

A background image showing a clear plastic globe resting on a pile of US dollar bills. The globe is centered in the upper half of the frame, with its continents visible against a bright, slightly overexposed background. Below it, several US dollar bills are scattered across the surface, with visible denominations of \$10, \$5, and \$1. The bills are slightly out of focus, creating a sense of depth.

Market failure and socially undesirable outcomes

- In a free competitive market, when the price of a good adjusts to make quantity demanded equal to quantity supplied, the equilibrium quantity reflects the '**best**' or optimal allocation of resources to the production of that good.
- Allocative efficiency $MC=MB$
- Social surplus is maximum.

Market failure

- **Market failure**: the failure of the market to allocate resources efficiently. Markets fail to produce the output at which marginal social benefits are equal to marginal social costs; social surplus is not maximized.
- Market failure → **allocative inefficiency**
- **Allocative inefficiency**: **too much or too little** of goods or services are produced and consumed from the point of view of what is socially most desirable.
 - **Overallocation**: Overprovision of a good means too many resources are allocated to its production (overallocation);
 - **Underallocation**: underprovision means that too few resources are allocated to its production (underallocation)

Market failure

1. Externalities
2. Common pool resources
3. Public goods
4. Asymmetric information
5. Monopoly power



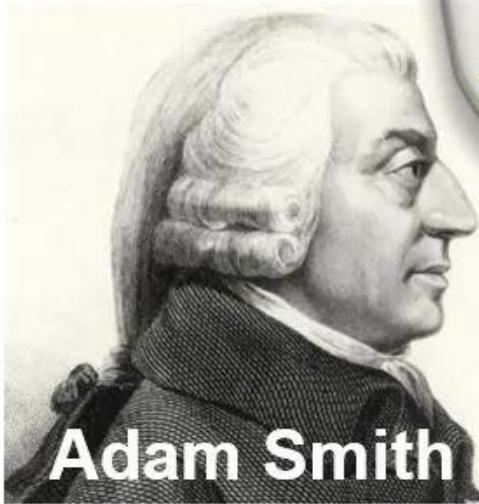


Externalities

**Market failure and
socially undesirable outcomes**

Competitive market & market failure

Is competitive market perfect?



Invisible Hand

Better than a Central Planner



Price Mechanism:

- Price as signal
- Price as incentive
- Price can allocate resources efficiently.



- **Market failure:** the failure of the market to allocate resources efficiently.



- **Allocative inefficiency:** too much or too little of goods or services are produced and consumed from the point of view of what is socially most desirable.

- Overallocation
- Underallocation

When they buy or sell the oranges, they are considering...?

