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Externalities

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Externalities

- Q: Do you remember what an externality is from intermediate micro?
  - Let's look at some examples

Pollution

- Paper mills
  - Use chlorine to bleach wood pulp
  - Process produces dioxin
  - Dioxin is released into the environment
  - Ends up in everyone's fat tissue
  - Causes birth defects and cancer
- Q: Other examples?
  - CO2-emissions => Global warming

Agglomeration

- Malls
  - When clothes retailer opens a store in a mall
  - More people come to the mall to shop
  - Neighboring food stores get more customers
- Q: Other examples?
  - Towns (may need city planning)

Congestion

- Road traffic
  - Suburbanites drive to work downtown
  - Road capacity is limited
  - Speed falls as more cars enter the roads
- Q: Other examples?
  - Mobile networks

Consumer networks

- Telephones
  - Phone are used to talk to others
  - The more people who have a phone, the more useful my phone is
- Q: Other examples?
  - Fax machines, credit cards, language

Externalities

- Definition
  - When one agent's (person or firm) activity affects the welfare of another
  - and the link is outside (external to) the market
  - the effect is called an *externality*

Externalities

- Special example
  - If a person produces a public good
  - Other people benefit
  - The first person's activity causes an *externality*
  - Not always meaningful to separate public goods and externalities.

Externalities

- Why do we care about externalities?
  - They cause inefficiencies

Externalities

- Pollution
  - If paper mill stops using chlorine, fewer people will die from cancer.
  - Value of the saved lives may be higher than cost of not using chlorine
    - Paper mill maximizes profits ⇔ it doesn't care about the deaths
    - Caricature

Externalities

- Congestion
  - If I take the bus instead of the car, my neighbors get to work quicker
  - Their willingness to pay for the time-saving may be higher than my cost of discomfort
    - But I maximize my utility ⇔ I don't care about my neighbors' time savings
    - Caricature

Externalities

- But…
  - If I eat an apple
  - There is one apple less for you
- Q:
  - Is this an externality?
- No
  - I have to pay a price for the apple
  - The price is equal to your value of eating it
  - Therefore I am forced to take the effect into account
  - Even if I don't care for you

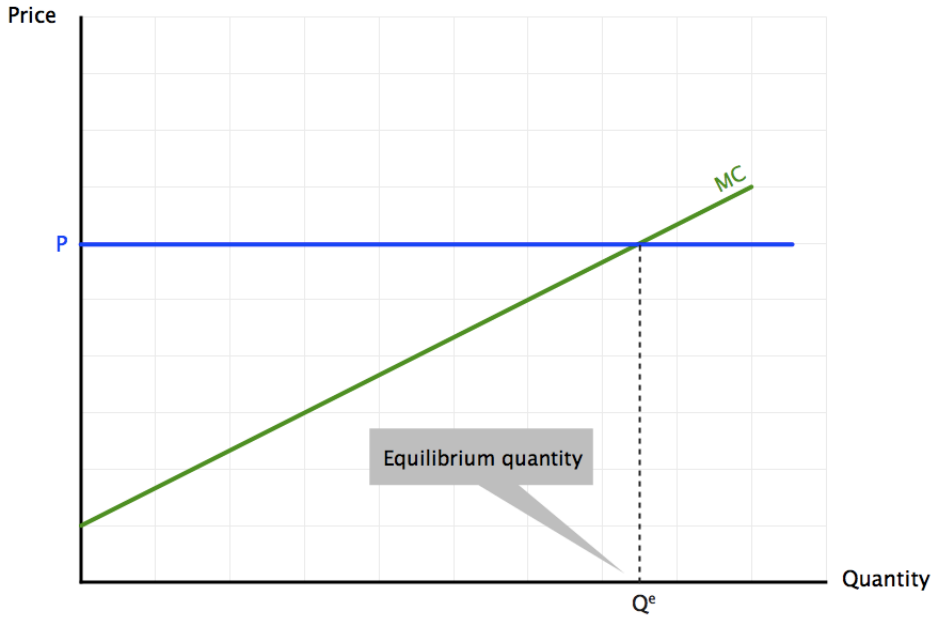
Externalities

- But…
  - If I buy an enormous amount of apples
  - The price of apples is increased
- Q:
  - Is this an externality?
- Conventional terminology: No
  - Since the effect is via the price (internal to market)
  - This is called market power – another type of inefficiency

Pollution – Graphical analysis

Pollution

- Consider
  - Price taking firm: P
  - Increasing marginal cost: MC(Q)



Pollution

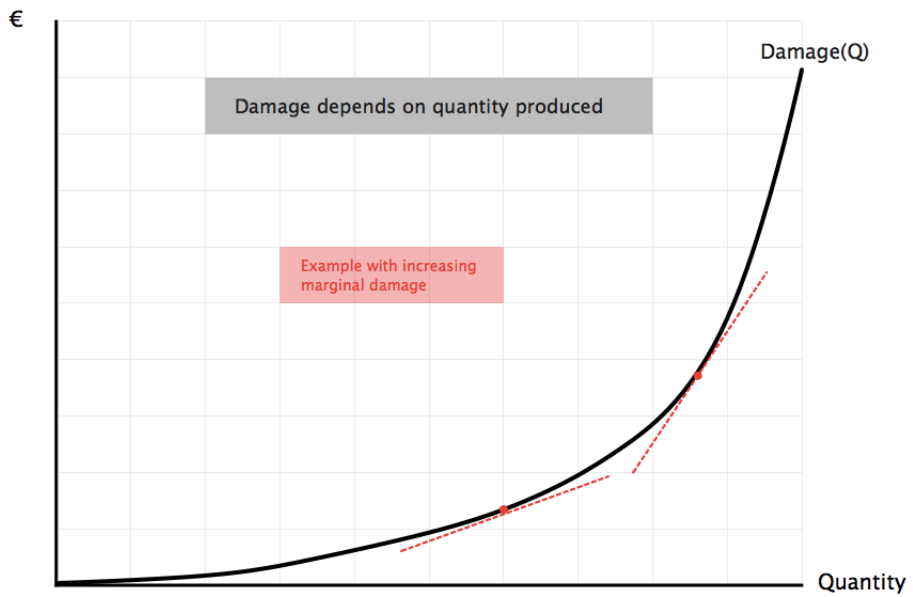
- Pollution damage
  - Production causes pollution
  - Pollution reduces welfare in neighborhood
  - Damage = WTP to avoid the pollution
    - Economic analysis only cares about pollution if someone is willing to pay for avoiding it
    - If many people affected: Damage = sum of WTP
      Recall Samuelson's condition for public goods

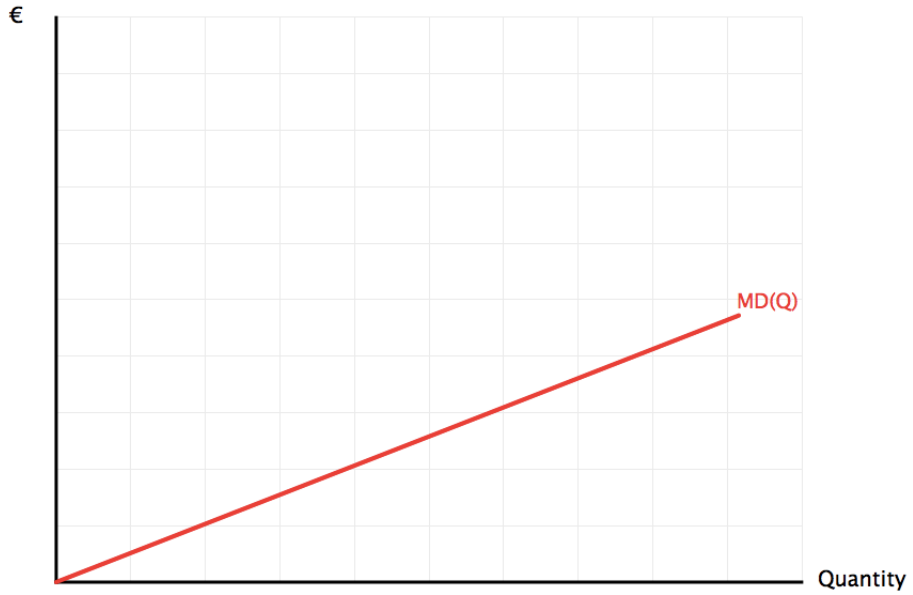
Pollution

- Pollution damage
  - Production causes pollution
  - Pollution reduces welfare in neighborhood
  - Damage = WTP to avoid the pollution

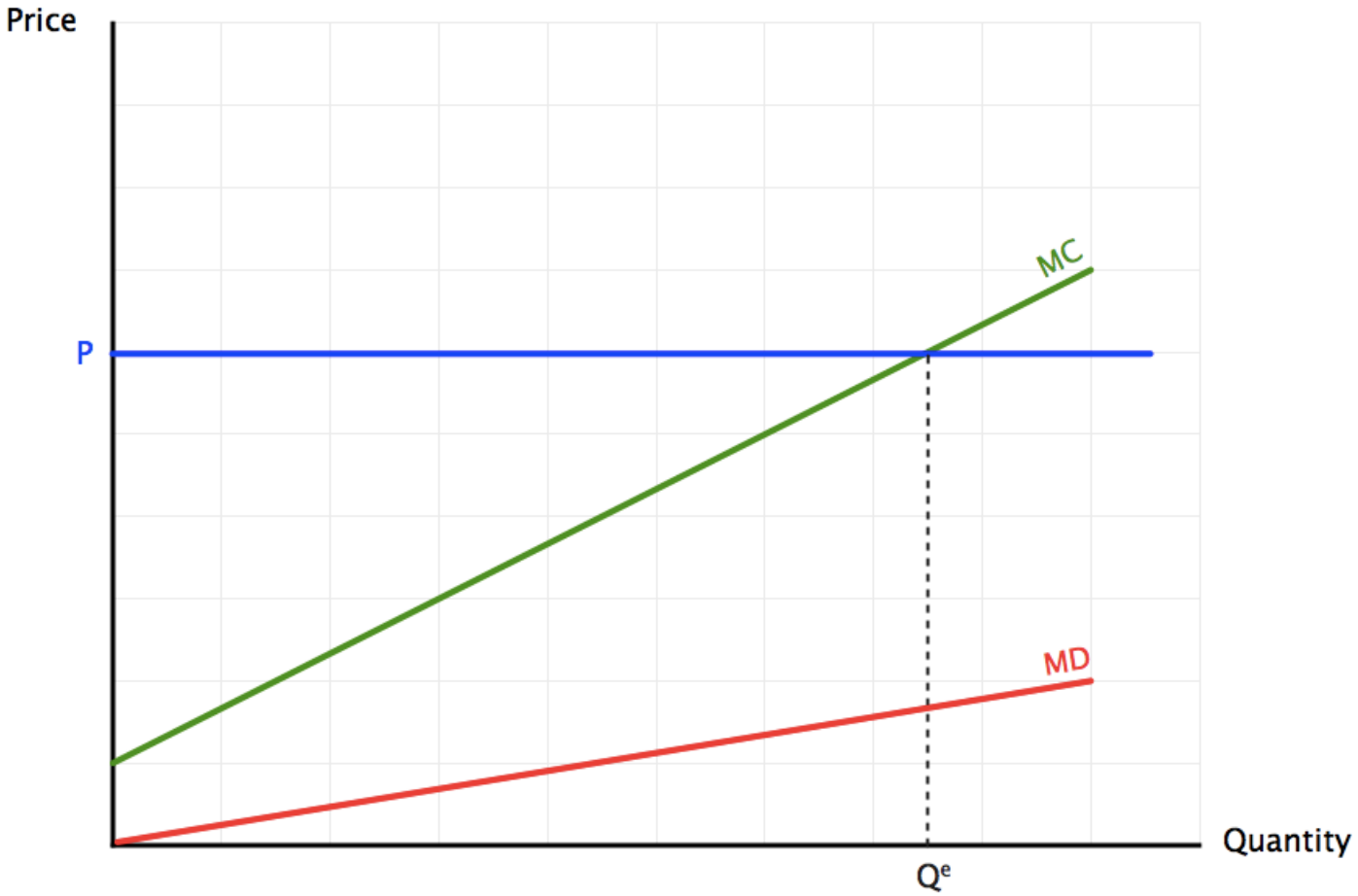
Economic analysis on
pollution if someone
avoiding it

If many people affected:
Damage = sum of WTP
Samuelson's rule


€
Damage(Q)
Damage depends on quantity produced
Example with increasing marginal damage
Quantity

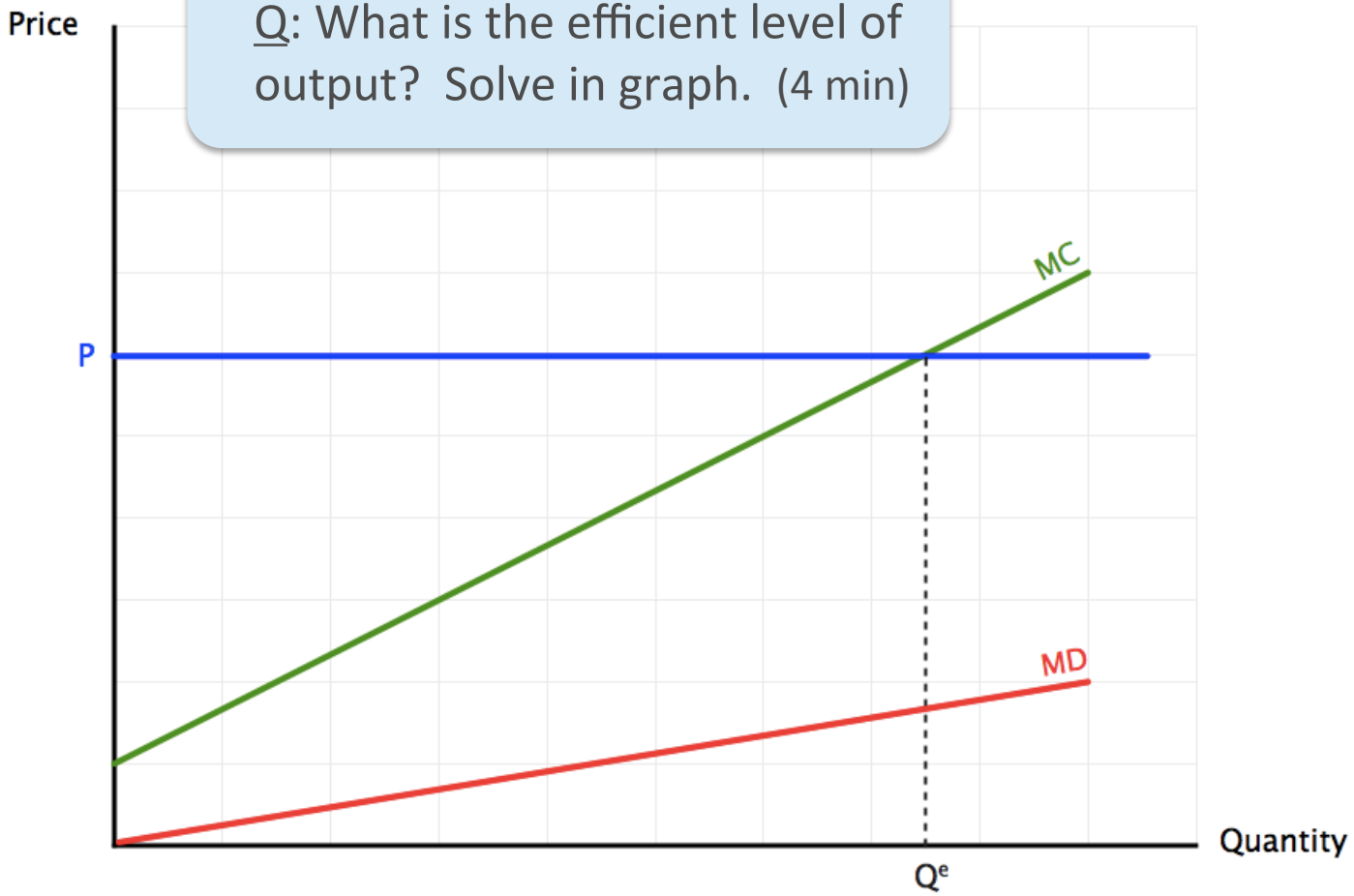

€
MD(Q)
Quantity

Pollution



Pollution

Q: What is the efficient level of output? Solve in graph. (4 min)

