Lecture 02

Market Failures

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AEM 4510

Roadmap

- What are market failures?
- When do they happen?
- What are the consequences?

Market failures and the environment

The ideal world: graphical

In the best case scenario, a market equilibrium leads to the efficient allocation

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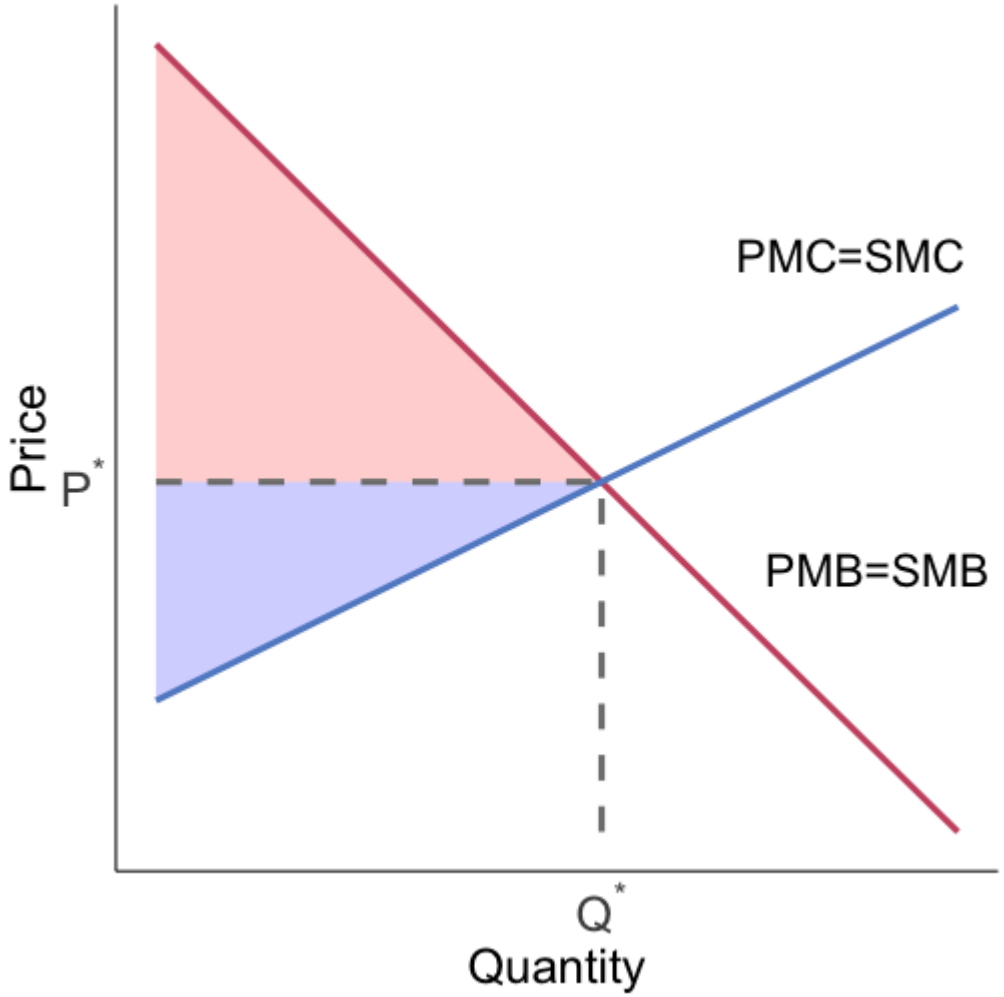
For bread, the private costs and benefits are very likely the social costs and benefits

Market equilibrium

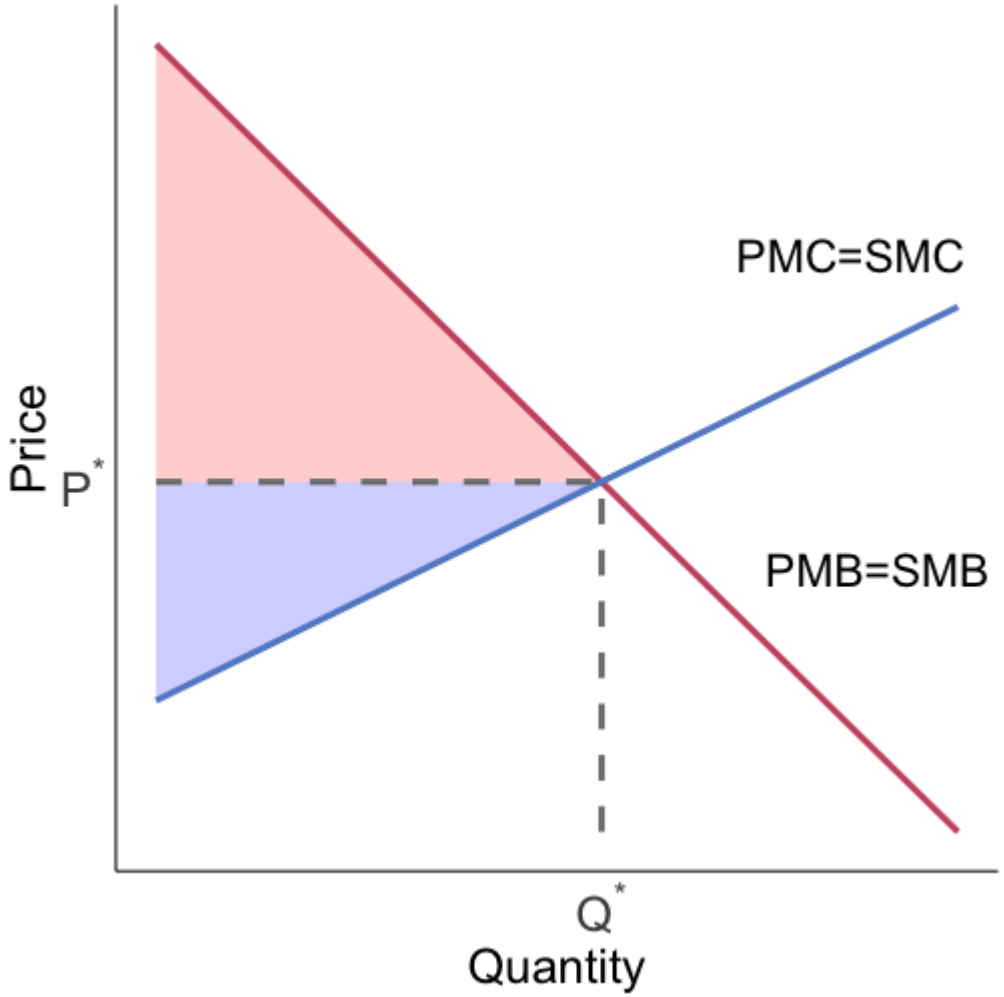


Consumer surplus is the difference between willingness to pay (demand) and price

Producer surplus is the difference between price and marginal cost (supply)

Total surplus is the sum of CS and PS

Market equilibrium



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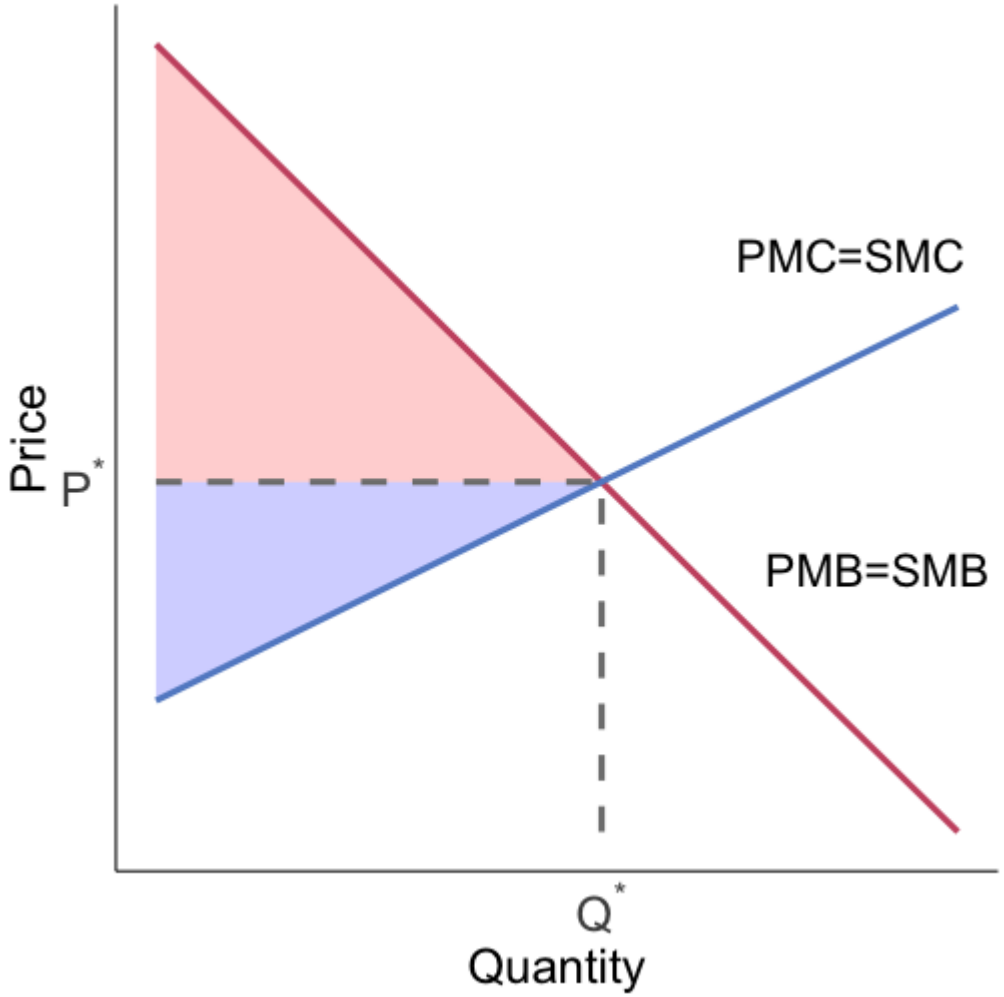
What does this mean about the market allocation?

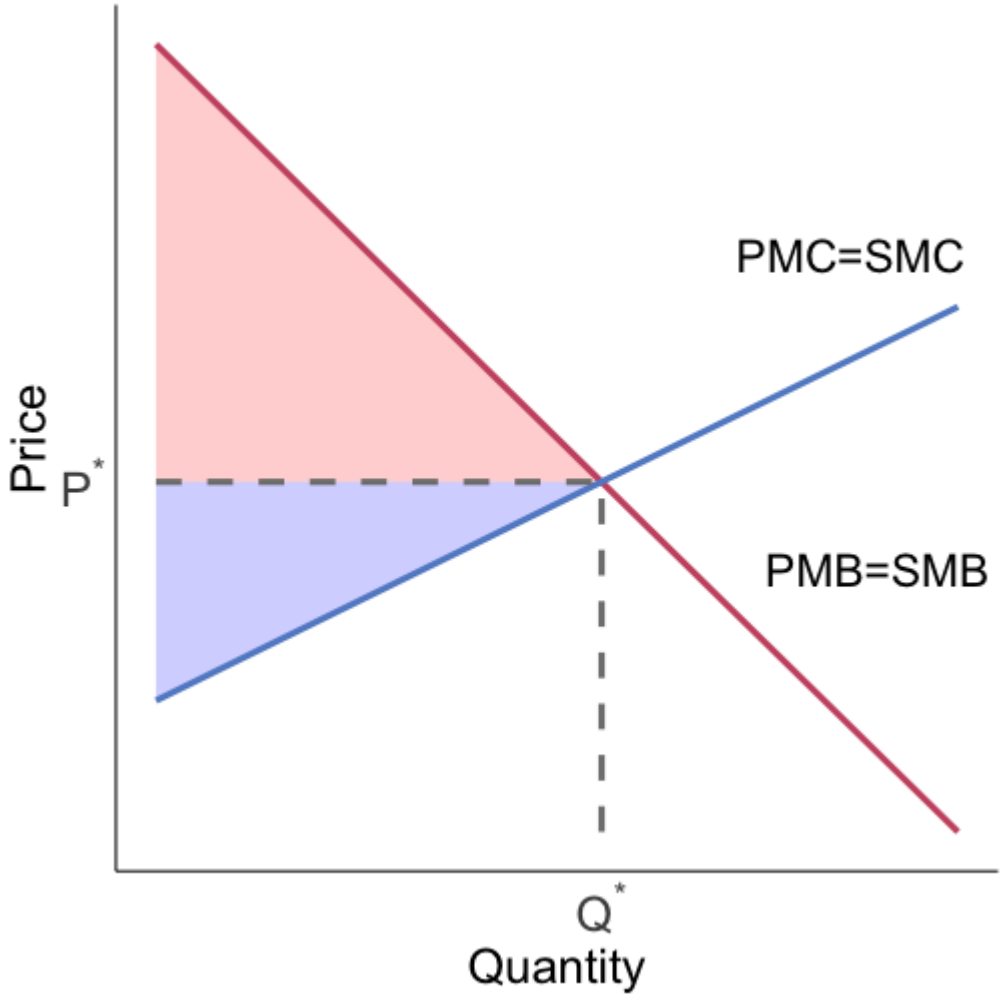
Market equilibrium



The market allocation is **efficient** because SMC = SMB

Why?

Market equilibrium



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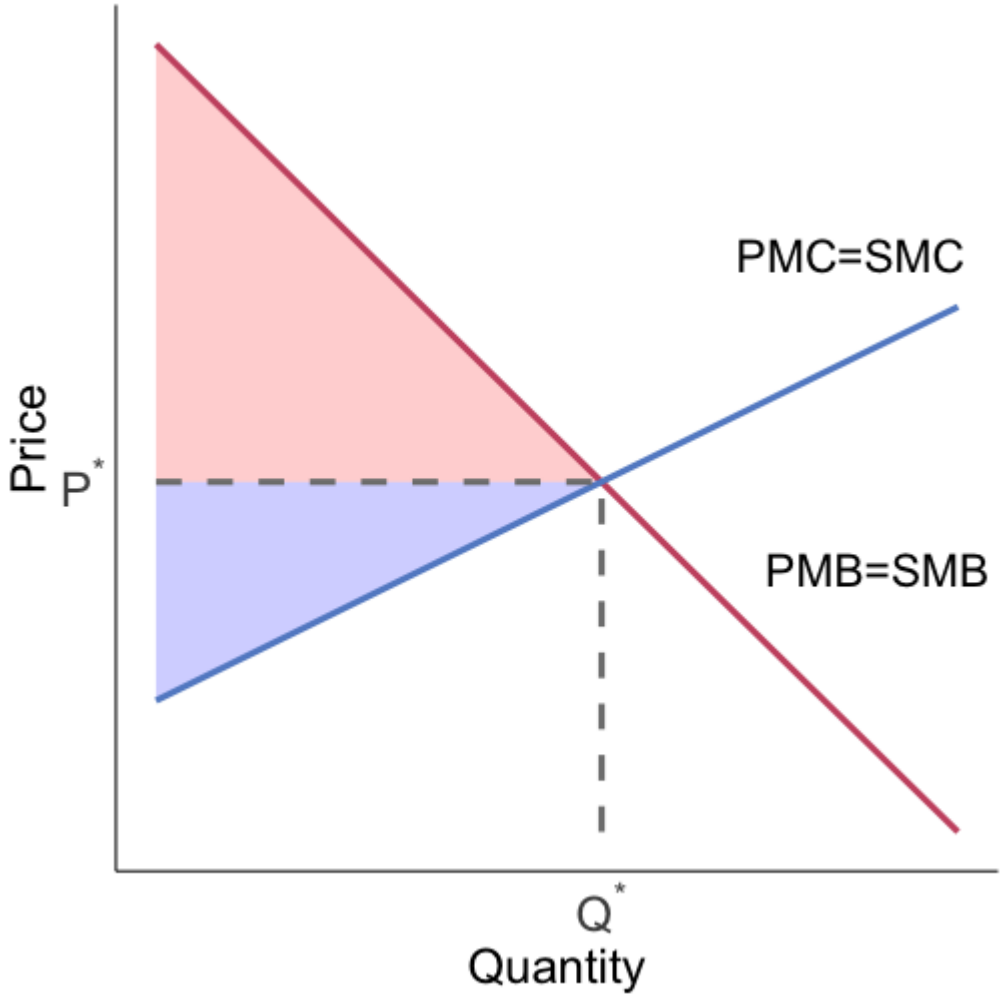
Why?

Consider deviating from (P^*, Q^*)

Market equilibrium



Cost of next unit after Q^* > benefit

Benefit of last unit $\geq$ cost of last unit before Q^*

Competitive market allocations are efficient for private goods

Externalities

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In the real world we have **externalities**

> An externality exists whenever an individual or firm undertakes an action that impacts another individual or firm in an unintended way for which the latter is not compensated (a negative externality), or for which the latter does not pay (a positive externality)

Externalities

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The central problem is that there are goods that are **not priced**, why is this a problem?

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- Cleaner air outside
- Biodiversity in the Amazon

The central problem is that there are goods that are **not priced**, why is this a problem?

Markets rely on prices to signal the social value of goods

No markets lead to issues in the Southwest

Externalities: several classifications

We can classify externalities in a few ways:

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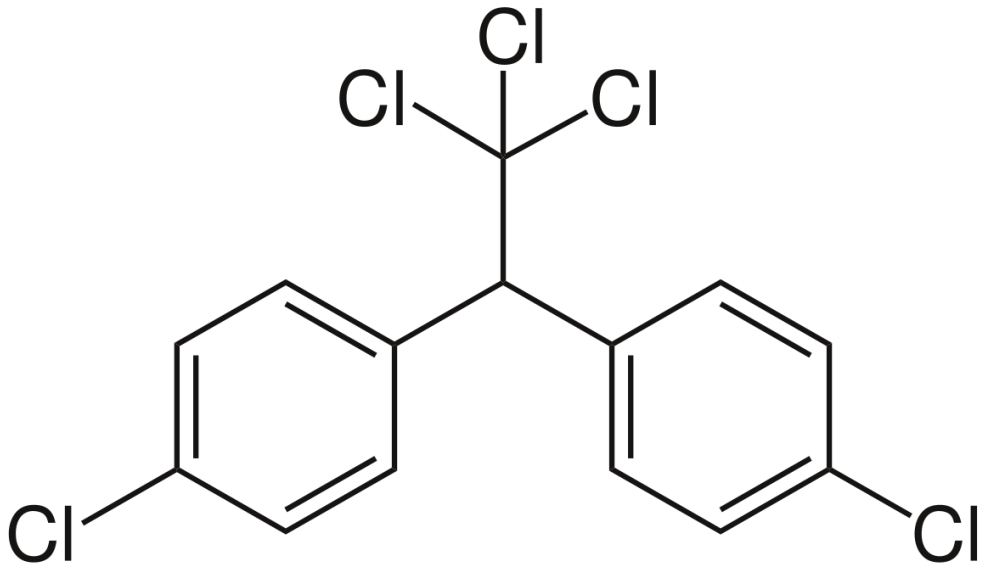
Negative externalities: imposes external **costs** (e.g. pollution)

Positive externalities: imposes external **benefits** (e.g. vaccination)

Negative externalities: what is this?