My Marginal
Benefit

to buy to sale

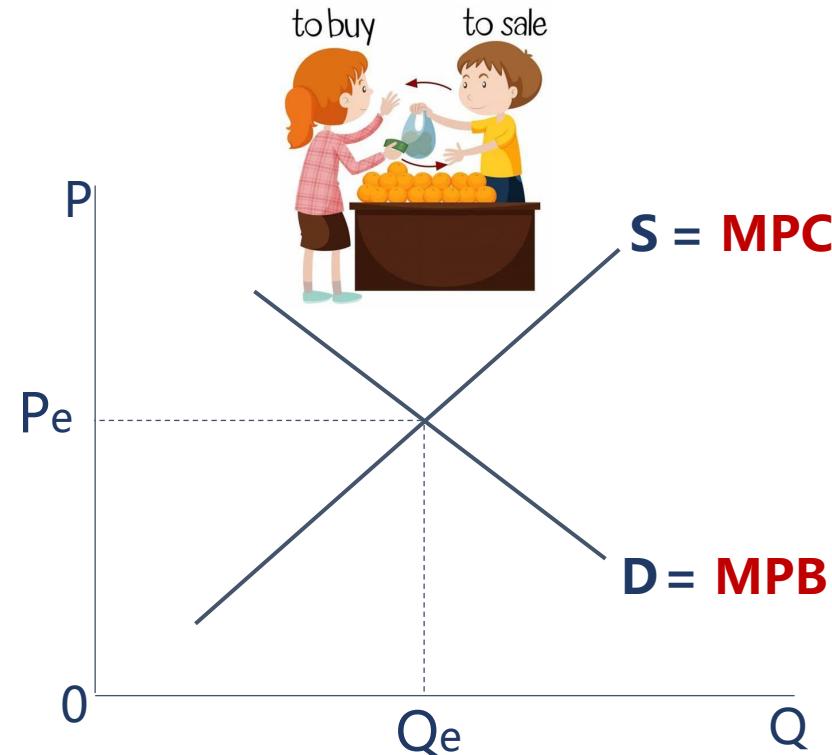


My Marginal
Cost

Marginal private cost & Marginal private benefit



- Demand curve represent **Marginal private benefits (MPB)**: benefits to consumers from consuming one more unit of a good.



→ Allocative efficiency
is achieved
→ Social optimum is
achieved.



- Supply curve represent **Marginal private costs (MPC)**: costs to producers of producing one more unit of a good.

Think about the whole society?



Your action of **production** or
consumption might affect other people
or other groups of people **in the society**

Externality



- An **externality** occurs when the actions of consumers or producers give rise to **negative or positive side-effects** on other people ("third parties") who are not part of these actions, and whose interests are not taken into consideration.
- **Externalities can result from:**
 - Consumption activities (consumption externalities)
 - Production activities (production externalities)
- **The consumption and production activities can result to:**
 - Positive externality – external (spillover) benefit
 - Negative externality – external (spillover) costs.

Marginal social cost & Marginal social benefit

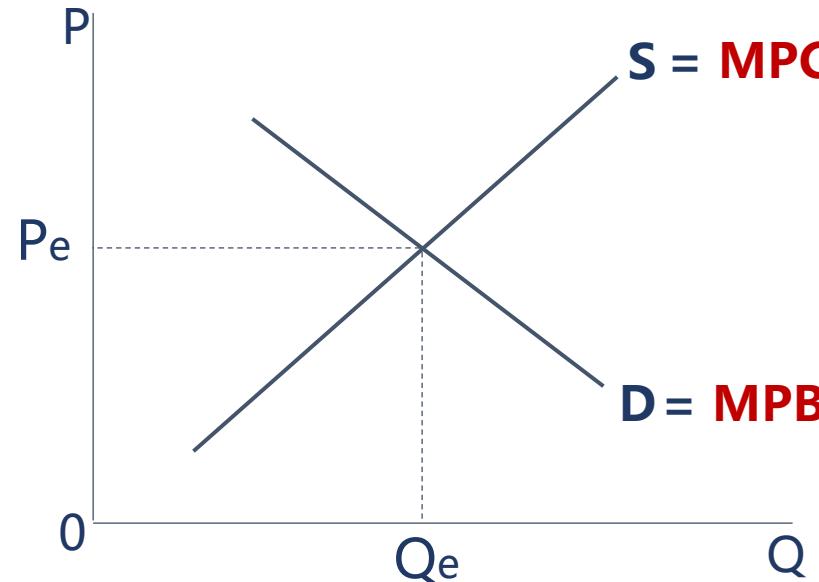


- Supply curve represent **Marginal private costs (MPC)**: costs to producers of producing one more unit of a good.



+ external benefit
OR - External cost

- Marginal social costs (MSC)** : costs to society of producing one more unit of a good.