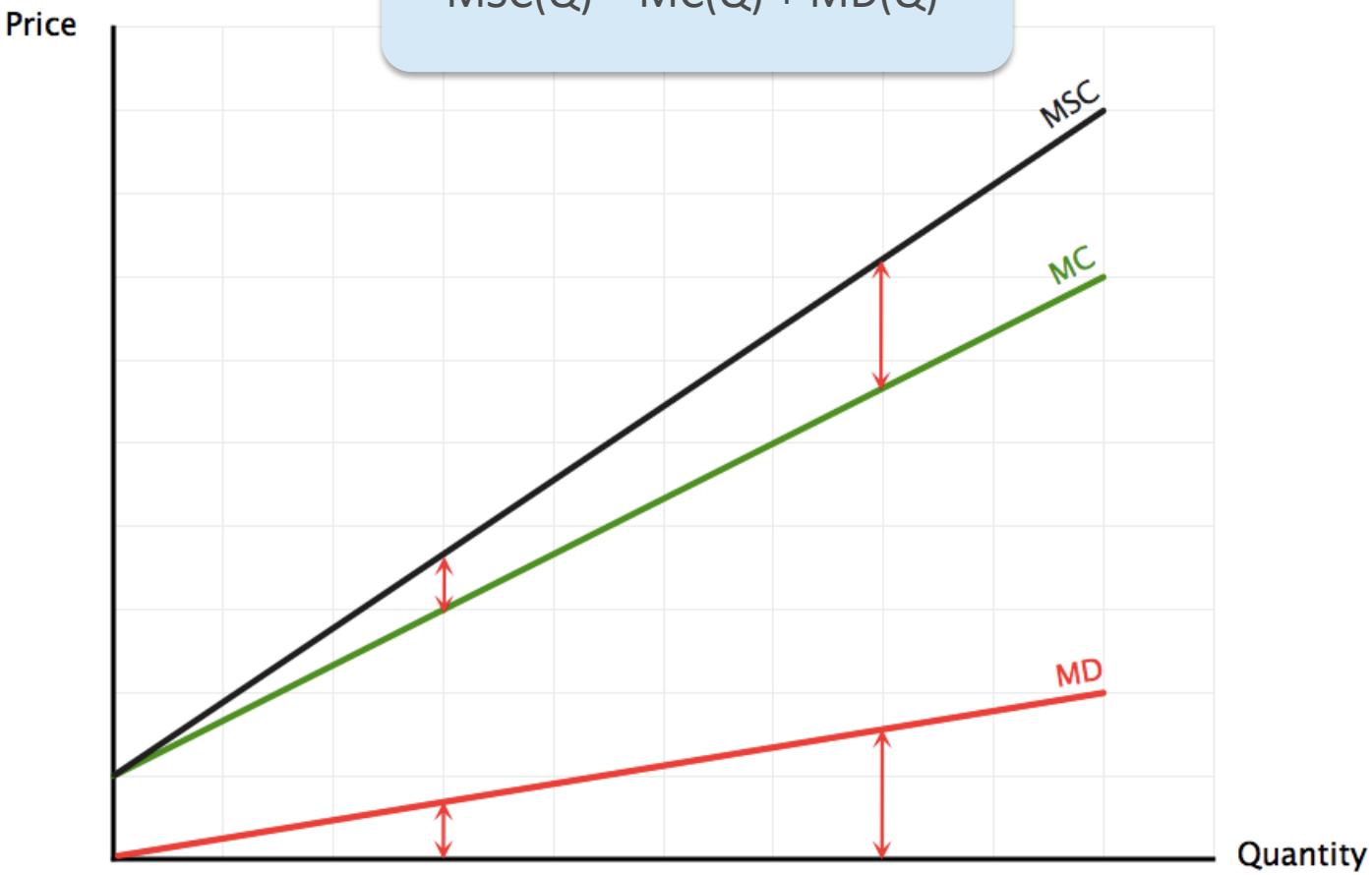


Pollution

- Step 1: Define social cost of production
  - Firm's cost for input + damage
  - MSC = MC + MD

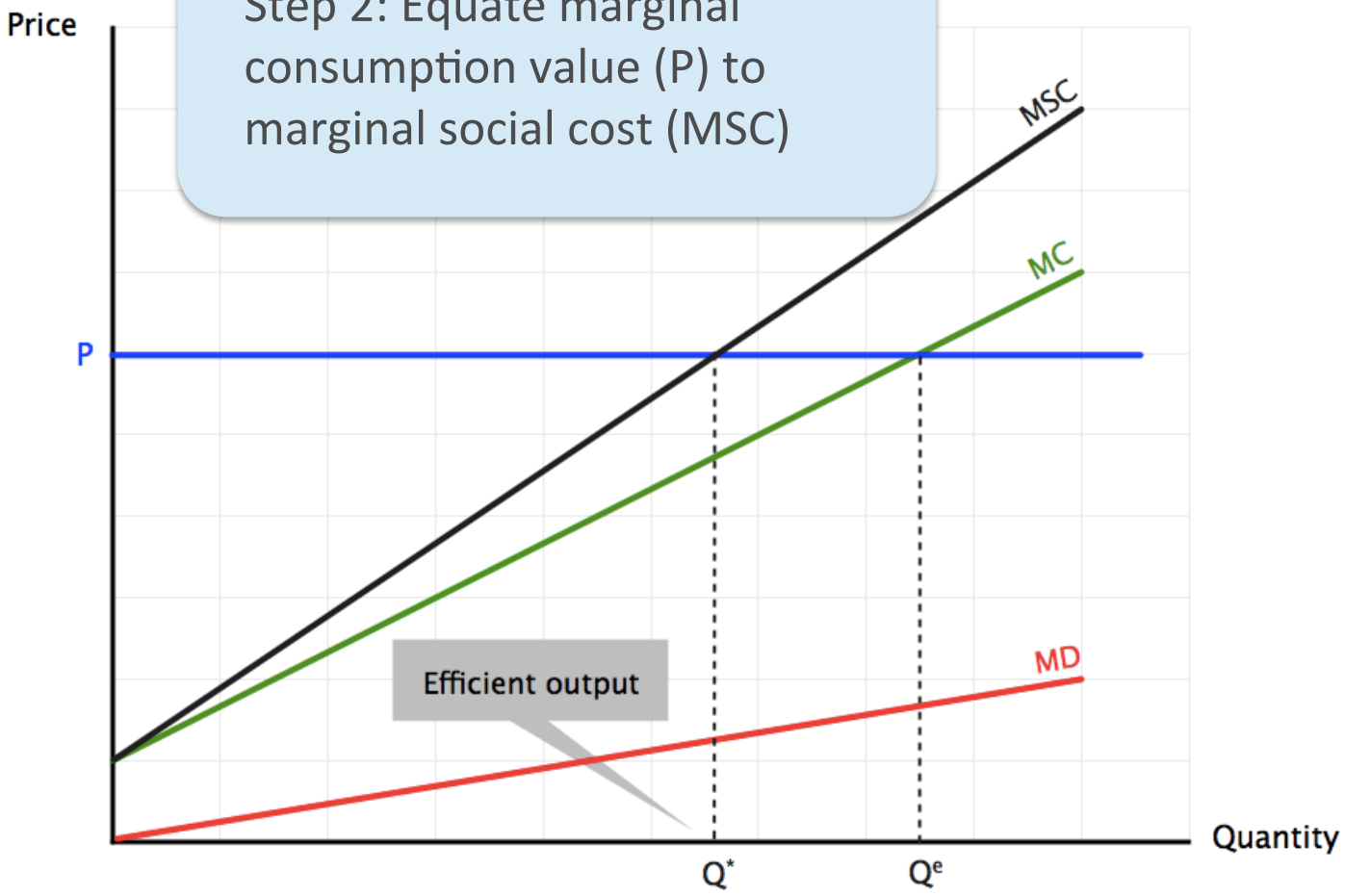
Pollution

MSC(Q) = MC(Q) + MD(Q)



Pollution

Step 2: Equate marginal consumption value (P) to marginal social cost (MSC)

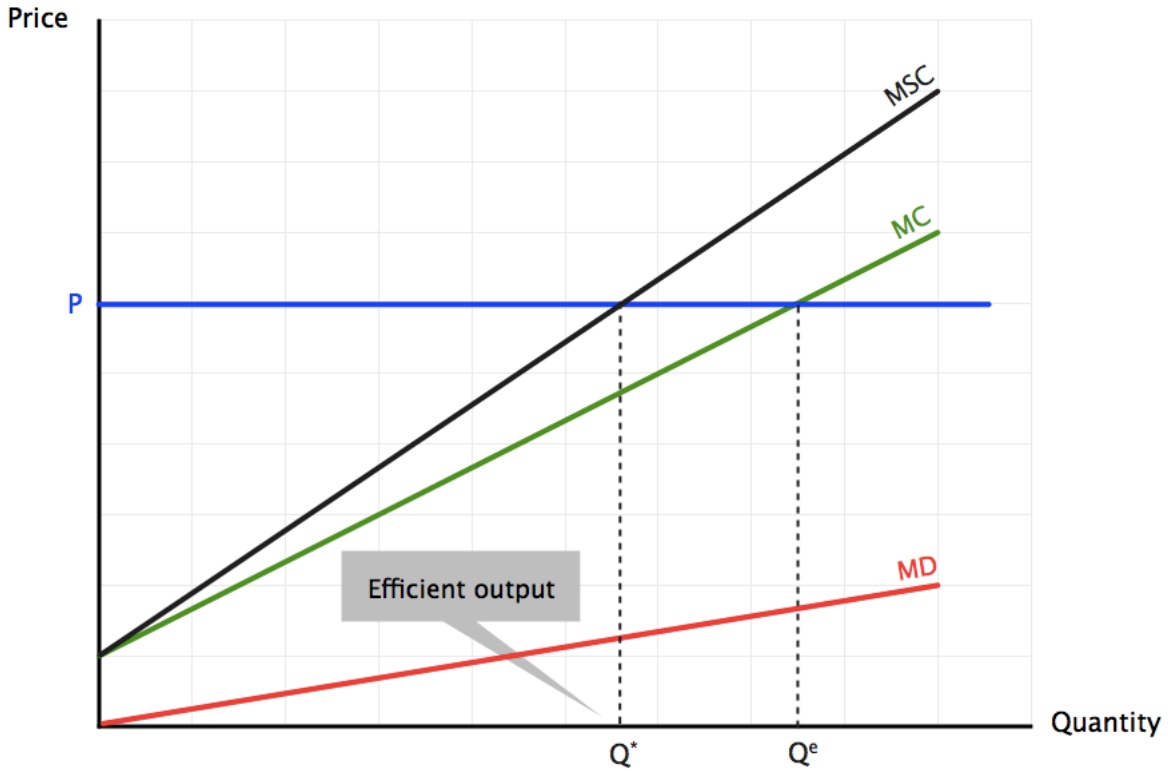


Pollution

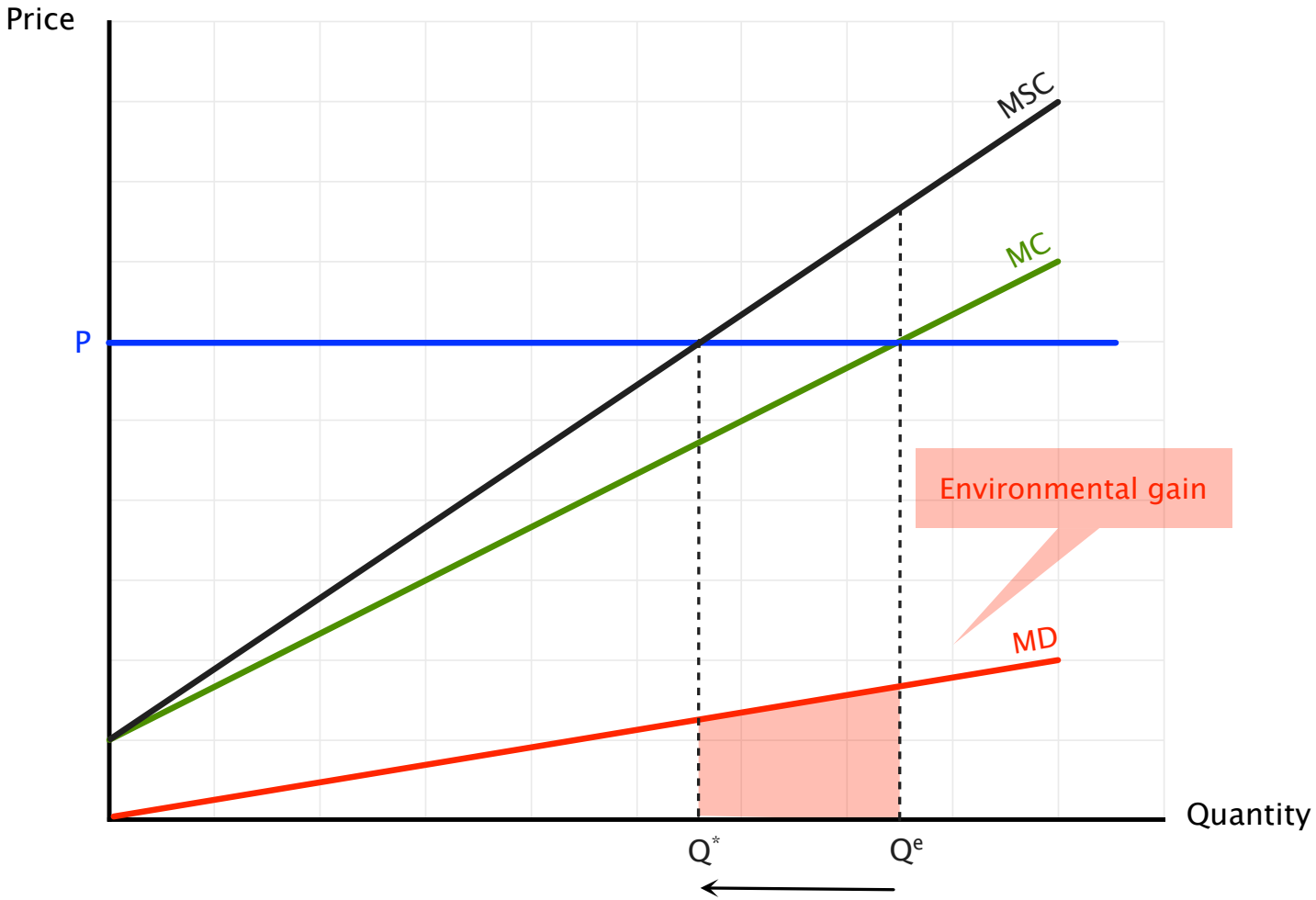
- Conclusion 1
  - When a good generates a negative externality, too much of it is produced relative to the efficient level
- Conclusion 2
  - Zero pollution is not socially desirable

Pollution

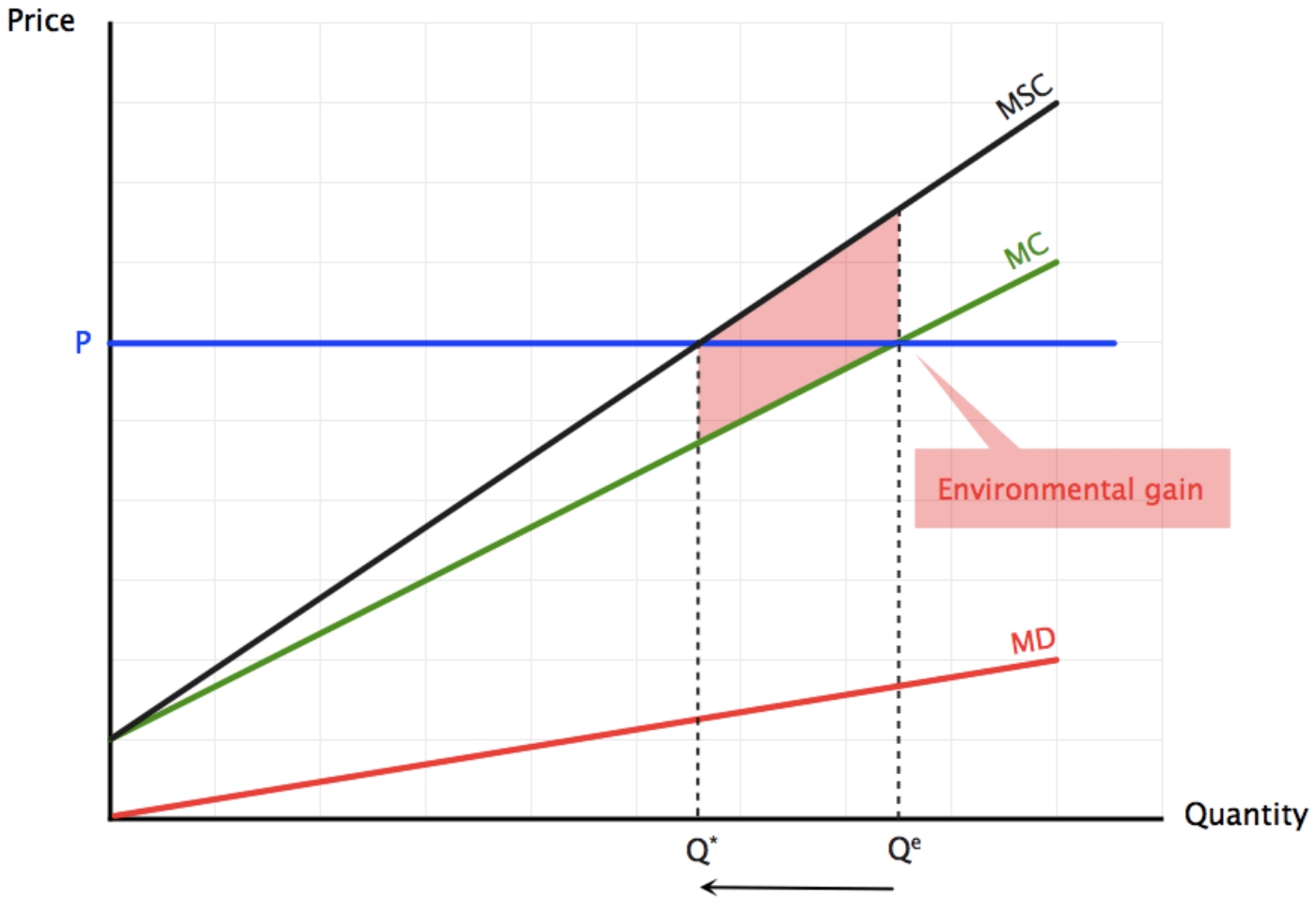
- Q: What are the welfare gains from reducing production from Q^e to Q^*? Find in diagram. (4 min)



