

# Lecture 5: Market failures and government interventions

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FOR 4684 Natural Resource  
Economics and Management



School of Forest Resources



## Conditions and assumptions for a free market

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- Ownership of resources / property rights
- Firms and consumers are maximizers
- Perfect competition
- Free entry of firms into an industry
- Perfect information
- Mobility of labor and capital
- No unpriced side effects (externalities)
- Priced inputs and outputs



## Ownership of resources

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- Range from total privatization to complete government intervention
- Government intervention to promote and improve societal welfare.
- "A welfare maximum is an elusive allocation of resources – land and natural resources, people and capital – such that no re-allocation could yield a net gain." Klemperer 1994, pg. 59.
- A Pareto optimum is one where no one can be better off without making someone else worse off.
  - More restrictive, as there are always some winners and losers
  - If gainers could potentially compensate losers (net gains positive across all people), then this "compensation principle (Kaldor, 1939) could mean the change in allocation is optimal.



## Why maximize welfare

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- Consumer's needs are met
  - Consumers "vote" with purchases
  - Consumers maximize total utility (satisfaction) through application of equi-marginal principle by purchasing the mix of goods and services that maximizes their well-being.
- Capital is efficiently allocated
  - Investment will take place in firms which earn the best returns and reflect the demands of consumers
- Labor, land, and other resources are allocated efficiently
  - Labor moves to best-paying firms
  - Resources are used to meet consumer demands
- Producers seek efficient levels of output
  - Maximizing net revenue by producing where  $MC=MR$



## Market failures

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- Ownership of property rights not enforced
- Market structure – imperfect competition
- Unpriced side effects - externalities



## When is government intervention into free markets justified?

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- When the cost of such intervention is less than the benefits to society from the intervention.
- Must be a demonstration that the free market is not capable of efficiently allocating resources.
- Failure of government action to efficiently allocate resources is a likely future cost.



## Lack of enforcement of property rights

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- Unlimited access to resources
- Users won't invest in resources where others are likely to reap the benefits
  - "Tragedy of the commons" (Harden 1968)
- Many forest resources suffer with this problem to a certain degree:
  - Fish and game
  - Scenic beauty
  - Hiking
  - Water



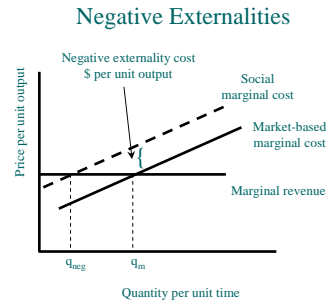
## Other market failures...

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- Imperfect information
  - Stumpage prices for NIPF landowners
  - Who are buyers?
  - What are product possibilities?
- Immobility of labor and capital
  - Not much of a problem in USA, across states or international borders

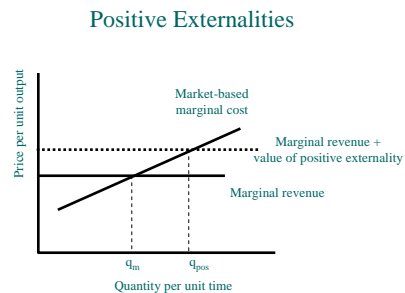
## Unpriced side effects: externalities

- Negative externalities
  - Social cost of production is higher than private (market) cost of production
  - Result: too much output for social optimal economic distribution of resources



## Unpriced side effects: externalities

- Positive externalities
  - Social marginal revenue curve is higher than private marginal revenue
  - Result: too little output for social optimal economic distribution of resources





## Dealing with free outputs – unpriced goods and services

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- Hard to control property rights to
  - ORV/ATV trails
  - Hiking / horse trails
  - Public waterways
- Government typically underprices goods where it is hard to control property rights
  - Better to get something rather than nothing
  - “Encourage” good social behavior



## Government actions to deal with unpriced goods

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- Tax incentives or direct subsidies
- Education programs
- Taxes or fines
- Regulations
- Government ownership



