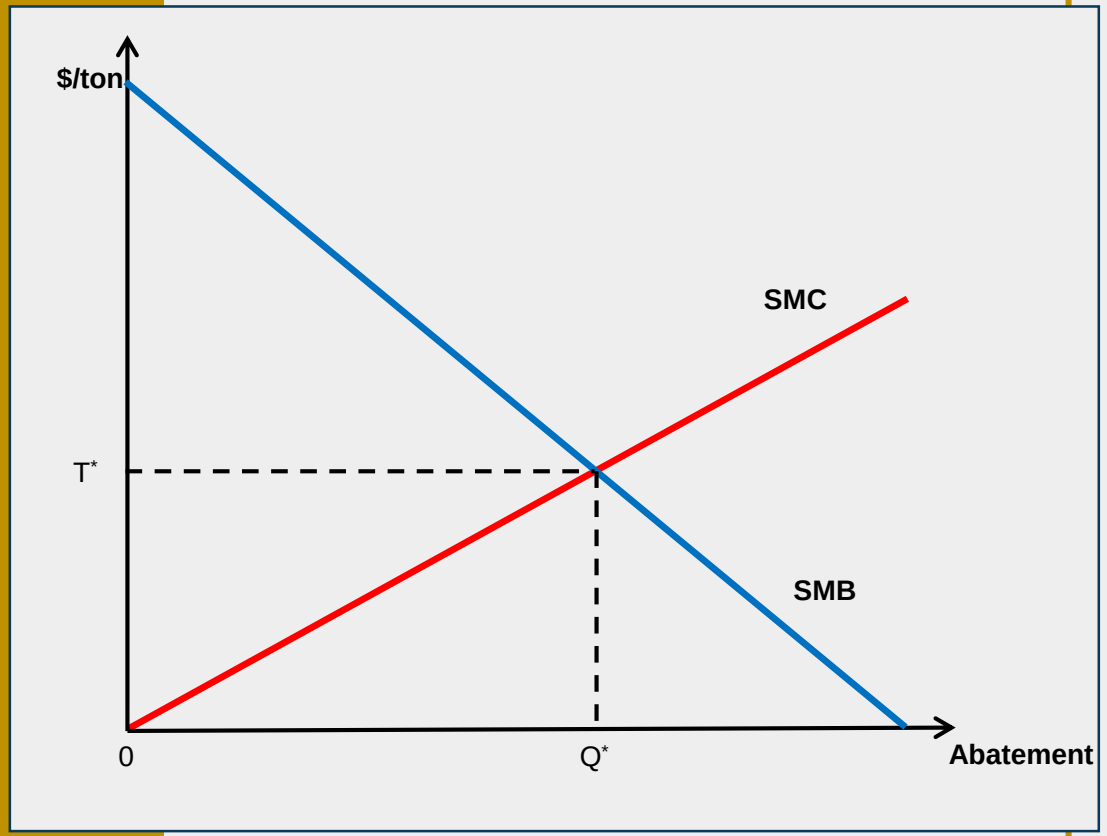
Suppose those harmed by pollution could be induced to pay for pollution control according to their true valuation

- Under perfect competition and complete information outcome would be efficient

But does this demand ever arise?

How could the government "fill in" the missing demand?

- Set price of emissions (tax)
- Set quantity of emissions (permits)