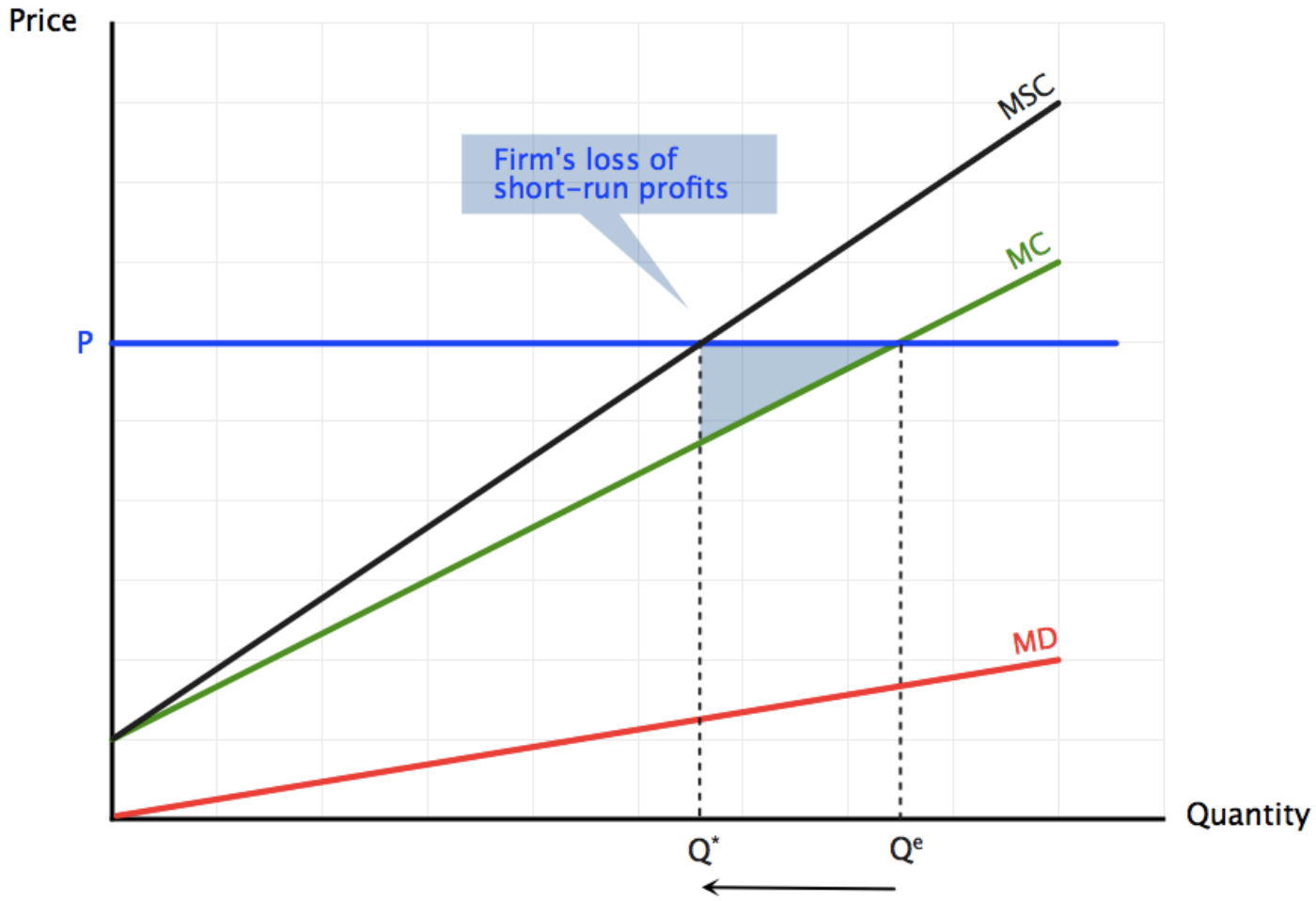
Pollution



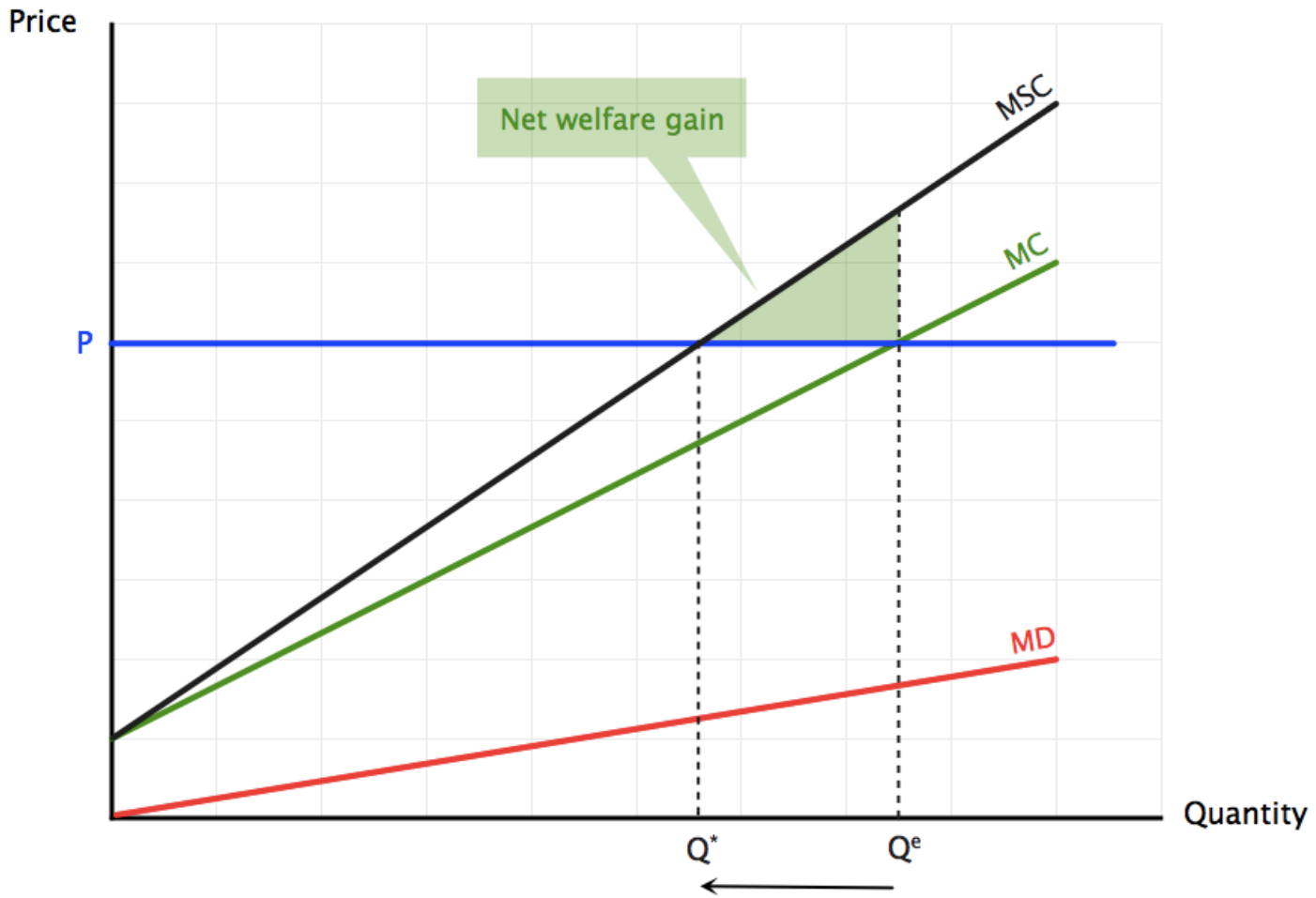
Pollution



Pollution


Price
MSC
Firm's loss of
short-run profits
MC
P
MD
Quantity
Q*
Qe

Pollution

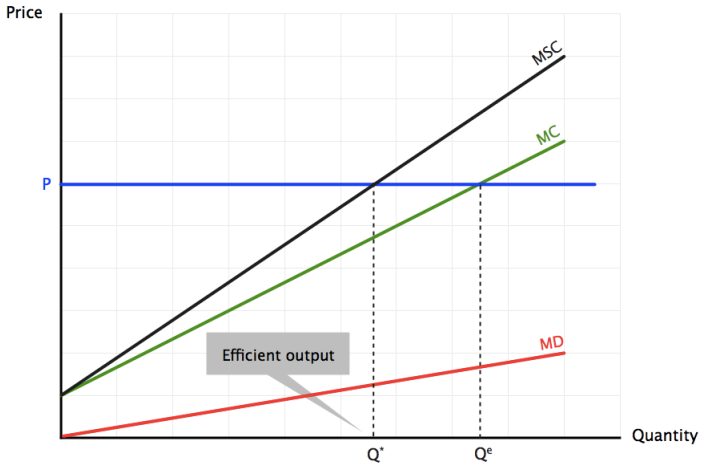


Pollution

- Conclusion 3
  - We can measure the welfare gain from reducing output to the efficient level
- Notice
  - Here I am using the *compensation principle*
    - The firm loses
    - Neighbors gain
    - Since gain > loss, it would be possible for neighbors to compensate the firm for its loss

Pollution

- Q:
  - What information do we need, to compute the efficient level?
  - 4 min
- Answer: Everything in the diagram



Pollution

- Information requirement
  - Price
    - Requires accounting information
  - MC
    - Requires accounting or engineering information
  - MD
    - Chlorine + Wood pulp => dioxin?
    - Is it really this firm that produced this dioxin?
    - Does dioxin cause cancer?
    - What is the value of reducing cancer?

Pollution

- Conclusion 4
  - Implementing the efficient solution may require a huge amount of information
  - It may require collaboration between economists, engineers, chemists and medical doctors

Private solutions

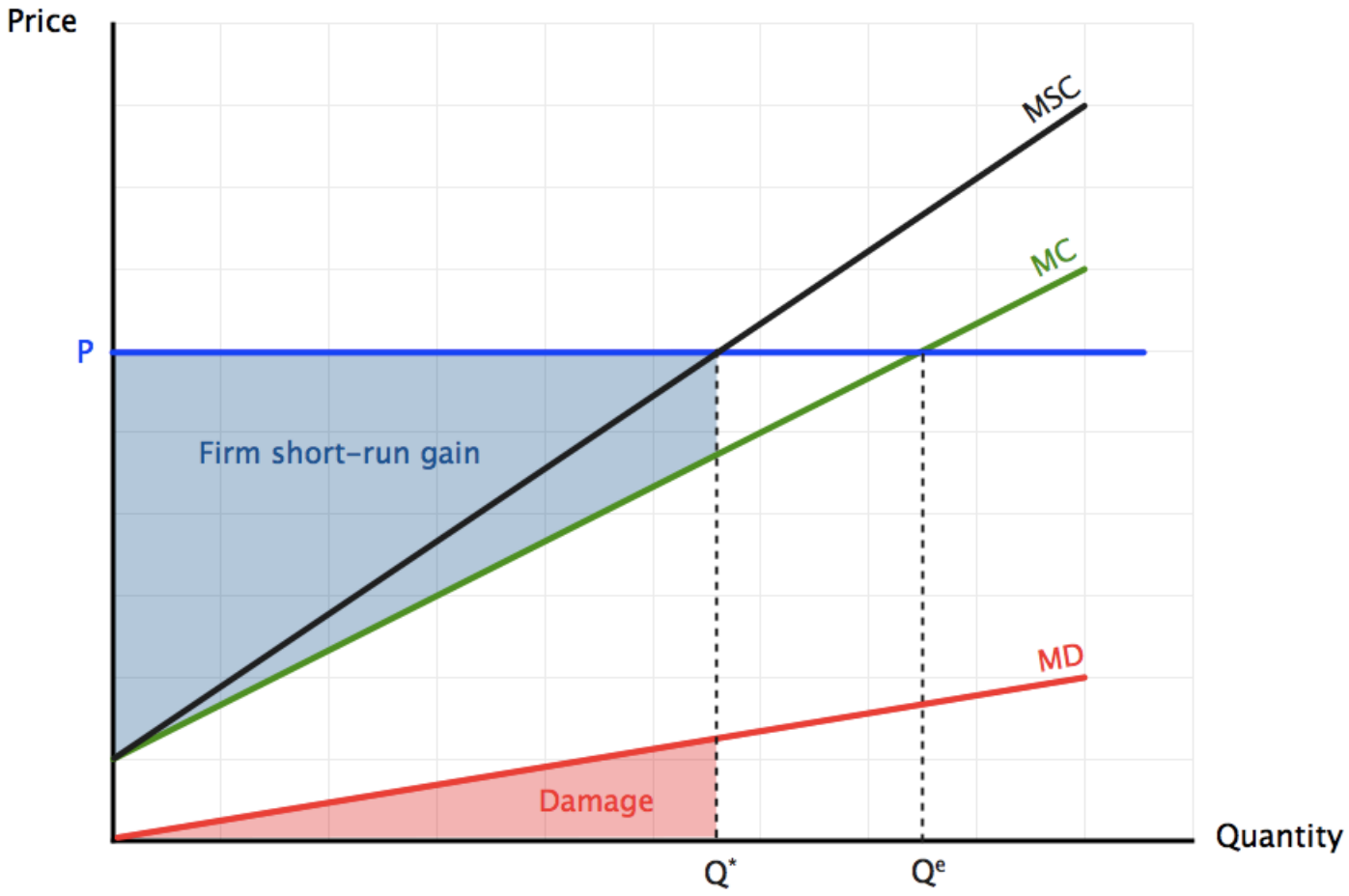
Property rights and bargaining

- Q:
  - Consider a firm polluting a river
  - What would happen if the neighbors who are adversely affected own the river?
  - 4 min

Property rights and bargaining

- Possible answer
  - Negotiation between firm and neighbors
  - Firm is willing to pay maximum its short run gain for the right to pollute the river
  - Neighbors demand at least compensation for damage
  - Agree that firm may pollute according to Q^*

Property rights and bargaining



Property rights and bargaining

- Note 1
  - Both parties can gain since SRΠ > D
  - We only now that SRΠ > price > D
  - Exact price depends on bargaining strength

Property rights and bargaining

- Note 2
  - The neighbors will not insist on less pollution:
    - Damage would go down
    - But firms loss would be larger

Property rights and bargaining

- Note 3
  - The firm will not ask for more pollution:
    - Short run profit would increase
    - But damage would increase even more

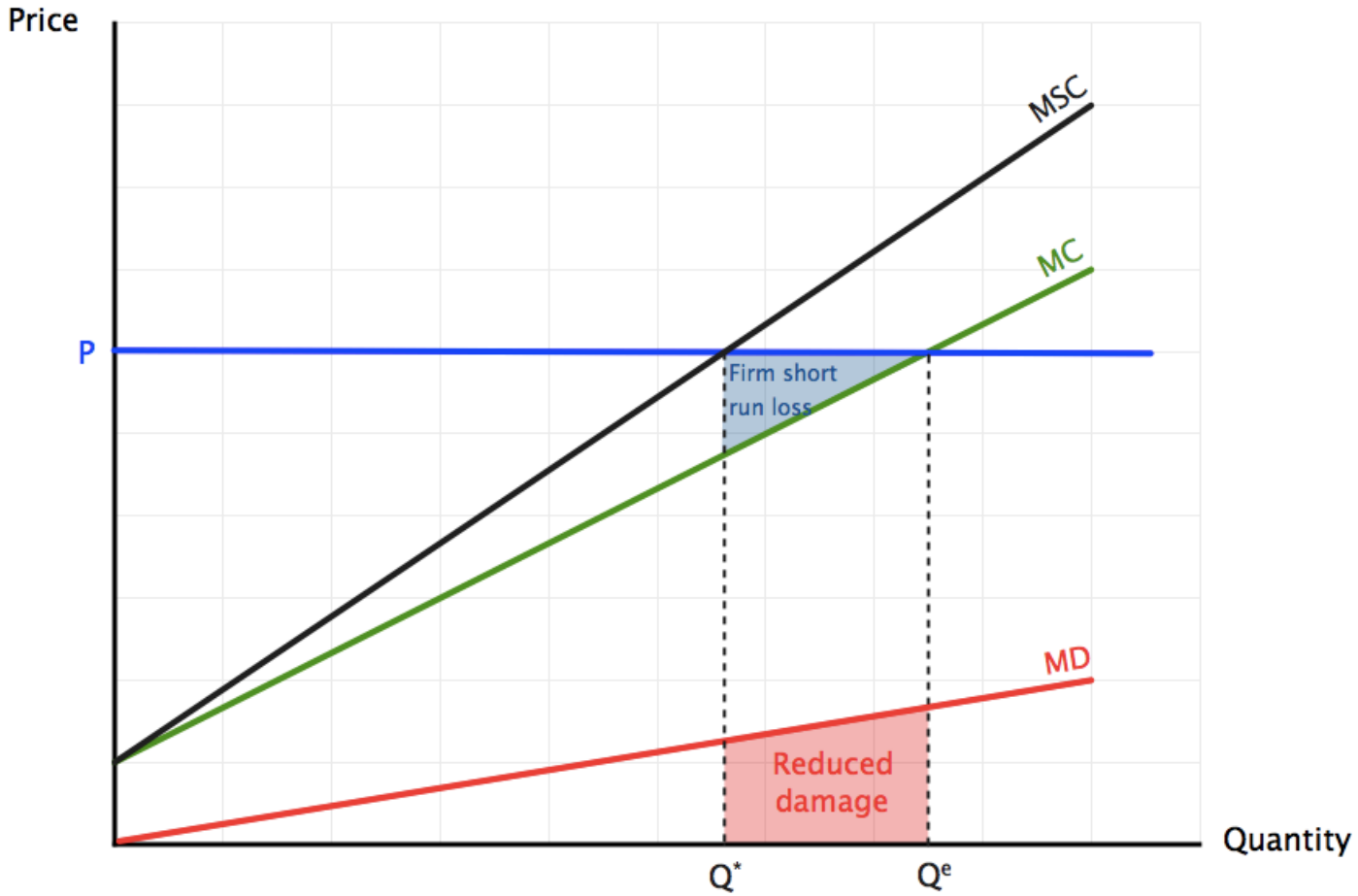
Property rights and bargaining

- Note 4
  - Requires all information
  - Requires that those who are affected can join to do the bargaining

Property rights and bargaining

- Question
  - Consider a firm polluting a river
  - What would happen if the firm own the river?
- Possible answer
  - Negotiation between firm and neighbors
  - Agree that firm reduce pollution according to Q^*
  - Neighbors are willing to pay for the reduced damage
  - Firm demands at least its loss of short run profits

Property rights and bargaining



Property rights and bargaining

- Notes
  - Both parties can gain
  - Consumers will not ask for larger reduction
  - Firm will not insist on producing more
  - Requires information and collective action

Property rights and bargaining

- Coase theorem (a)
  - If someone has property rights, the efficient solution is achieved through bargaining
  - no matter who has the property rights
- Coase theorem (b)
  - Property rights determine who has to pay whom

Property rights and bargaining

- Objection
  - Information
  - Pollution may affect millions of people – difficult to get together
- Coase theorem is controversial
  - Some economists: Believe in Coase => disprove of public policies
  - Other economists: Believe Coase thm might work in some contexts involving only a few people.