Negative externalities: DDT, shockingly bad for you

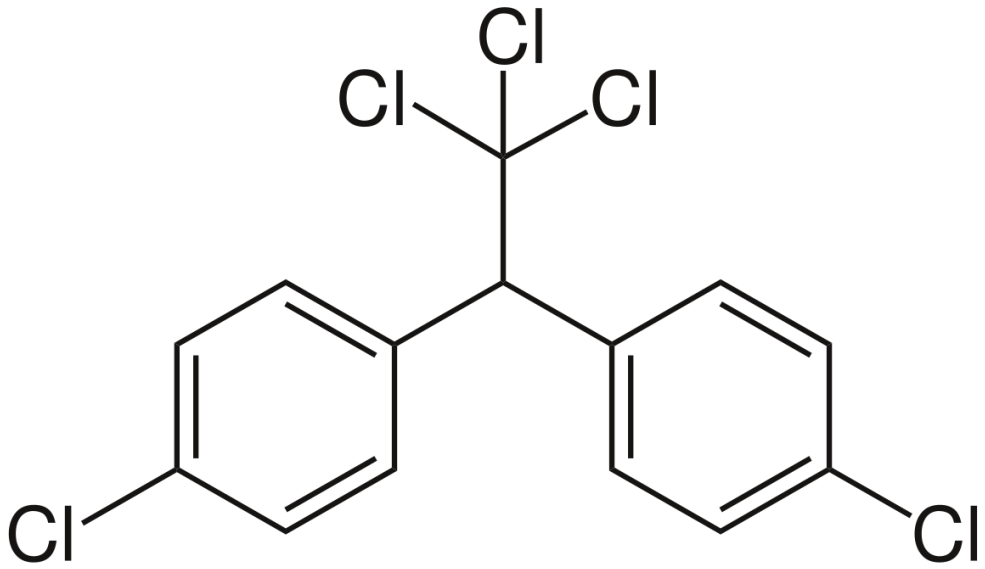


DDT is a chemical that was was widely used as an insecticide in the early-mid 1900s

Widely used to eradicate Typhus and Malaria

Used to treat lice

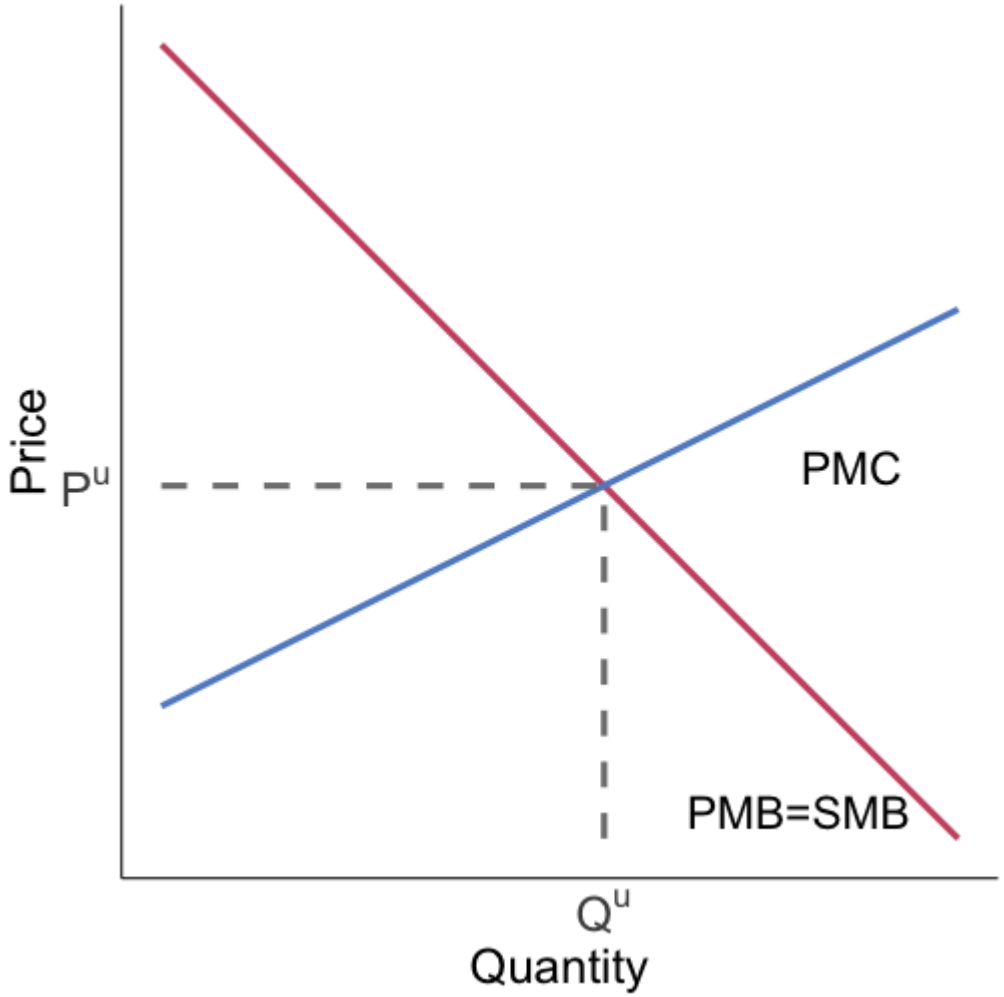
Negative externalities: DDT, gives you cancer



A relationship between DDT exposure and reproductive effects in humans is suspected, based on studies in animals. In addition, some animals exposed to DDT in studies developed liver tumors. As a result, today, DDT is classified as a probable human carcinogen.

The birth of the environmental movement

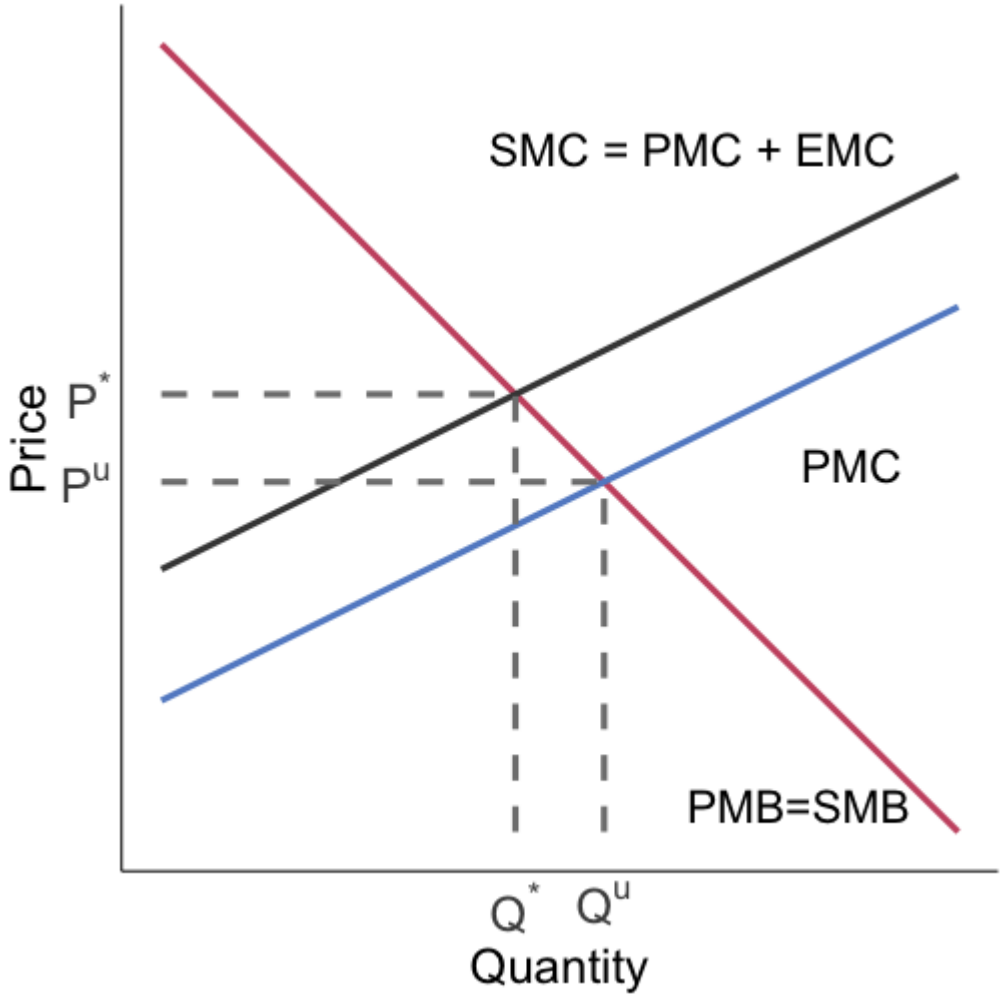
Negative externalities: graphical



Social marginal cost (SMC) is the sum of private marginal cost (PMC) and the external marginal cost (EMC)

Where is the SMC?

Negative externalities: graphical



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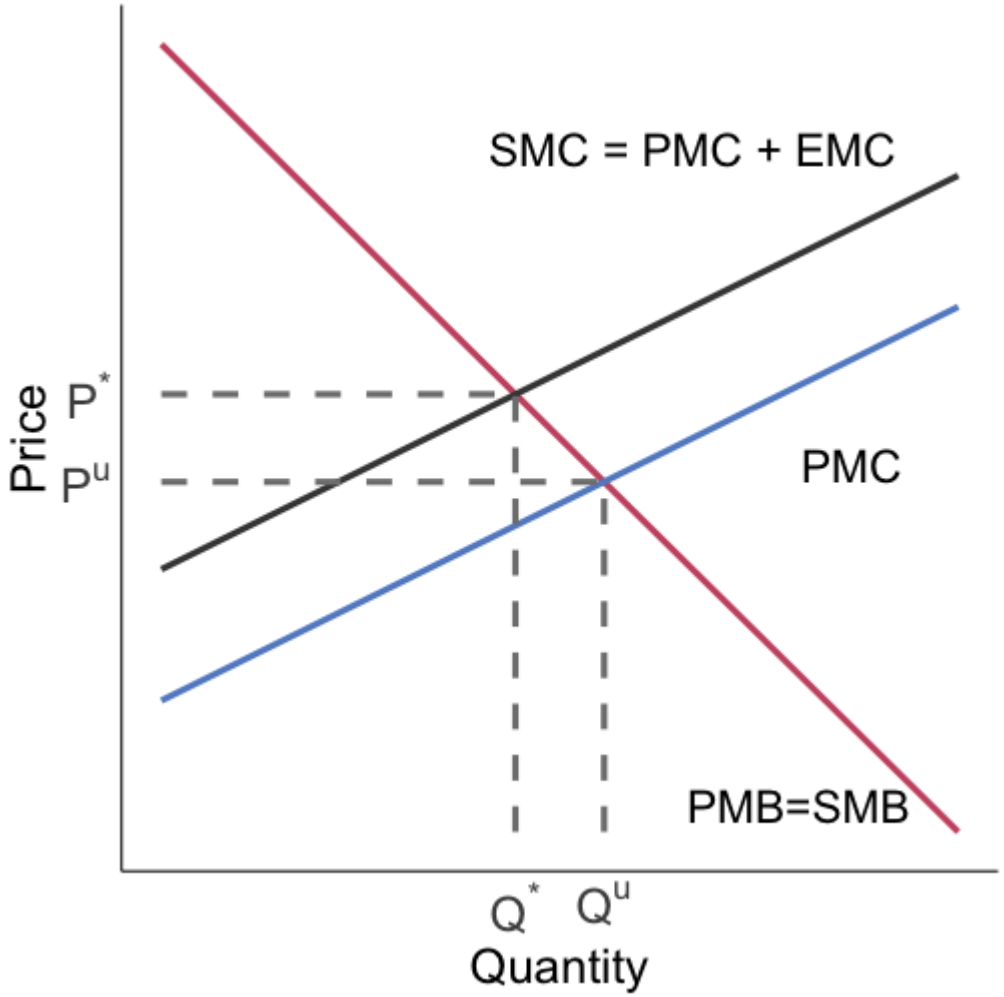
The PMC curve only reflects the **private costs** of making the DDT

It does not account for the external health and wildlife costs

Negative externalities: graphical



Adding the private and external marginal costs together gives us the SMC, what we care about from the social planner or regulator's perspective

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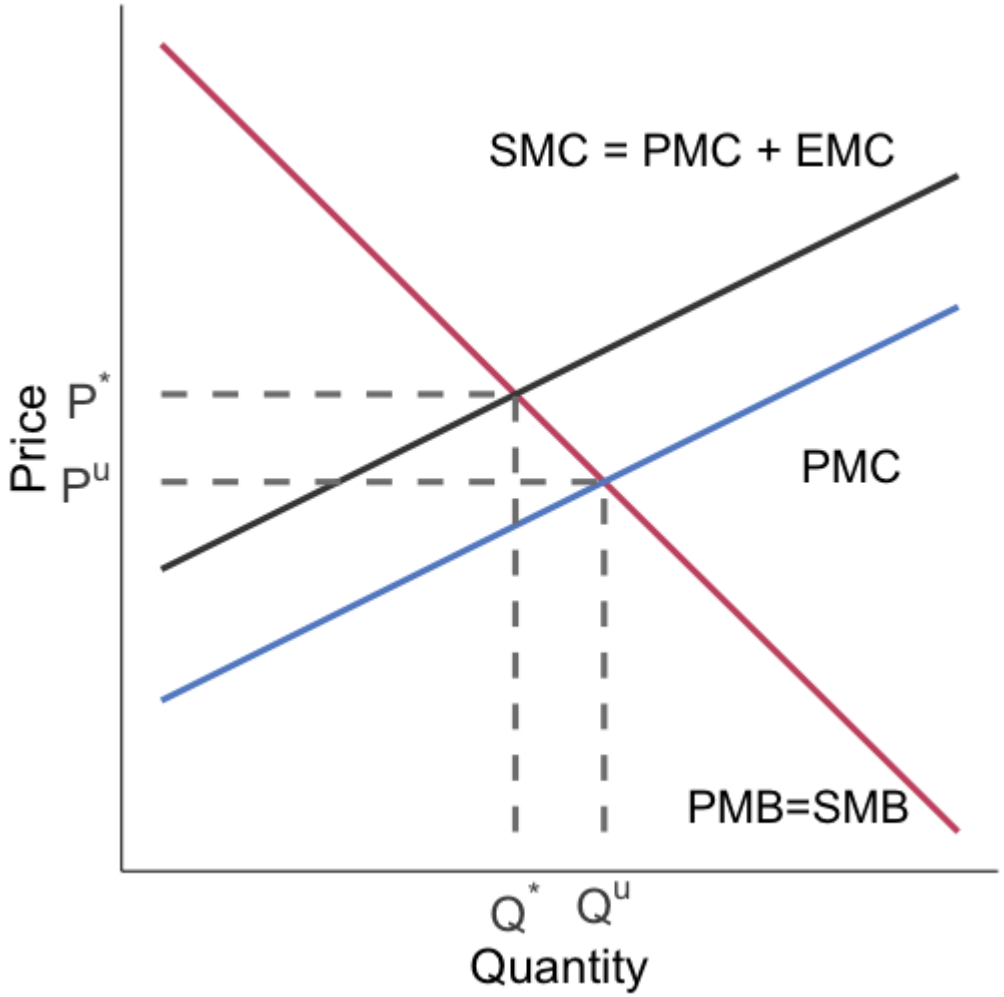

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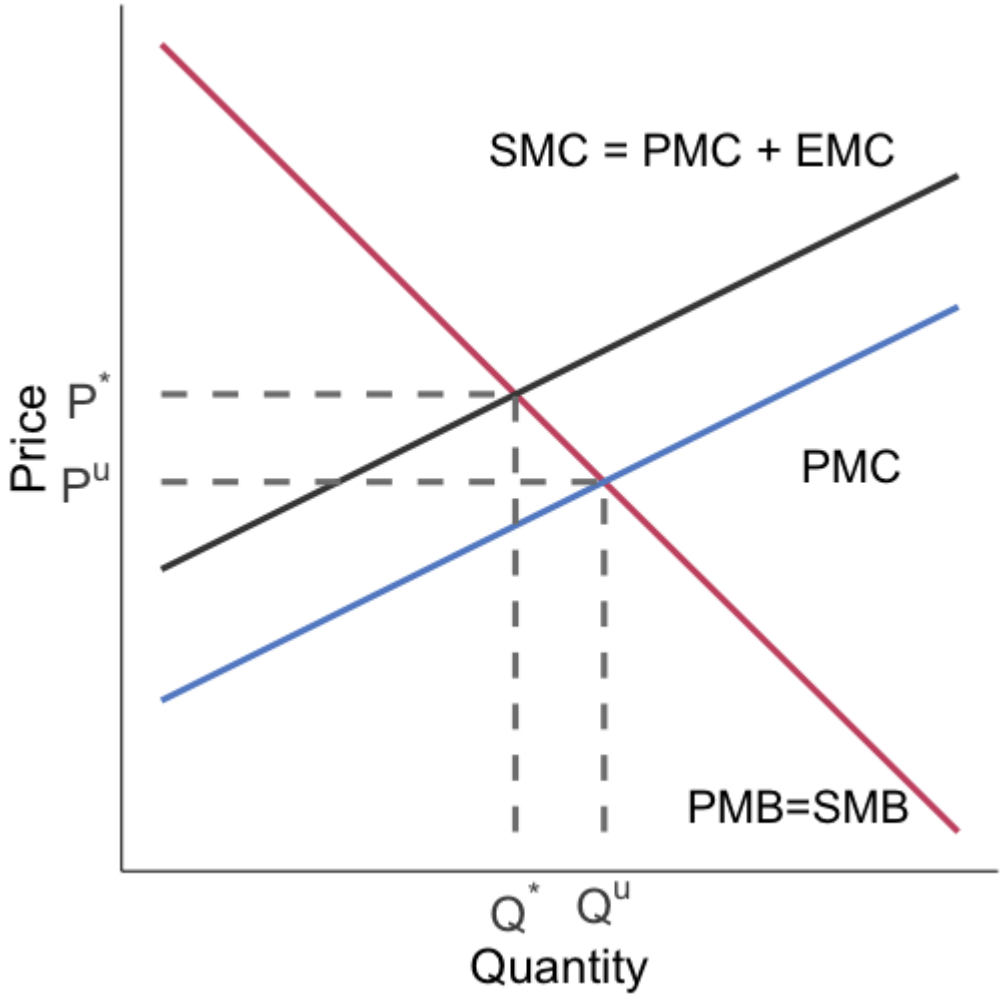

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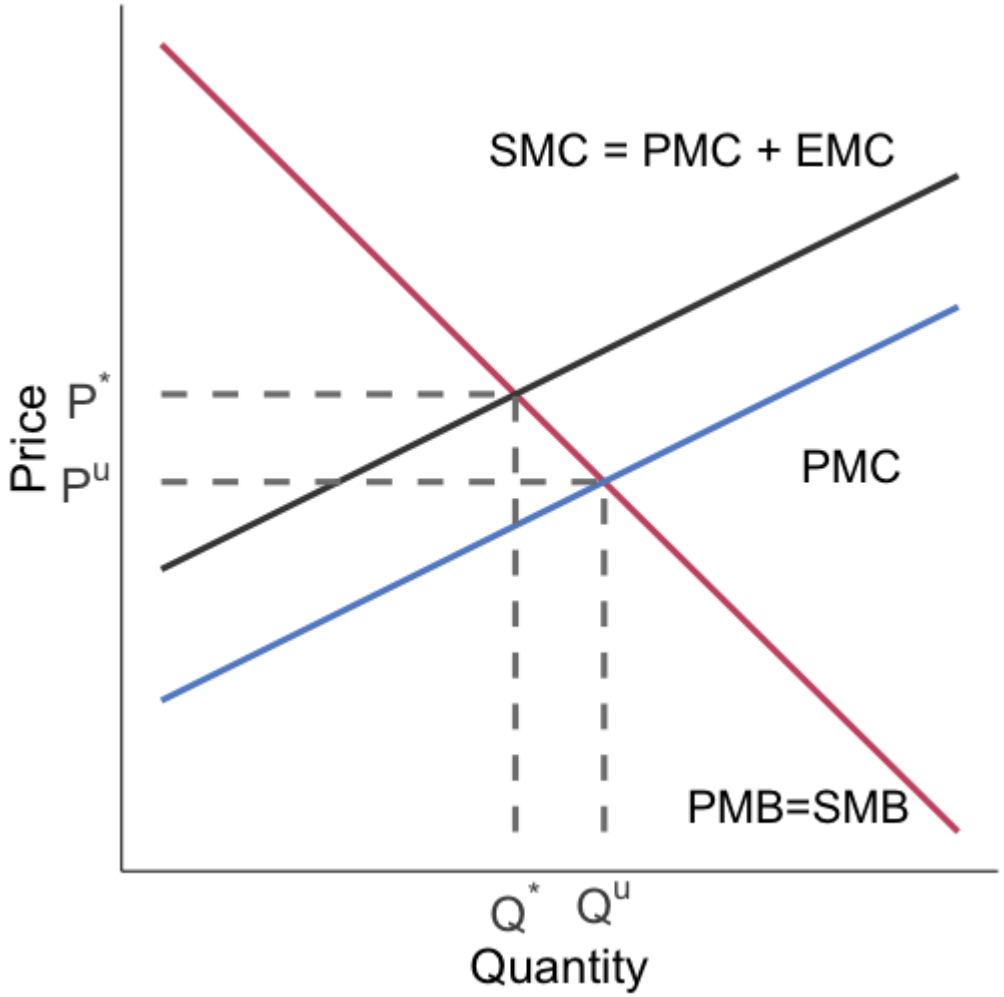
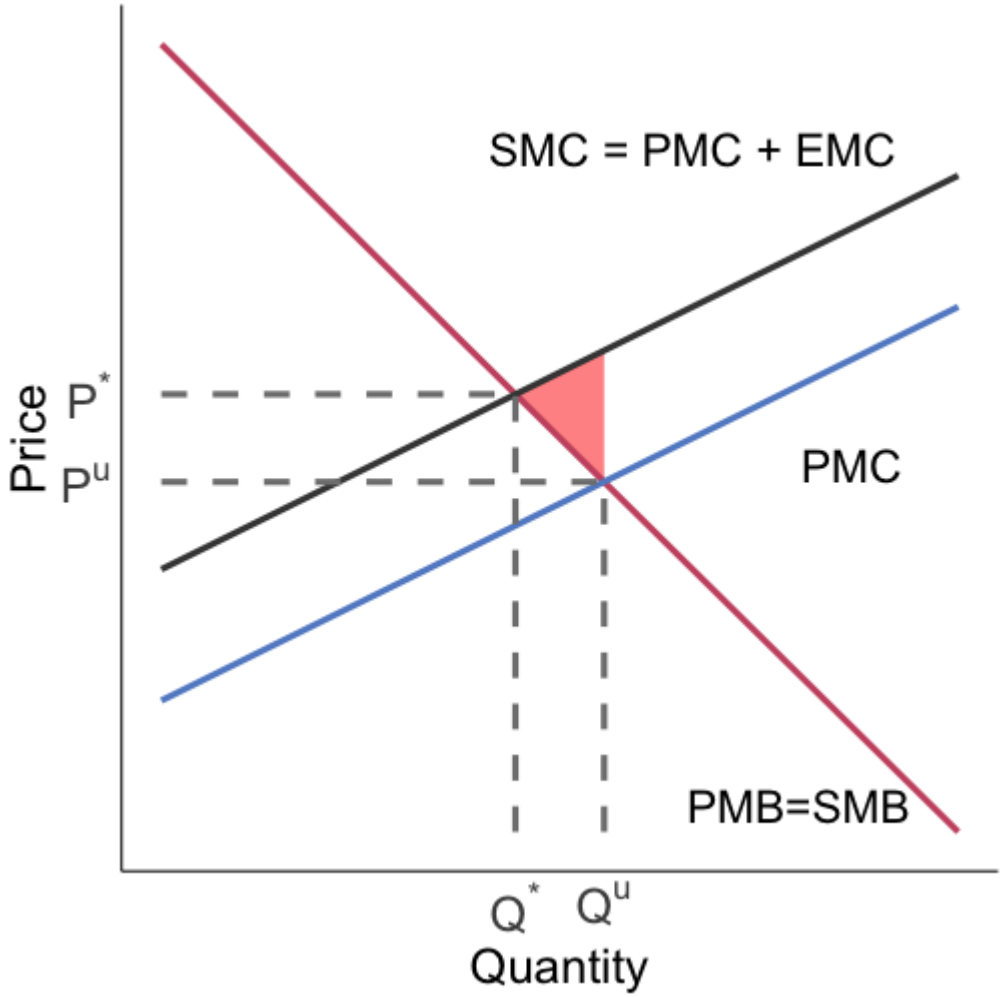