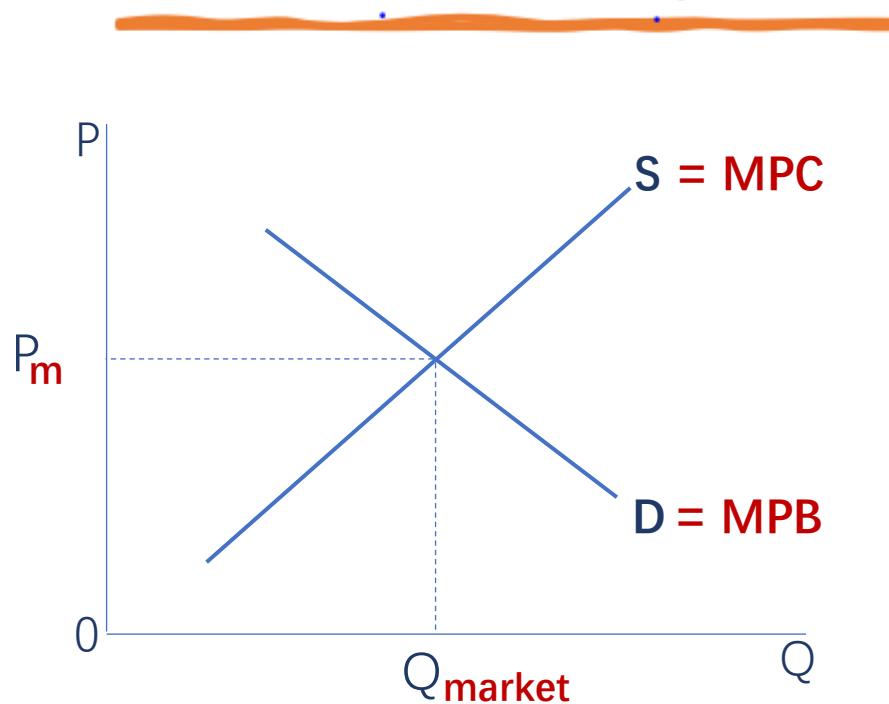
- Demand curve represent **Marginal private benefits (MPB)**: benefits to consumers from consuming one more unit of a good.

+ external benefit
OR - External cost



- Marginal social benefits (MSB)** : benefits to society from consuming one more unit of a good.

MPC & MPB



Allocative efficiency
is achieved

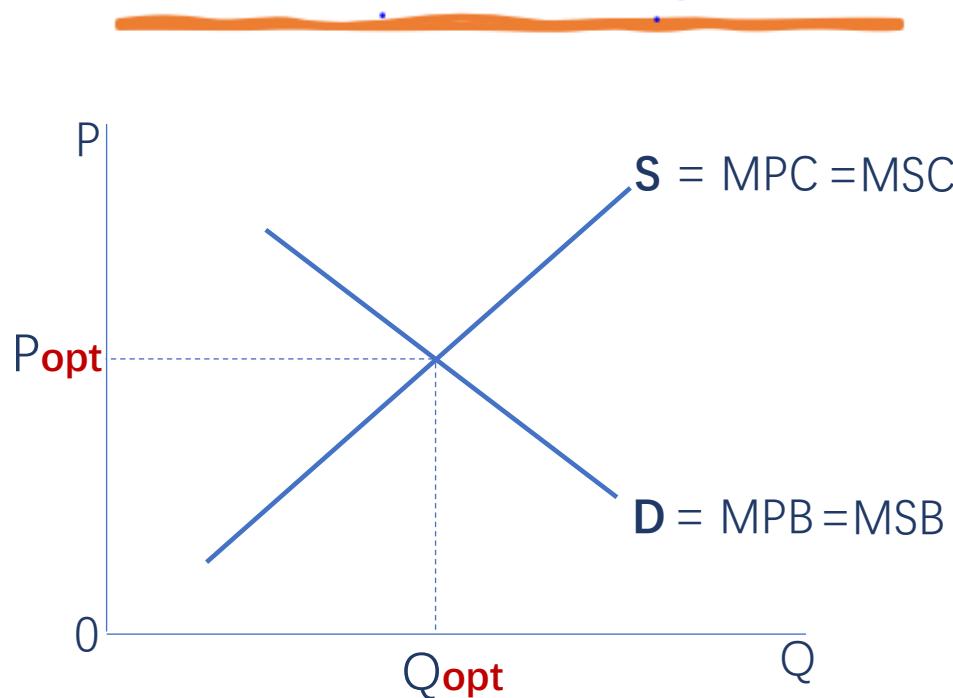
- Supply curve represent **Marginal private costs (MPC)**: costs to producers of producing one more unit of a good.
- Demand curve represent **Marginal private benefits(MPB)**: benefits to consumers from consuming one more unit of a good.