Mergers

- Consider
  - A firm pollutes a river
  - Reducing profits of a fish farm downstream
- Possible solution
  - Firms merge
  - Merged entity will maximize sum of profits

Social conventions

- Example
  - Children are taught that littering is not “nice”

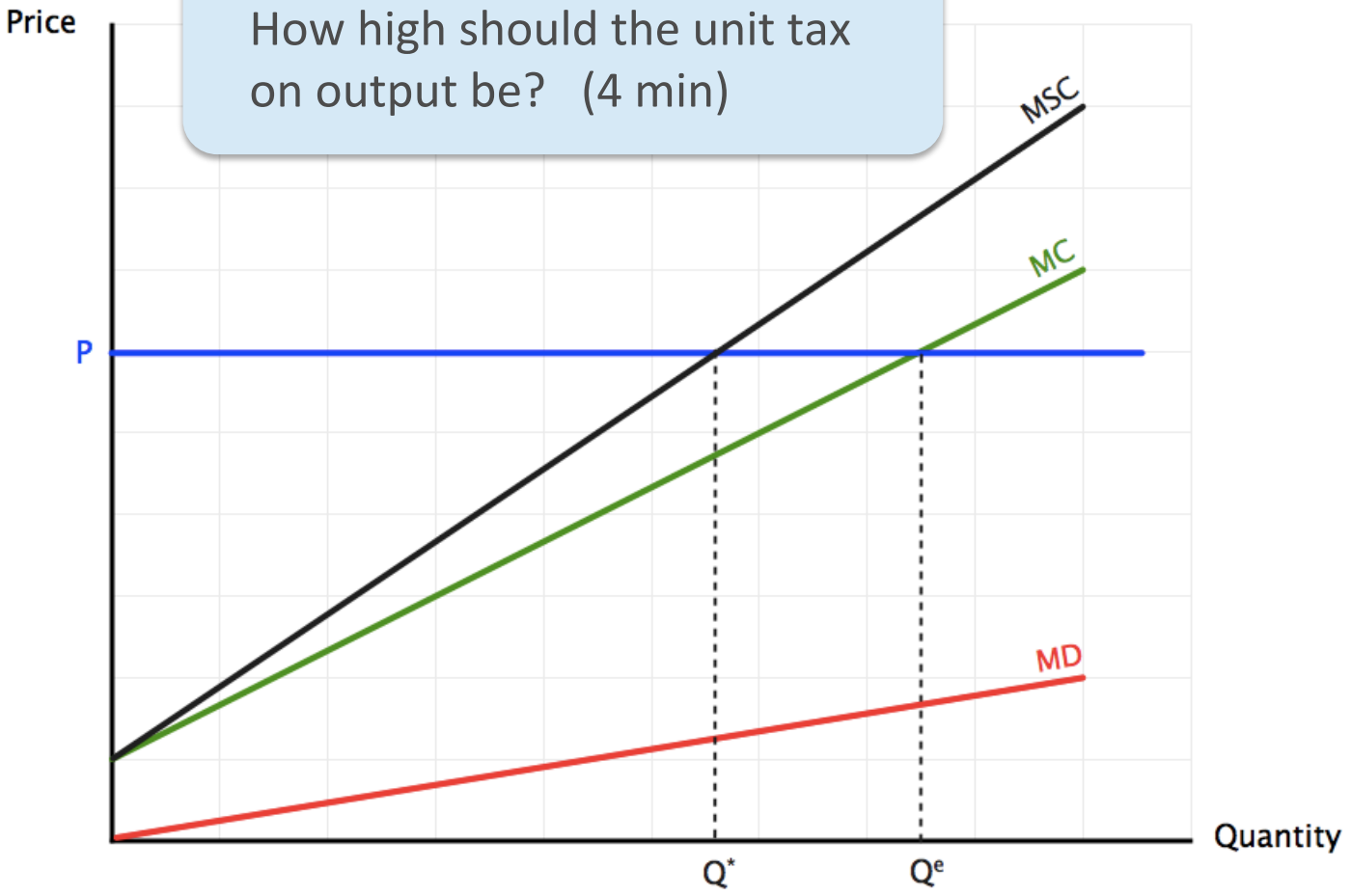
Public responses to externalities

Output tax

- Q:
  - Assume that the government wishes to levy a tax on each unit of output
  - You are hired as an economic expert

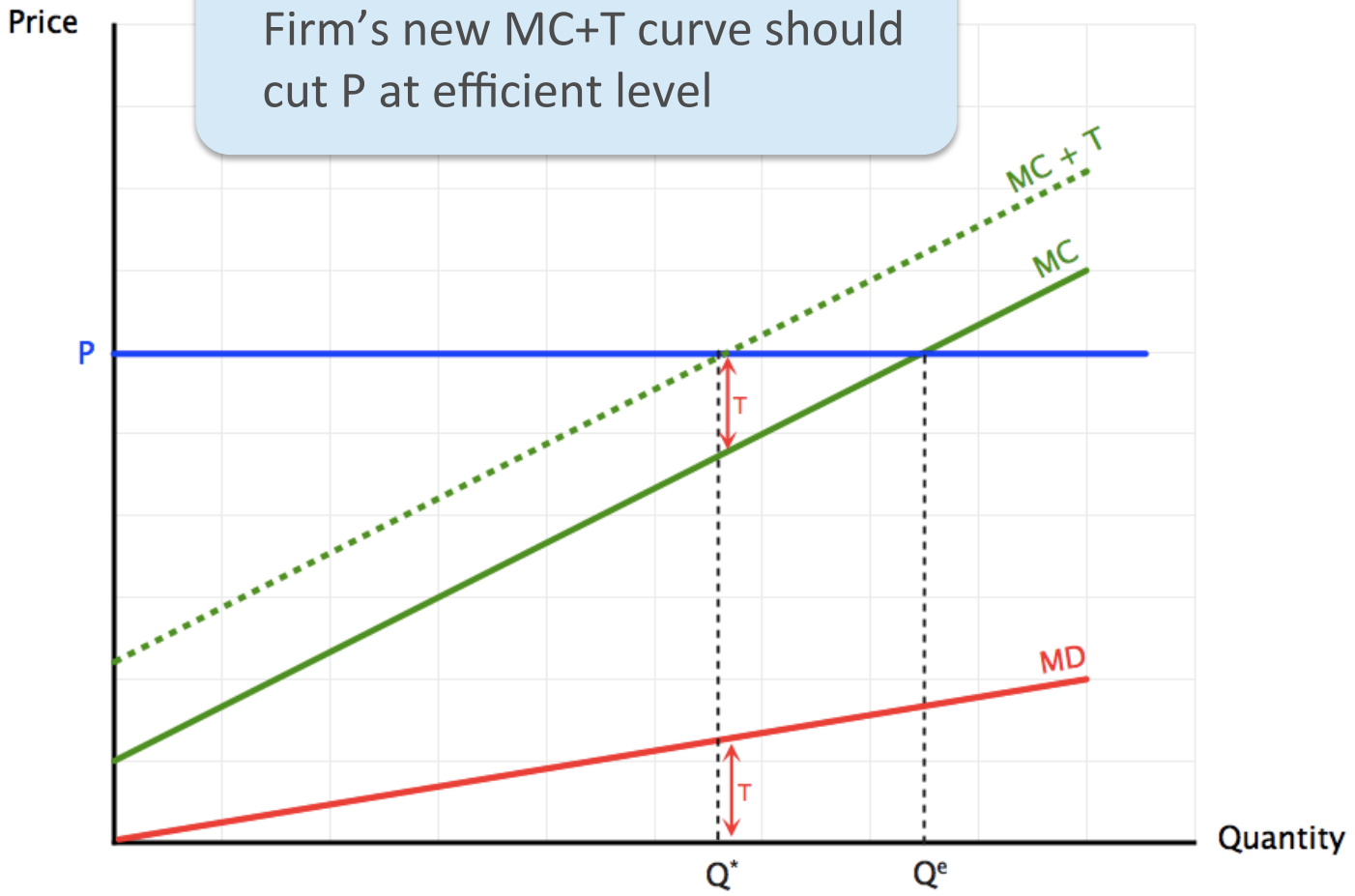
Output tax

How high should the unit tax on output be? (4 min)

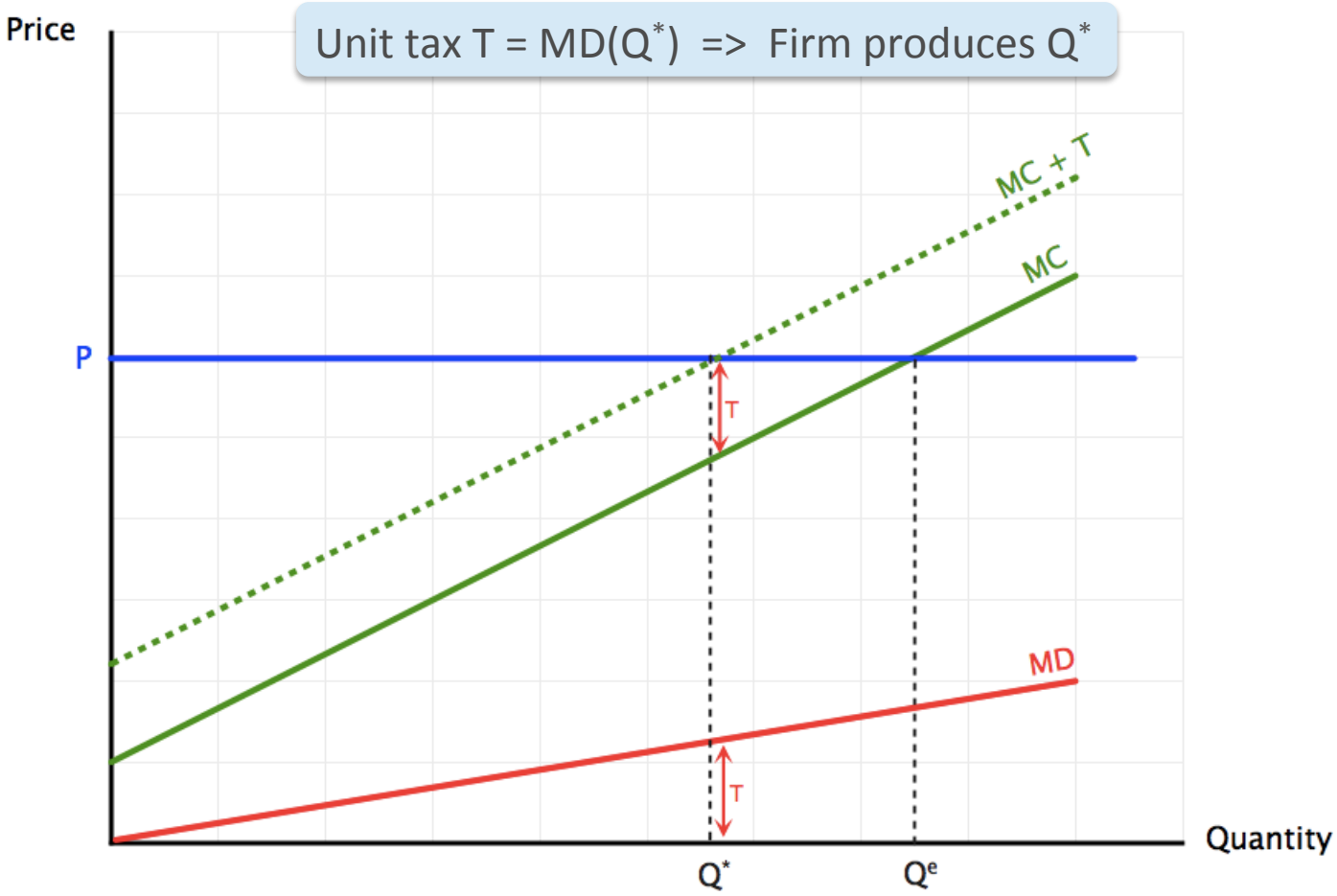


Output tax

Firm's new MC+T curve should cut P at efficient level



Output tax


Unit tax T = MD(Q*) => Firm produces Q*
Price
MC + T
MC
P
T
MD
T
Quantity
Q*
Qe

Output tax

- Pigouvian tax
  - Tax on each unit of output
  - Equal to the marginal damage at efficient output

Output tax

- Q: What information do you need to compute the level of a Pigouvian tax?
  - All the data in the diagram

Emission fee

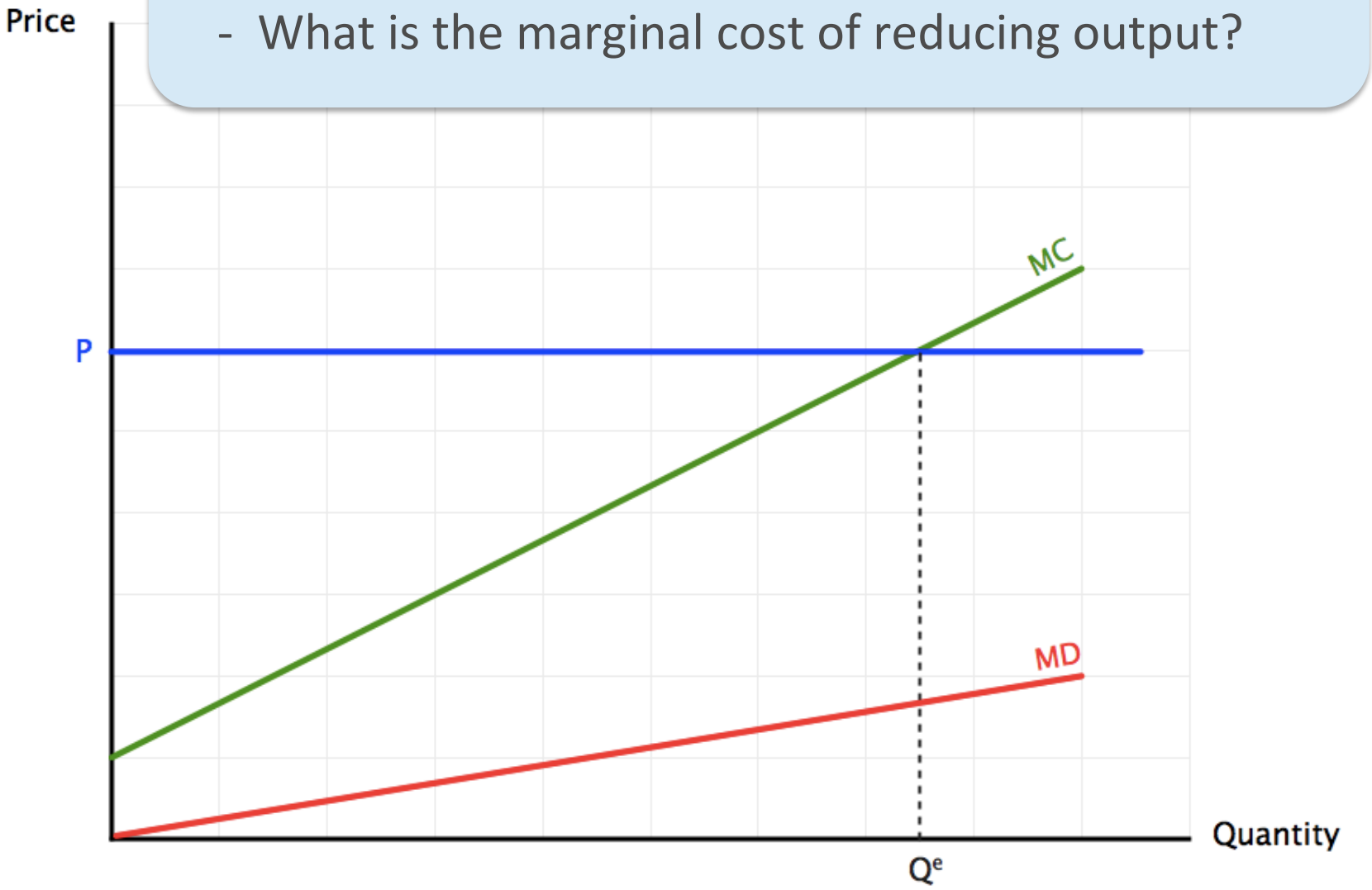
- Alternative ways to reduce pollution
  - Reduce output
  - Shifting to cleaner inputs
  - Shifting to cleaner technology
  - Installing cleaning devices
- Problem with output tax
  - Doesn't give firms incentives to find ways to reduce pollution, other than reducing output