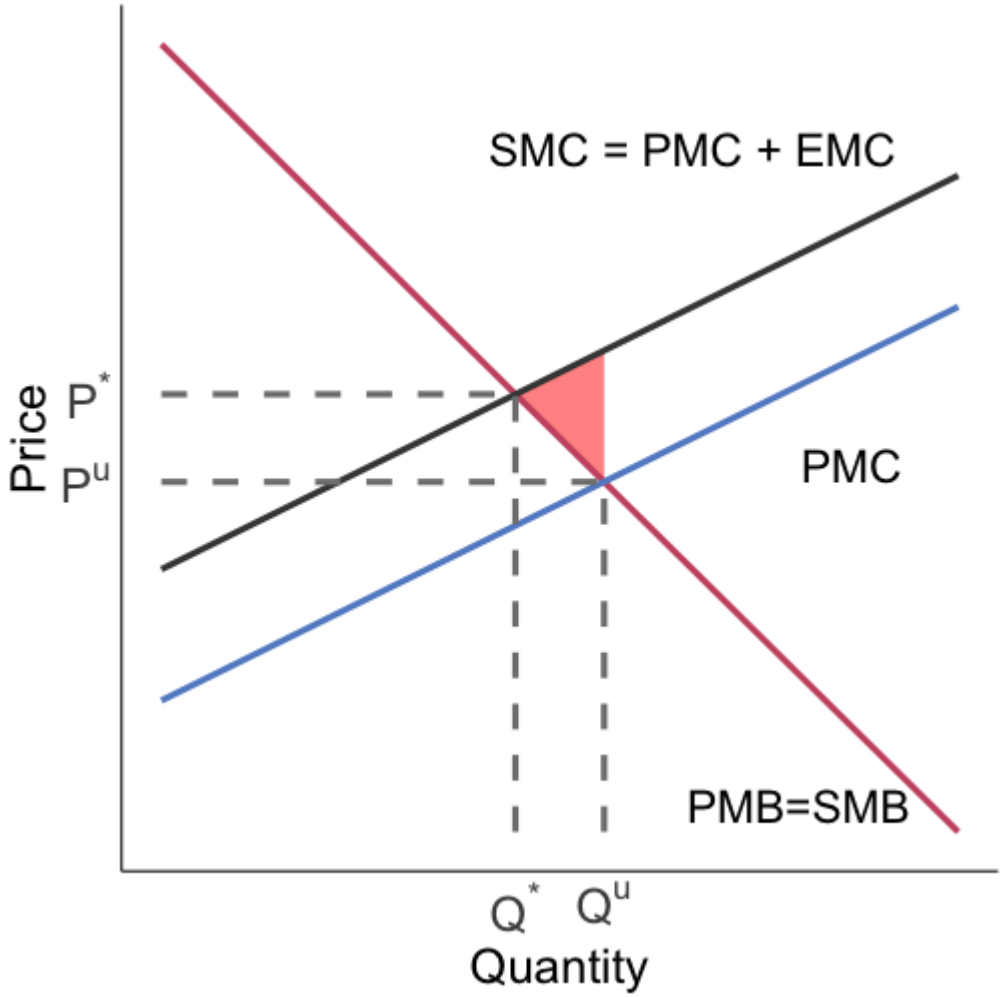
Negative externalities generate deadweight loss equal to...

Negative externalities: graphical



Negative externalities generate deadweight loss equal to the **red** area

Negative externalities: graphical



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This is the difference in SMC and SMB for units bought/sold where SMC > SMB:

Total SMC - SMB from Q^* to Q^u

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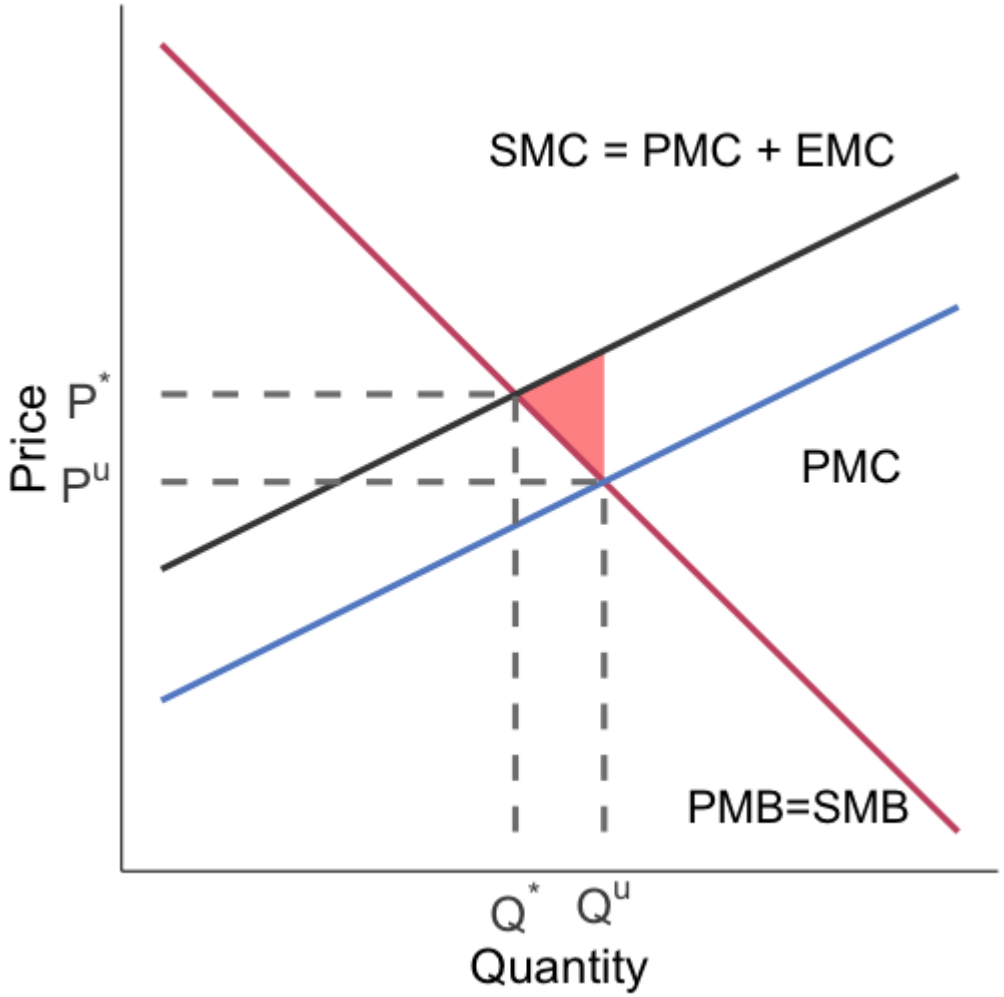

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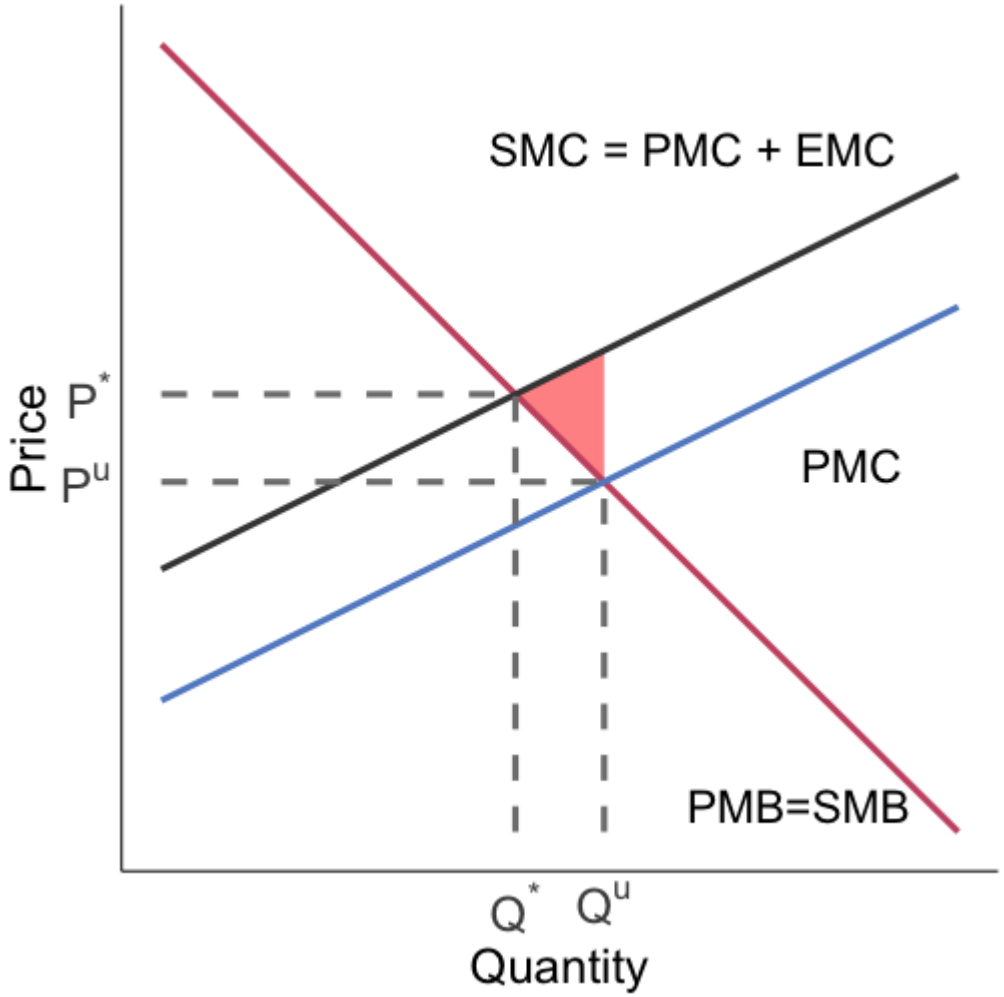

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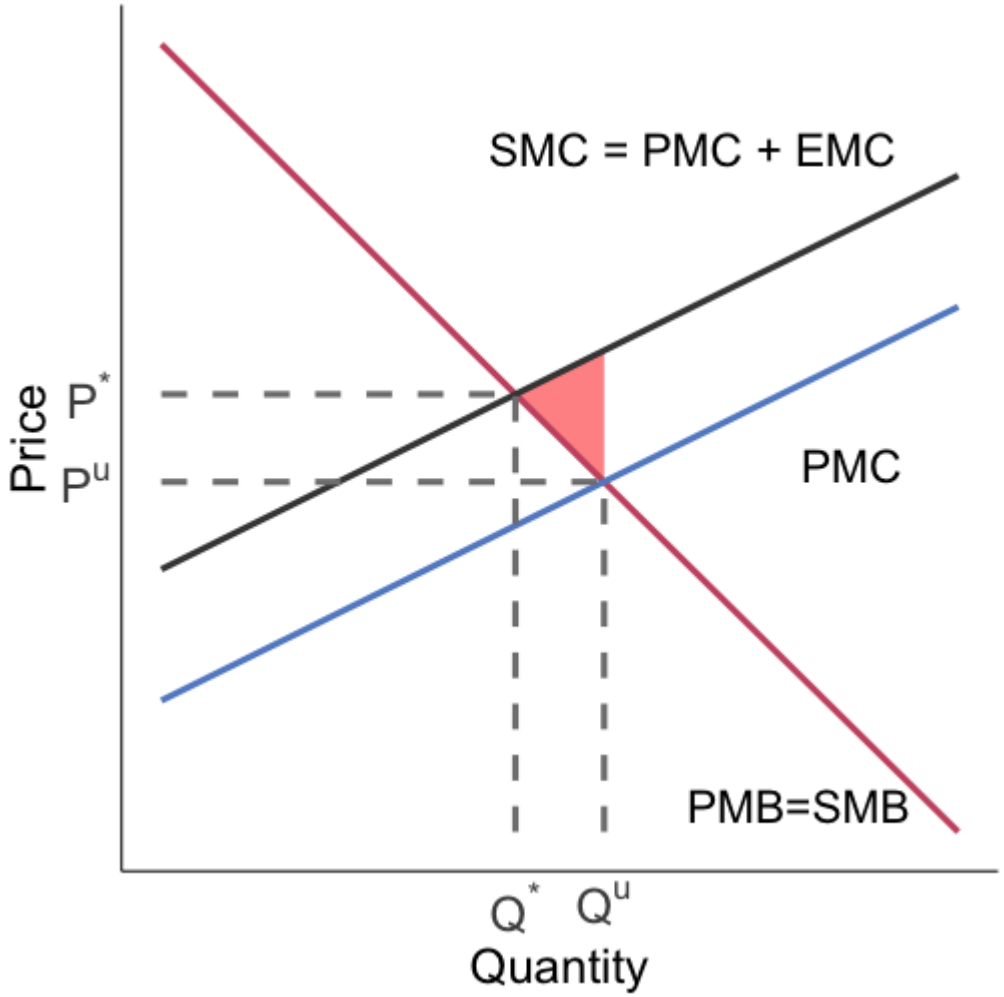

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The private market produces too much DDT

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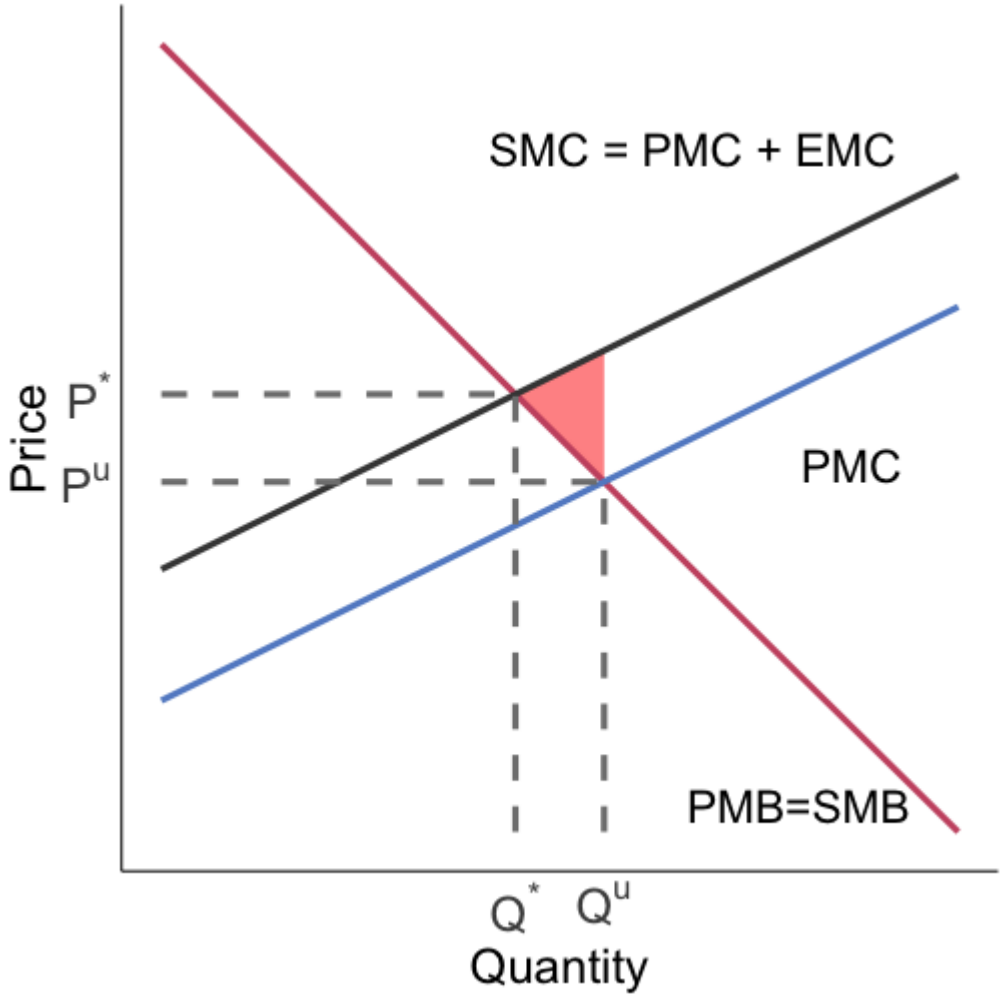

Key takeaway:

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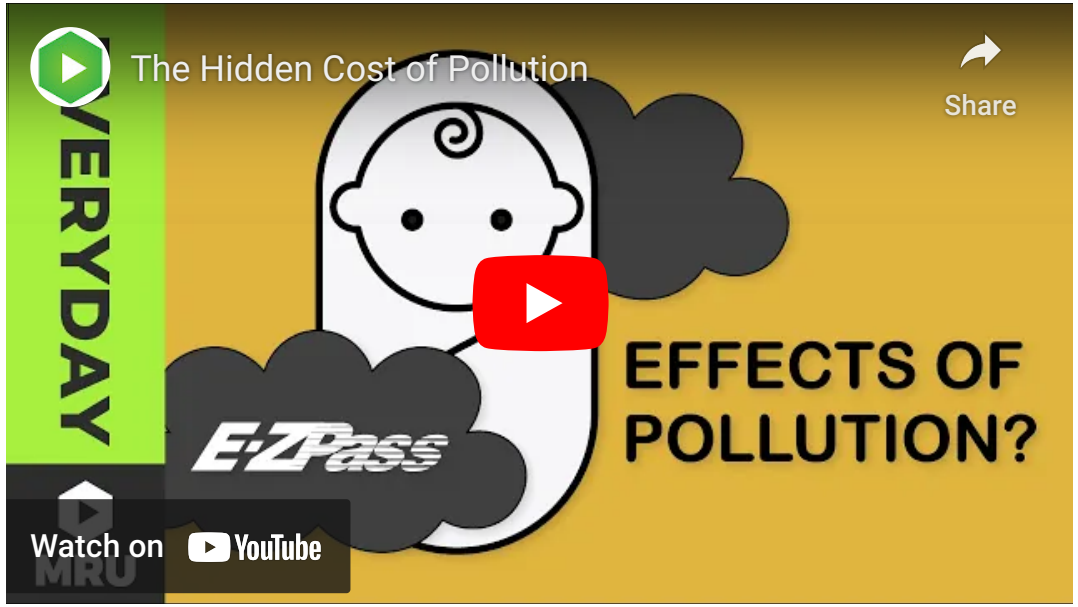
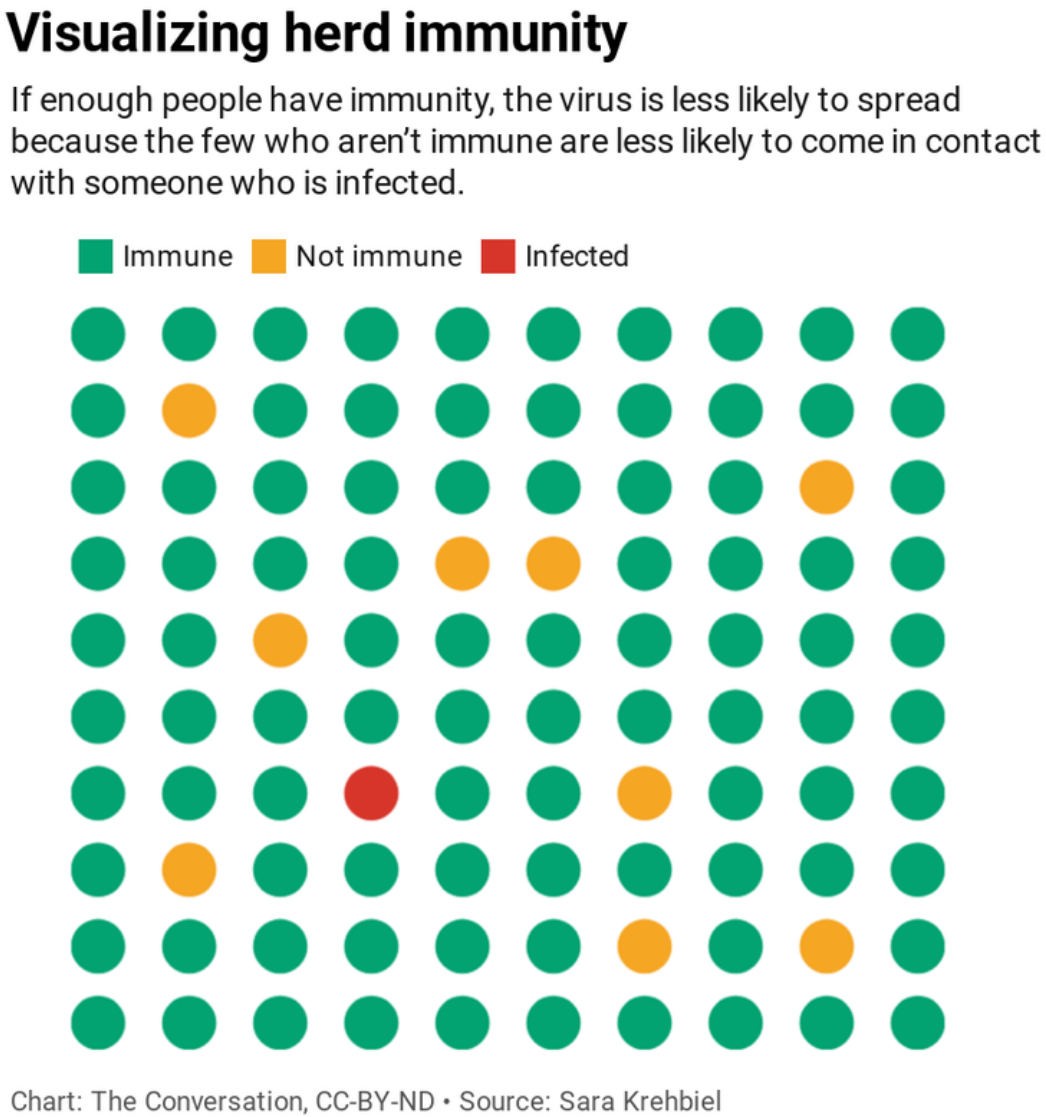
The private actors are not accounting for the **external costs** they are imposing on people who are not in the DDT transaction (e.g. third parties whose health is being affected)

Estimating marginal damages with EZ-Pass



Positive externalities

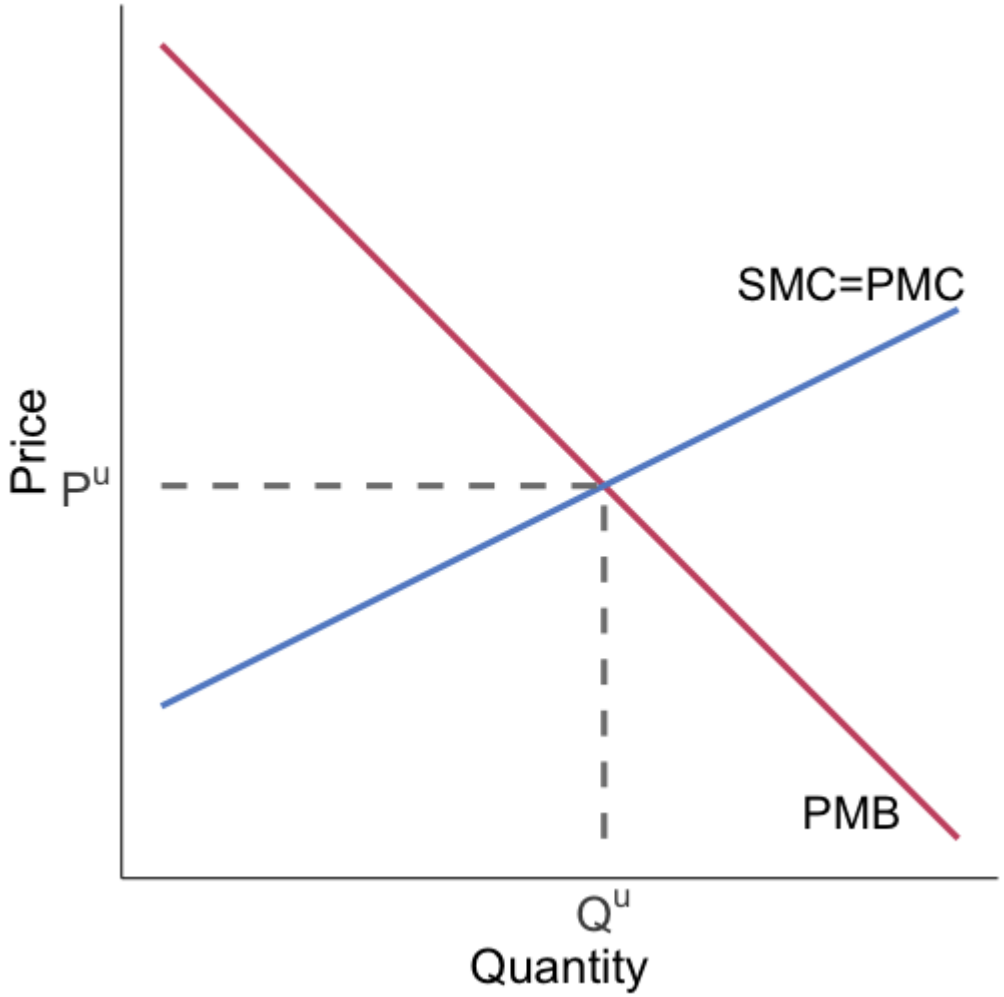


Positive externalities

Vaccines and masks are examples of good with positive externalities

You getting or using them has benefits for other people not involved in your vaccine or mask transaction

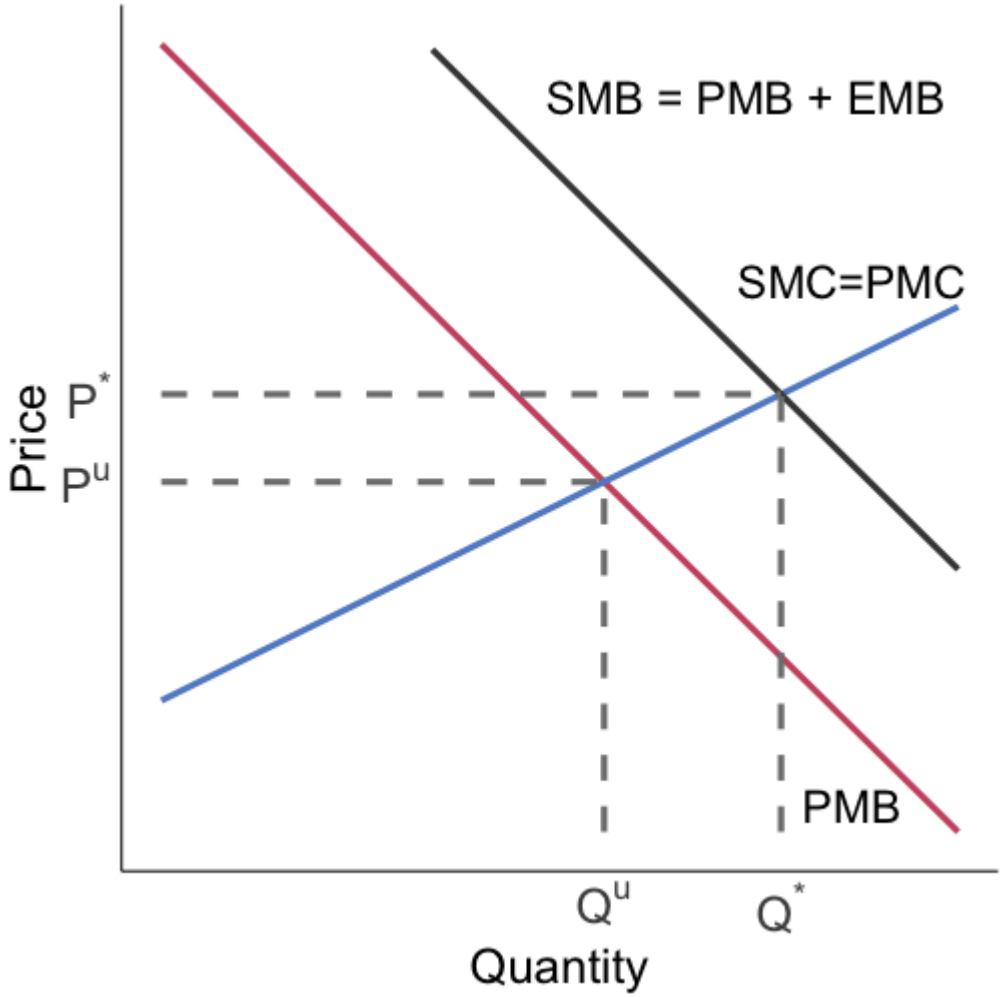
Positive externalities: graphical



Social marginal benefit (SMB) is the sum of private marginal benefit (PMB) and the external marginal benefit (EMB)

Where does the SMB curve lie?

Positive externalities: graphical



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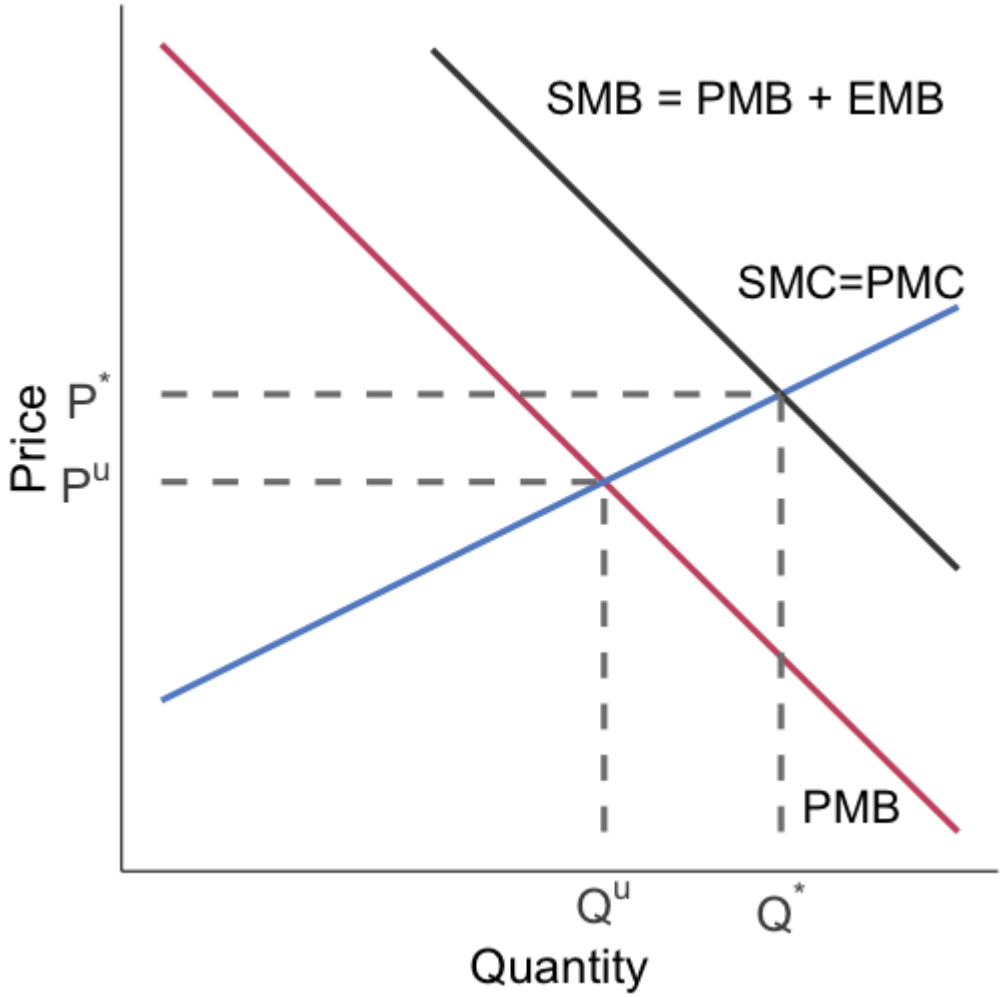

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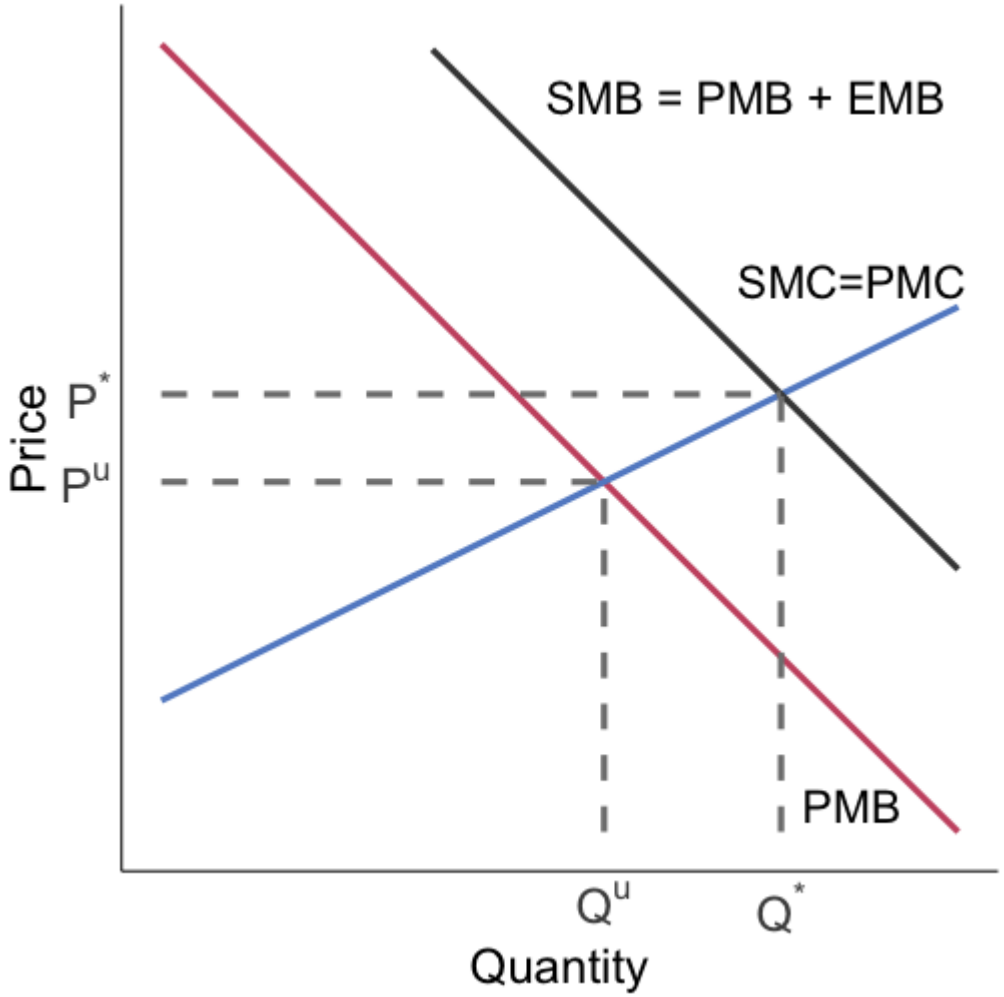

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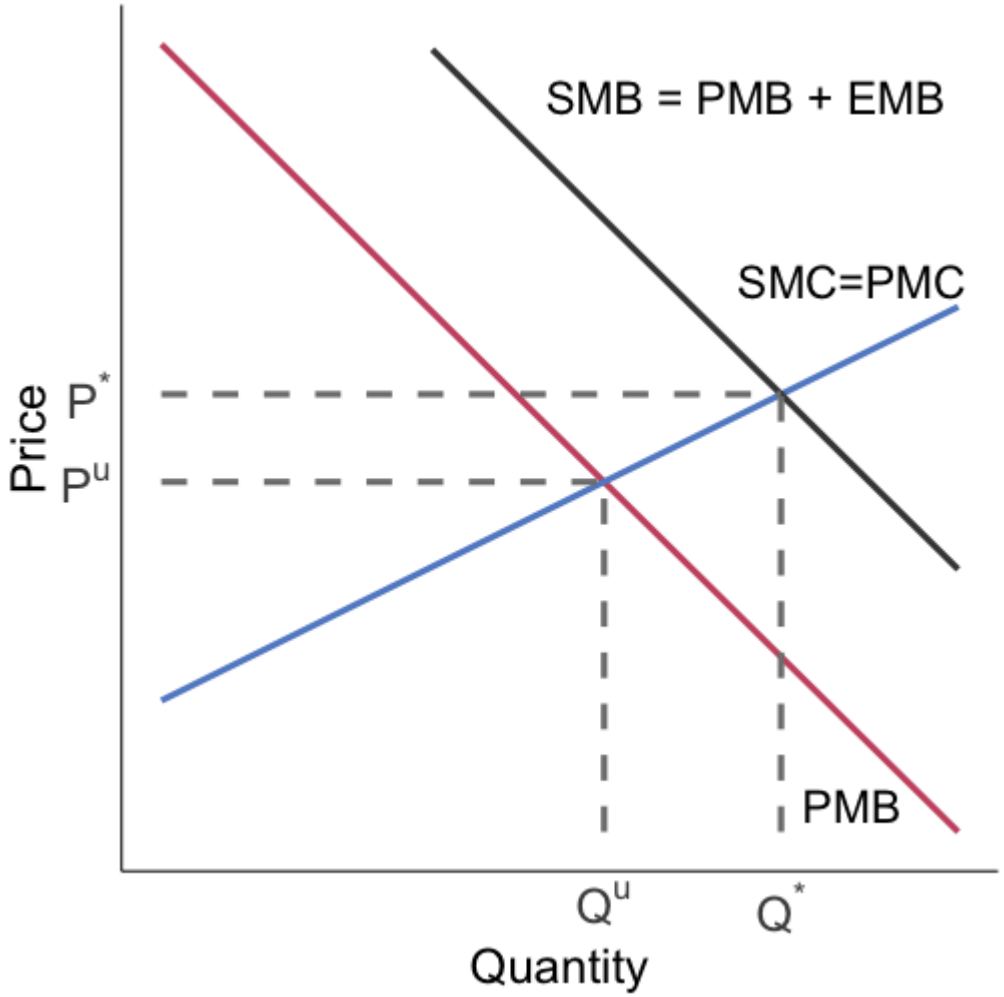