## Forms of demand that are difficult in a market setting...

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- Option demand is a willingness to pay for the option to use some resource in the future
- Existence demand
  - The Nature Conservancy buys land outright to protect it – may not ever *use* the resource.
- Bequest demand
  - Willingness to pay to leave resources for future generations




## Other market failures

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- Economic instability
  - Time lag in economy leads to cyclic booms and busts
  - Government control can build in stability, but is often inefficient and slow in responding to change
- Income satisfaction
  - Utility from any given sum of money differs by a person's total resource allocation
    - \$100 taken from a rich man and given to a poor man – it is easy to argue that total societal satisfaction is positive
  - Intergenerational income satisfaction
    - National debt
    - Natural resource depletion



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## Optimal levels of environmental damage – a politically incorrect idea?



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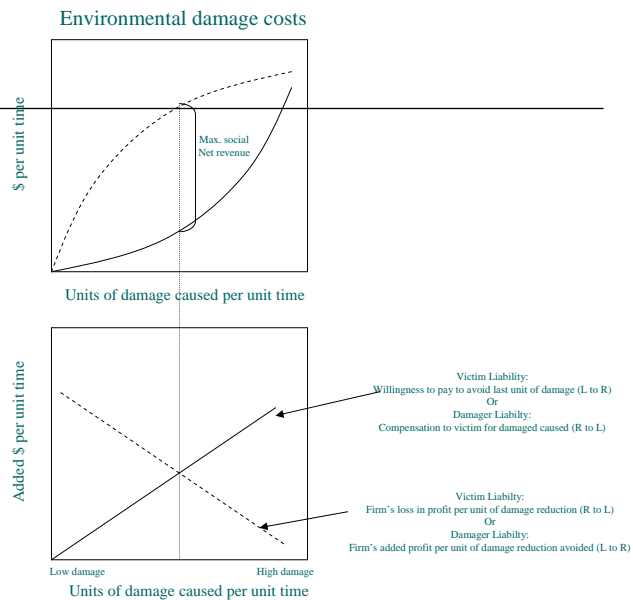
### Definitions

- Damage – some loss of utility or satisfaction or money or resources incurred by someone
- Damagers – those people or entities causing damage
- Victims – those people or entities harmed by the action of the damager

## Two bargaining approaches

- Victim Liability
  - Victims are liable for reducing damage beyond some allowable level
  - Emphasizes private property rights
  - Assumes some level of socially acceptable damage
- Damager Liability
  - No uncompensated damage allowed
  - All costs of damage placed on damagers
  - Compensation to victims for all damage
  - Stresses amenity rights – community rights to public goods such as ecosystem services

Optimal solutions when all damages can be expressed in monetary units

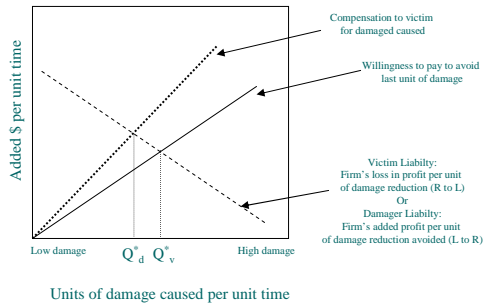


(Adapted from Klemperer, 1996, page 79-80)

## Optimal solutions when damages are non-monetary

### Market-based system won't give optimal result

- Amounts victims are willing to pay to reduce damages is less than the compensation they would require to accept the damage
- Compensation demanded exceeds willingness to pay because of diminishing marginal utility for money

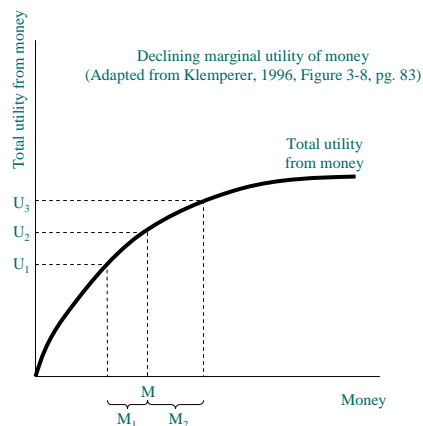


(Adapted from Klemperer, 1996, page 79-80)