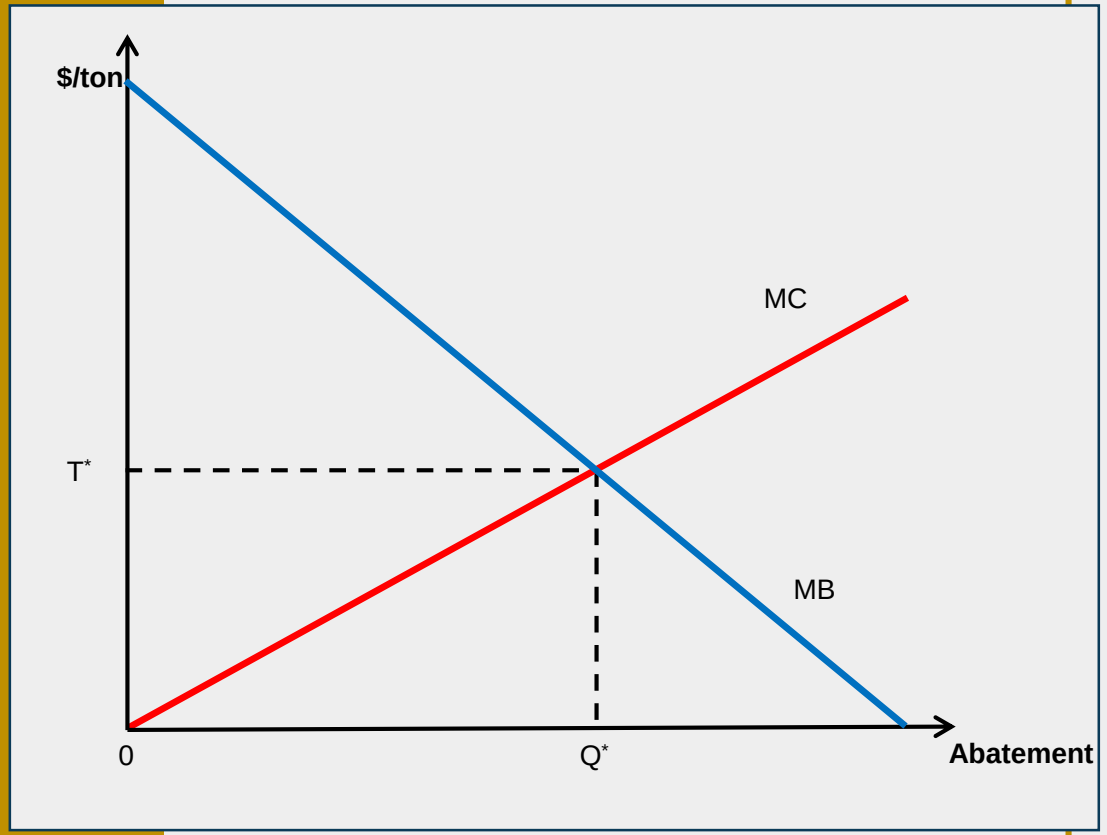
EQUIVALENCE OF TAXES AND PERMITS

Market Equivalence

- Tax of T* yields a quantity of Q*
- Requiring quantity Q* yields price T*

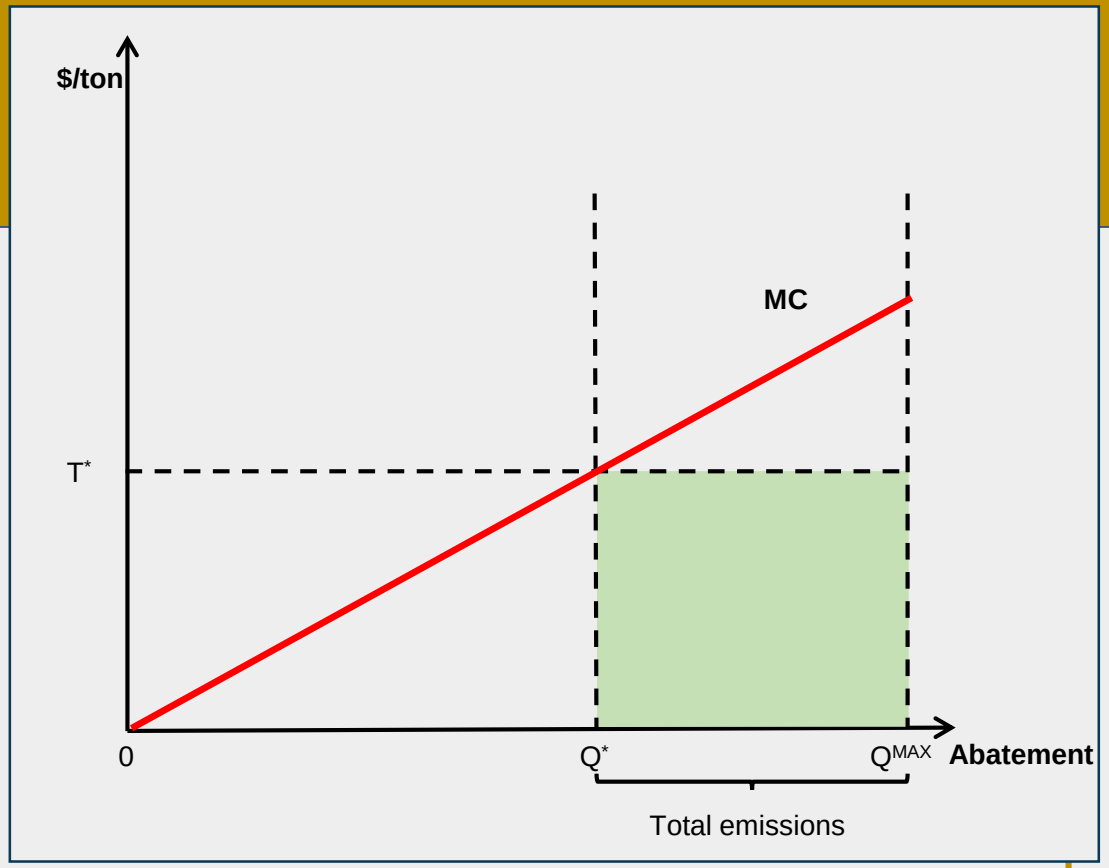
Firm Equivalence

- Taxes incentive firms to abate until MC= T*
- Permits incentivize firms to abate until MC = Permit price = T*



RAISING REVENUES (TAXES)

Taxes raise revenues for the government



WHAT ABOUT PERMITS?

Can permits generate revenue for the government?

Consider if the government gave permits out for free
- Eg. Distributed permits based on historical emissions levels

This would not generate revenues for the government
- Firms could earn revenues based on the initial distribution of permits but this would not go to the government.

Is there a way governments could raise revenues through permits? What if they auctioned off the permits?
- What would the revenues be? How would they compare with taxes?

RAISING REVENUES (PERMITS)

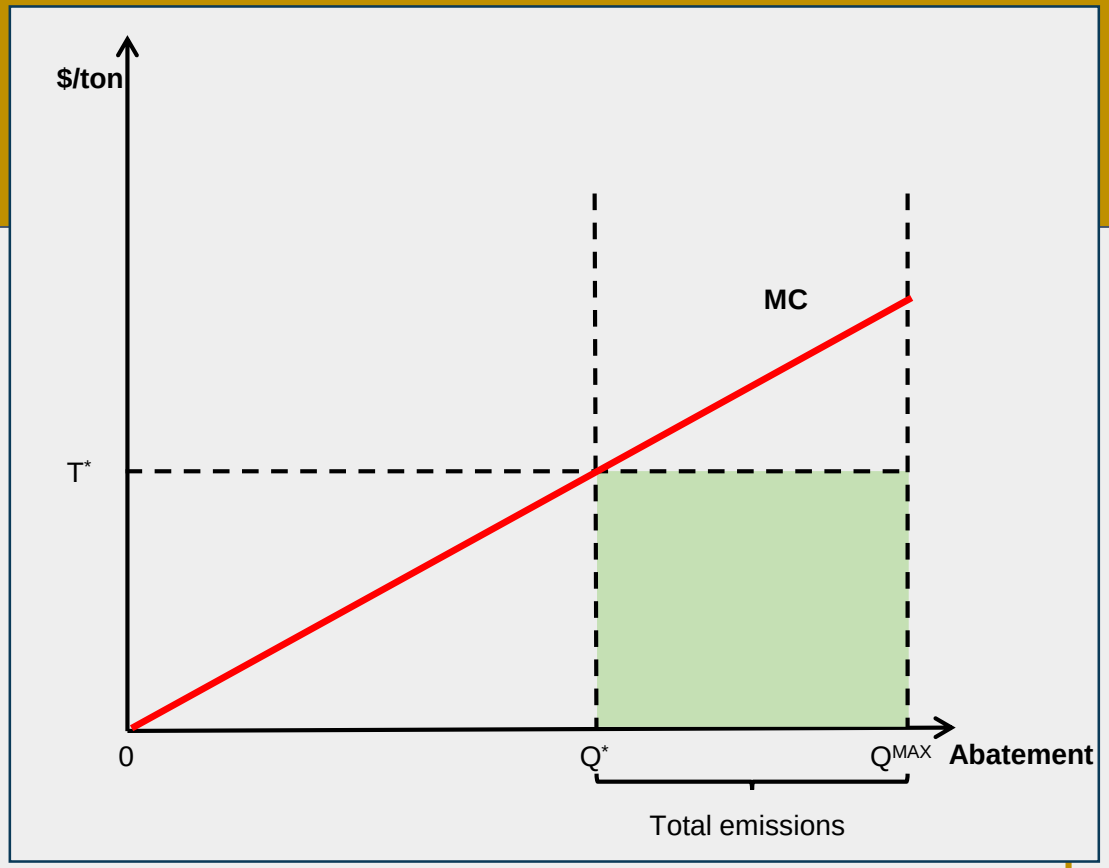
Consider the government auctions permits

What would be the value of each permit?

- If firms had complete information it would be the market permit price, which is equal to the efficient tax

Auction permits raise revenues equal to tax revenues!

- Remember initial distribution does not affect cost effectiveness



GOVERNMENT/ POLICYMAKERS

The potential to raise revenues makes taxes and permits attractive to policymakers

FIRMS

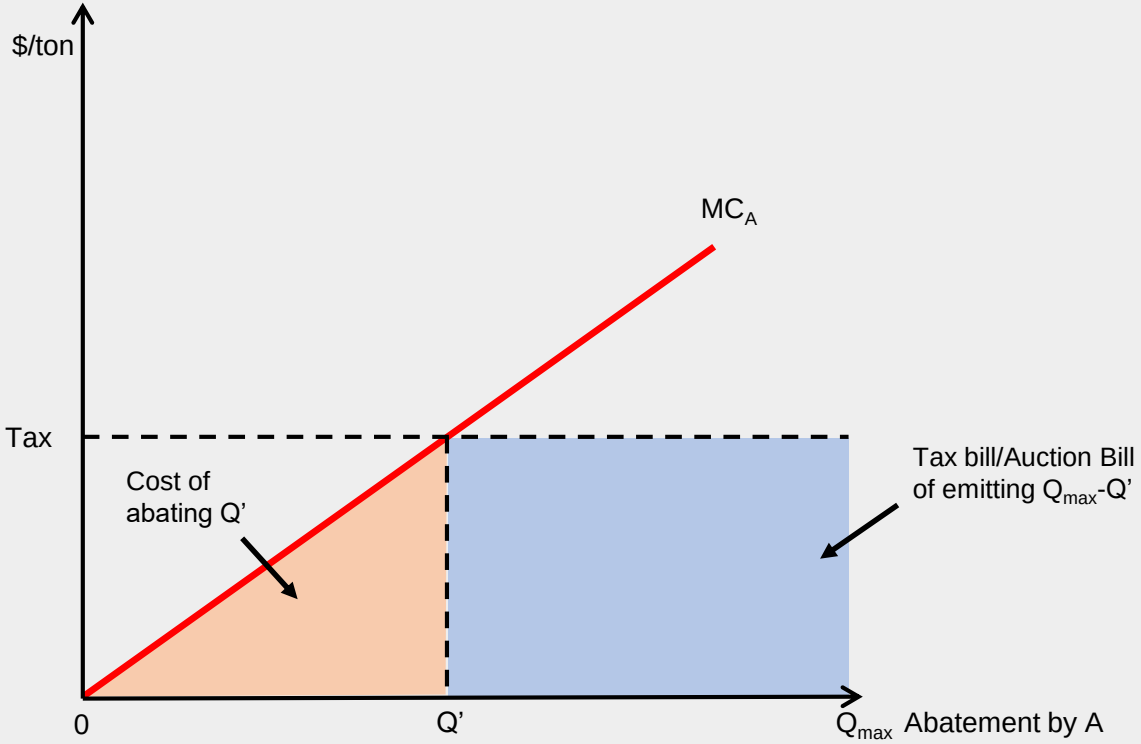
Firms dislike taxes and auctioned permits because they bear the cost of abatement AND the tax/auction bill