MSC & MSB

- **Marginal social costs(MSC)**: costs to society of producing one more unit of a good.
- **Marginal social benefits (MSB)**: benefits to society from consuming one more unit of a good.

→ When $MSB=MSC$, there is a social optimum and allocative efficiency is realized.

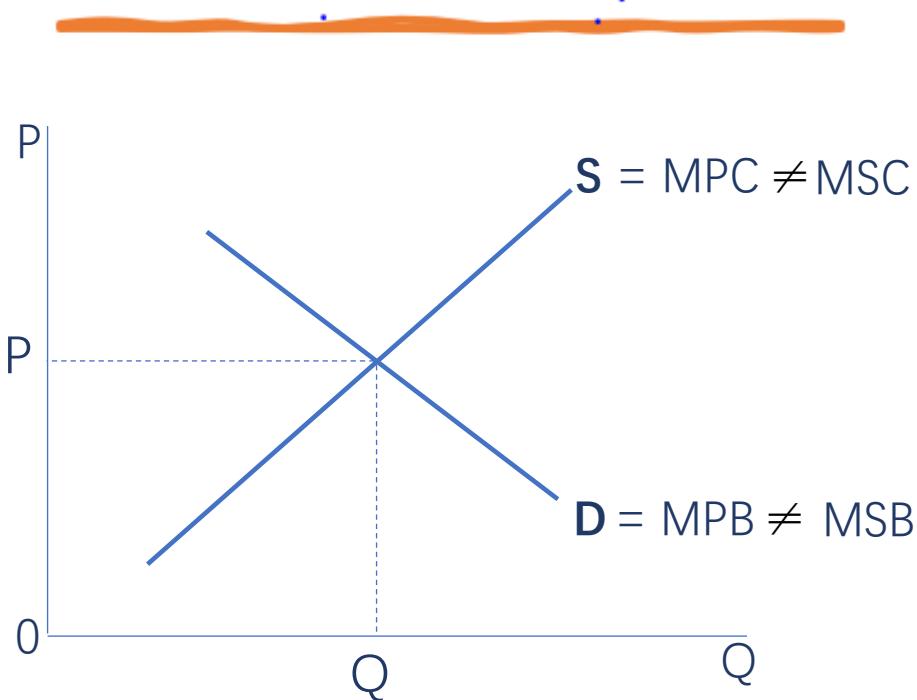
When there are no externalities



- $D = MPB = MSB$
- $S = MPC = MSC$
- When $MPC = MSC = MPB = MSB$, there is a social optimum and allocative efficiency is realized.

**Allocative efficiency
is achieved**

When there are externalities



$\text{MPB} \neq \text{MSB}$

$\text{MPC} \neq \text{MSC}$

The intersect of MPC and MPB curve
is no longer a social optimum.

→ Social allocative inefficiency.