Emission fee

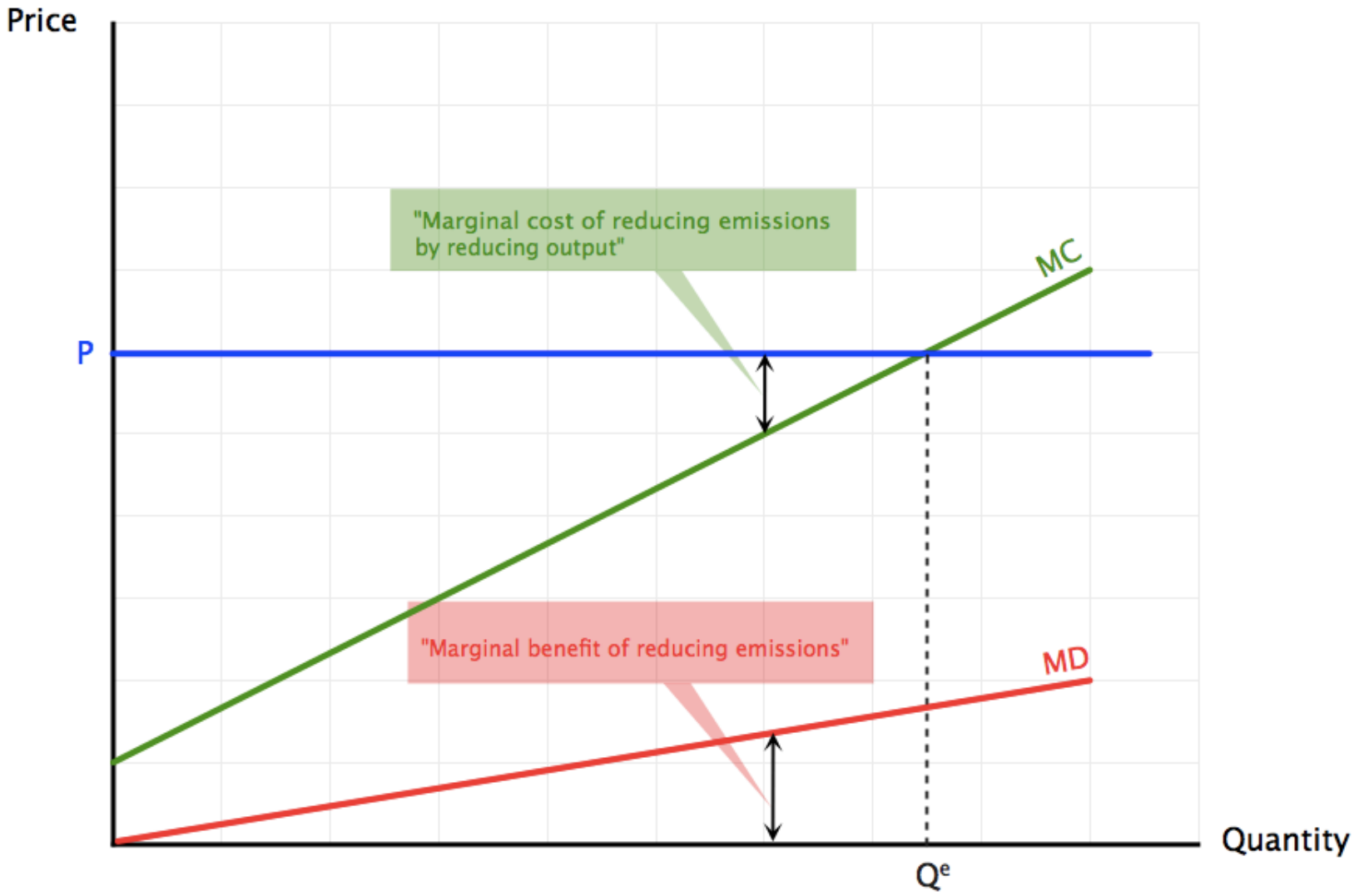
- Alternative policy: Emission fee
  - Pay for every unit of emissions (similar to input price)
  - Not for producing output
- To analyze this
  - Rewrite diagram in terms of emissions reductions

Starting at equilibrium output, Q^e.

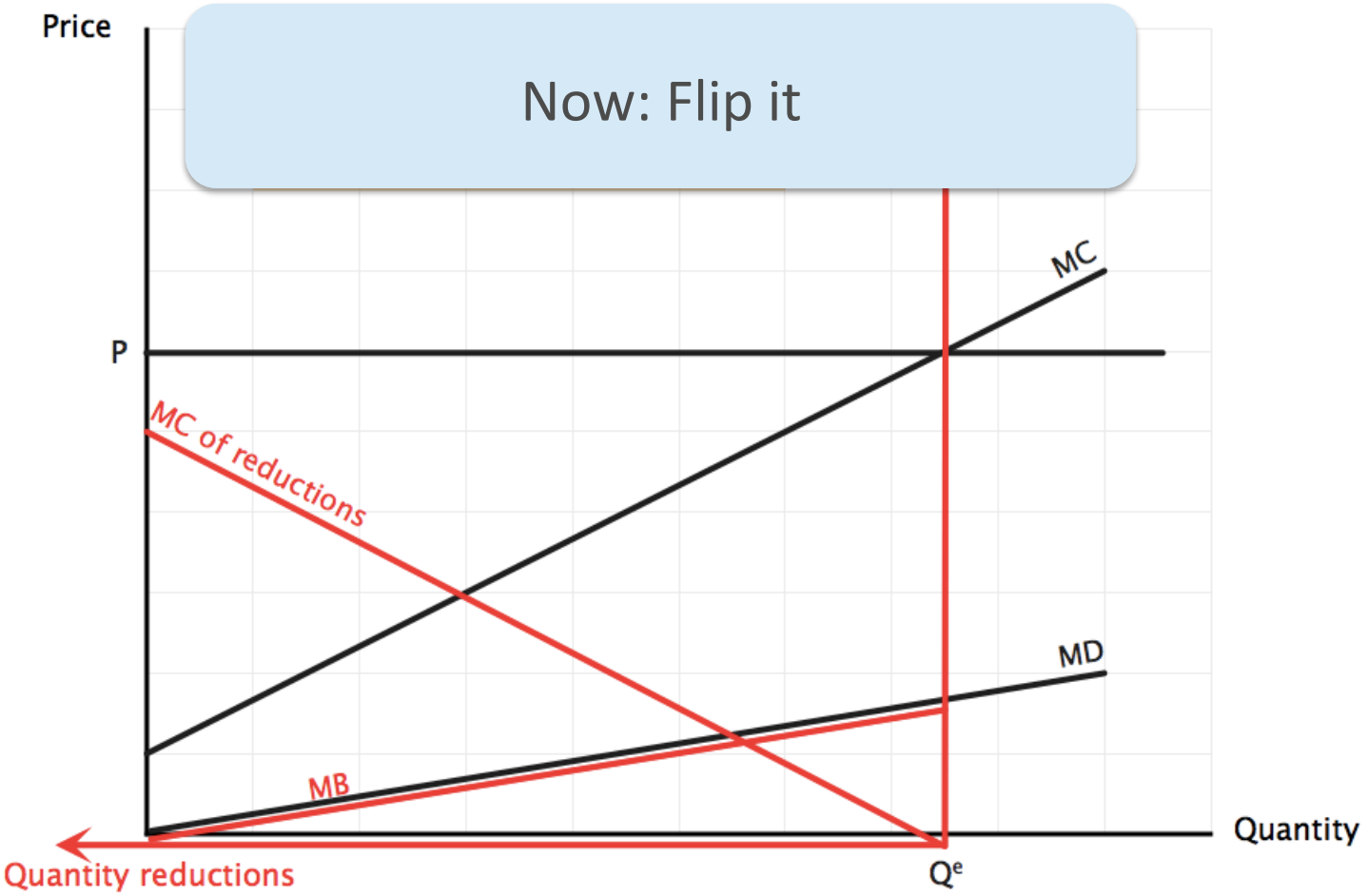
- What is the marginal benefit of reducing output?
- What is the marginal cost of reducing output?