FIRM'S COSTS

How much will firm A abate?

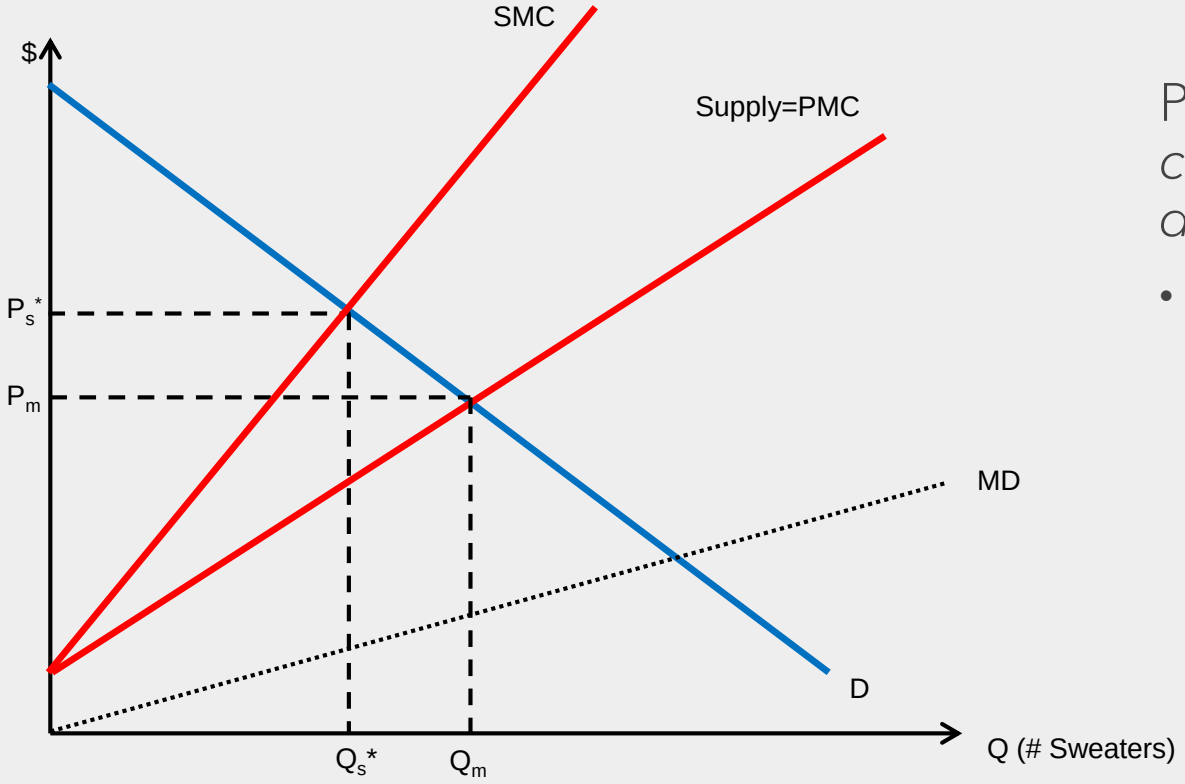
What is the cost of abatement?

What is the tax bill?



REVENUE IMPLICATIONS FOR EFFICIENCY AND EQUITY

CORRECTIVE VS. DISTORTIONARY



Pigouvian taxes are *corrective* not *distortionary*

- They reduce DWL rather than creating DWL

Remember:

Economic incidence is independent of statutory incidence.

It does not matter if the tax is on the producer or the consumer.

Both producers and consumers are likely to pay a part of the cost of the tax

REGRESSIVE TAX SYSTEM

System in which the *lower* the income, the higher percentage of income is paid in taxes

PROGRESSIVE TAX SYSTEM

System in which the *higher* the income, the higher percentage of income is paid in taxes

HOW TAXES ARE REDISTRIBUTED (SPENT) CAN HELP BALANCE THINGS OUT

The Incidence of U.S. Climate Policy: Alternative Uses of Revenues

TABLE 3
CONSUMER SURPLUS LOSS AS PERCENT OF INCOME, BY DECILE

	Decile										
	1	2	3	4	5	6	7	8	9	10	Avg
Initial CS Loss of CO_2 Pricing	4.42	2.82	2.32	2.05	1.82	1.65	1.51	1.35	1.23	0.91	1.42
Cap-and-Dividend (Taxable)	–4.25	–1.13	–0.44	–0.10	0.01	0.17	0.27	0.38	0.46	0.51	0.23
Cap-and-Dividend (Non-Taxable)	–1.64	–0.44	–0.18	0.00	0.06	0.18	0.23	0.28	0.35	0.41	0.23
Reduce Income Tax	4.15	2.55	1.71	1.44	0.98	0.80	0.46	0.30	–0.18	–0.74	0.23
Reduce Payroll Tax	3.89	2.21	1.37	0.96	0.62	0.38	0.18	–0.04	–0.16	–0.14	0.23
Expansion of EITC	–4.56	–2.14	–1.44	–0.53	0.04	0.33	0.43	0.53	0.58	0.57	0.23

Source: Burtraw et al. (2009)

HOW TAXES ARE REDISTRIBUTED (SPENT) CAN HELP BALANCE THINGS OUT

PRICES VS. QUANTITIES

Thus far, we have seen an equivalence between taxes vs. permits as market based policy alternatives

So is there a situation where it matters which is used? From an economic efficiency standpoint?

It turns out there is! When there are uncertainty in costs.