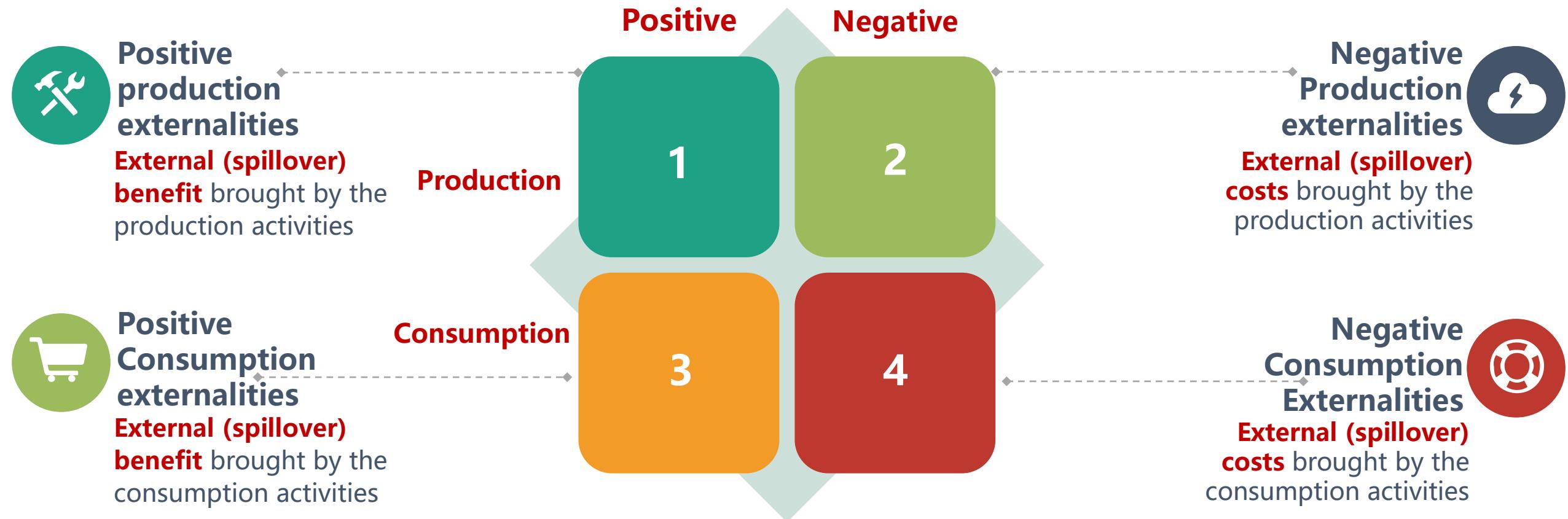
**Social Allocative
inefficiency**

External benefit & External cost

External benefits: the advantages or gains of production or consumption to a third party, i.e. individual and/or firms not directly involved in an economic transaction.

External costs: the disadvantages or losses incurred from production or consumption to a third party not directly involved in an economic transaction.