## Diminishing marginal utility for money

If you are at income  $M$ , and accepting a certain level of environmental damage that reduces utility from  $U_2$  to  $U_1$  (note that  $U_3 - U_2 = U_2 - U_1$ )

- The money you would pay to reduce the damage is  $\$M_1$  (victim's liability), this would keep your utility at  $U_2$ .
- The money required to compensate you to accept an additional unit of damage is equal to having one more unit of utility in monetary terms. To move from  $U_2$  to  $U_3$  in terms of money costs  $\$M_2$ . Note also that  $M_2 > M_1$
- This is why a person's compensation line is higher than the WTP line (WTP to avoid damage) on the previous slide's chart.





## Considerations regarding optimal levels of environmental damage

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- Damage fines
  - Firms with high costs of damage reduction (coal burning electric plants) would pollute more than firms that cheaply can reduce pollution
- Transaction costs of pollution markets can be high
  - Trading CO<sub>2</sub> credits
- Income effects
  - Wealthy citizens require higher compensation for damage than do poorer citizens
  - Greater pollution in areas with lower incomes is a natural effect of market forces



## Considerations regarding optimal levels of environmental damage

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- Victim liability places responsibility on public to clean up environment
- Damager liability places responsibility on individual to pay for damages
  - Compensation required by wealthy people may be unfair
  - Valuation of amenities – what price compensation for reduced aesthetics?



## Compensation for a government “taking”

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- The government wants to build a road through your land, and they pay you market price for the land they actually use to build the road.
  - Right of eminent domain.
- A more complex case:
  - What if you bought land 20 years ago for \$250 / acre?
  - Now, due to surrounding development, the land is appraised at \$1250 / acre
  - Government doesn't want to take your land, but wants to place restriction on developing this land for the public good (to preserve green space).
  - With government restrictions, land has appraised value of \$900 / acre
  - Should government compensate landowner for this \$350 loss in appraisal value?
  - What if you bought the land 1 year ago for \$1250 per acre?