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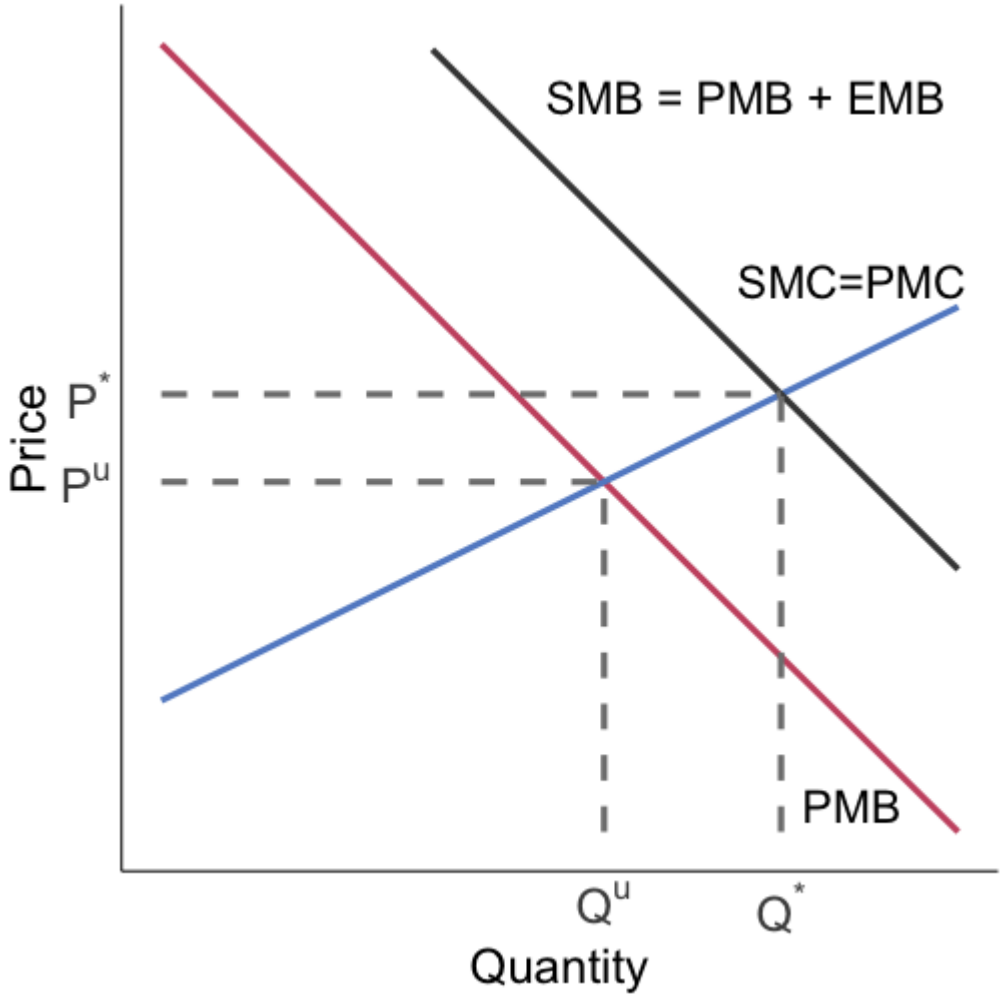

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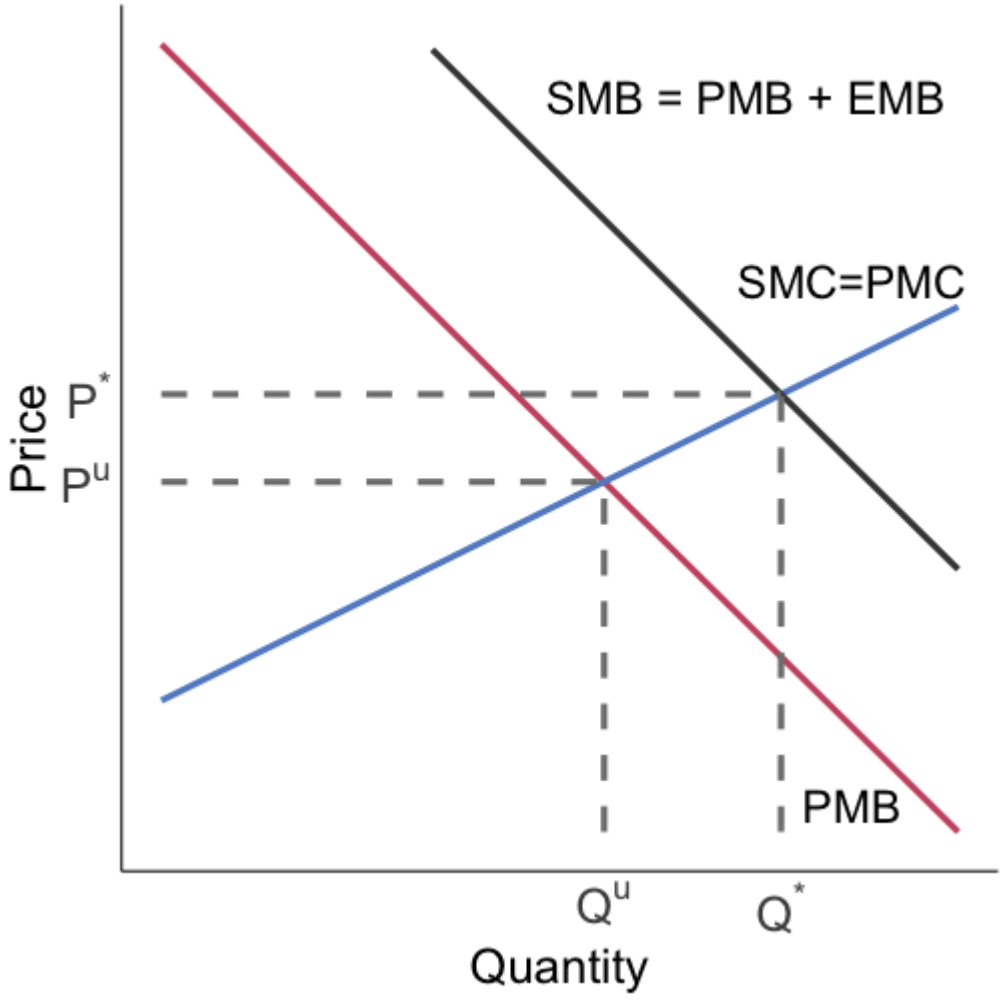

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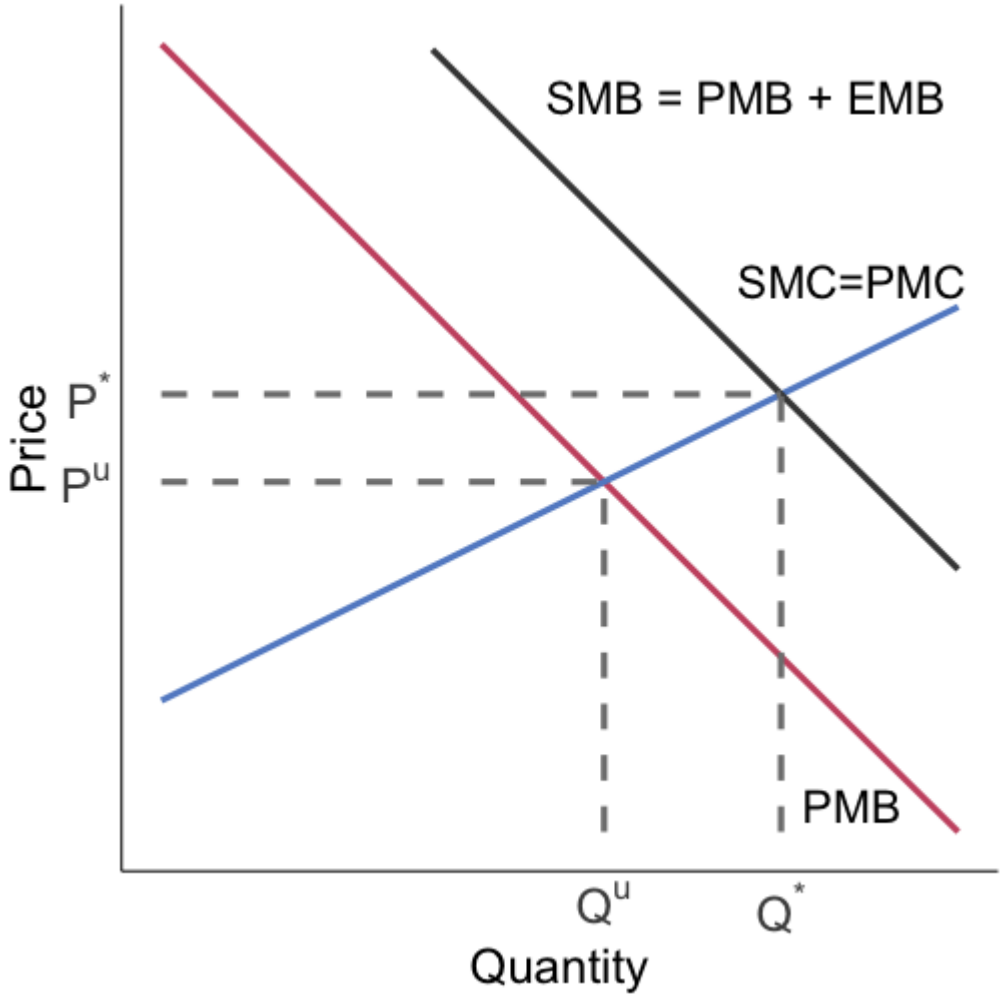

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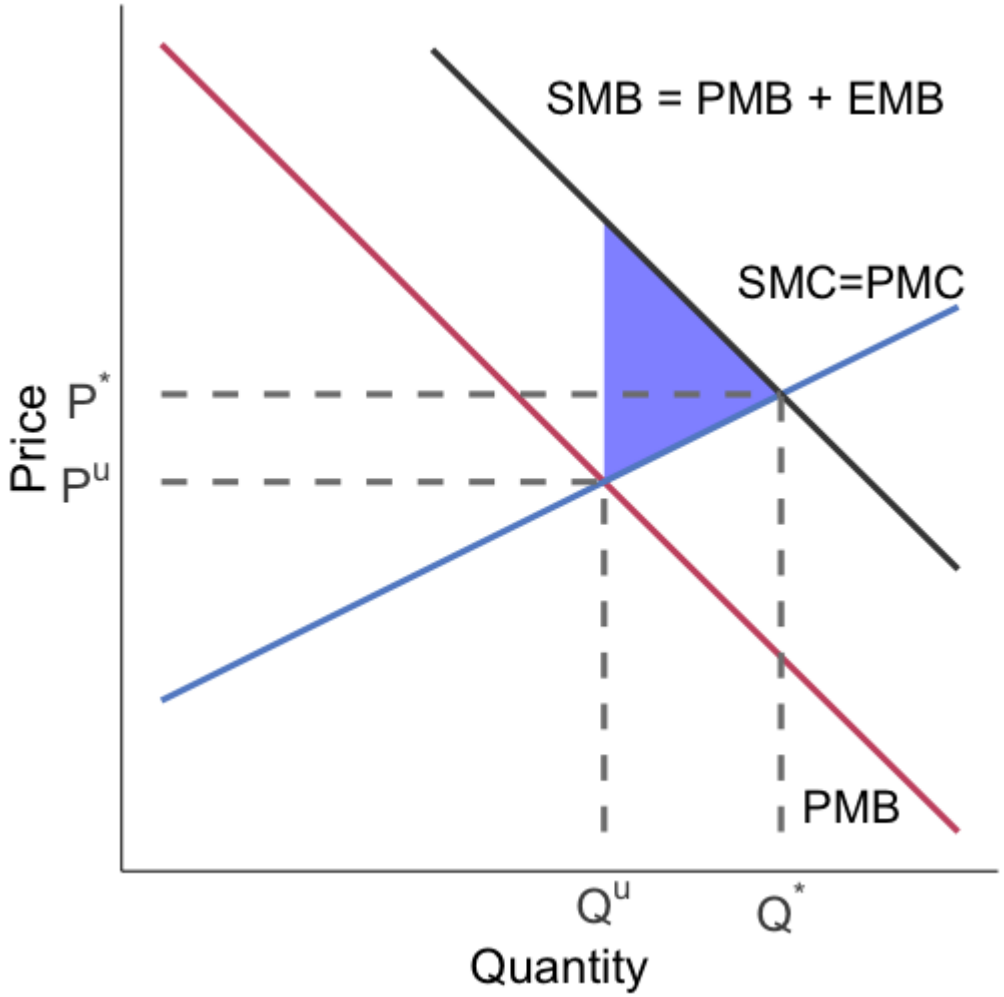

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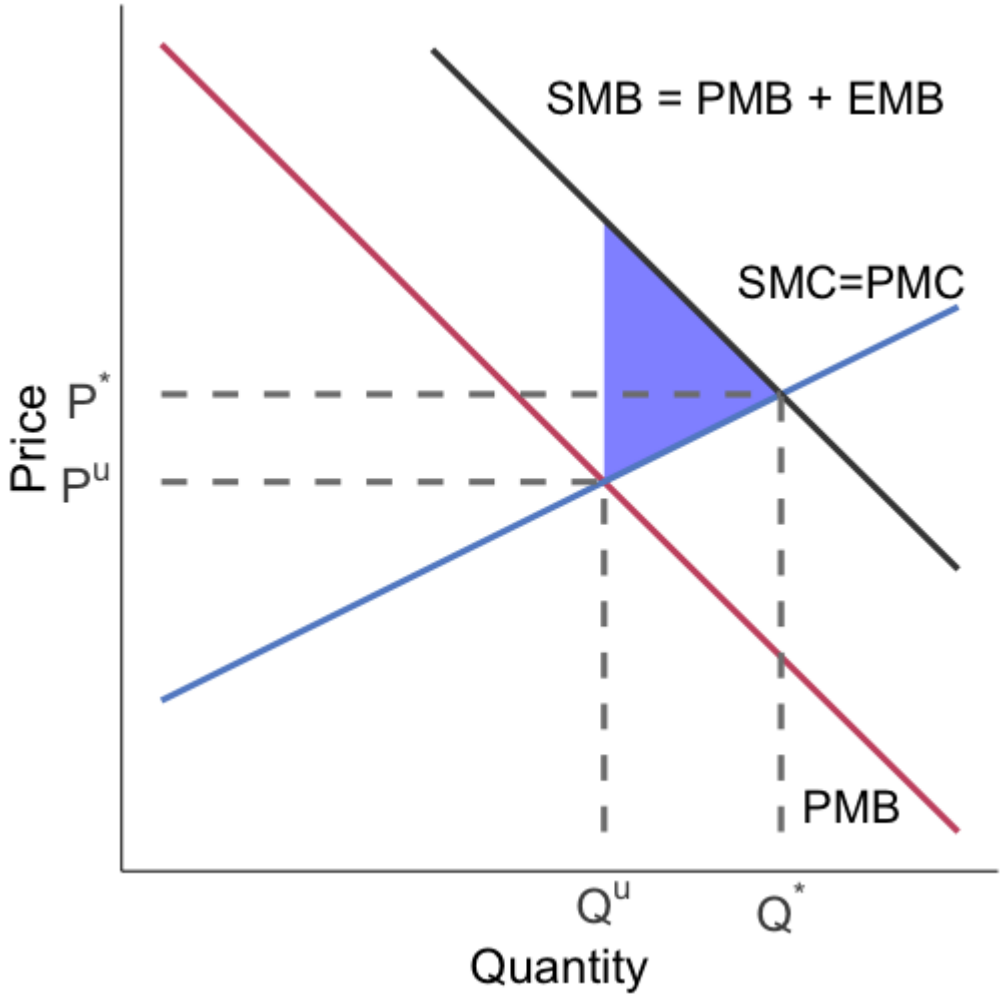

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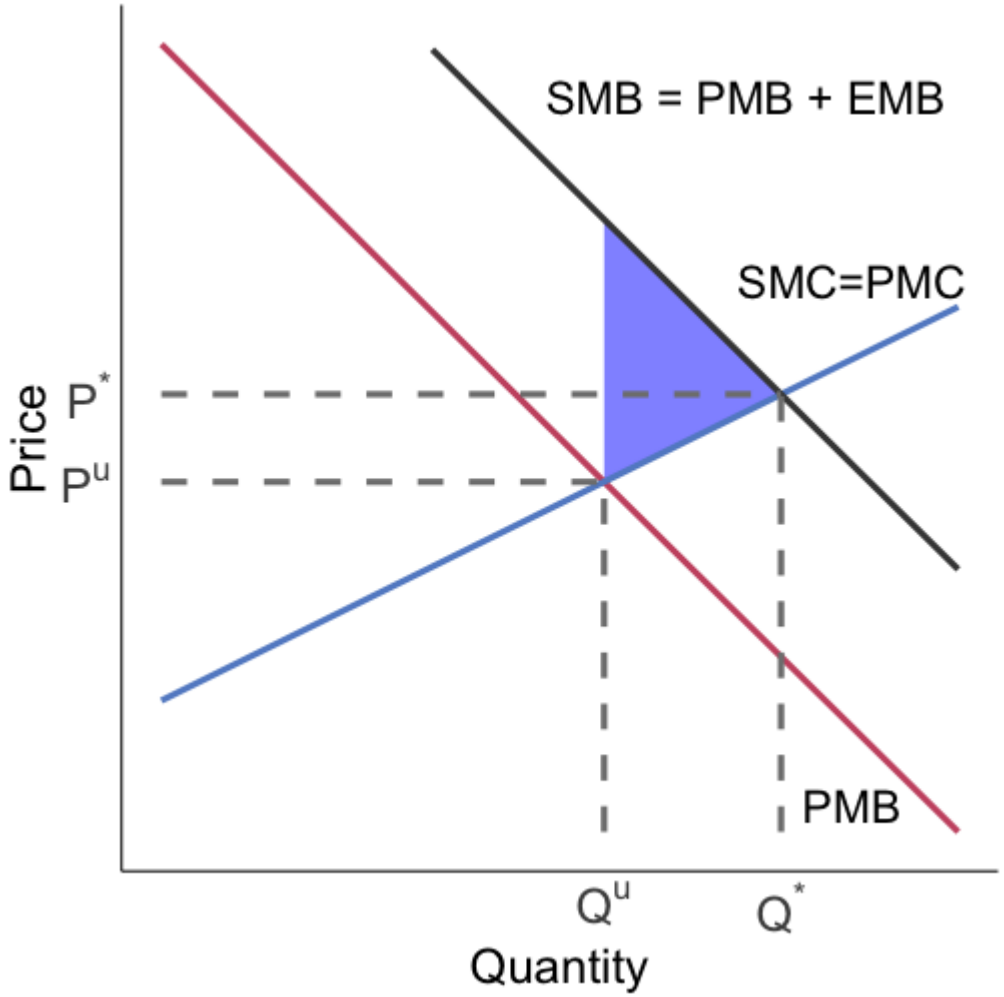

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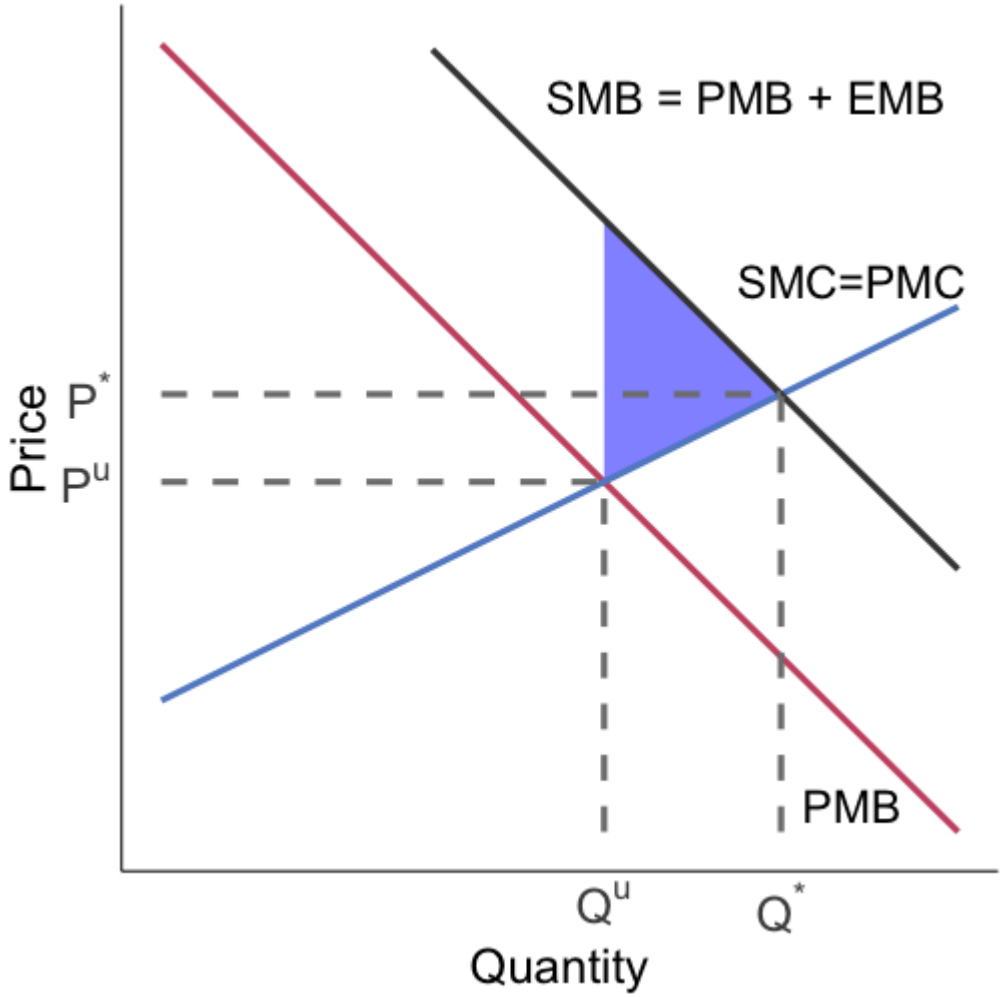

The private market produces too few vaccines

The private actors are not accounting for the social benefits they are imposing on people who are not in the vaccine transaction (e.g. third parties whose health is being affected)

COVID and positive externalities

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Why do externalities arise?