Types of Externalities



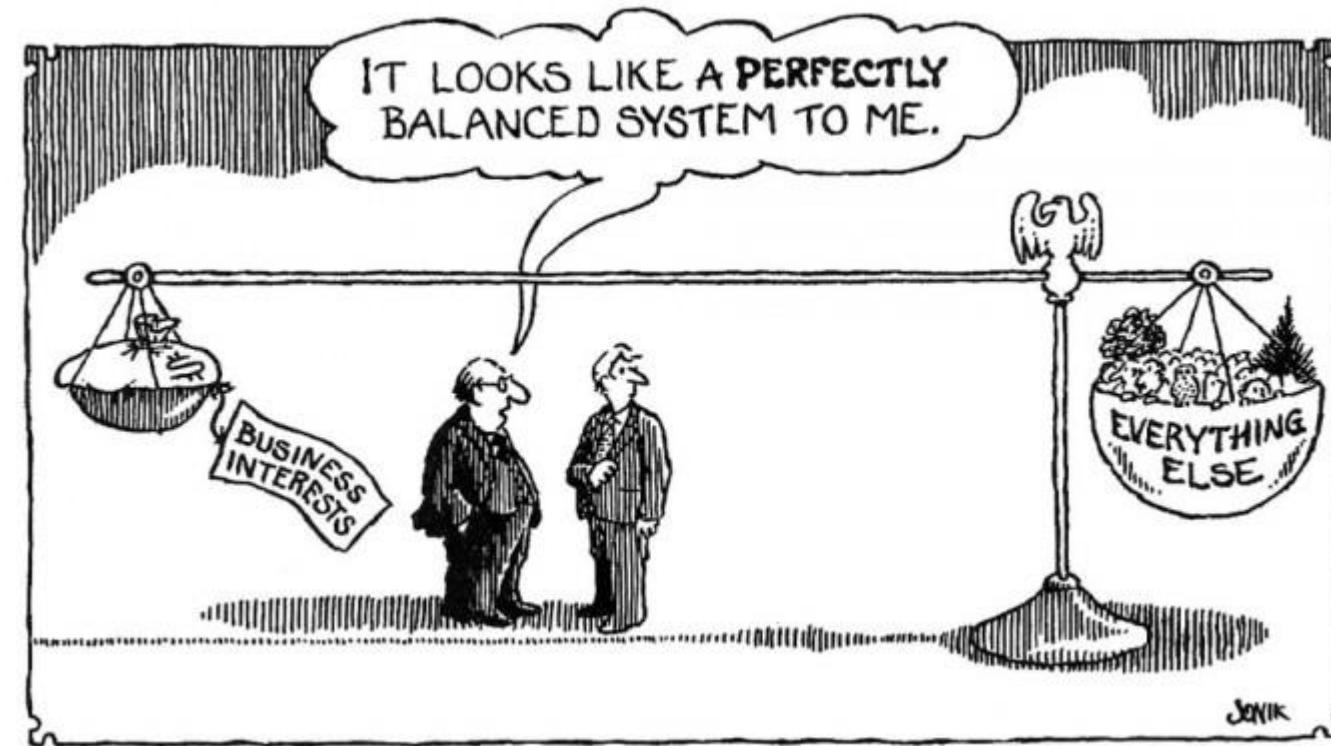


Negative Production externalities

Negative production externalities

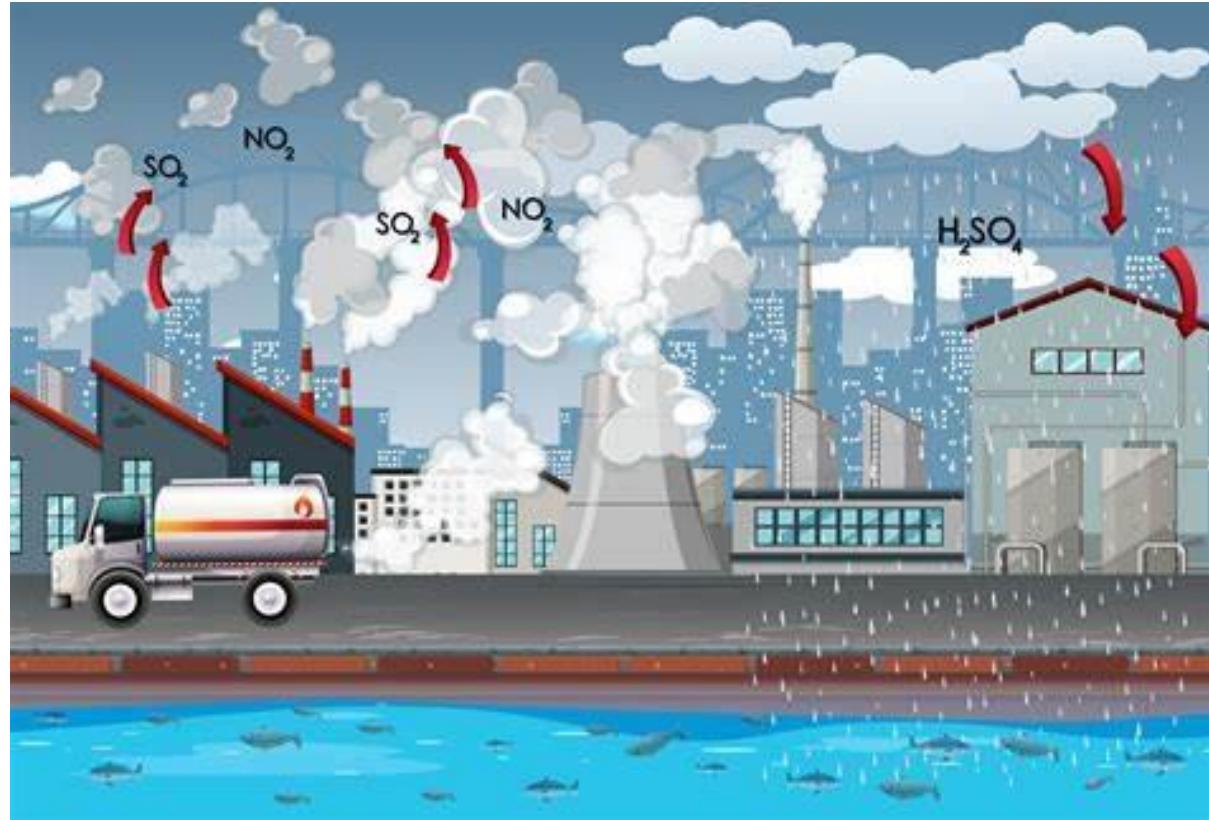
Negative production externalities refer to **external costs** created **by producers**. (side-effect) –

→ Additional cost that spill over onto society.