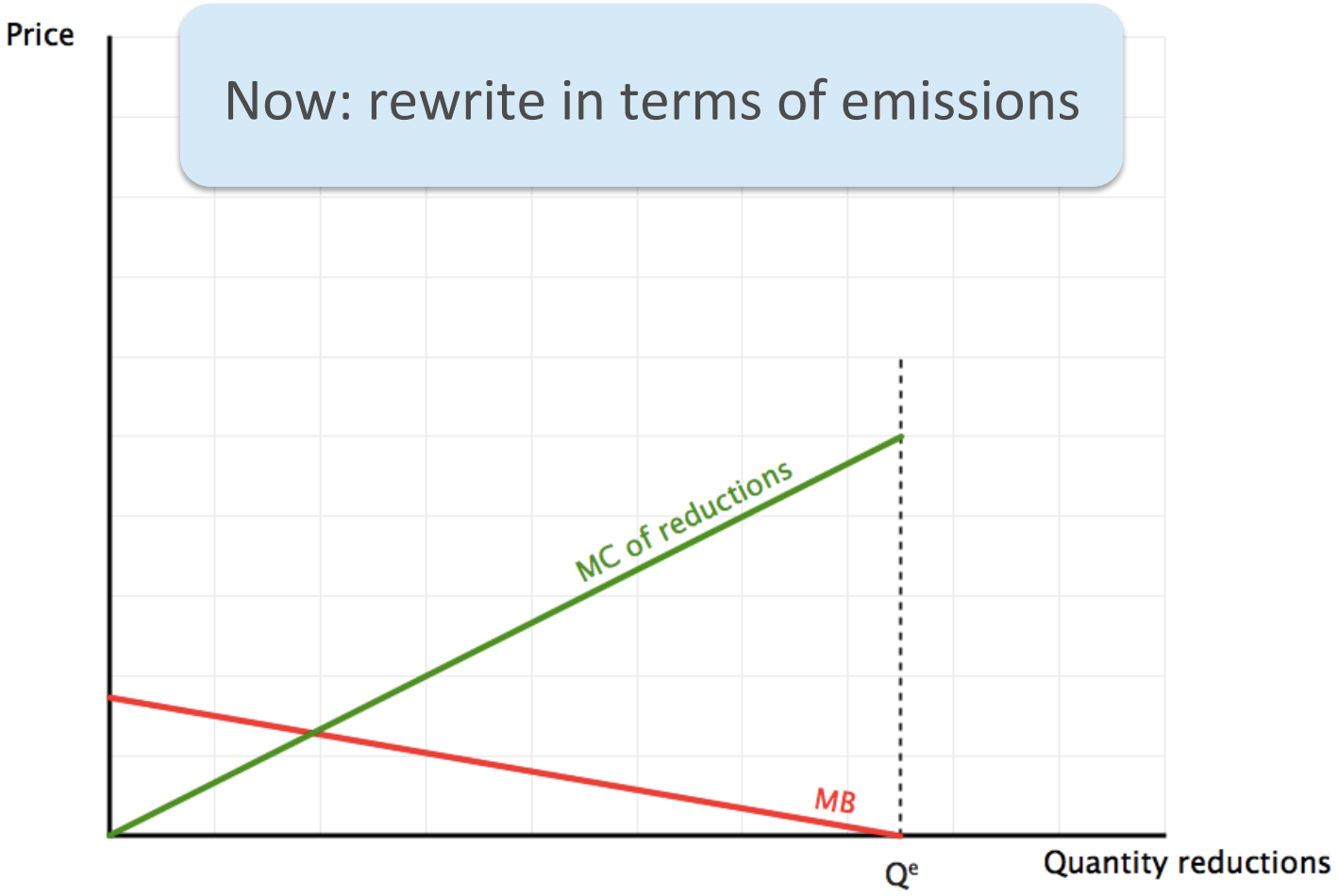
Emission fee



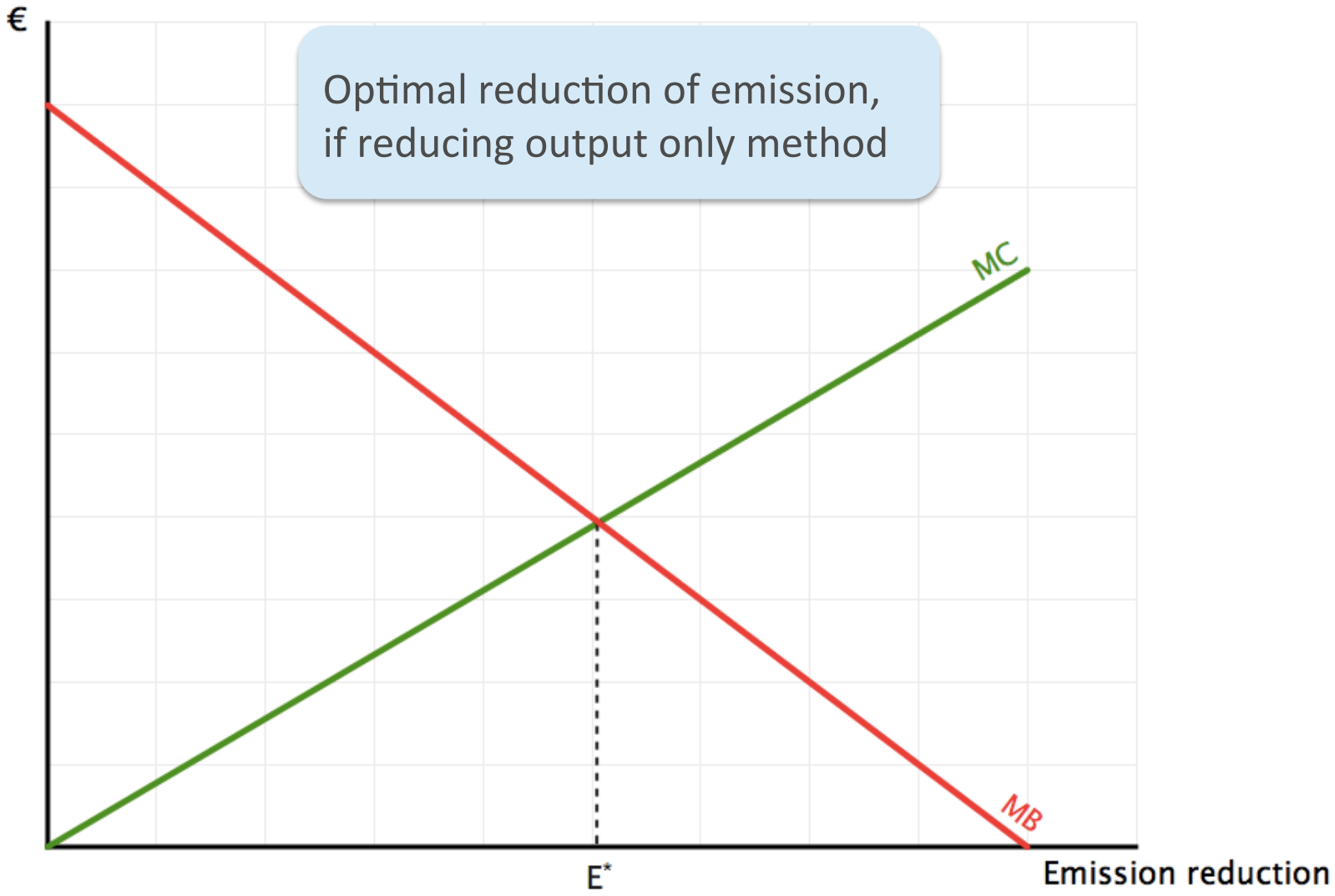
Emission fee



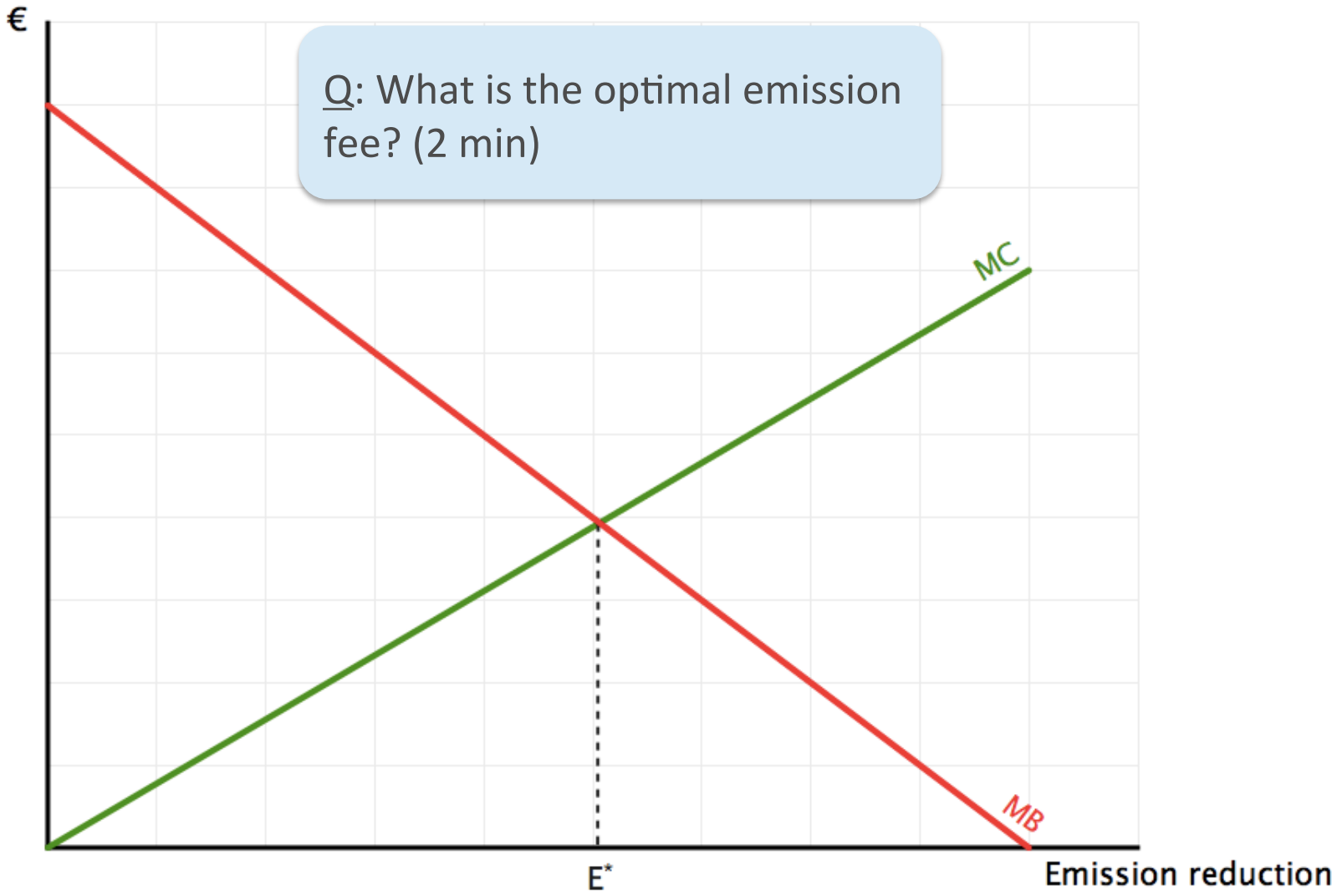
Emission fee



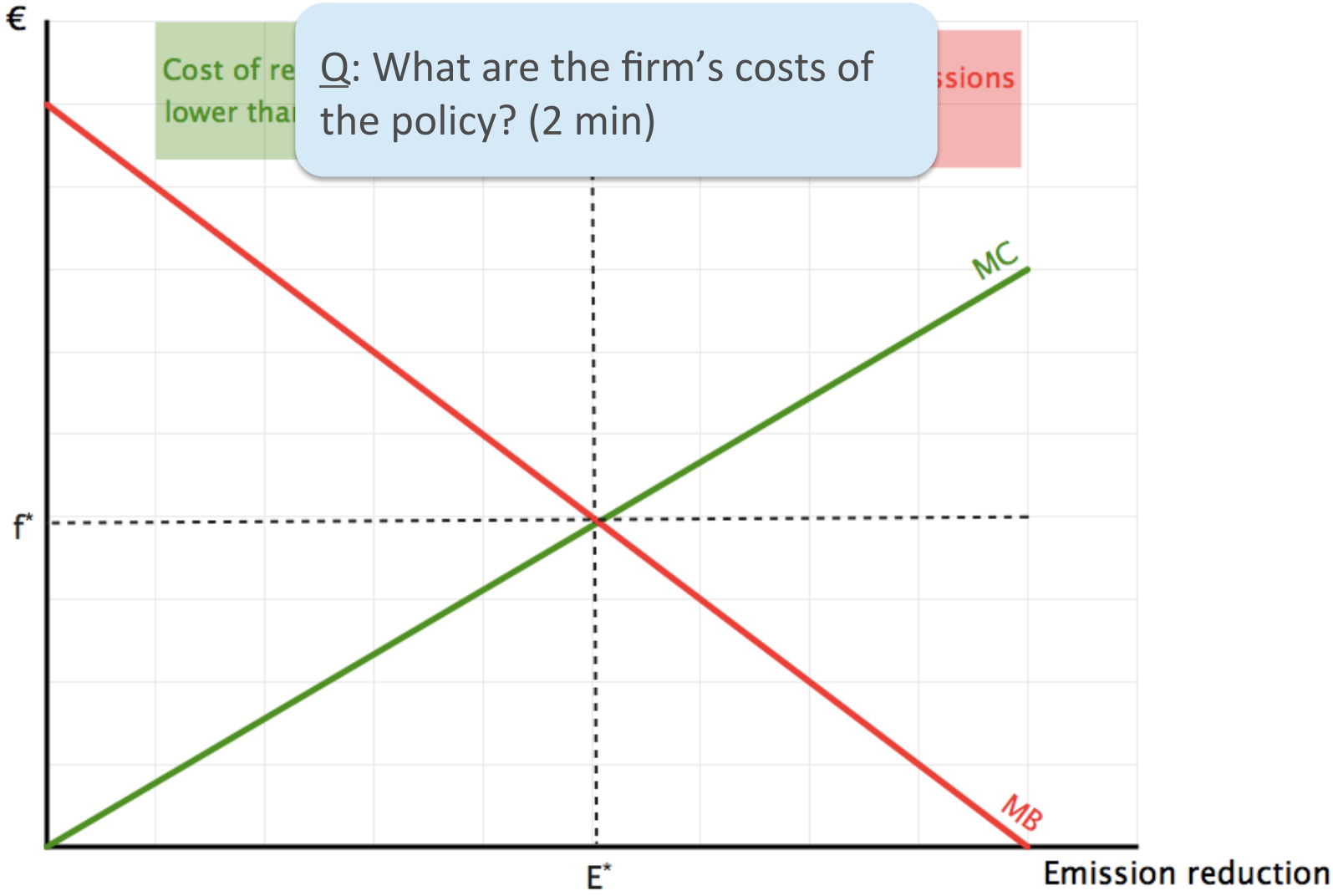
Emission fee



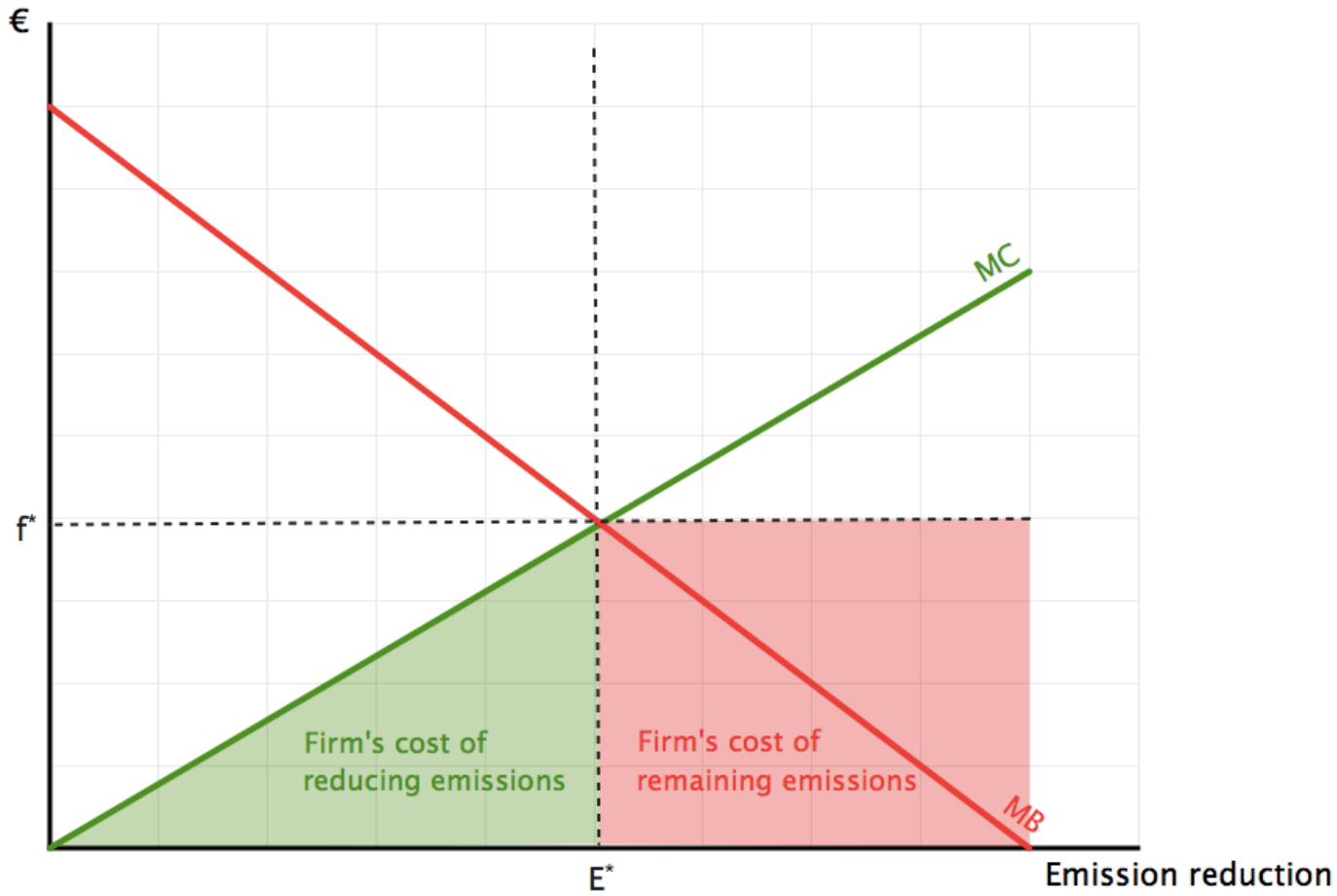
Emission fee



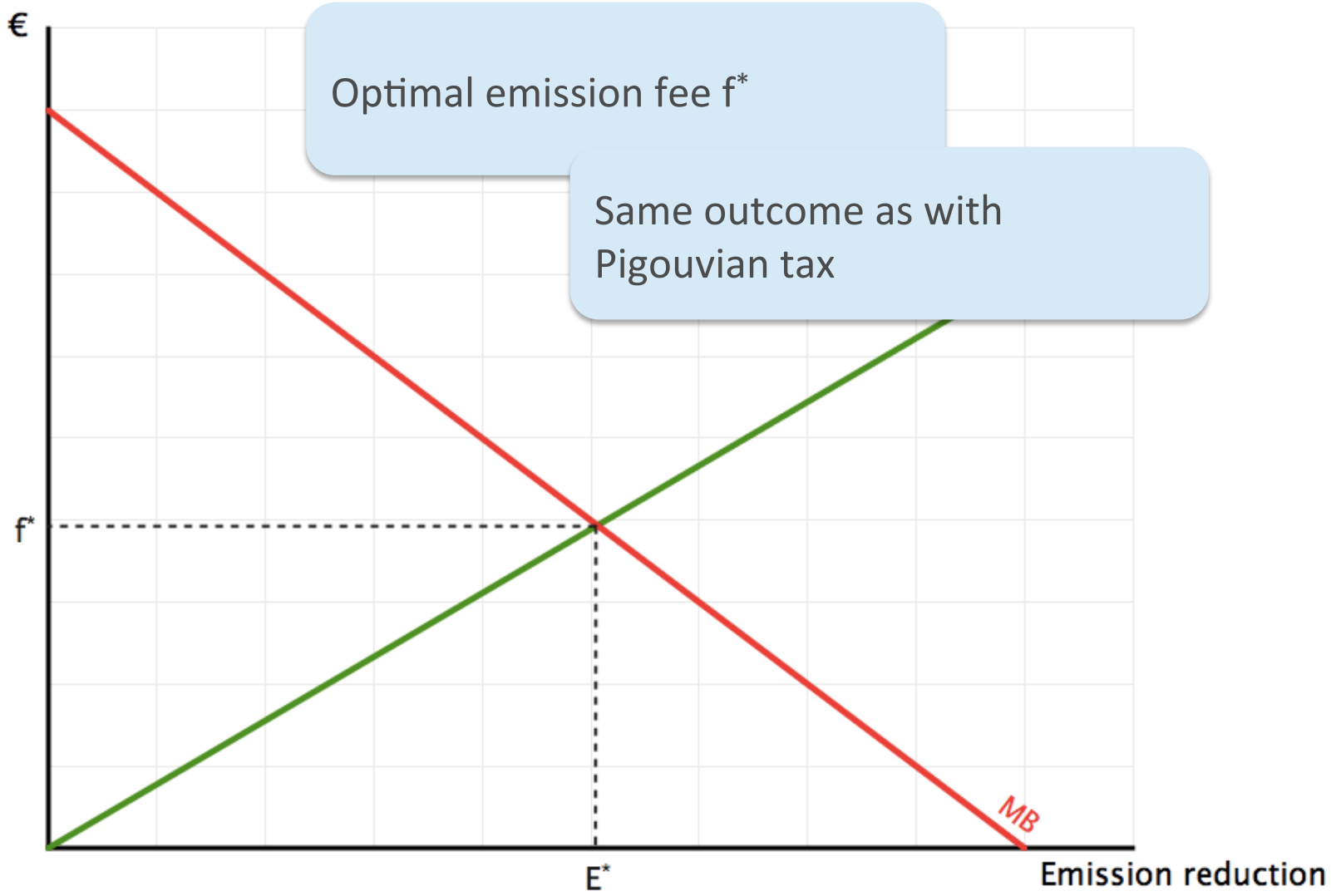
Emission fee



Emission fee

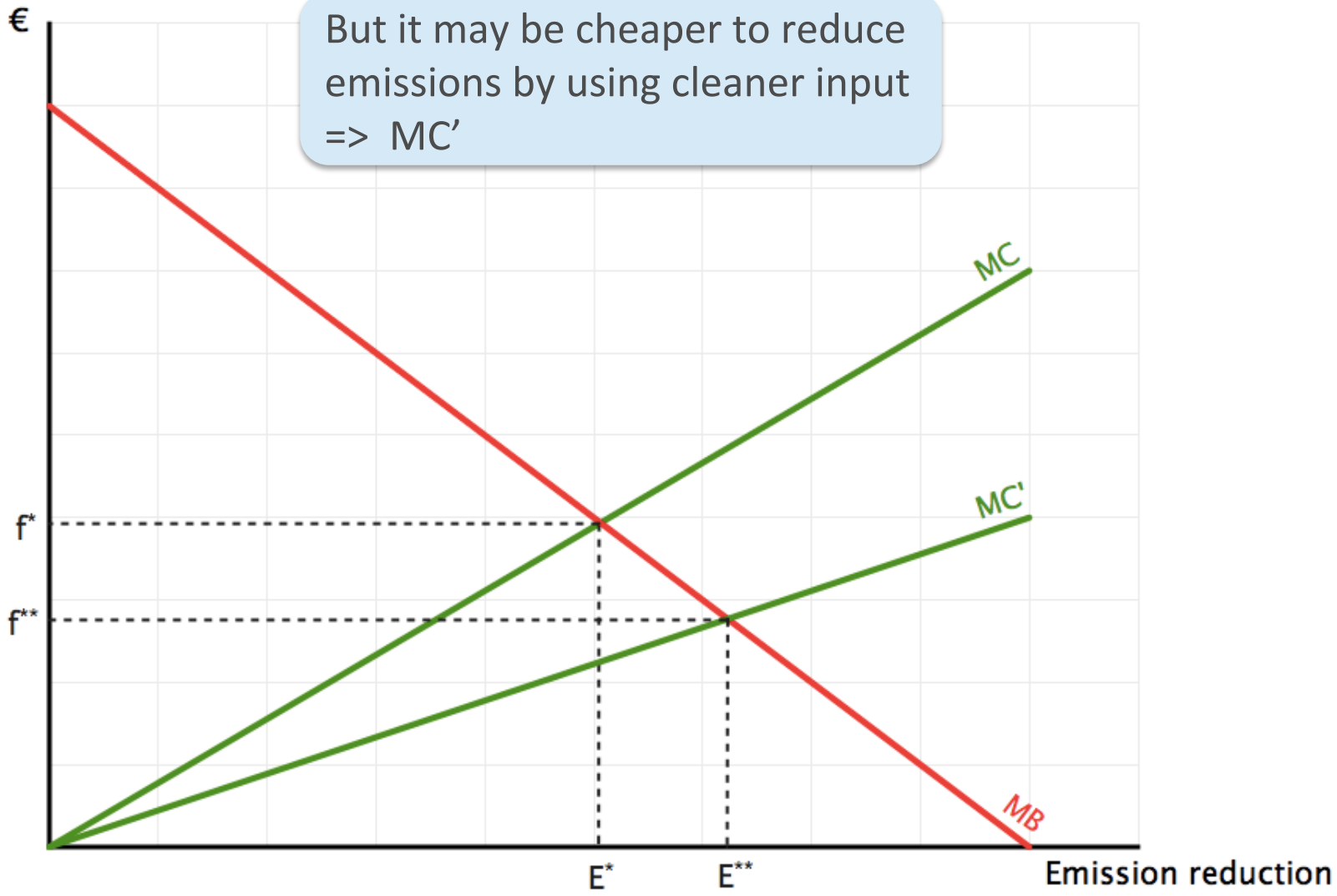


Emission fee

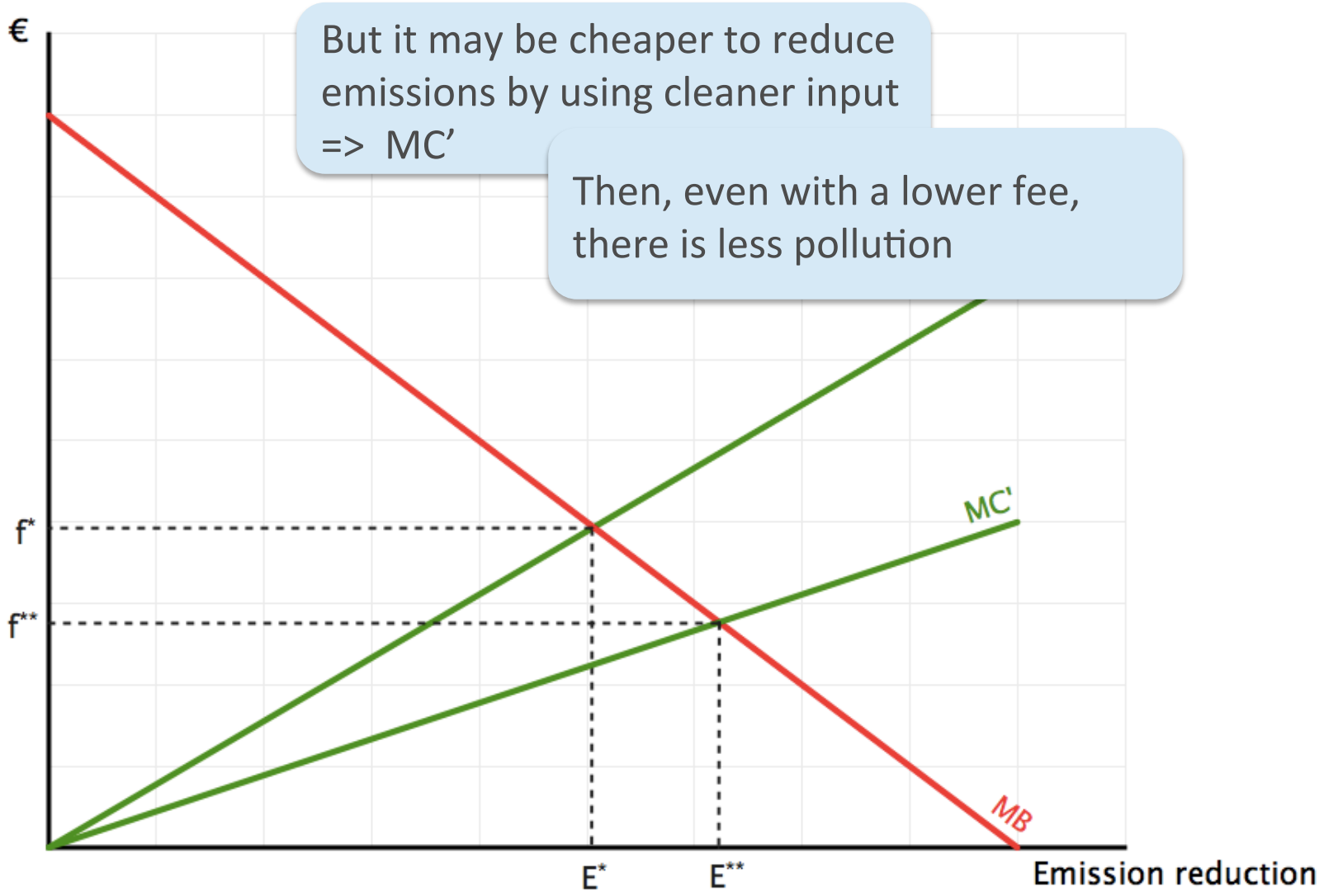


Emission fee

But it may be cheaper to reduce emissions by using cleaner input
=> MC’