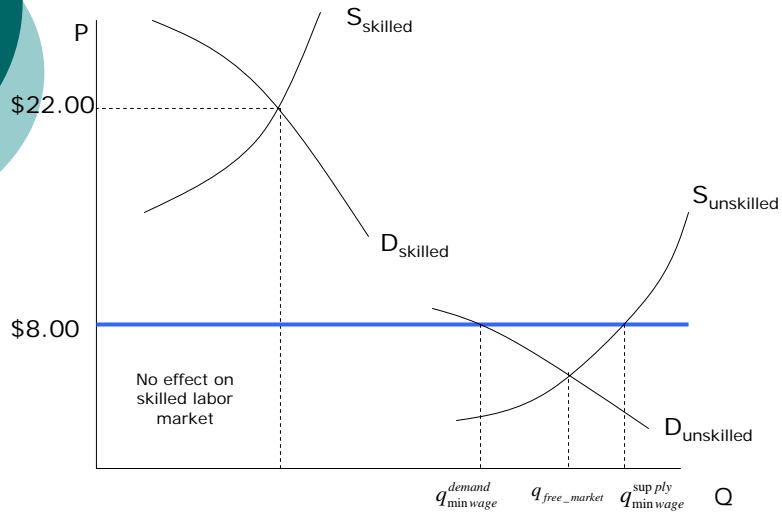


## Types of government interventions

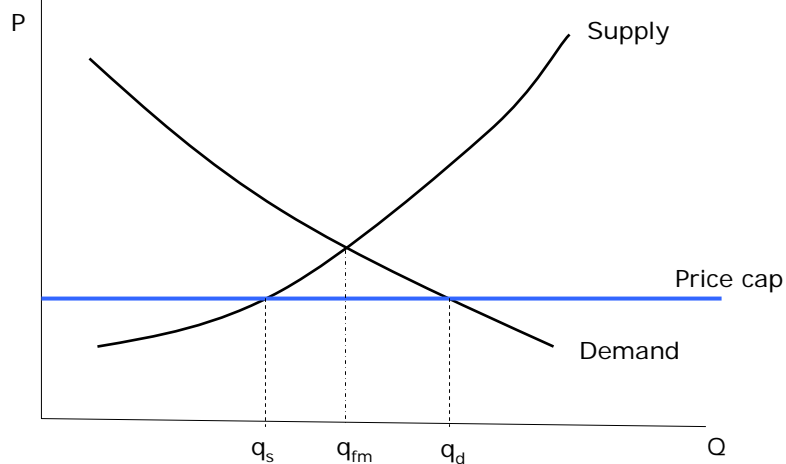
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- Minimum wages
- Price caps/freezes
- Rationing
- “Green” or “environmental-markets”
  - Carbon markets
- Incentives and cost-sharing programs
  - Conservation Reserve Program (CRP)
  - Forest Stewardship (FIP)
  - Environmental Quality Improvement Program (EQIP)
- Taxation incentives
  - Reforestation allowance
  - Interest deductions
  - Capital gains tax rate
  - Direct tax credits

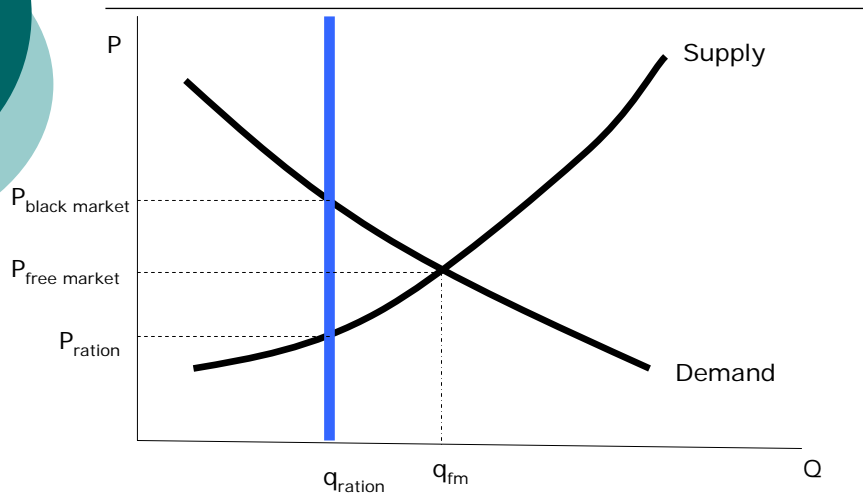
## Minimum wage of \$8.00 per hour



## Price caps or freezes



## Rationing



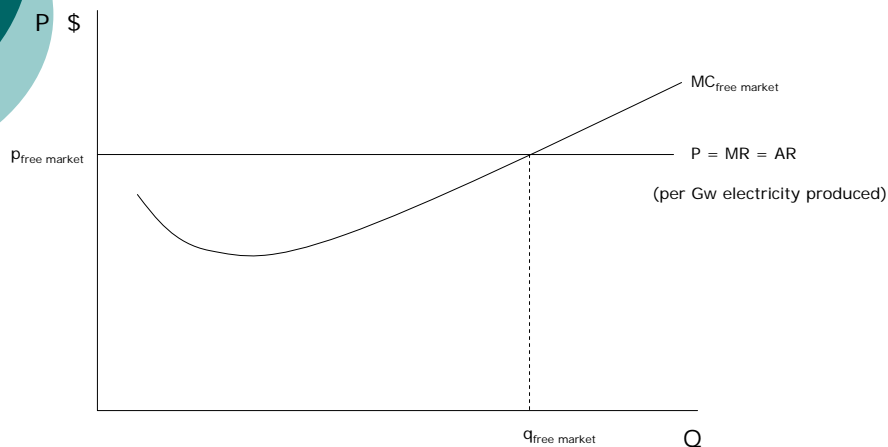
## Green markets – pollution trading

- 1990 Clean Air Act permits trading in “greenhouse gases”
  - CO<sub>2</sub>, methane, nitrous oxides, sulfur dioxide, sulfur hexafluoride
- Big business - SO<sub>2</sub> market is \$7 billion a year
- Markets like this exist in Europe and are growing quickly