Discussion time



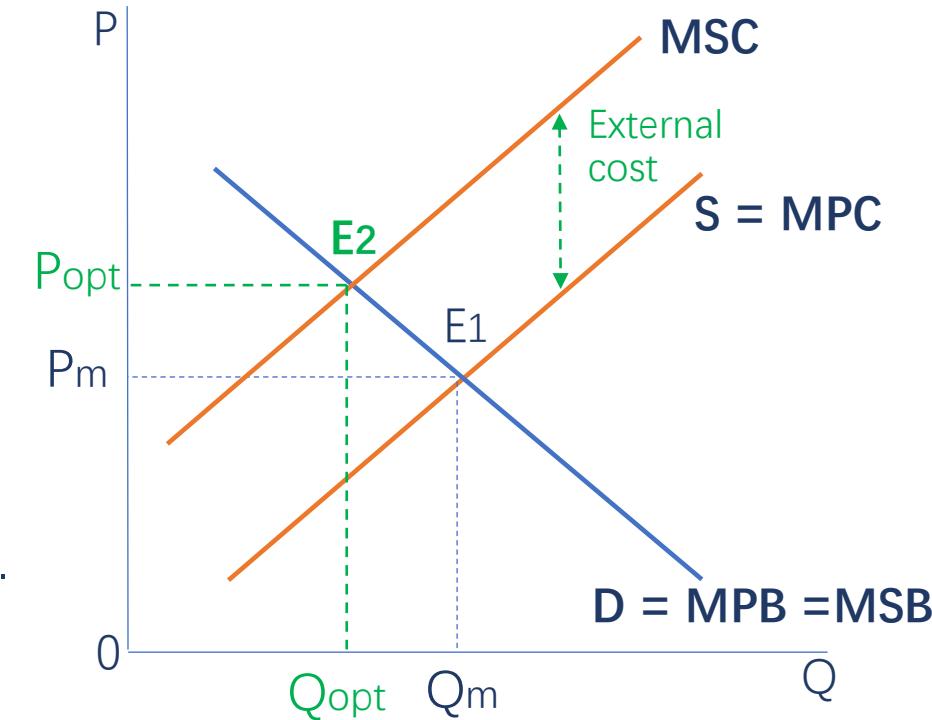
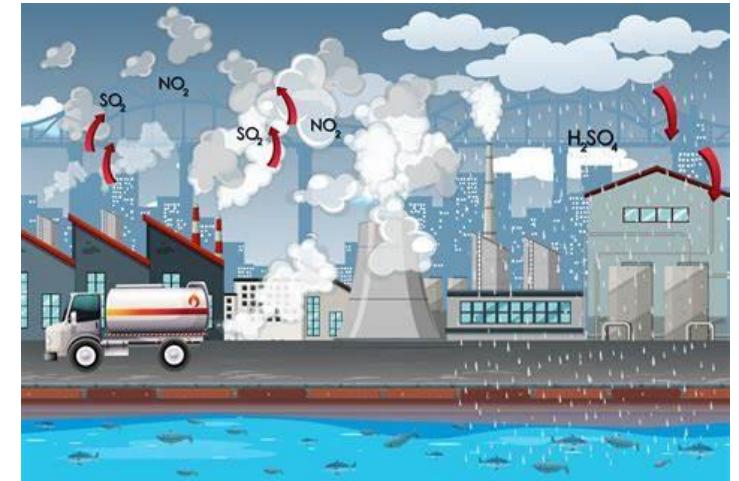
➤ A factory that emits harmful gas in production activity.

- **Private cost:** cost of land, construction cost, raw materials, labour costs, etc.
- **External cost:** the factory emission of harmful gas have negative impact to:
 - The healthy condition of People who live nearby
 - Global climate
 - Ozone layer
 - and so on.
- **Social cost:** the total costs to society from an extra unit of production of a particular product.