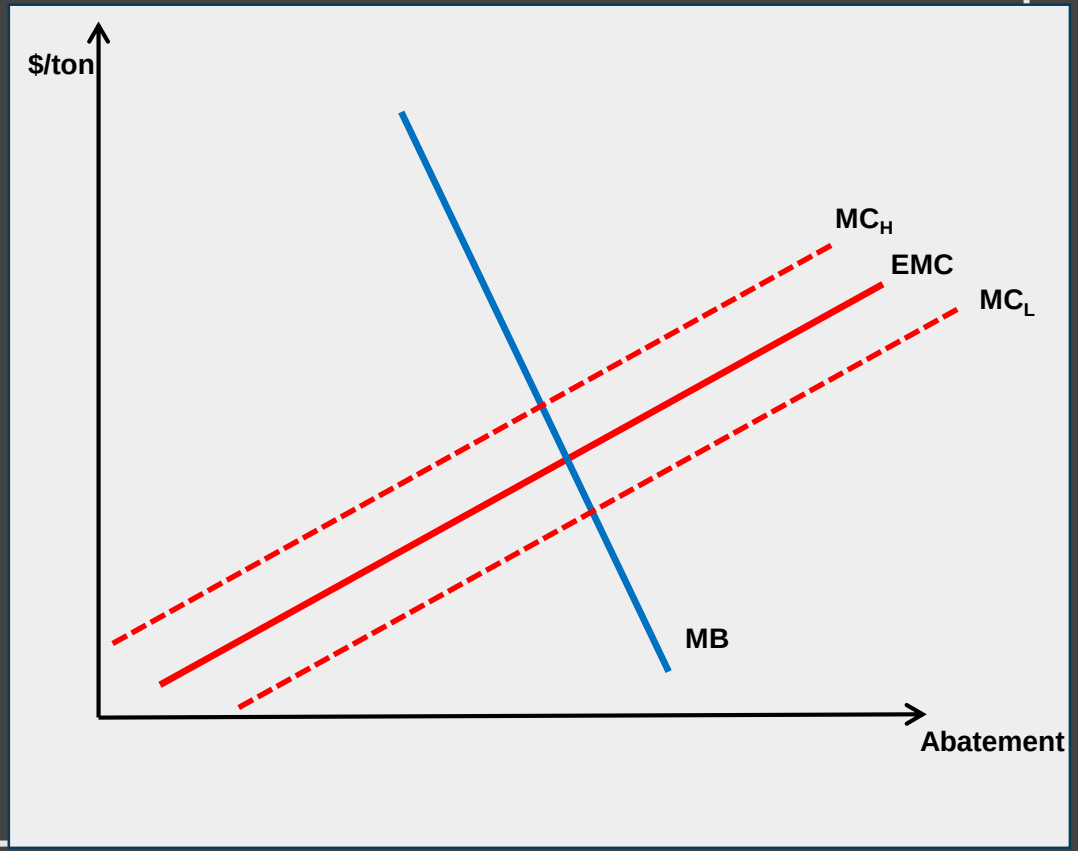
CONSIDER DESIGNING POLICY FOR A MARKET WITH UNCERTAIN COSTS

Uncertainty could be due to "sticky" regulation

- Cost of regulation are unknown
- Once policy is set, it can't be changed ("sticky")

Uncertainty could be due to strategic decision-making

- Cost of regulation is private information (unknown to the regulator)
- Firms don't have incentive to reveal true costs



CONSIDER DESIGNING POLICY FOR A MARKET WITH UNCERTAIN COSTS

<u>Tax</u>

Set tax at EMC=MB

What if MC turns out to be MC_H?

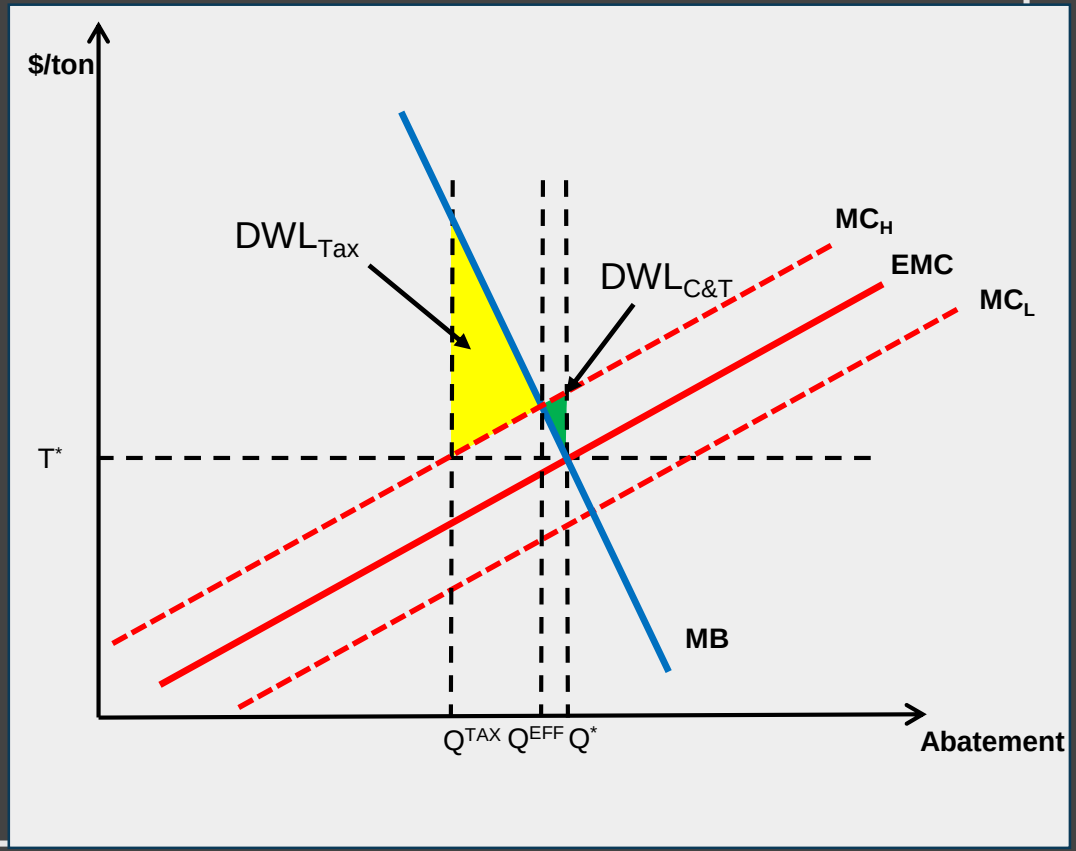
<u>Cap-and-trade</u>

Set quantity at EMC=MB

What if MC turns out to be MC_H?

DWL under Tax is <u>greater</u> than DWL under Cap-and-trade!

Under uncertainty, the <u>efficiency</u> of tax and cap-and trade are not equal!