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    - Who owns the right to the air?

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1. Poorly defined property rights
    - Who owns the right to the air?
2. High transactions costs
    - Hard to bargain over desired air quality with millions of people

Lets conceptualize a model of efficient bargaining using an Edgeworth Box

Why do externalities arise? Edgeworth Box

- Two individuals: A and B
- Two private goods: X and Y

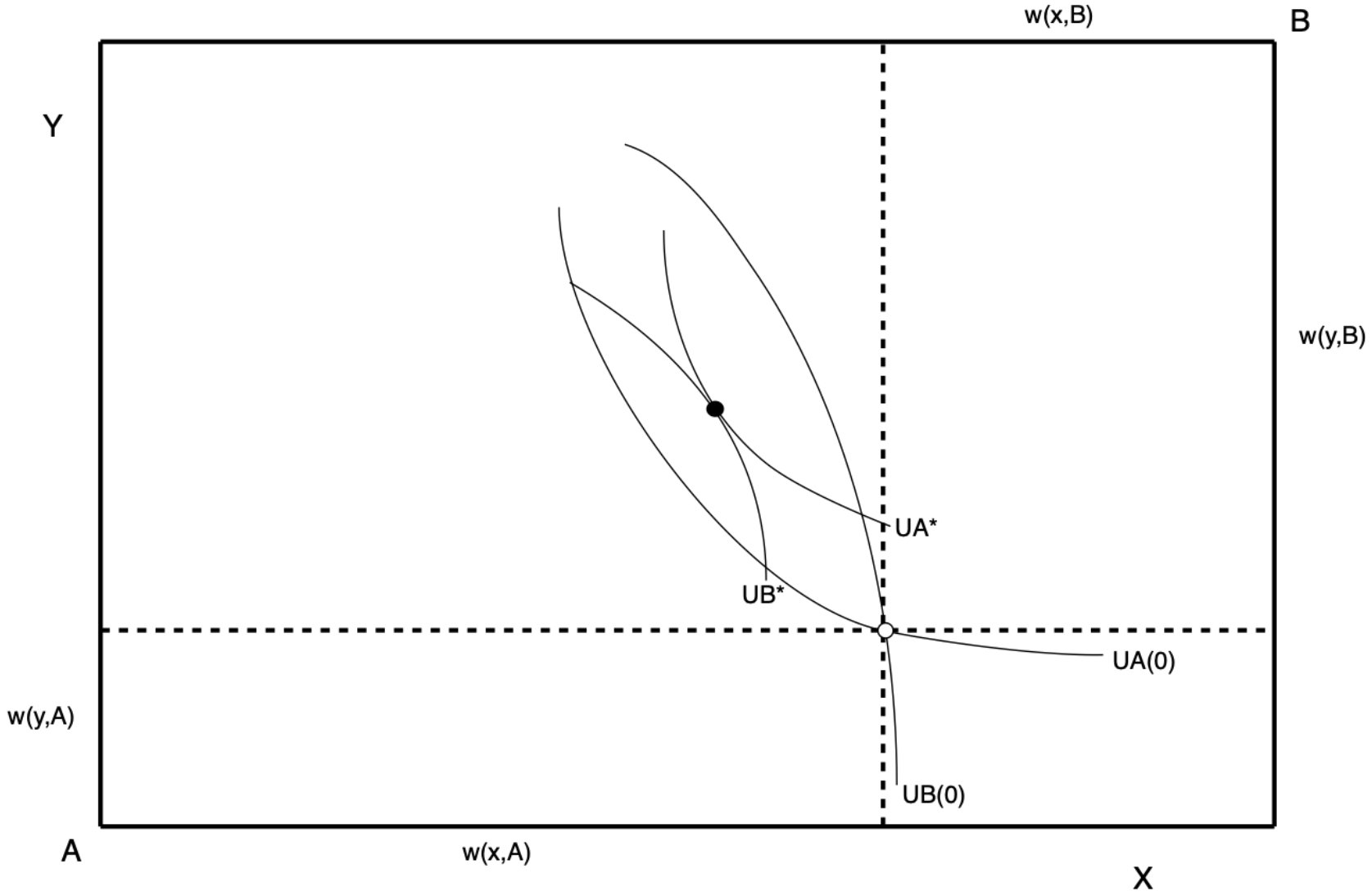
Each individual begins with an initial endowment of each good:

- $A : w_X^A, w_Y^A$
- $B : w_X^B, w_Y^B$

This gives us a total endowment:

- $W_X = w_X^A + w_X^B$
- $W_Y = w_Y^A + w_Y^B$

Why do externalities arise? Edgeworth Box



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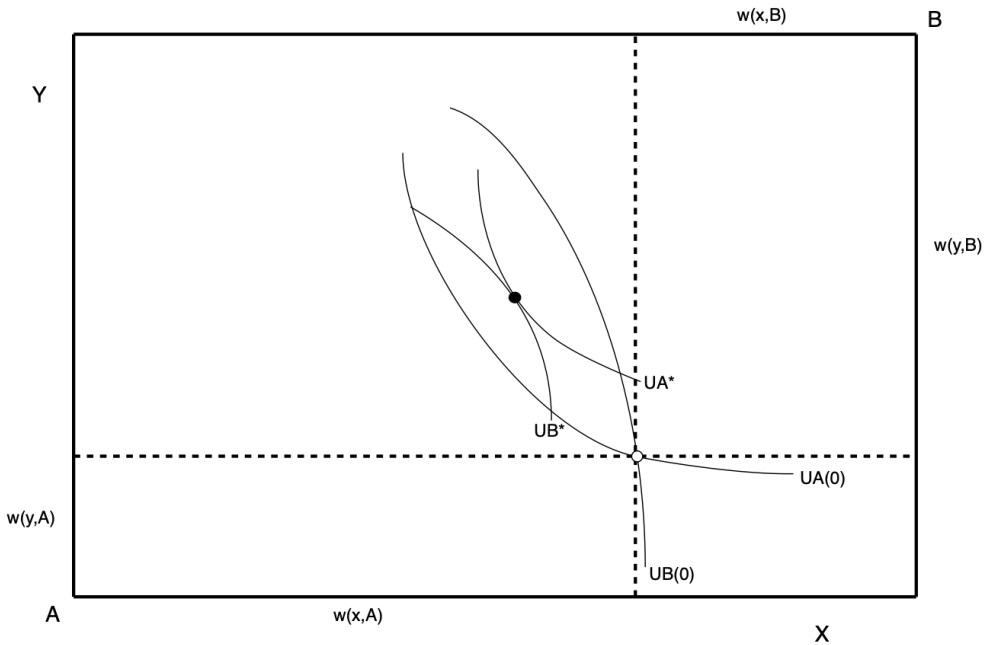


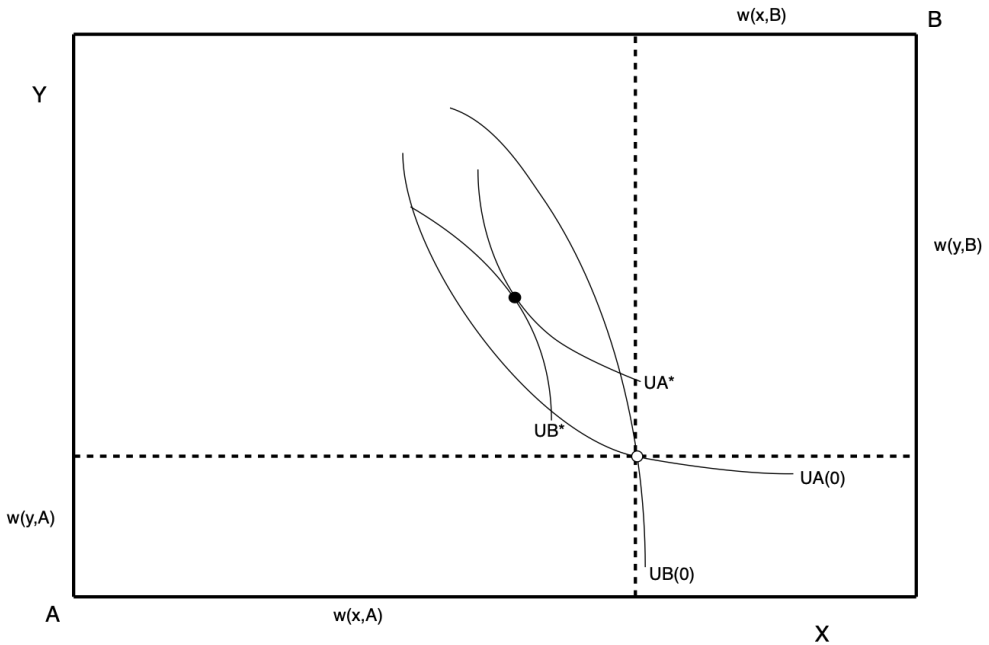
Total vertical distance is W_Y

Total horizontal distance is W_X

Initial endowment is given by the empty circle

Initial indifference curves for A and B are $UA(0)$ and $UB(0)$

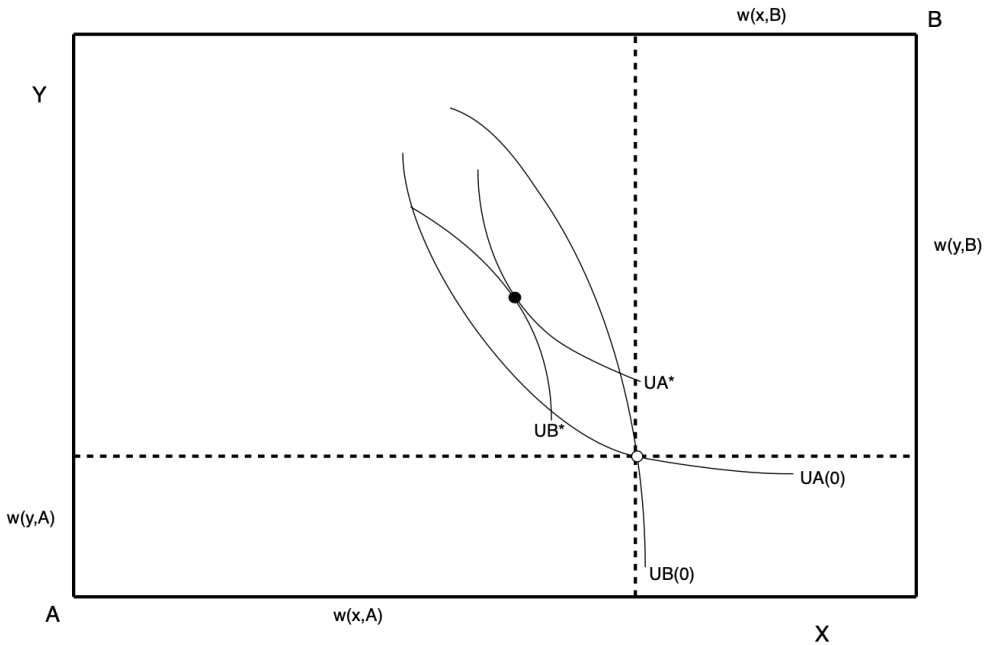
Why do externalities arise? Edgeworth Box



Is there a possible Pareto improvement?

e.g. can we make both A and B better off?

Why do externalities arise? Edgeworth Box



Yes!

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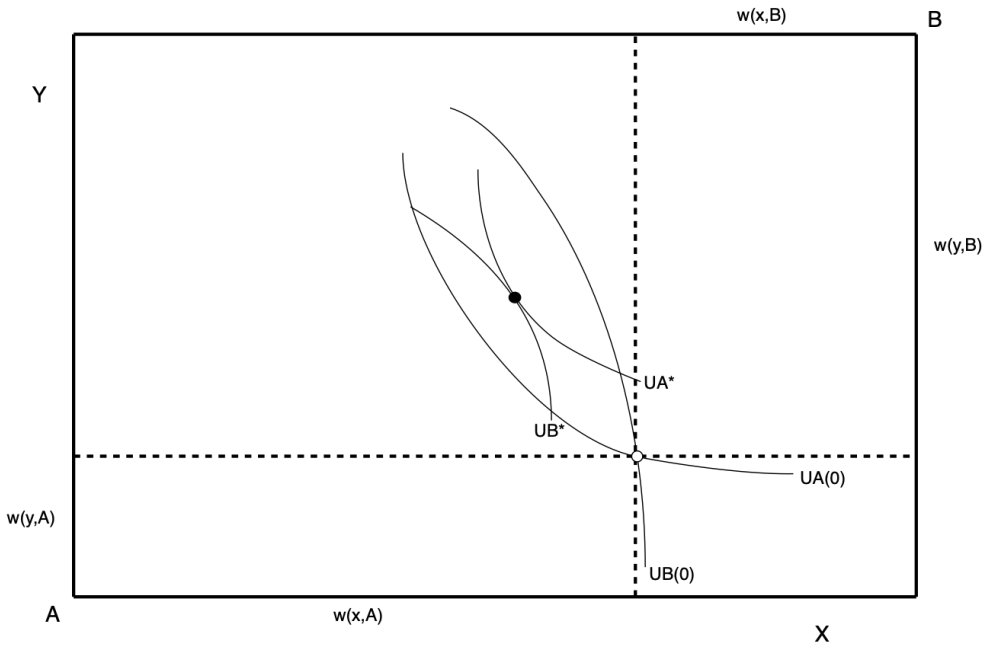

Yes!

If we move anywhere in the lens of their initial indifference curves we have a Pareto improvement

If we move to an allocation where their indifference curves are **tangent** to one another (e.g. the filled-in point), we have a Pareto optimum

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In a properly functioning market:

- The endowment point is well-established

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- The endowment point is well-established
- A and B can trade X and Y to some Pareto improving point
- They continue trading until they achieve a Pareto optimal allocation
- This allocation lies on the **contract curve**: the line consisting of all Pareto efficient allocations

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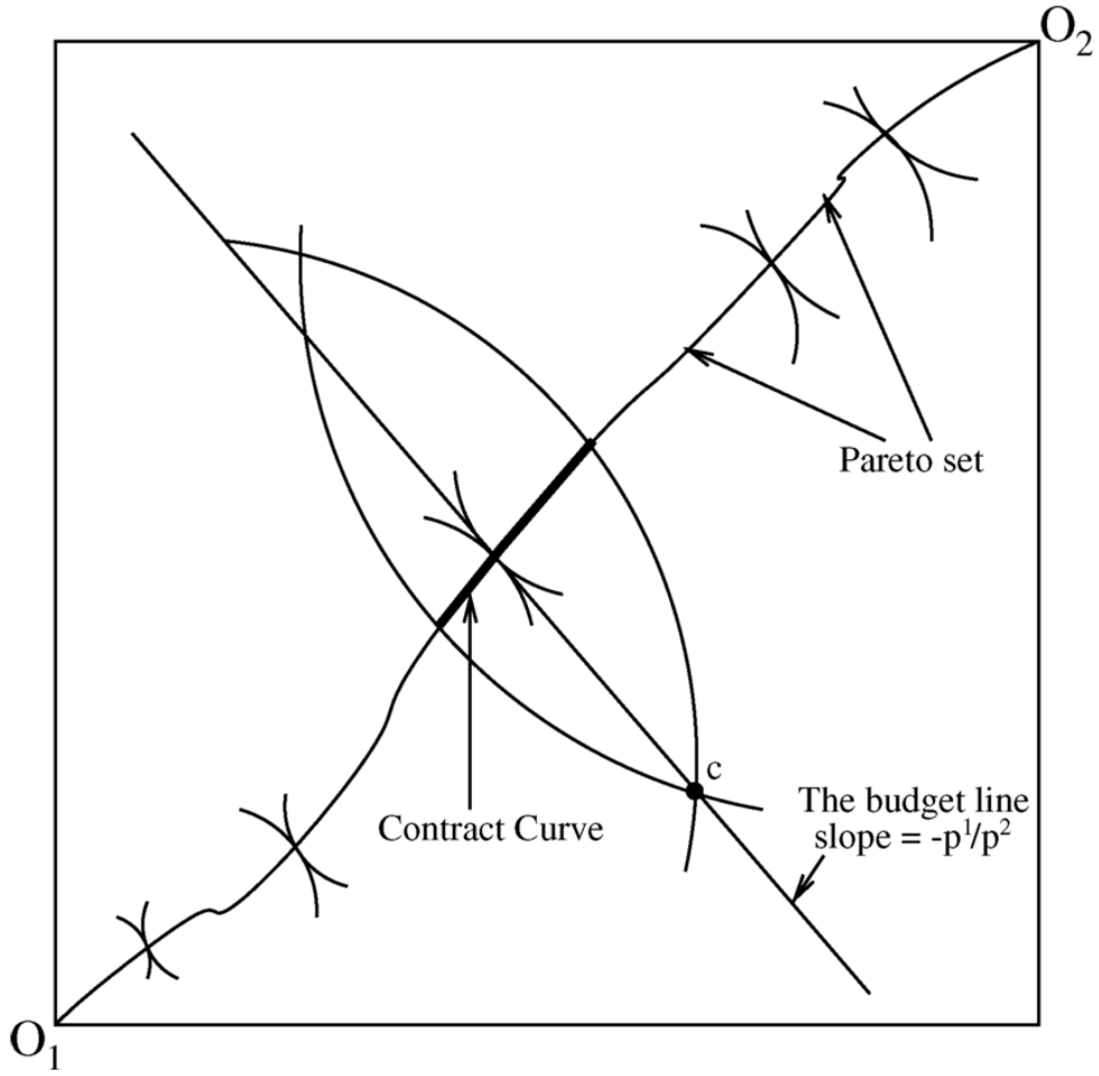

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Now suppose Y is not a private good, but a public good/bad, e.g. smoke

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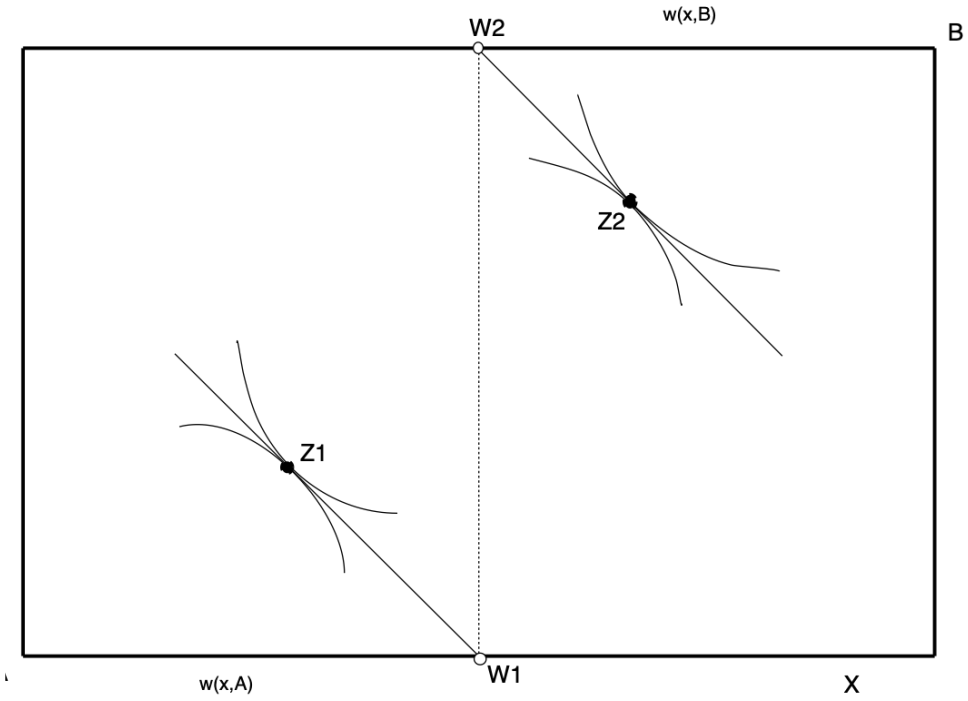
Suppose both start off with the same quantity of X