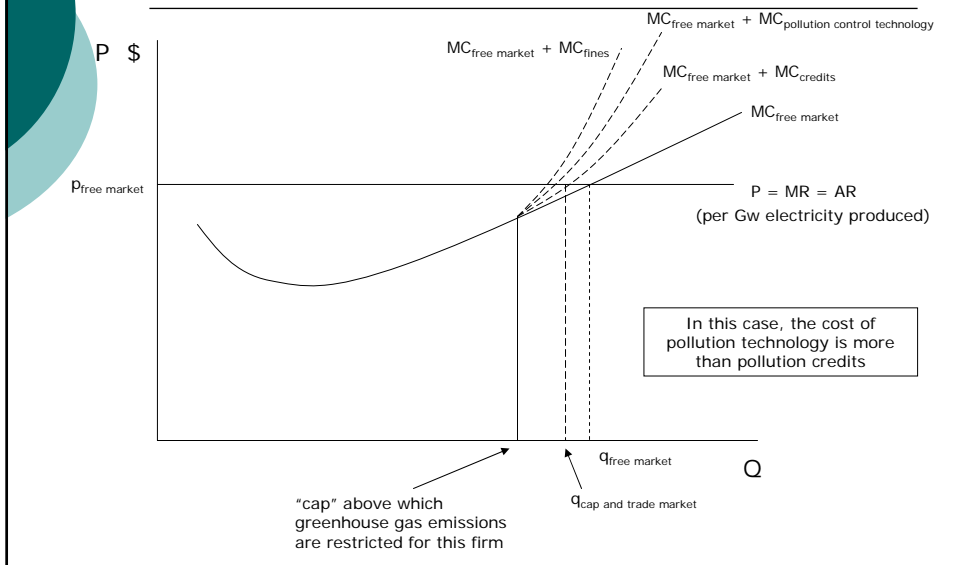
## How pollution markets work

- Called a “cap and trade” market
- US EPA grants the right to emit a specific amount of  $\text{SO}_2$  annually to 2,000 power plants and factories
- These “pollution allowances” can be used by the company or sold to other companies.
- Companies that emit beyond the cap are fined heavily
- If a company’s  $\text{SO}_2$  levels exceed their cap, they can:
  - Pay the fines
  - Install pollution reduction devices
  - Buy another company’s pollution allowance
- Pollution allowances are now a commodity, bought and sold on the Chicago Board of Trade
- $\text{CO}_2$  prices are \$35 per metric ton
- Annually, the EPA is lowering the cap on total emissions

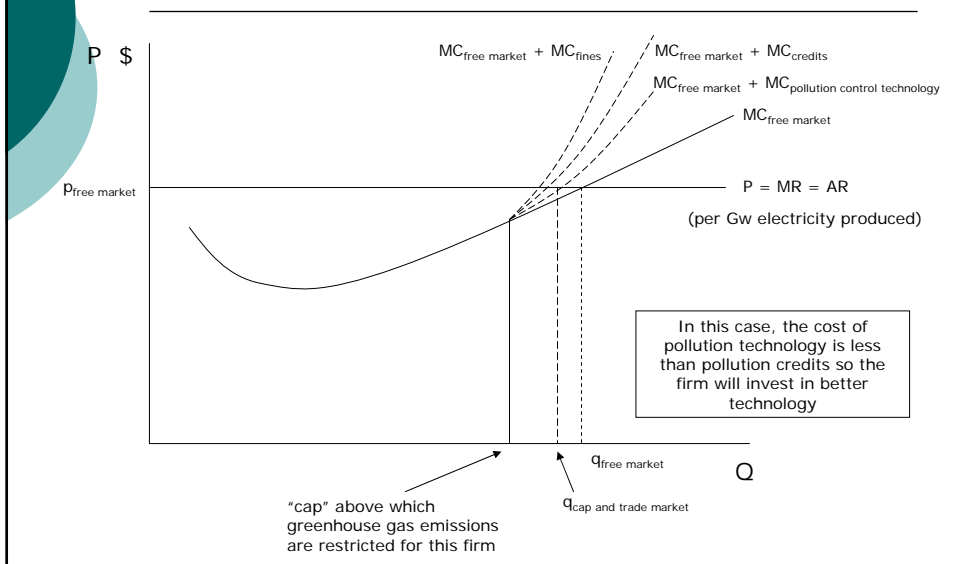
## Energy production without “cap and trade” greenhouse gas program