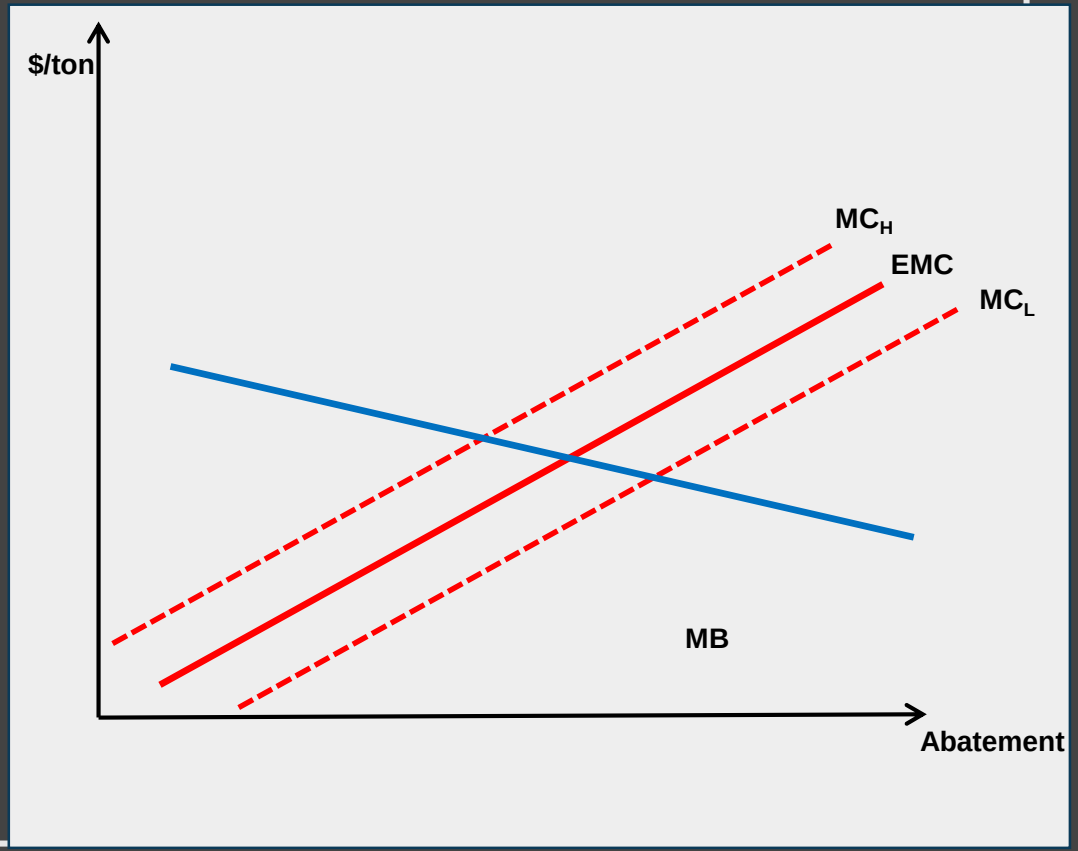


SO WHAT DETERMINES WHICH MARKET BASED INSTRUMENT IS BETTER UNDER UNCERTAINTY?

ATTENDANCE ACTIVITY

Evaluate DWL for tax and C&T when slope of MB is flatter than MC.

How does it compare to DWL when MC is flatter than MB?



ATTENDANCE ACTIVITY

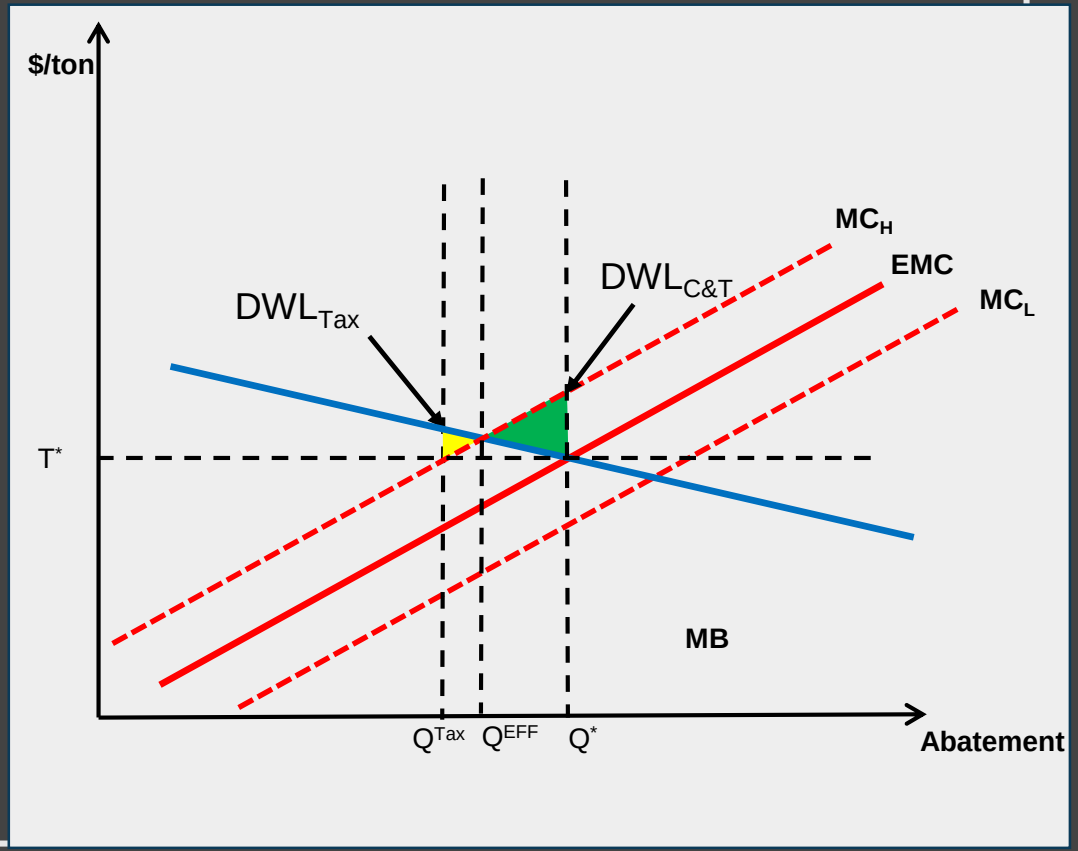
Evaluate DWL for tax and C&T when slope of MB is flatter than MC.

How does it compare to DWL when MC is flatter than MB?

<u>Tax</u>
Set tax at EMC=MB

<u>Cap-and-trade</u>
Set quantity at EMC=MB

DWL under Cap-and-trade is <u>greater</u> than DWL under Tax!



SO WHAT DETERMINES WHICH MARKET BASED INSTRUMENT IS BETTER UNDER UNCERTAINTY?

Previously we saw the economic equivalence between a tax and tradeable permits.

However, under uncertainty in marginal costs, there is a preference on the basis of efficiency

- When MB is steeper than MC, C&T is preferable
- When MB is flatter than MC, tax is preferable

Firms can respond to realization of MC under tax but not under C&T

- Importance of this flexibility depends on relative slopes of MC and MB

Uncertainty in MB does not matter

02

STANDARDS VS. MARKET-BASED POLICIES

WHAT ABOUT INNOVATION?

Policymakers often hope for (and sometimes count on) innovation.

Innovation entails both the development and diffusion of new technologies.

Example: Climate Change

- Innovation in renewable energy

So far, we have evaluated efficiency (cost-effectiveness) of policies in a static setting without innovation.

Let's compare each policy in their ability to incentive adoption of new technologies or methods.