Emission fee



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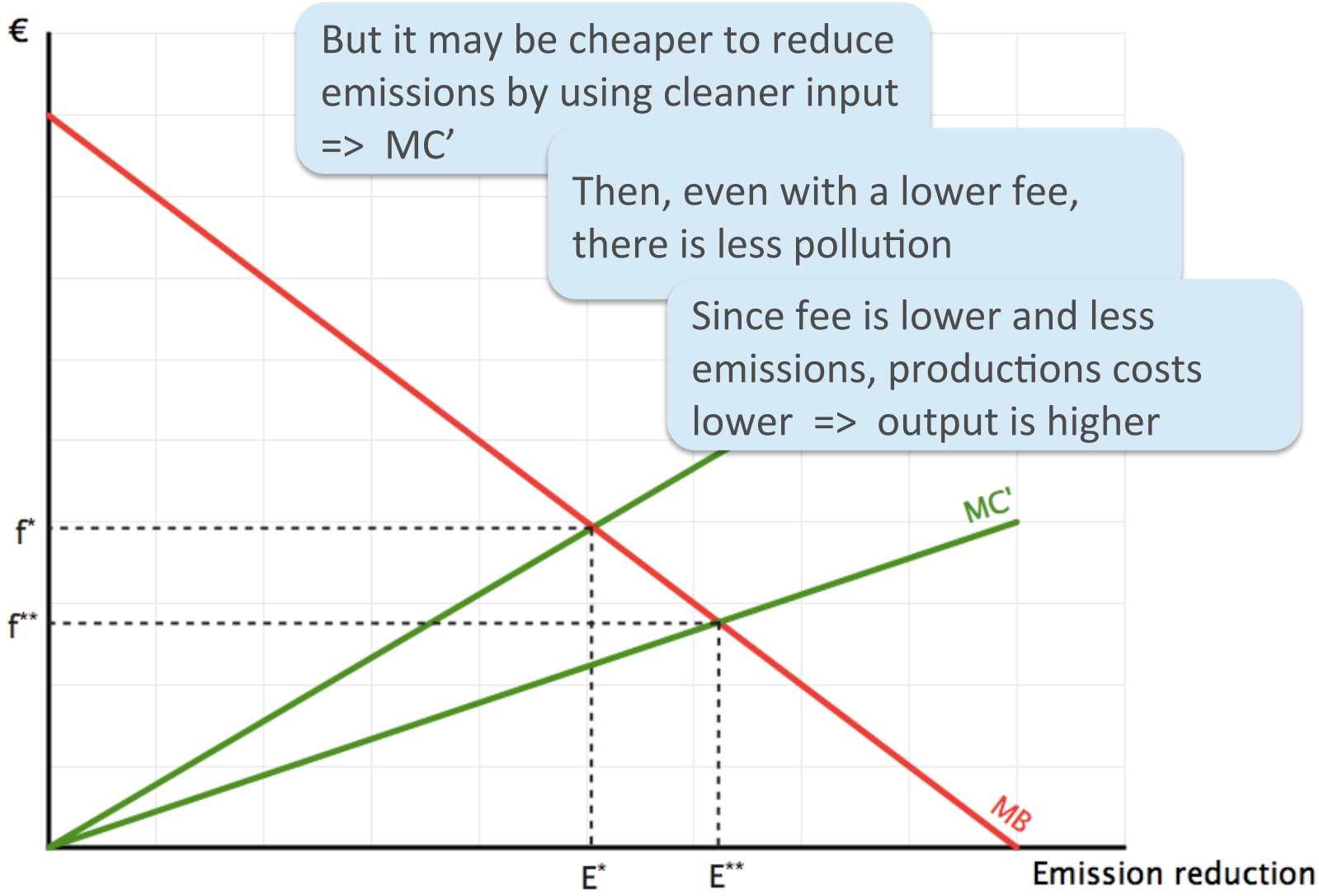
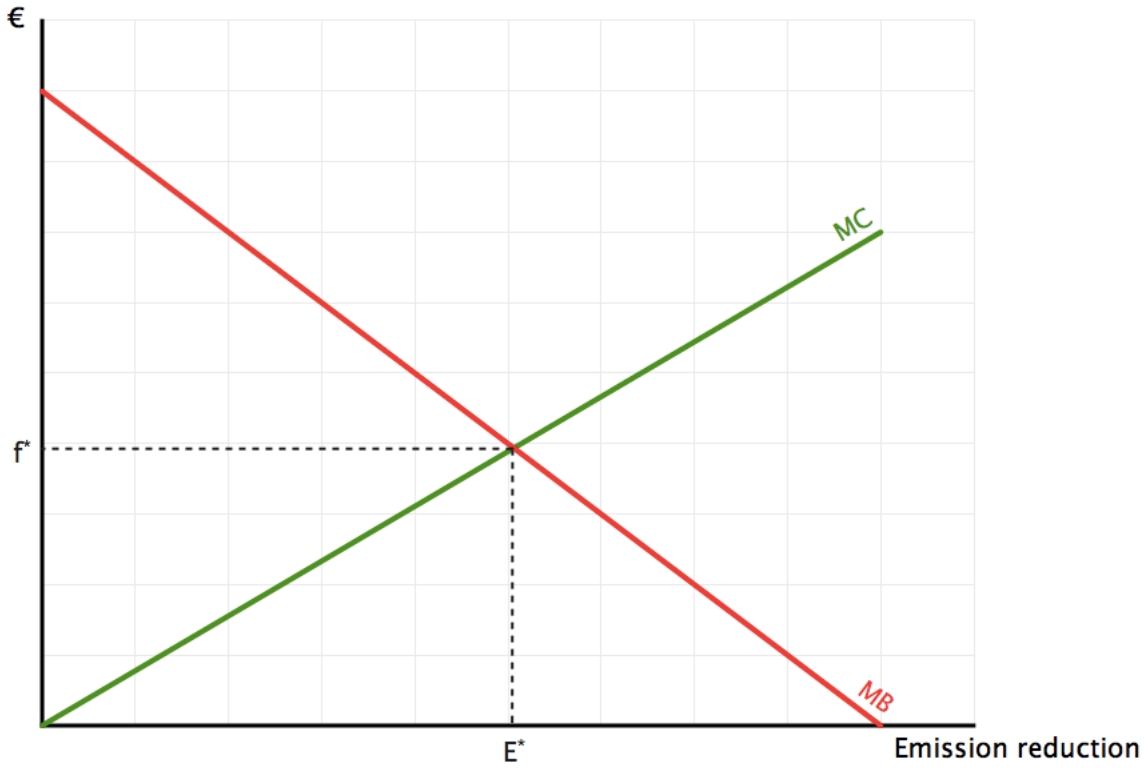


Cap

- Alternative r… …he emissions
  - Cap on emissions E^*

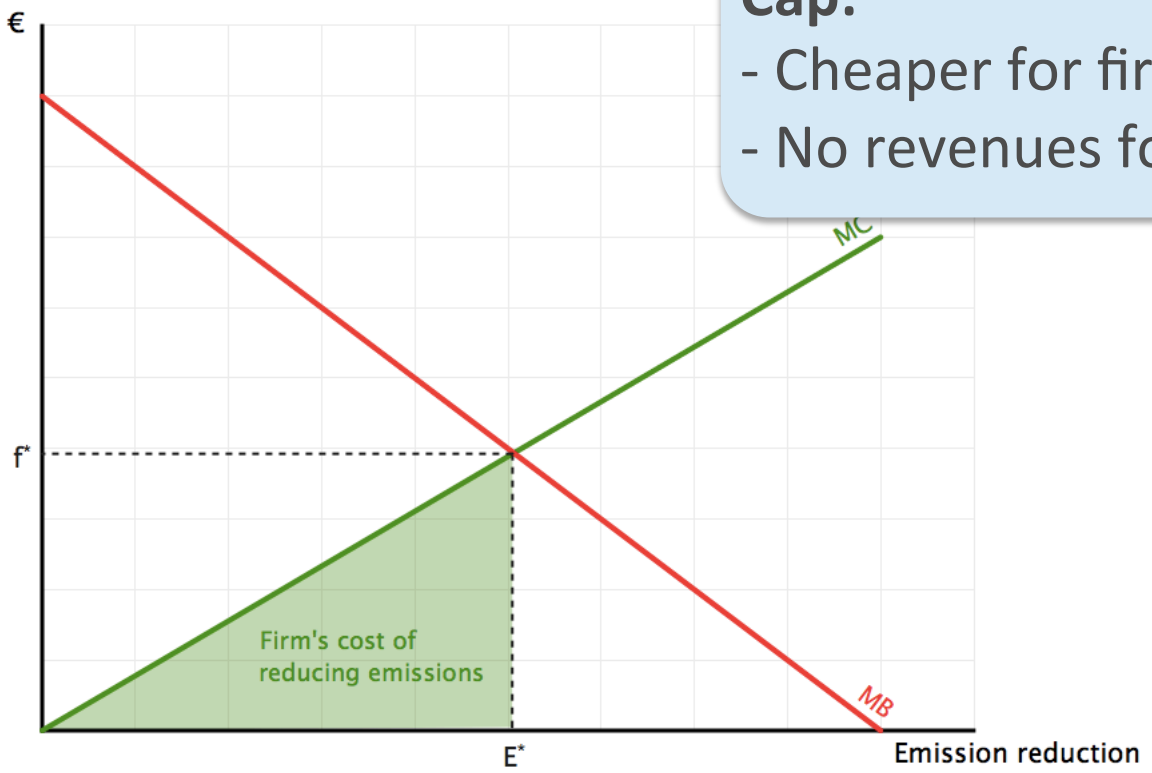
Q: What are the firm's costs of the policy? (2 min)



Cap

- Alternative method to achieve same emission
  - Cap on emissions

Cap:
- Cheaper for firms
- No revenues for Gov



Cap-and-Trade

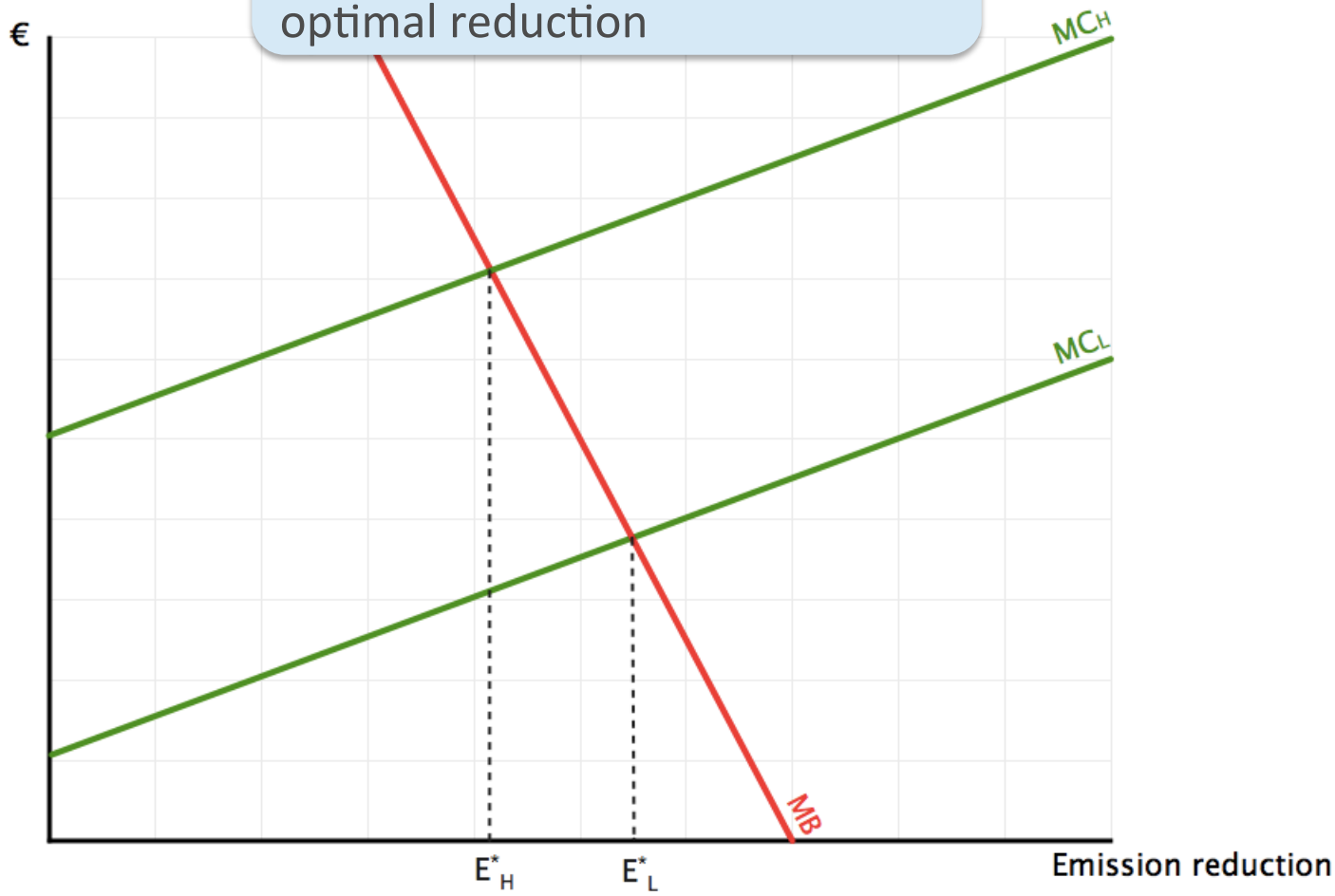
- When many polluters
  - Decide how much emissions should be allowed in total
  - Issue one permission for every unit of emission. The permissions may be given to firms for free.
  - Require firms that emit to hand in a permission for every unit of emission
  - Let firms trade in emission permission

Emission Fee vs. Cap-and-Trade

- Equivalence between fee and cap
  - Only true when there is no uncertainty
- Now assume
  - Government doesn't know the cost of reducing pollution
  - Only one polluter
- Question
  - Is it better with a cap or a fee?