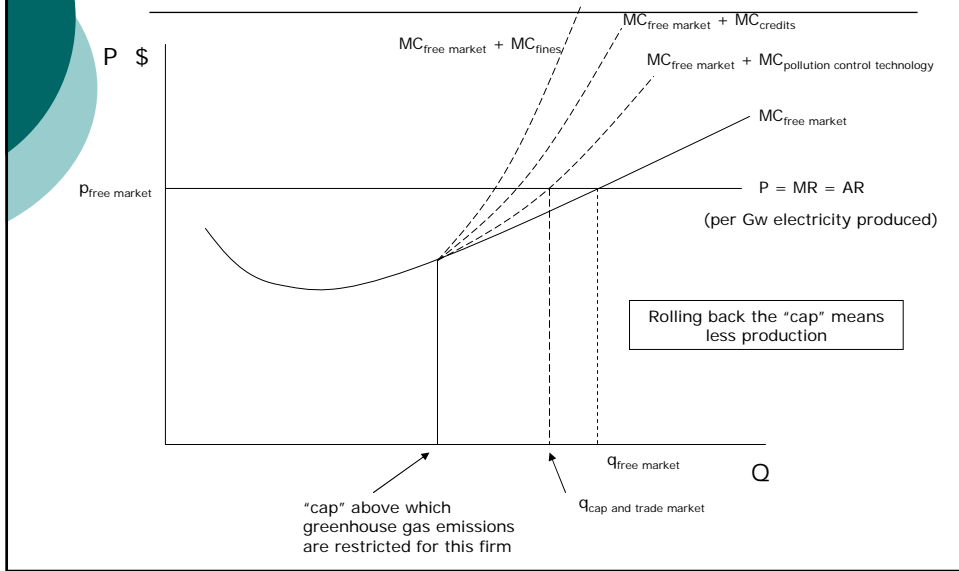
## Energy production with a “cap and trade” greenhouse gas program



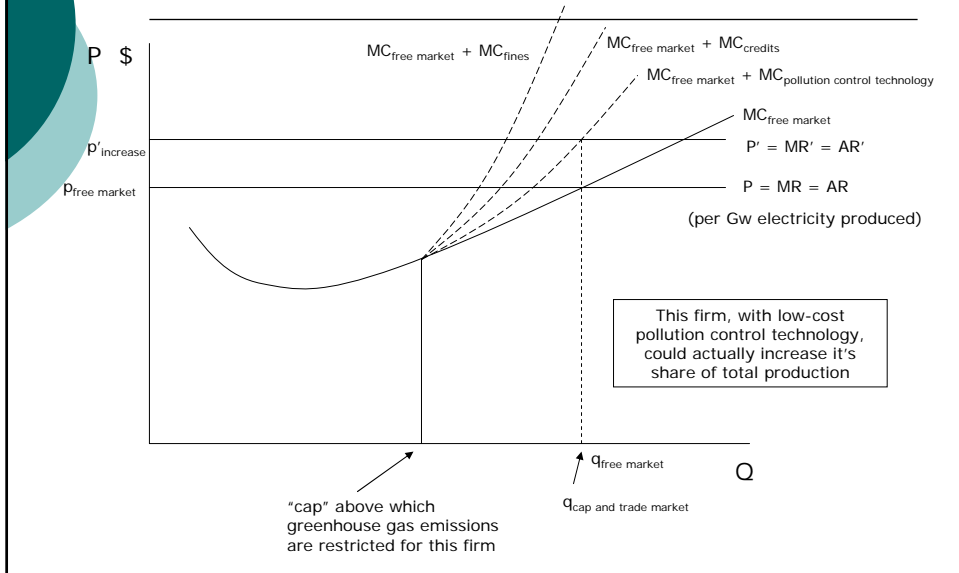
## Energy production with a “cap and trade” greenhouse gas program - 2