Why do externalities arise? Edgeworth Box

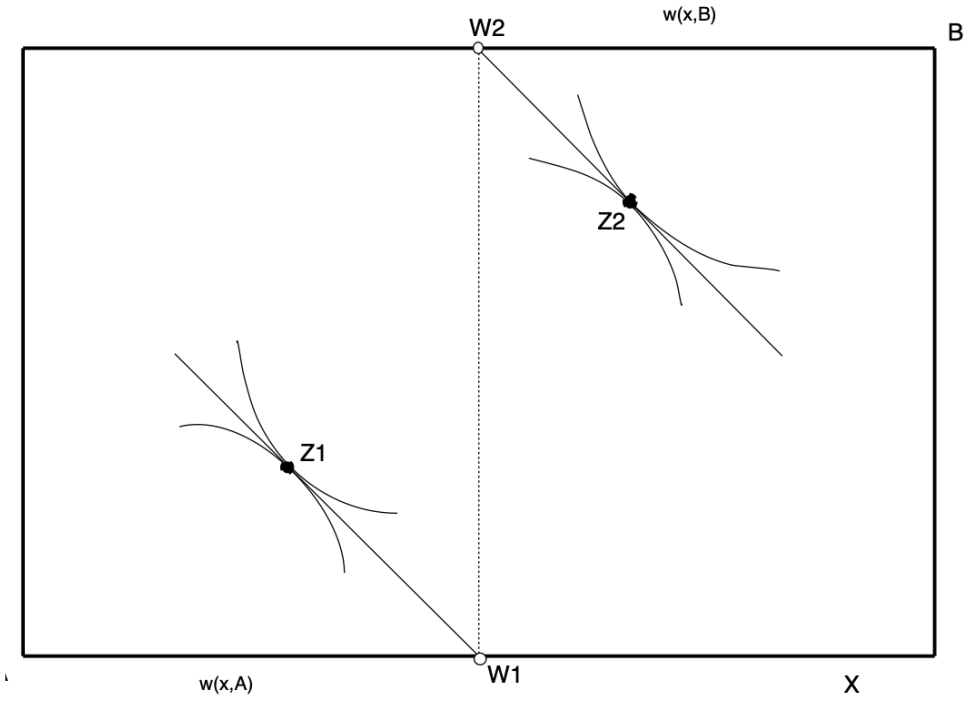


Depending on who has property rights, we either start at:

- W1 (B has property rights)
- W2 (A has property rights)

Think about why these are where we must start

Why do externalities arise? Edgeworth Box



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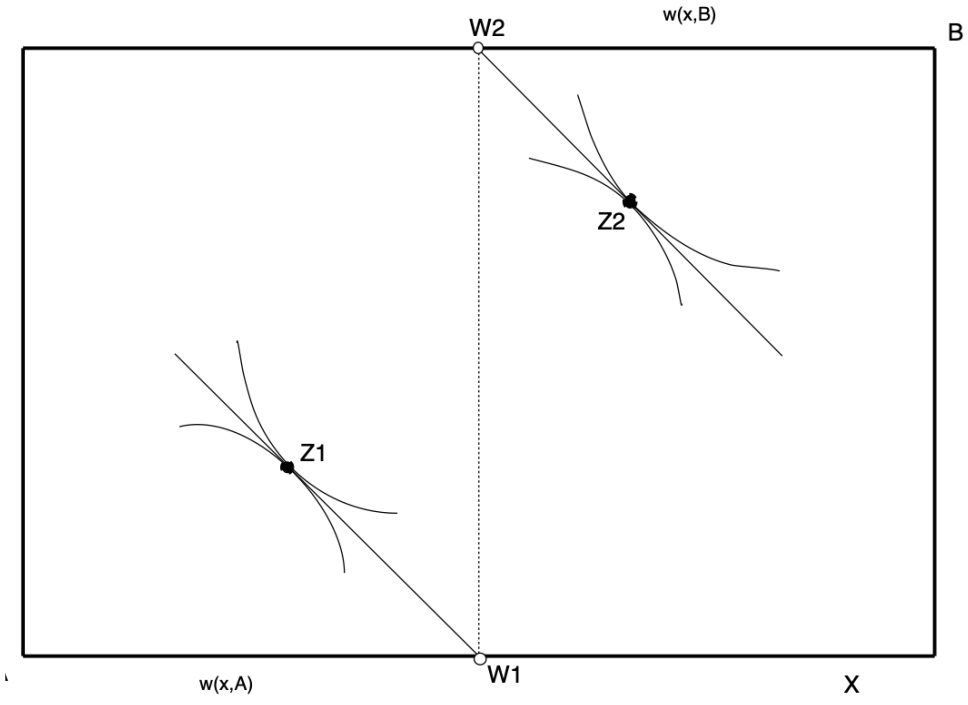
Why do externalities arise? Edgeworth Box



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A wants to have more Y, but this imposes a cost on B

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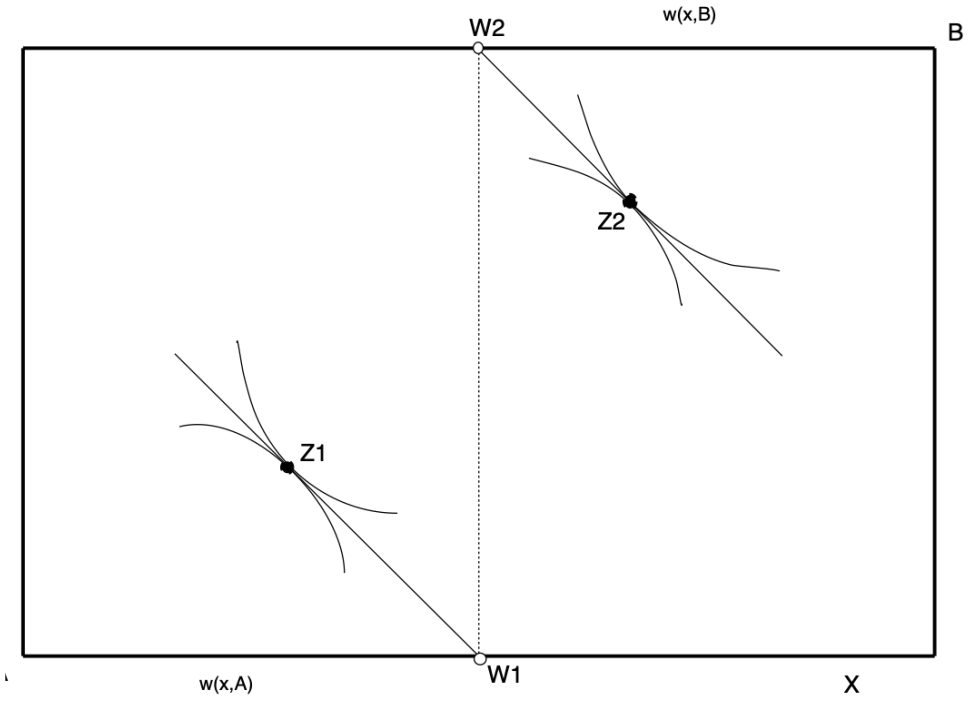

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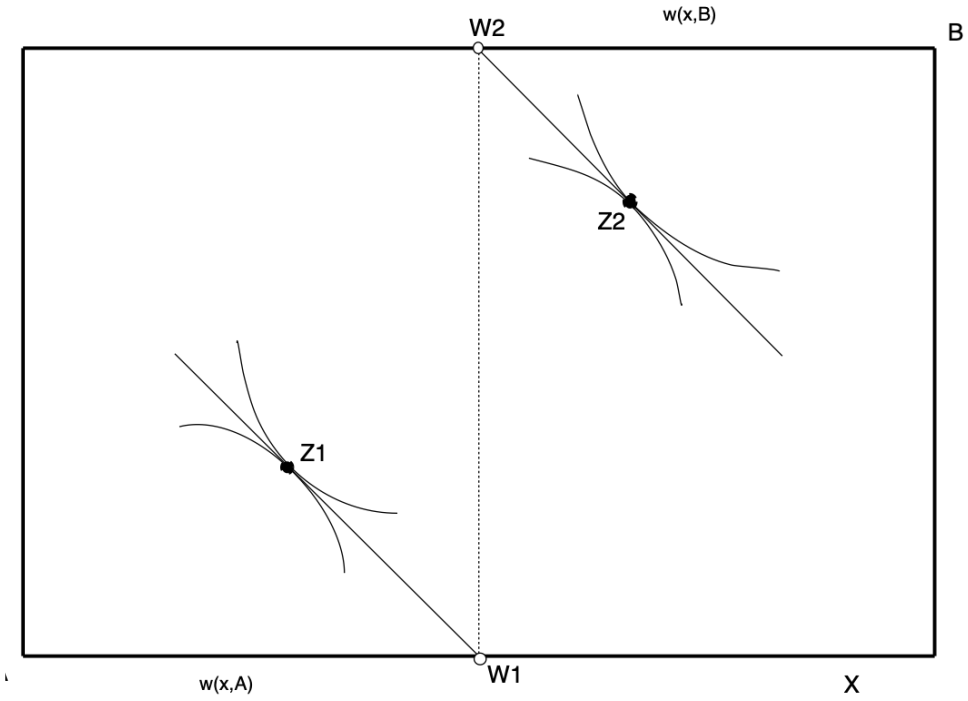

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A pays B in units of X, move to Z1, Pareto optimum

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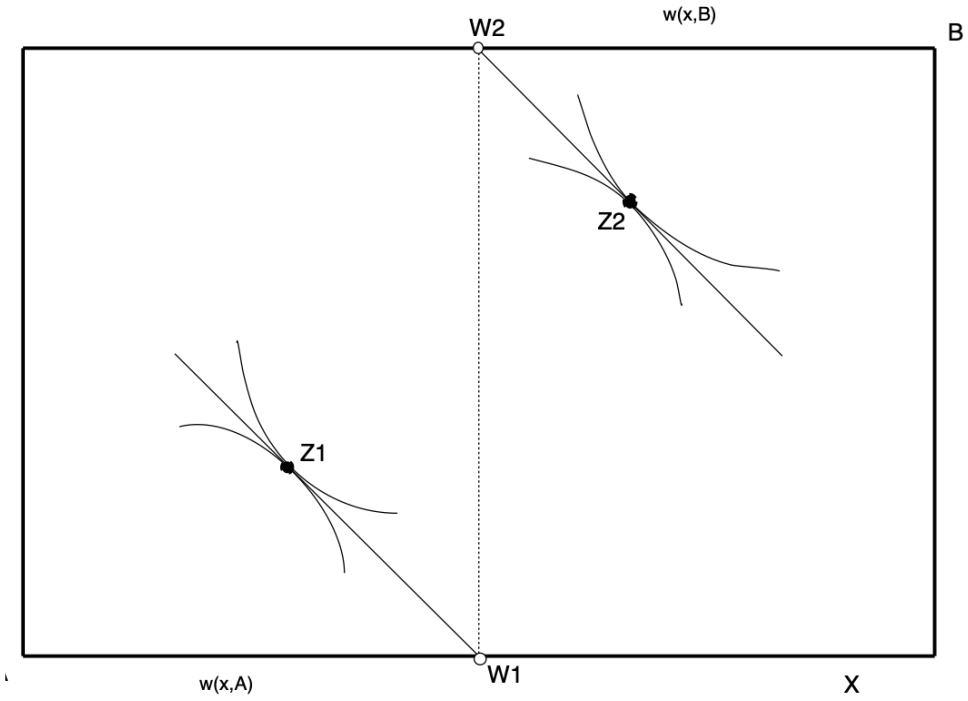
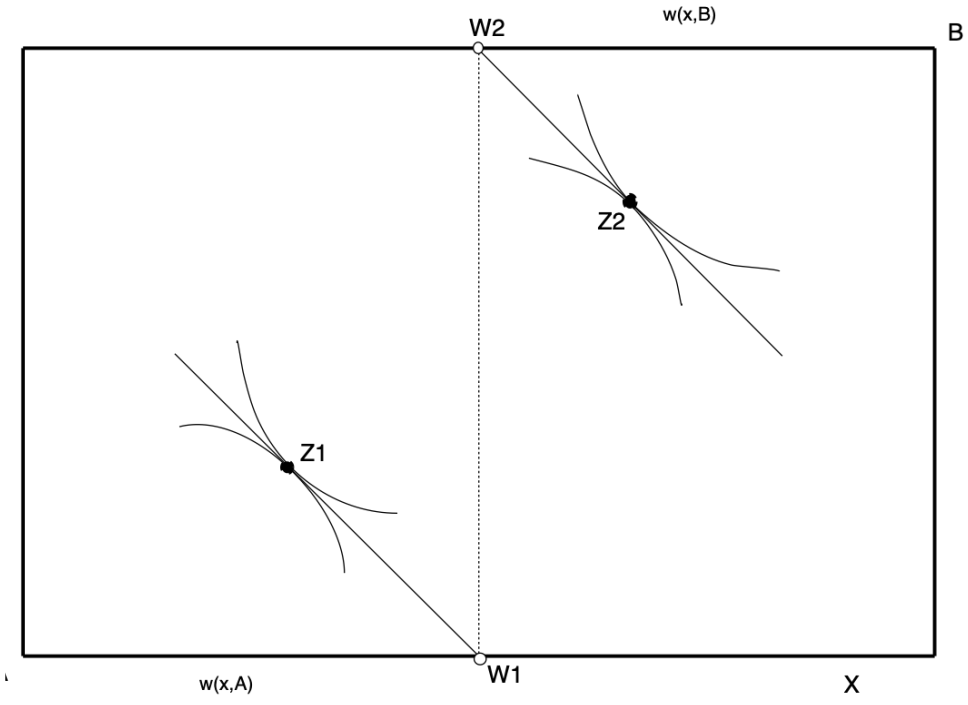


Suppose we start at W2, what happens?

Why do externalities arise? Edgeworth Box



Suppose we start at W2, what happens?

B wants to have less Y, but this imposes a cost on A

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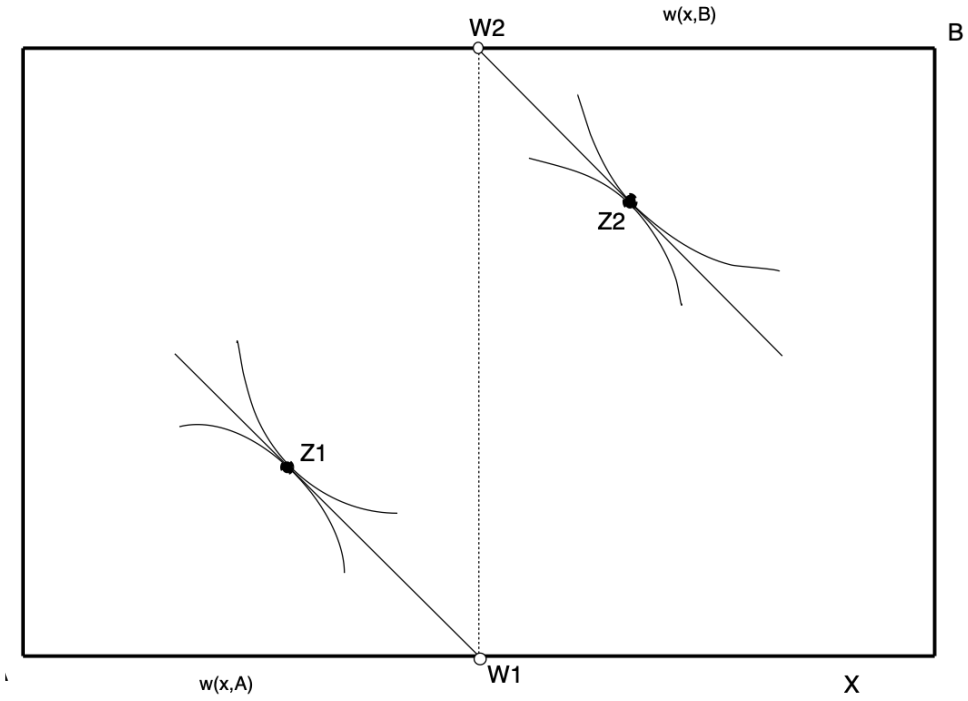

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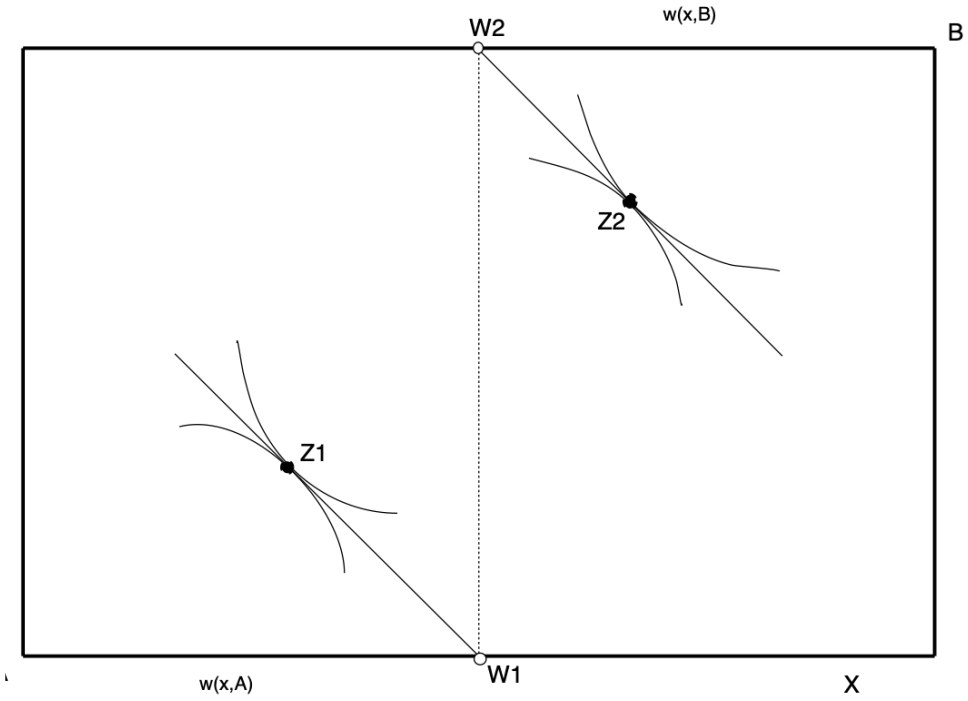

Suppose we start at W2, what happens?

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B pays A in units of X, move to Z2, Pareto optimum

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In the previous example we were able to achieve the Pareto optimum even with a public good / externality

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Why do externalities arise? Edgeworth Box

In the previous example we were able to achieve the Pareto optimum even with a public good / externality

Why?

1. Property rights were assigned to either A or B
2. Transactions costs were low (didn't have to pay a fee to trade X)

Property rights and externalities

A solution to many externalities is to just assign property rights and let the market do its thing

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We'll talk about a few ways that we can assign property rights

Transactions costs and externalities

Now suppose there were many non-smokers

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Even if they were assigned the property rights, it might be hard for them to bargain

- Takes a lot of time to find something that works for everyone
- Negotiating over how much X each person gets

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The costs of bargaining may exceed the benefits and we end up stuck at W2

Transactions costs and externalities

Road noise: drivers implicitly have property rights to noise around roads

Transactions costs and externalities

Road noise: drivers implicitly have property rights to noise around roads

Even if you prefer quiet, you can't negotiate a payment with every loud car that might pass pay

The free-rider problem

Externalities and public goods/bads often exhibit many of the same features

Both are subject to the **Free-Rider Problem**

> A type of market failure that occurs when those who benefit from resources, public goods (such as public roads or hospitals), or services of a communal nature do not pay for them[1] or under-pay

e.g.

- people don't pay their taxes for publicly-provided services
- non-smokers will wait for others to pay in order to reduce smoke

The provision of public goods

Public goods

How do we efficiently provide public goods?

We know:

- Private goods: PMB = PMC $\leftrightarrow$ SMB = SMC
- Goods with negative externalities: PMB = SMC $\leftrightarrow$ SMB = SMC
- goods with positive externalities: SMB = PMC $\leftrightarrow$ SMB = SMC

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Suppose we have a public good, e.g. depth of a river for public use

How do we decide the socially efficient depth?

Public goods

Optimal provision is **always** given by: SMB = SMC

What are the SMB and SMC for a public good?

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Non-rival: multiple people can use the same unit of a good (one person using the river doesn't 'use up' its depth)

Public goods

Optimal provision is **always** given by: SMB = SMC

What are the SMB and SMC for a public good?

Think about the characteristics of a public good, one of them is critical:

Non-rival: multiple people can use the same unit of a good (one person using the river doesn't 'use up' its depth)

This means multiple people can derive benefits from the provision of 1 unit of the good

Optimal provision of public goods

What does this mean?

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When we count up the SMB, we need to add up **everyone's** PMB:

Optimality: $SMB = \sum_i PMB_i = PMC$

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e.g. the free market underprovides clean air, national defense, etc

Modeling the provision of public goods

How do we model public goods?