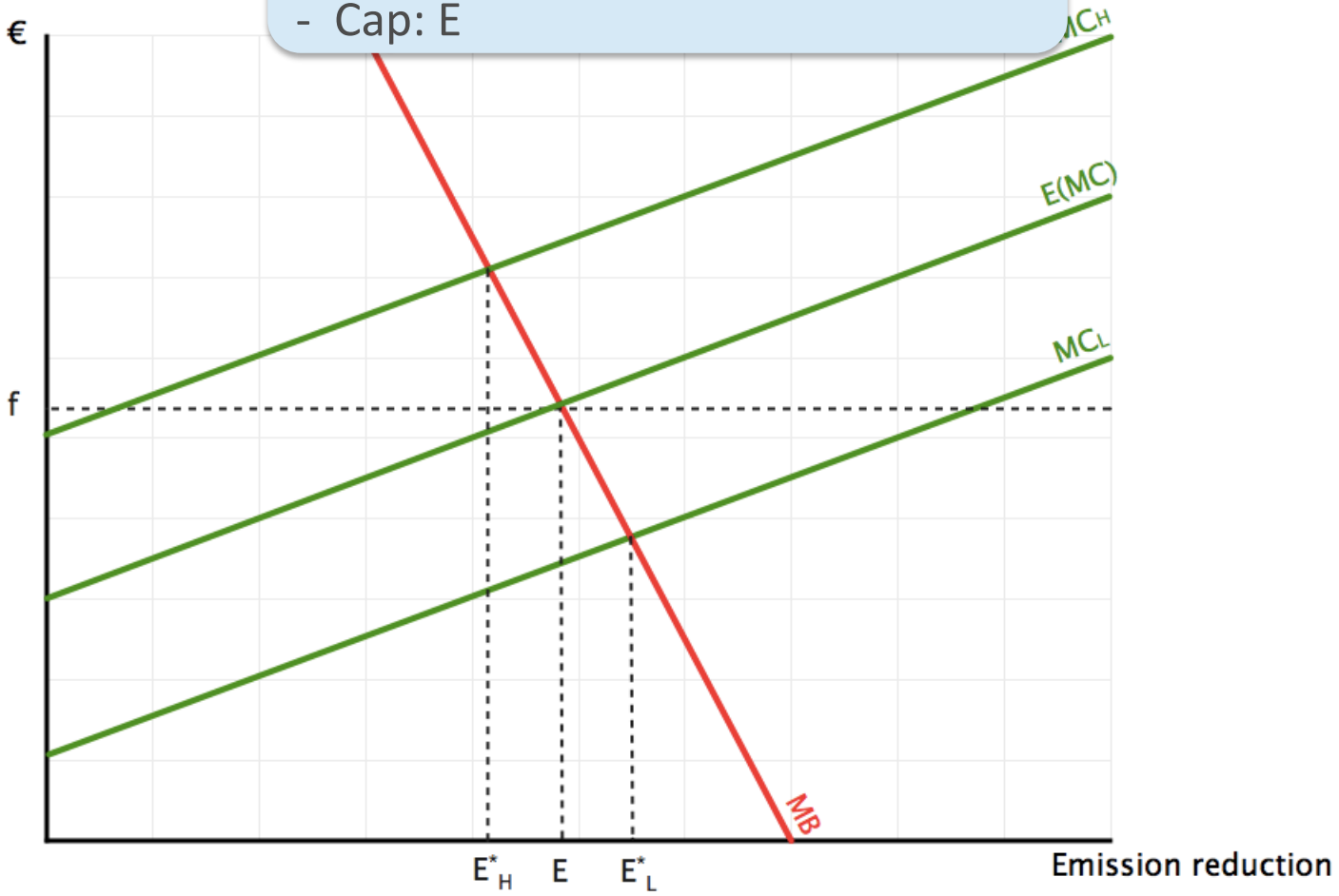
Emission Fee vs. Cap-and-Trade

Gov doesn't know if MC is high or low. => Doesn't know optimal reduction



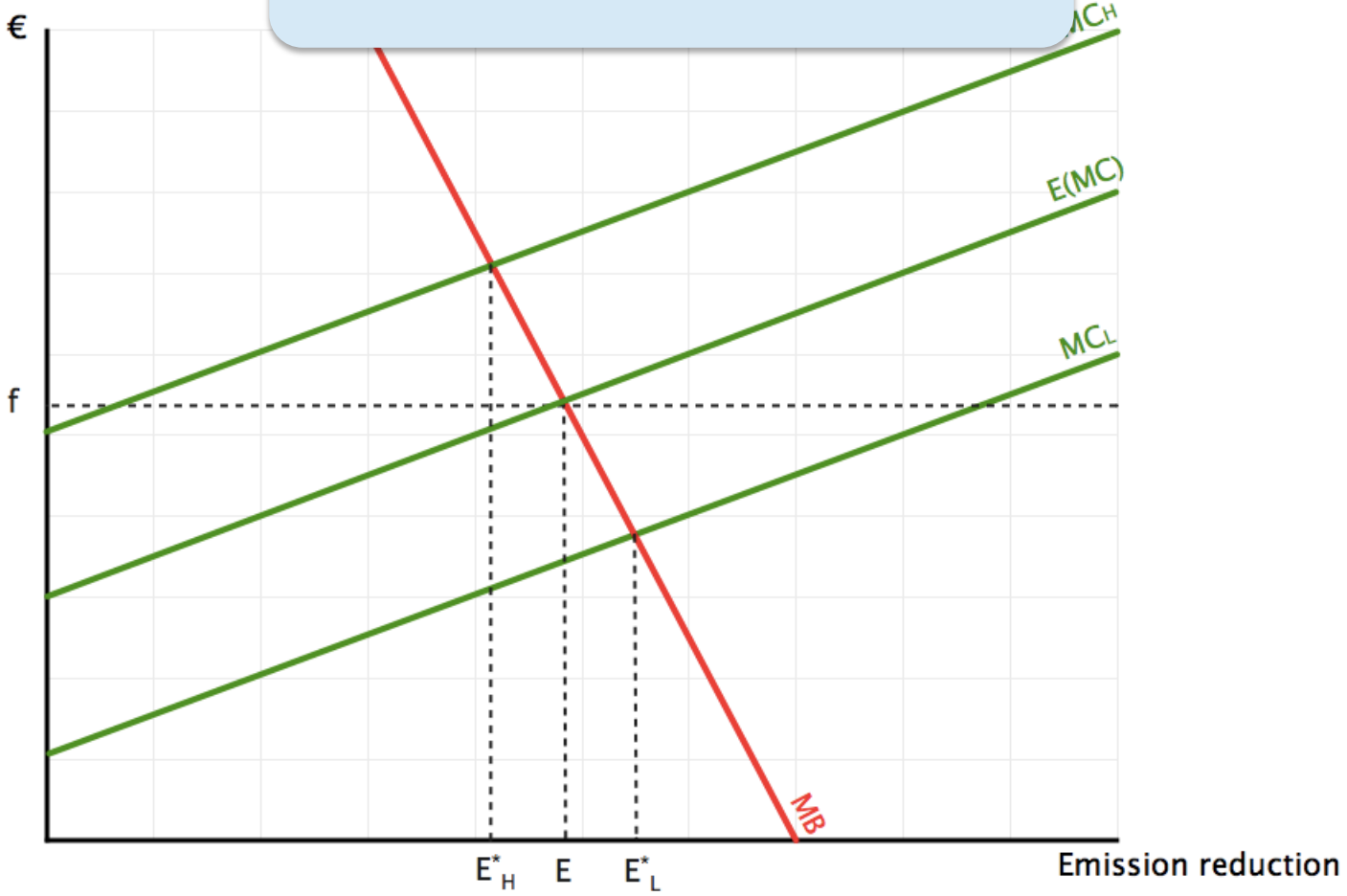
Emission Fee vs. Cap-and-Trade

Must base policy on expected MC.
- Fee: f
- Cap: E



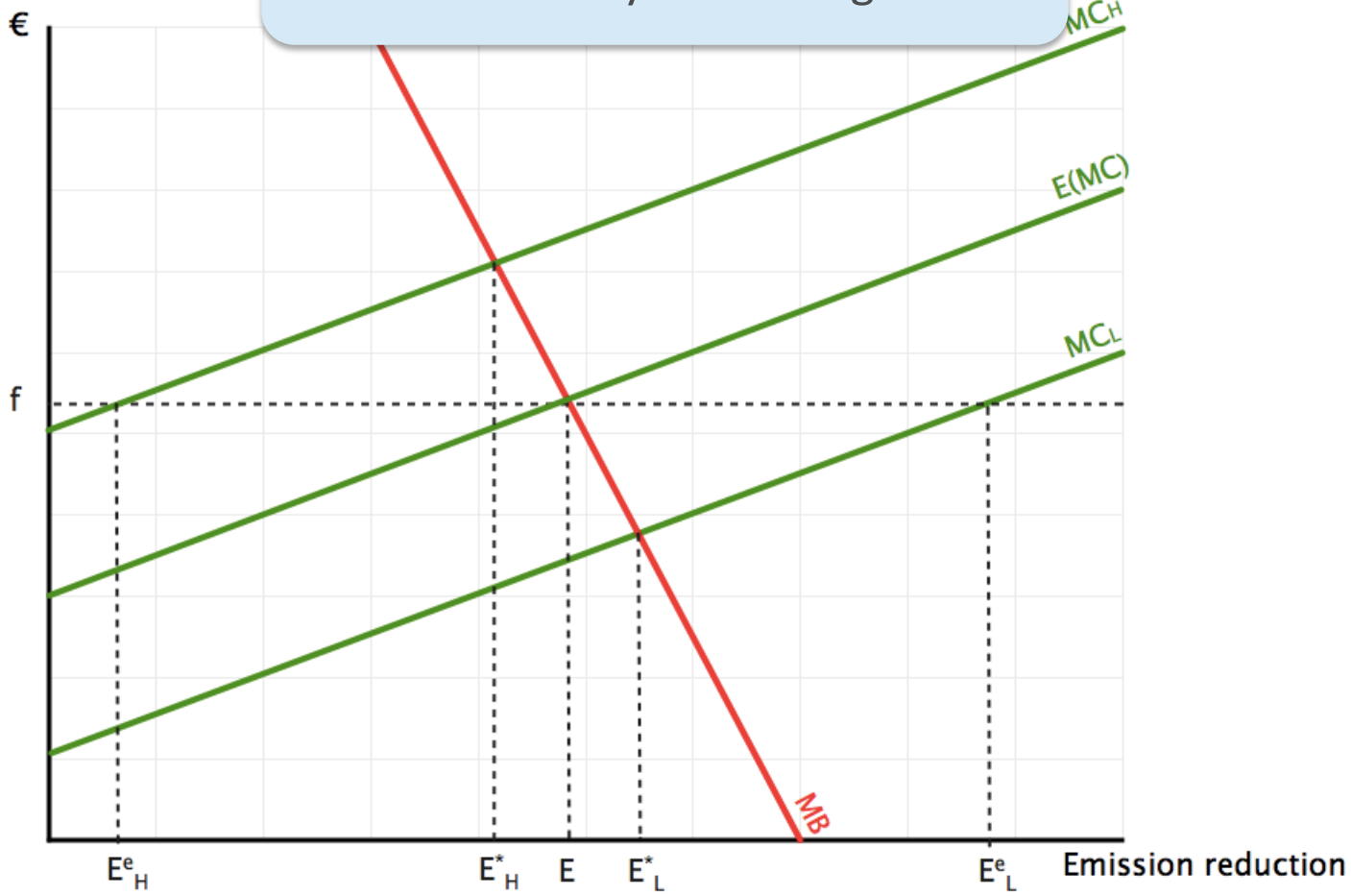
Emission Fee vs. Cap-and-Trade

Q: Which is best? (3 min)



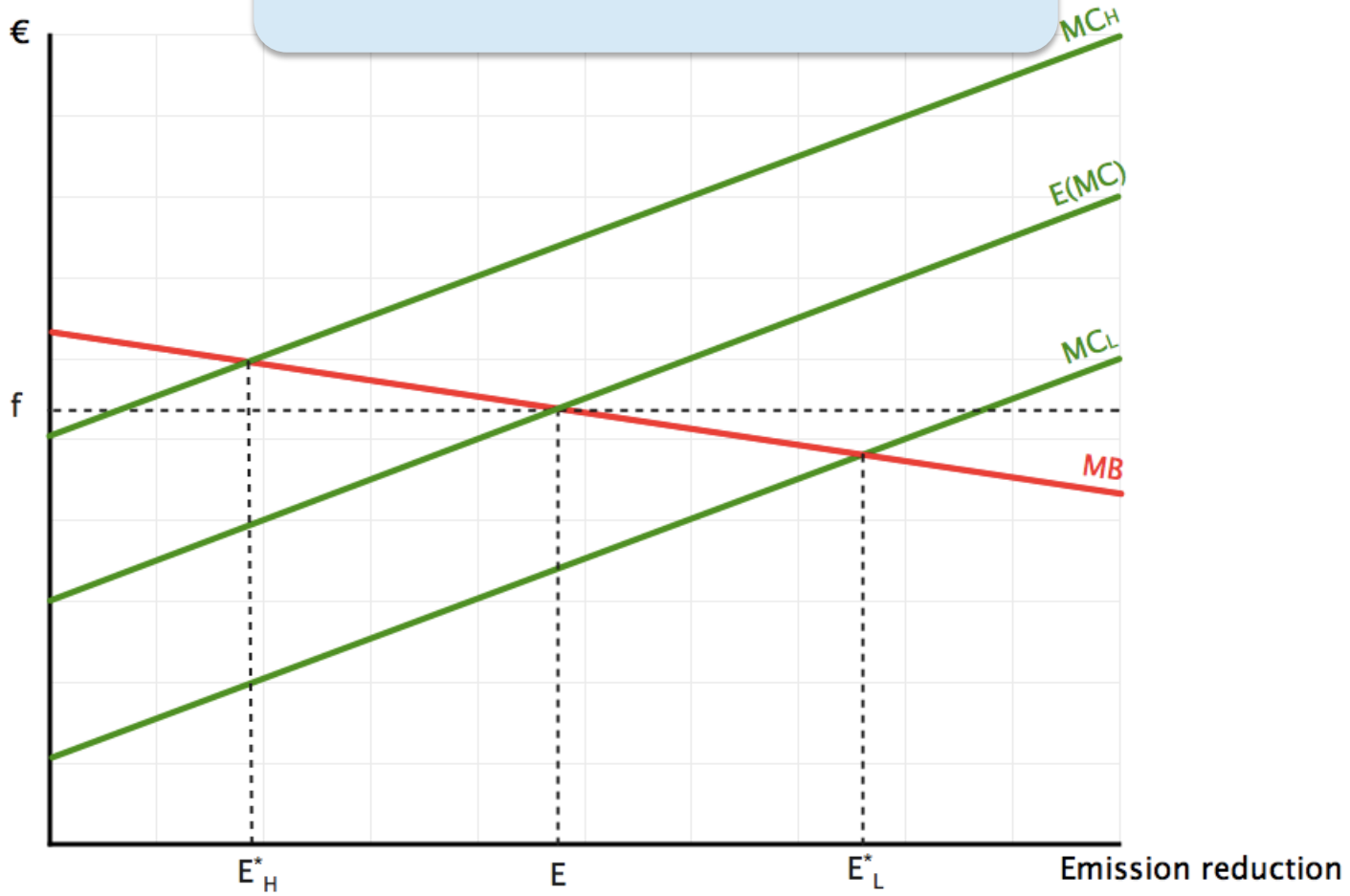
Emission Fee vs. Cap-and-Trade

Fee implies emission reductions that are far away from the goal



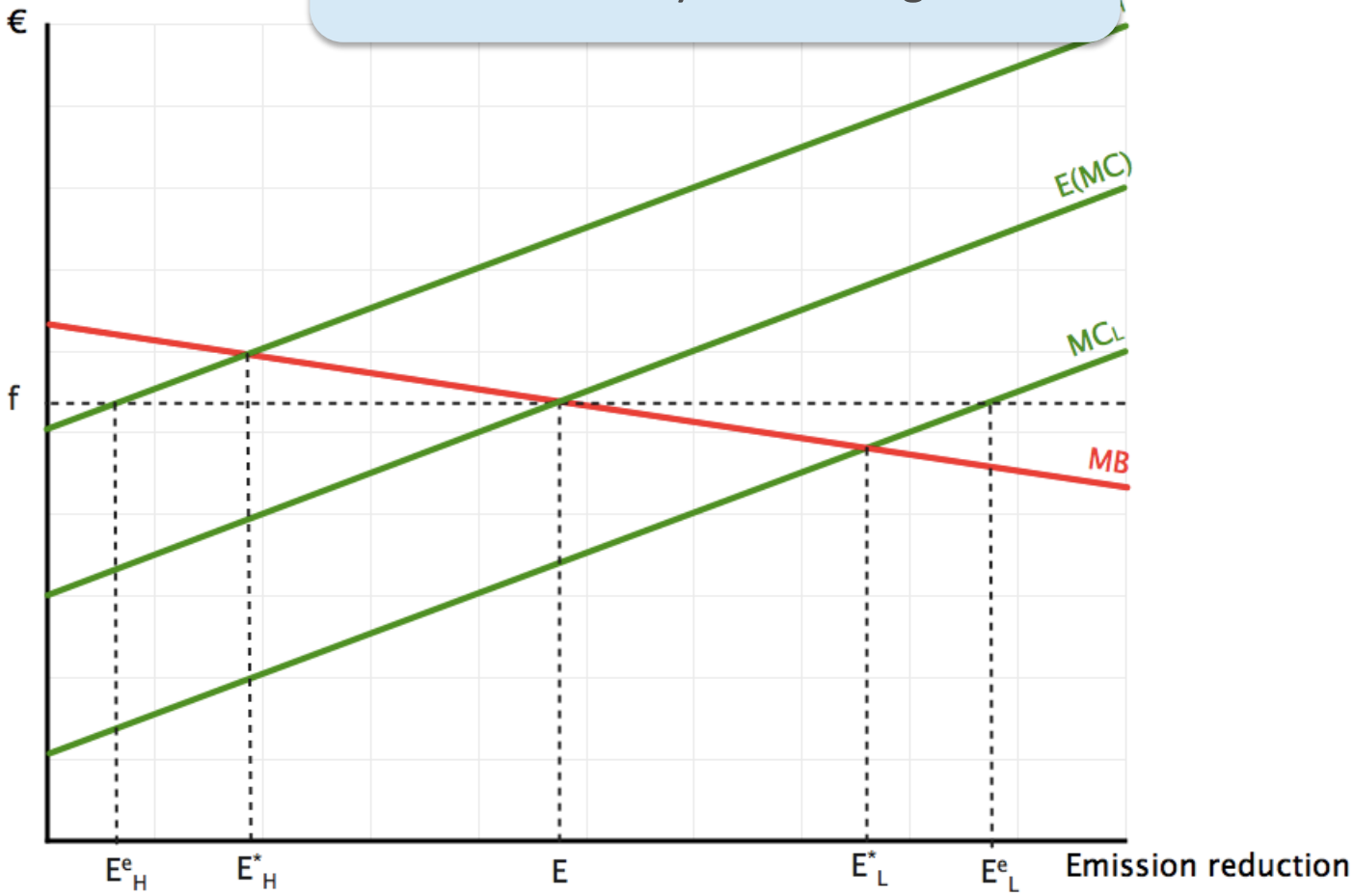
Emission Fee vs. Cap-and-Trade

Q: What about this case?



Emission Fee vs. Cap-and-Trade

Cap implies emission reductions that are far away from the goal



Cap-and-Trade

- Result
  - Cap is better when MB function is inelastic
  - Fee is better when MB function is elastic

Command-and-Control

- Incentives based regulation
  - Emission fee
  - Cap-and-trade
- Traditional approach
  - Technology standards: require polluter to install certain technology
- Q: What are the pros and cons?
  - Incentives – firms know more about most efficient way to reduce emissions
  - Traditional – do not need to monitor emissions