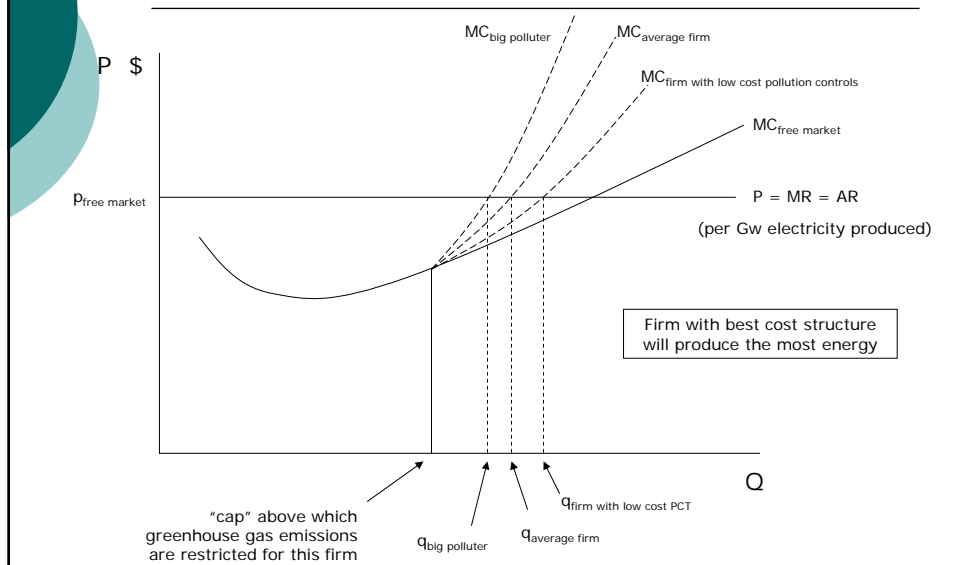
## “Cap and trade” - cap rollback



## “Cap and trade” - cap rollback and price increase caused by less supply



## Multi firm view of “cap and trade” impacts



## Advantages to pollution market

- Allows the free market to determine the “cost” of pollution
- Rewards companies with better pollution control technologies as they can sell their pollution allowances
- As “supply” of pollution credits is decreased by lowering the “cap,” companies will be encouraged to invest in pollution control devices

## Incentives or cost shares

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- Let's look at the following example of a forestry cost share
- Cost to establish forest is \$10,000
- After 30 years, returns are \$100,000
- If government cost share is 50% of establishment costs, what is the social rate of return and the private, individual, rate of return?

## Social rate of return

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$$ROR = \sqrt[30]{\frac{\$100,000}{\$5,000 + \$5,000}} - 1 = 0.08$$

## Private or individual rate of return

$$ROR = \sqrt[30]{\frac{\$100,000}{\$5,000}} - 1 = 0.105$$

Cost share increases private rate of return to 10.5%, society's rate of return is not reduced.



## Taxation incentives

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- Lower (marginal) tax rate to encourage more of a particular behavior
- Activities that receive tax incentives
  - Home ownership
  - Capital investment (long-term) – including timber holding ☺
  - Energy efficiency
  - Natural resource conservation



## Next lecture...

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Short-run timber demand