TAX VS. PERFORMANCE STANDARD

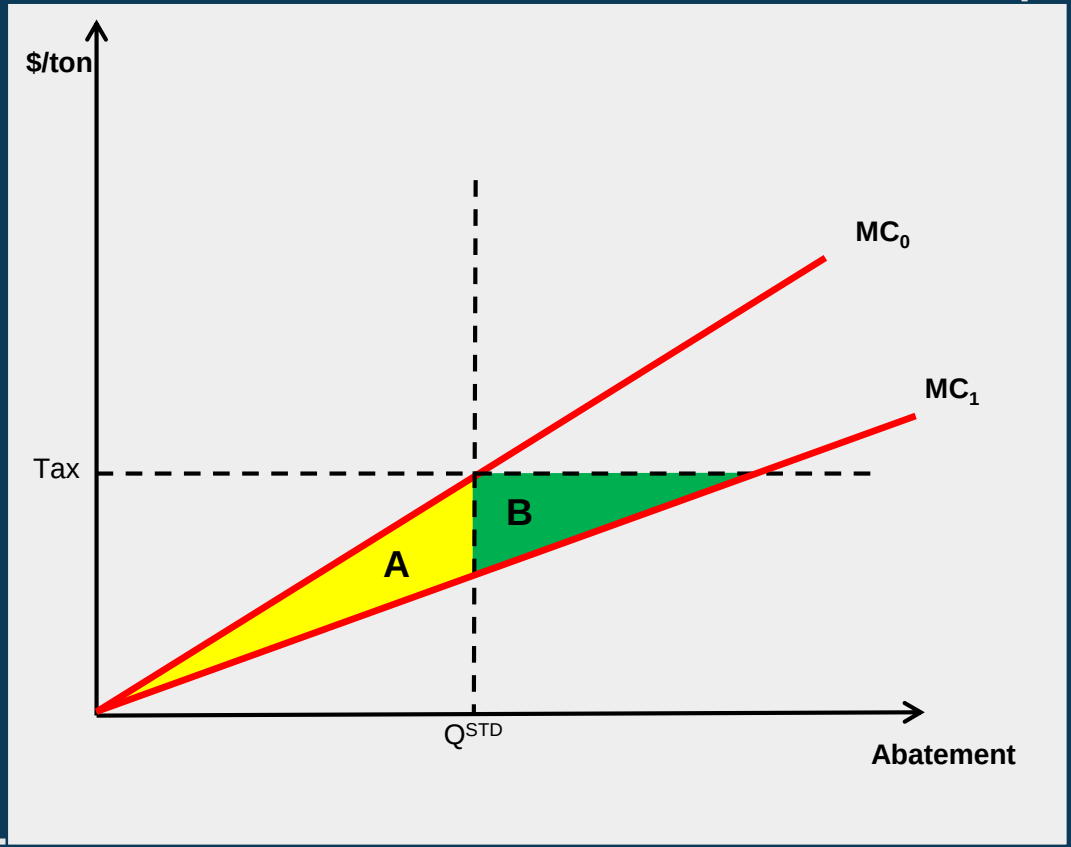
Consider a firm with marginal cost MC_0

Consider an equivalent tax and performance standard

A new technology becomes available that reduces marginal cost to MC_1

What are the cost savings of adoption for standard?

What are the cost savings of adoption for tax?



TECHNOLOGY ADOPTION: TAX VS. PERFORMANCE STANDARD

Firms have larger cost savings from adopting lower-cost technology under tax than performance standard

Under performance standard, firm has less flexibility

Thus, tax provides greater incentive for firms to *adopt* new technologies than a performance standard

TECHNOLOGY ADOPTION: TAX VS. CAP-AND-TRADE

Tax sets a constant price on pollution.

- This price provides incentive to adopt

C&T sets a quantity for the market. This gives a market price for pollution.

As more firms adopt a technology with a lower MC, what happens to the permit price?

- It declines.

What happens to the next firms incentive to adopt the technology?

- It declines.

Adoption of cost reducing technology

Tax is better than tradeable permits is better than performance standard

What about technology standard?

Under market-based policy instruments firms will adopt that technology *if* it is least cost.

Can work well if it *is* the least cost technology for all

Ie. homogenous

It is unlikely that the government knows more than firms.

INNOVATION VS. ADOPTION

We considered the incentives to *adopt* new technologies for different policy instruments.

Where do those new technologies come from?

What are the incentives to *innovate?*
Similarly, to adoption, marketed based instruments provide stronger incentive for firms to innovate to improve cost savings.

However, they will only internalize their own benefits, not the benefits the new technology can have for other firms. There are positive spillovers from innovation.

This is why governments often invest heavily in R&D and provide and enforce patents.

WHEN COULD IT BE BETTER TO USE A STANDARDS INSTRUMENT?

HOT SPOTS

We have assumed the marginal external damage of a pollutant is the same everywhere. Is this a reasonable assumption?

This is equivalent to the *uniform mixing assumption* that assumes all pollutants will uniformly mix independent of where they were emitted.

Is this a reasonable assumption?
It depends.

HOT SPOTS

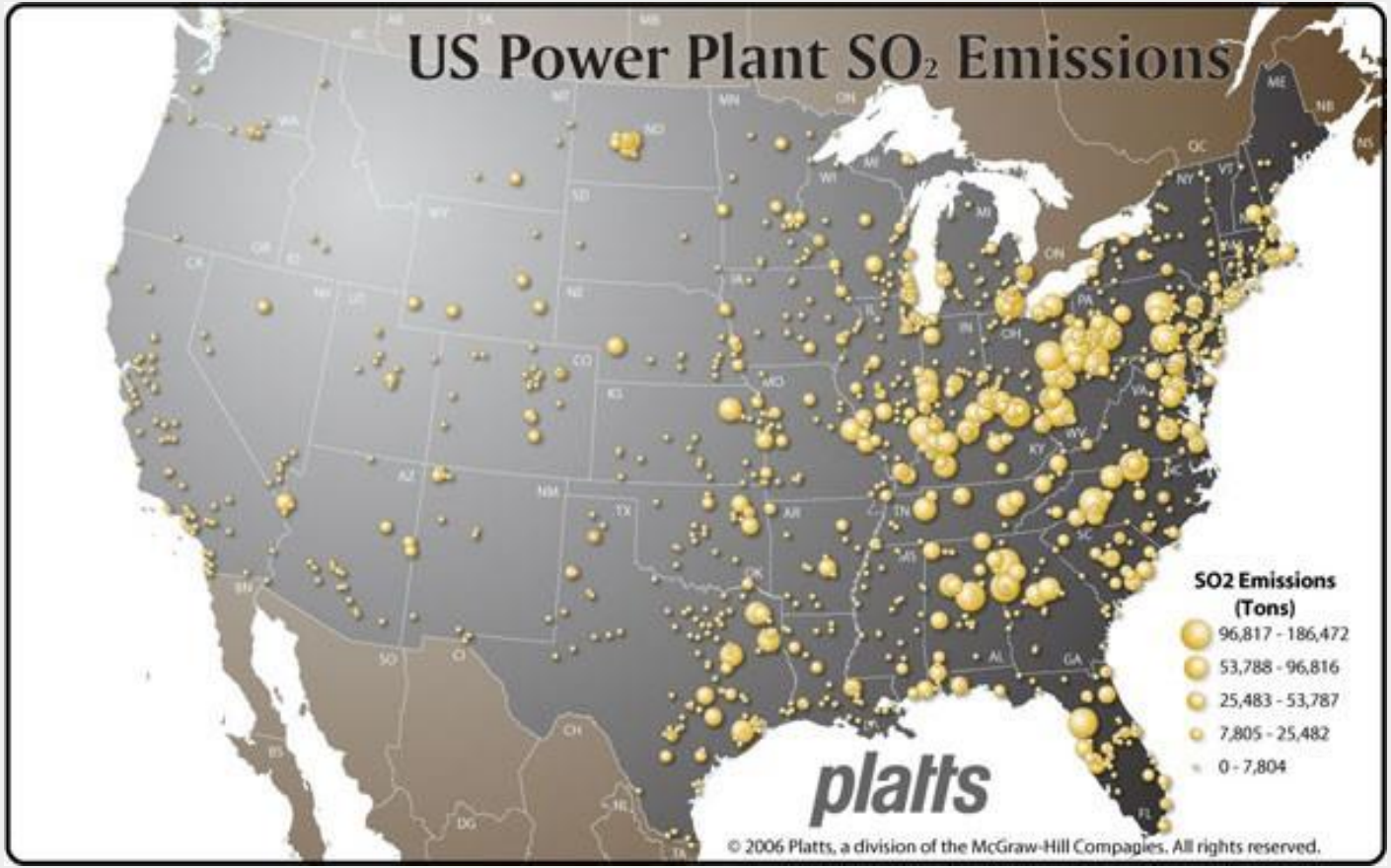
Some pollutants reasonably satisfy the uniform mixing assumption.

Example: CO_2
A ton of CO_2 emitted in Boston and a ton of CO_2 emitted in Beijing has the same effect on atmospheric concentrations of CO_2 and thus on external damages from climate change.