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Private goods: we add demand curves horizontally

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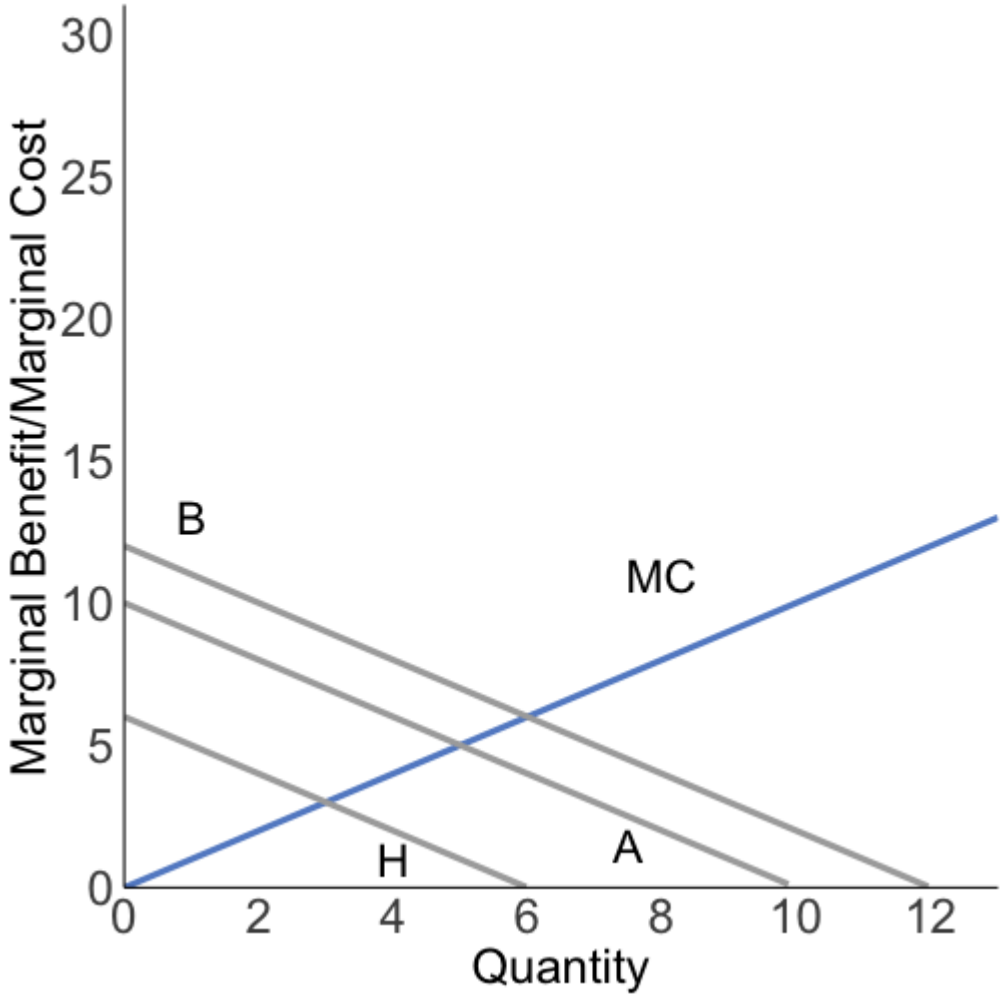
Public goods: we add demand curves vertically

Public goods: graphical

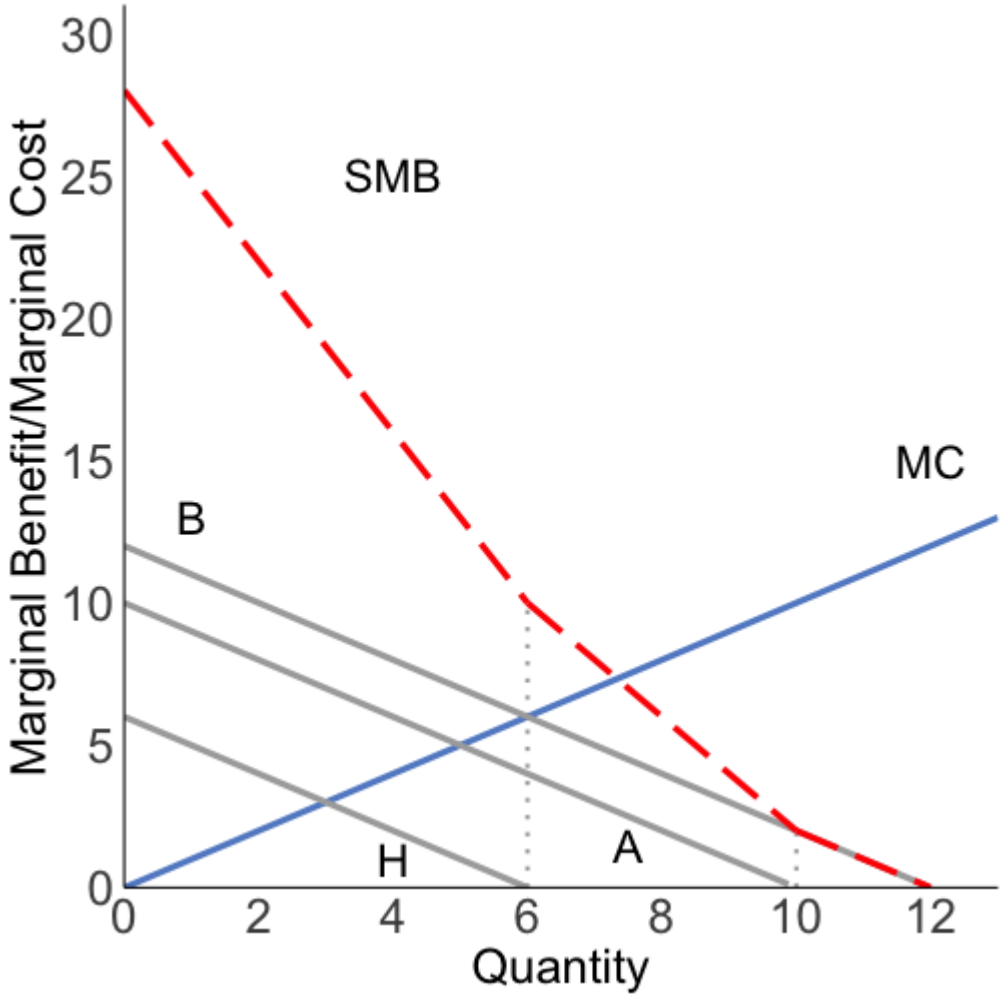


3 different groups: boaters (B), anglers (A), and hikers (H)

Each has a different marginal benefit for water depth:

- Boaters: MB = 12-Q
- Anglers: MB = 10-Q
- Hikers: MB = 6-Q
- MC of provision: MC = Q

Public goods: graphical

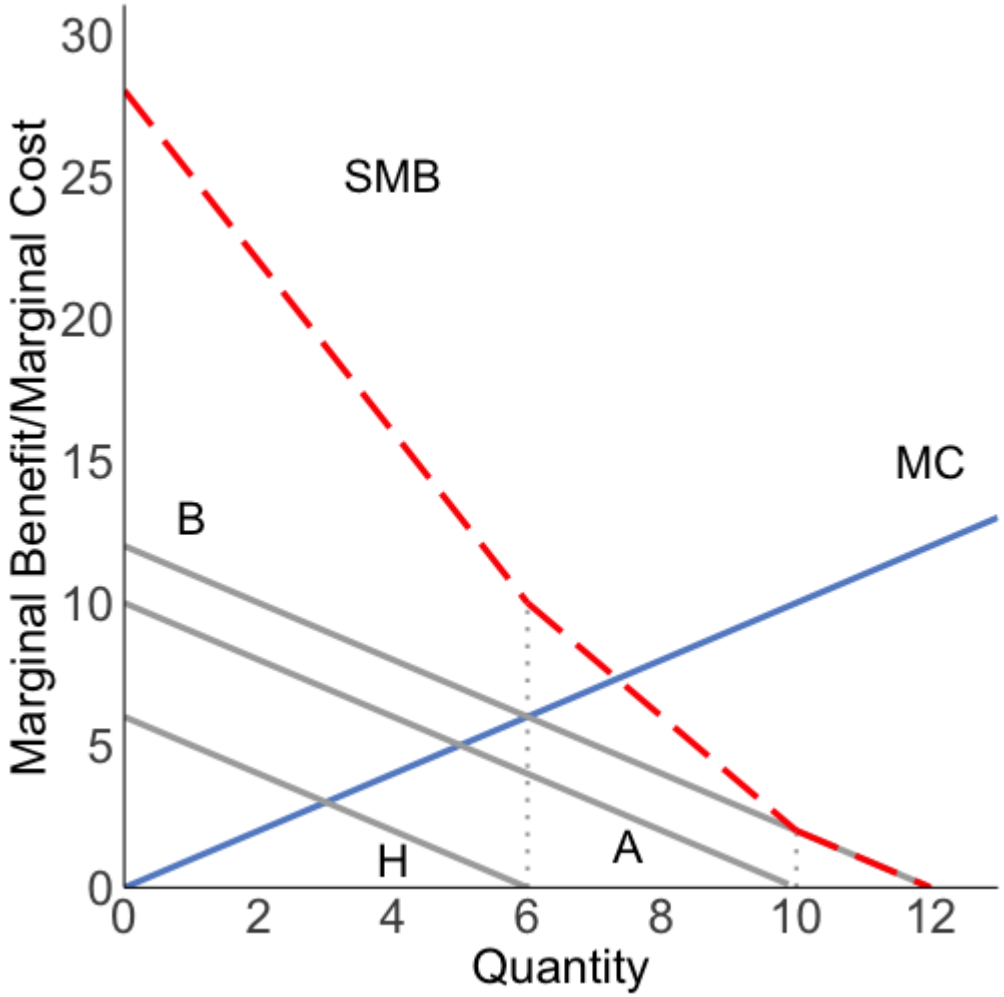


Now we need to aggregate them to get the **social marginal benefit**

We do so by adding up the demand curves vertically:

At each Q, sum the MBs

Public goods: graphical

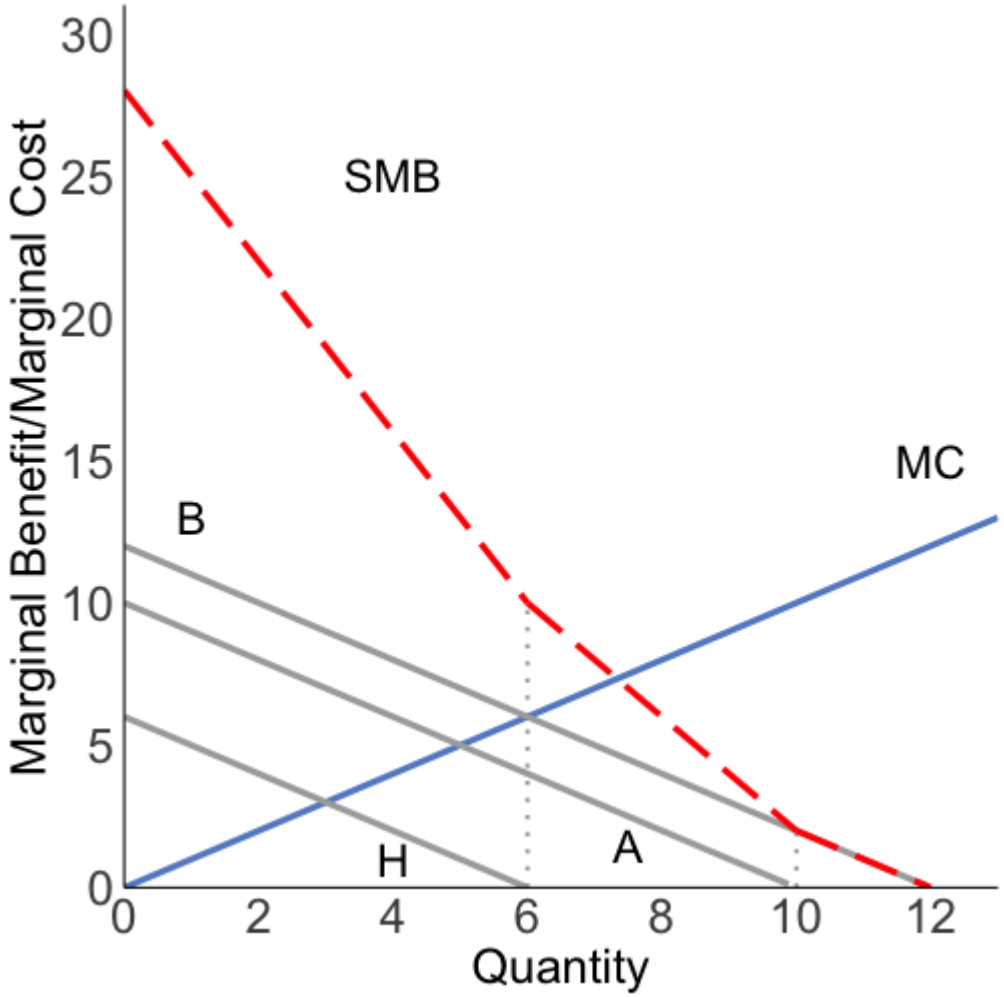


Why is the aggregate demand curve kinked?

Because at each quantity/depth, only certain groups are willing to use the river

Kinks are at the dotted lines, where PMBs hit zero

Positive externalities: graphical

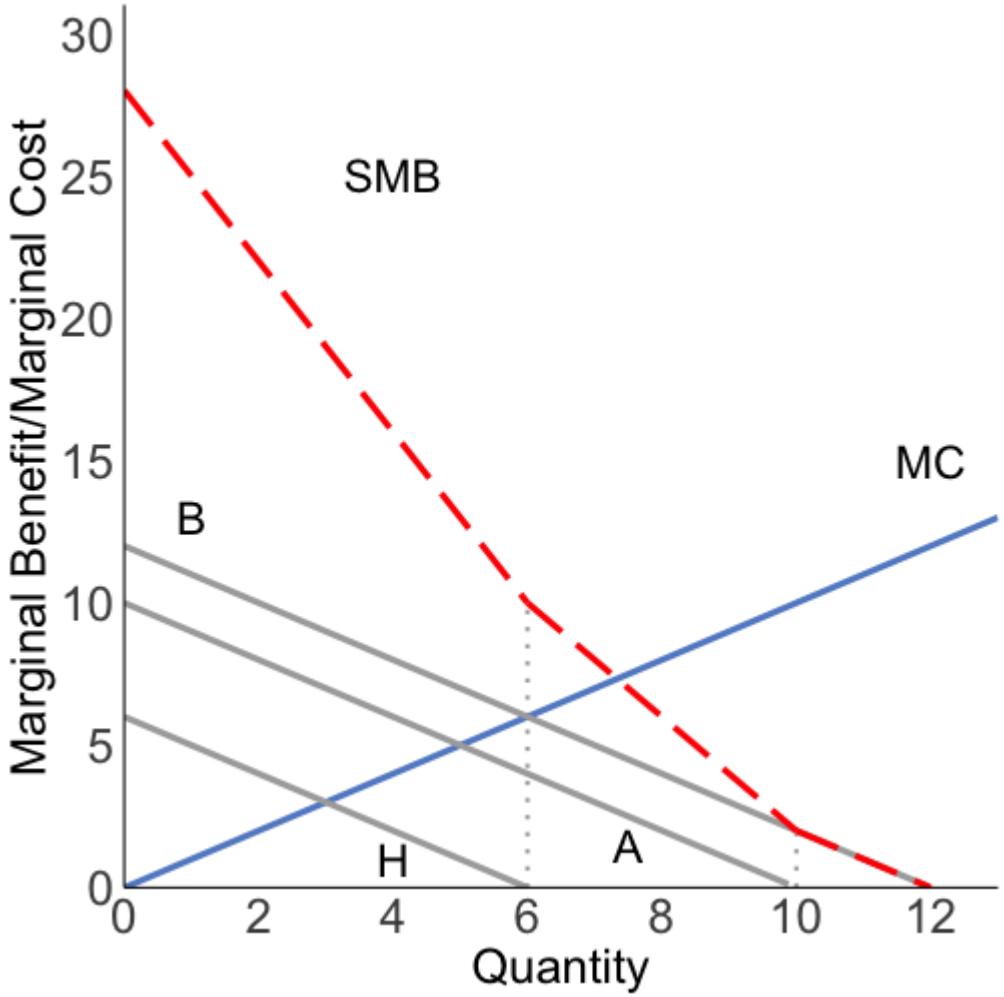


At quantities > 10, only boaters are willing to pay

At quantities > 6 and <= 10, only boaters and anglers are willing to pay

At quantities =< 6 all groups are willing to pay to use the river

Positive externalities: graphical



The SMB curve is:

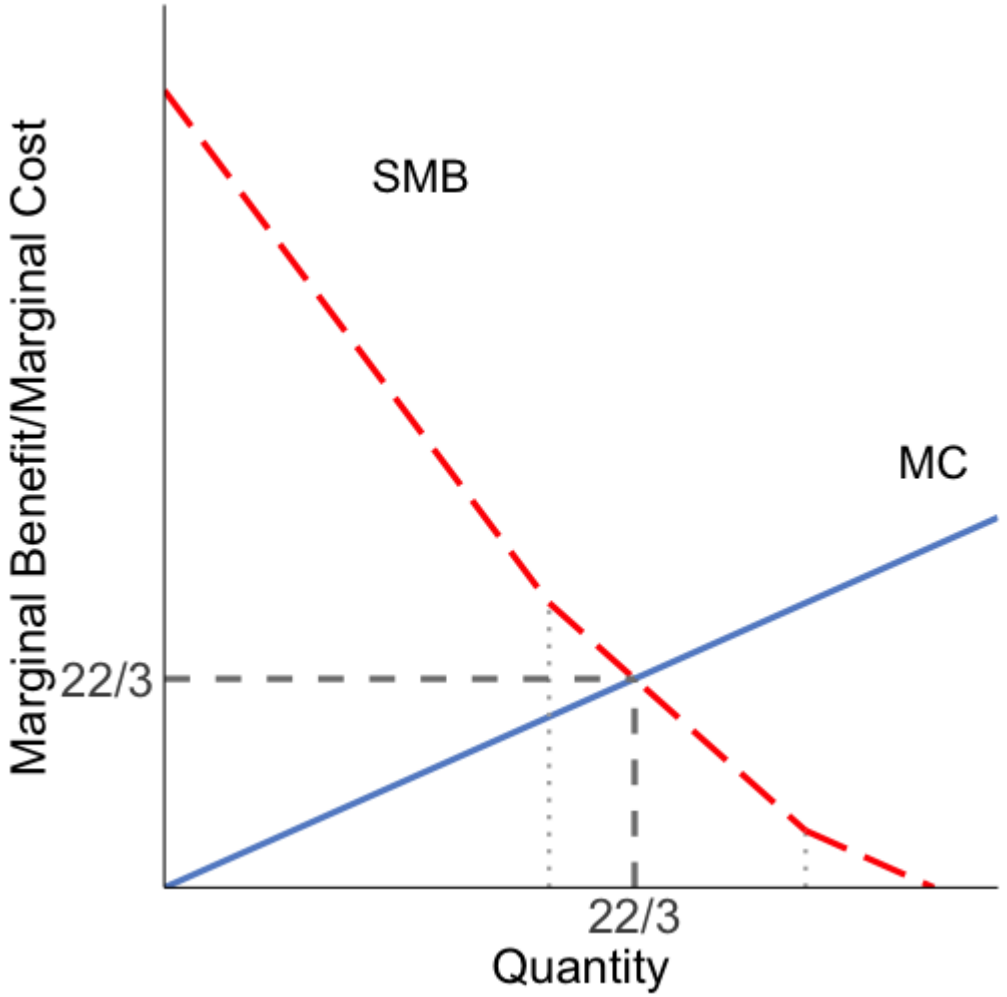
28 - 3Q for Q <= 6

22 - 2Q for 6 < Q <= 10

12 - Q for 10 < Q <= 12

Summing the PMBs over the relevant range of Q

Public goods: graphical



The optimal provision of the public good is where the MC curve crosses the SMB curve

This is across the middle segment

$Q = 22 - 2Q \Rightarrow Q = 22/3$

The optimal quantity of Q = 22/3 is greater than the quantity any individual group would be willing to purchase

Public goods financing

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If the government is able to provide the good, how does it finance the cost raising the river depth above zero?

Public goods financing

It charges each group a share of this price

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What share is everyone charged?

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Lindahl pricing: charge each group equal to their marginal benefit

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Anglers pay: 8/3

Hikers: free

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Anglers pay: 8/3
Hikers: free

Notice that the prices sum to the marginal cost!

Since the good is non-rival, this is enough to finance the cost

Public goods financing

What is a key problem with Lindahl pricing?

Public goods financing

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People can lie about which group they're in

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Public goods financing

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It requires perfect information on behalf of the regulator