HOT SPOTS

Many other pollutants do not satisfy this uniform mixing assumption.

Example: Water pollution.
Example: SO2


US Power Plant SO_2 Emissions
SO2 Emissions (Tons)
96,817 - 186,472
53,788 - 96,816
25,483 - 53,787
7,805 - 25,482
0 - 7,804
platts
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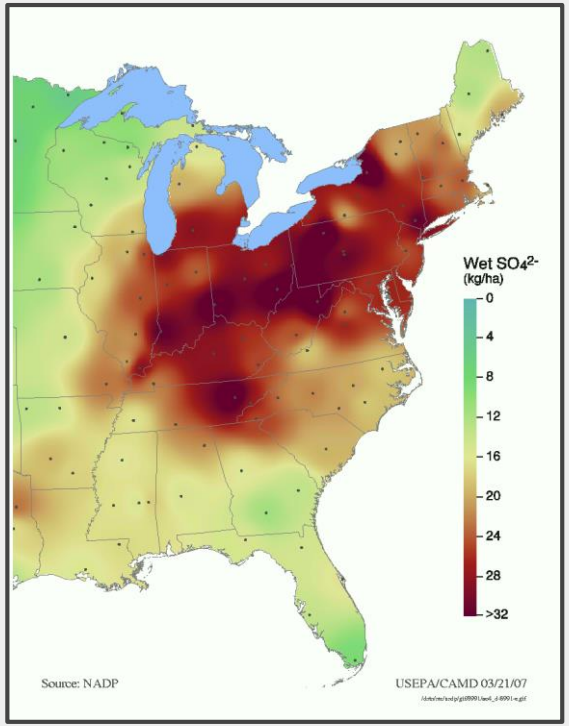
ACID RAIN


Wet SO_4^{2-}
(kg/ha)
0
4
8
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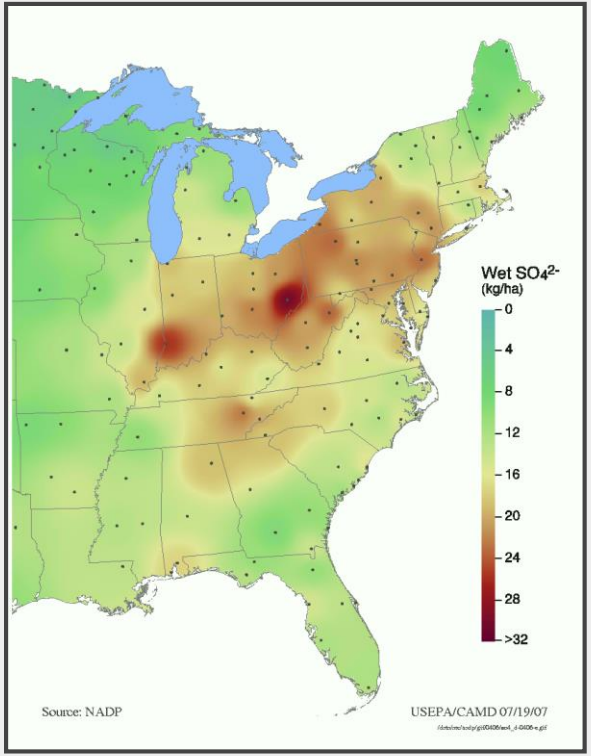
Source: NADP
USEPA/CAMD 03/21/07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0
4
8
12
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>32
Source: NADP
USEPA/CAMD 07/19/07

HOT SPOTS

This can create a problem.

What would happen if we capped emissions for the country, but allowed free trade of permits?

Those with highest marginal abatement costs would continue to pollute.

What if those areas are the same that have the highest marginal external damages from local pollutants?

This is called the *hot spot* problem

PROBLEM

Hot spots

SOLUTIONS?

Regionally cap emission

- Reduces gains from trading and increases enforcement costs

Limit trading

- Lose gains from trading

Use standards

WHAT ABOUT GOVERNMENT COSTS?

MONITORING AND ENFORCING

When discussing cost-effectiveness or efficiency of different policy instruments we have focused on the costs to the firm

- Private compliance costs

Are the private compliance costs the only costs of a policy or regulation?
No!

What about government costs?

- Monitoring
- Enforcing

INDUSTRY REGULATIONS

Consider policies that regulate industries behavior.
Often administrative costs are **small** compared to private compliance costs.

Example: SO_2 scrubbers
Private compliance cost:

- Firms must pay tens or hundreds of millions to install the scrubbers
- Firms must pay millions each year to maintain the scrubbers

Administrative costs:

- Monitoring equipment costs hundreds of thousands to install
- Monitoring equipment costs tens of thousands each year to maintain

INDIVIDUAL BEHAVIOR

Consider policies that regulate individual behavior.
Often administrative costs are large compared to private compliance costs.

Example: Car emissions
Private compliance cost:

- Car owners must pay thousands for a more fuel efficient car

Administrative costs:

- Monitoring equipment for each of the 253 million vehicles in the US cost significantly more

GOVERNMENT COSTS

Efficient policy compares the costs and benefits

- Important to capture *true costs*

Benefits may be larger than the private compliance costs, but that is not the total cost.
Also need to consider government costs.

When the administrative costs of monitoring performance of individual sources of pollution is too high, there are a few options:

Don't regulate

- If the government costs are too high, it may not be worth implementing the regulation.

Command-and-control regulations

- Monitor technology and fuel inputs rather than individual output
- Simplifies regulation and reduces number of individuals that need to be monitored

This describes a case where CaC may be preferable to market-based policies even if they are not cost effective!

STANDARDS VS. MARKET-BASED

While market-based policies can achieve the optimal level of pollution and are cost effective, we have shown that there are certain situations where standards may be preferable:

- Hot spot problem
- Homogeneous firm costs
- Homogeneous incentive for technology adoption
- High government costs

03

NATURAL RESOURCE POLICIES

NATURAL RESOURCES: MARKET FAILURE

We saw that open-access lead to market failure for renewable and other natural resources.

One solution was to assign and enforce property rights

- Sole owner internalized scarcity costs
- Still requires significant information about costs as well as biology.

How could we leverage market-based instruments?

FISHERY PROBLEM

Consider our fishery problem with a twist.

- Rising marginal costs
- Heterogenous costs between fishers

This model is more realistic

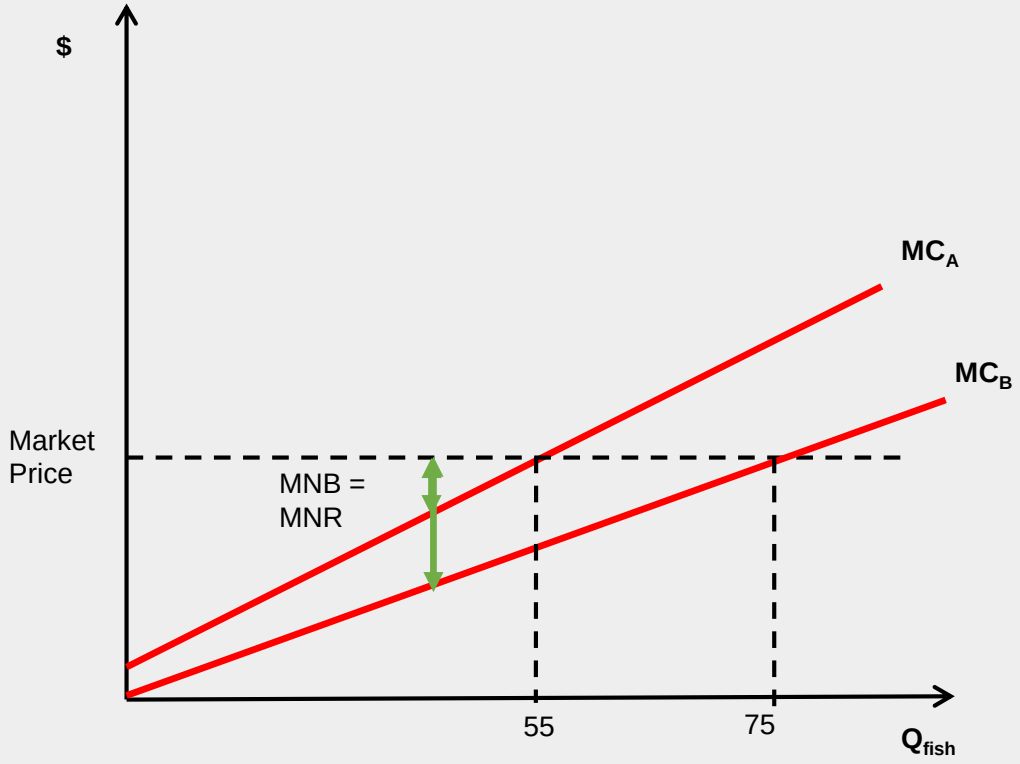
- As you catch more fish, you have to go further and wait longer to catch more
- Not every fisher has the same ability to catch fish

FISHERY PROBLEM

Consider 2 fishers with the costs shown

What would happen in open-access?

Each fisher would continue fishing until MNR=0

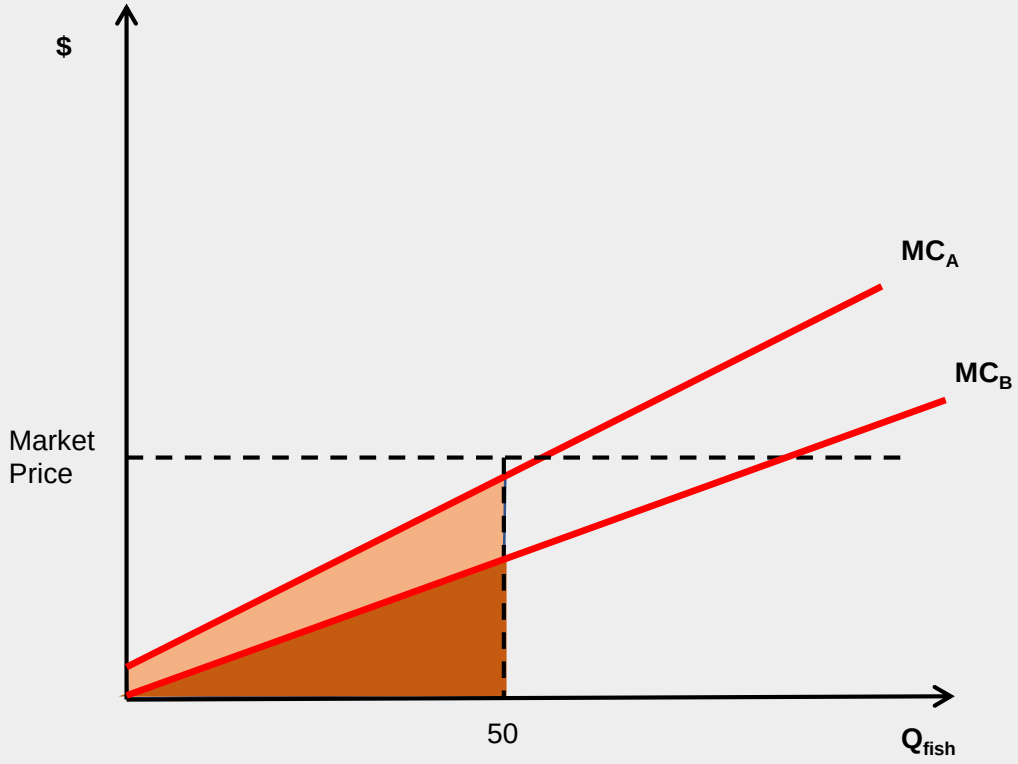


FISHERY PROBLEM

Consider 2 fishers with the costs shown.

Say we wanted to limit the number of fish caught to 100 fish.

What would the costs be if each fisher were allowed to catch 50 fish?

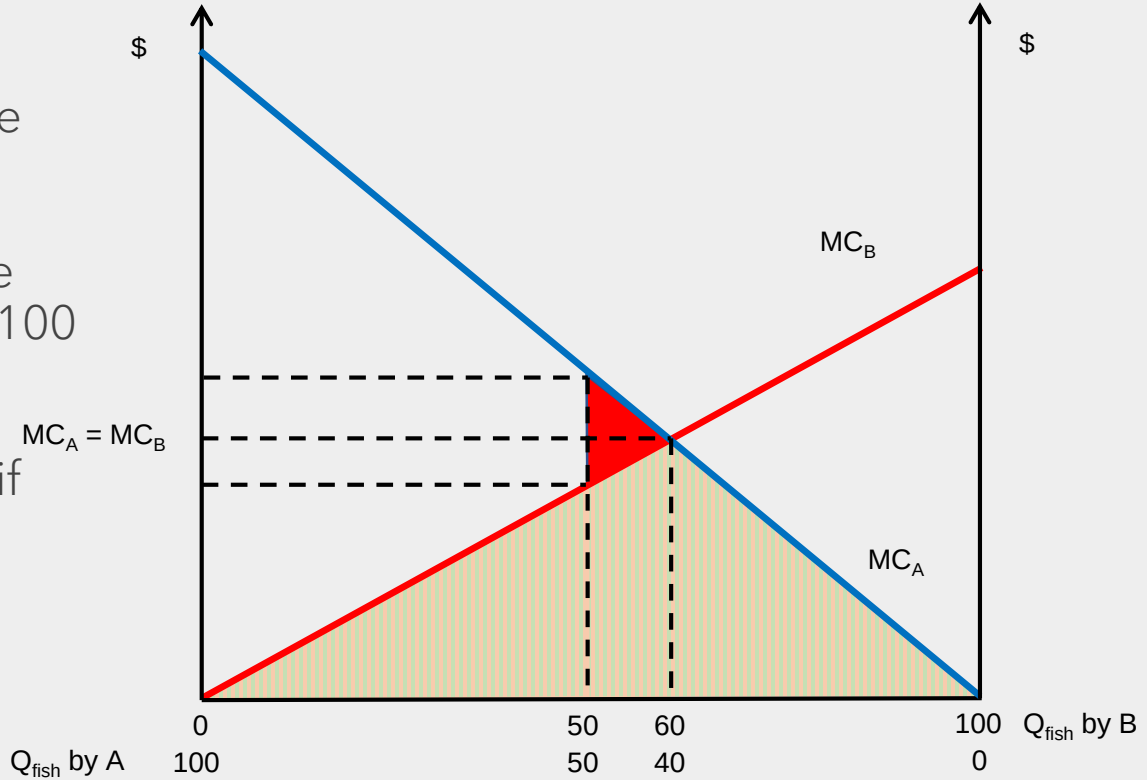


FISHERY PROBLEM

Consider 2 fishers with the costs shown.

Say we wanted to limit the number of fish caught to 100 fish.

What would the costs be if each fisher were given 50 tradable permits?



PROBLEM

Open-access leads to market failure

SOLUTION

Use market-based instruments to achieve optimal outcome in a cost-effective approach

This is the concept behind Individual Fishing Quotas (IFQs)

LESSON OBJECTIVES

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Analyze public policies for managing natural resources