→ Marginal social cost = Marginal private cost + external cost

Illustration of the impact of negative production externalities

- A factory emits smoke into the air and disposes its waste by dumping it into the ocean. (negative production externality with negative effect for third-parties)
- **E1 = Market equilibrium** P_m and Q_m .
 - Determined by the intersection of MPB and MPC.
 - $D=MPB=MSB$ (no consumption externality involved)
 - $S=MPC$ reflect the firm's private cost of production.
 - The action of supplier results in external cost to the society that $MPC \neq MSC$
 - **External cost**: additional cost that spill over onto society due to the polluted air and ocean, with negative consequences for the local inhabitants, swimmers, sea life, the fishing industry and the marine ecosystem.
- **E2= Socially optimum outcome** with P_{opt} and Q_{opt} .
 - Determined by the intersection of MSB and MSC.
 - → for each level of output, Q , the social costs of producing the product given by MSC are greater than the firm's private costs.
 - MSC reflects the full cost to society. (vertical distance between MSC and MPC represents the external cost)



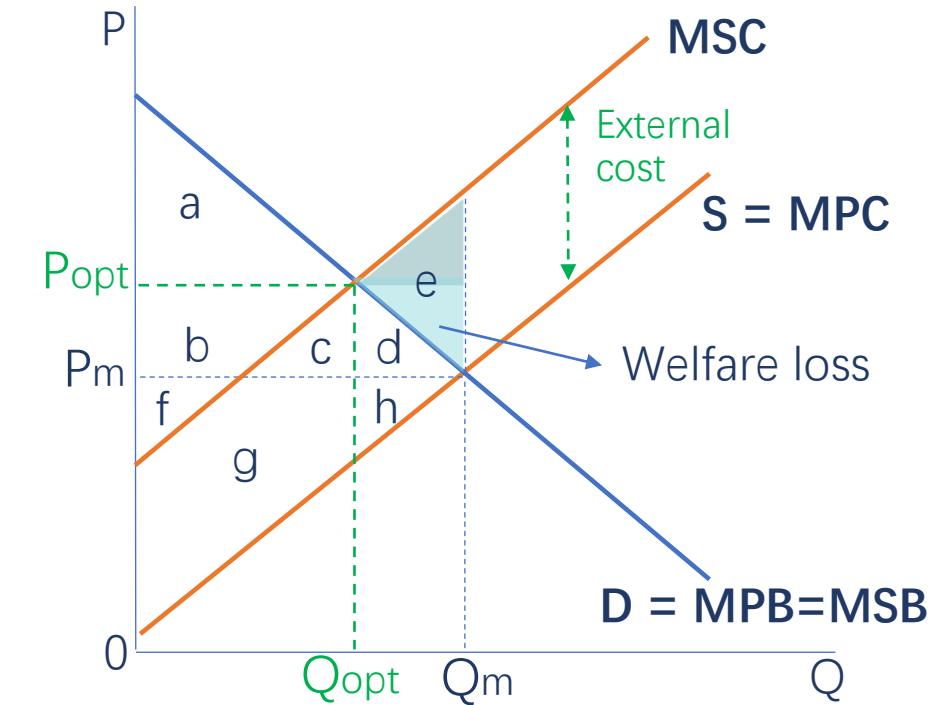
Welfare loss in relation to CS & PS

At market equilibrium:

- $CS = a+b+c+d$
- $PS = f+g+h$
- External cost = $c+d+e+g+h$
- Social benefits = $CS+PS-\text{external cost}$
 $= (a+b+c+d)+(f+g+h)-(c+d+e+g+h)$
 $= a+b+f-e$

At social optimum:

- $CS = a$
- $PS = b+f$
- Social benefit = $a+b+f$



→ Difference **e** is the **welfare loss** arising from the negative production externality.
• the difference between MSC and MSB for the amount of output that is overproduced ($Q_m - Q_{opt}$) → **overallocation of resources**

Illustration of the impact of negative production externalities

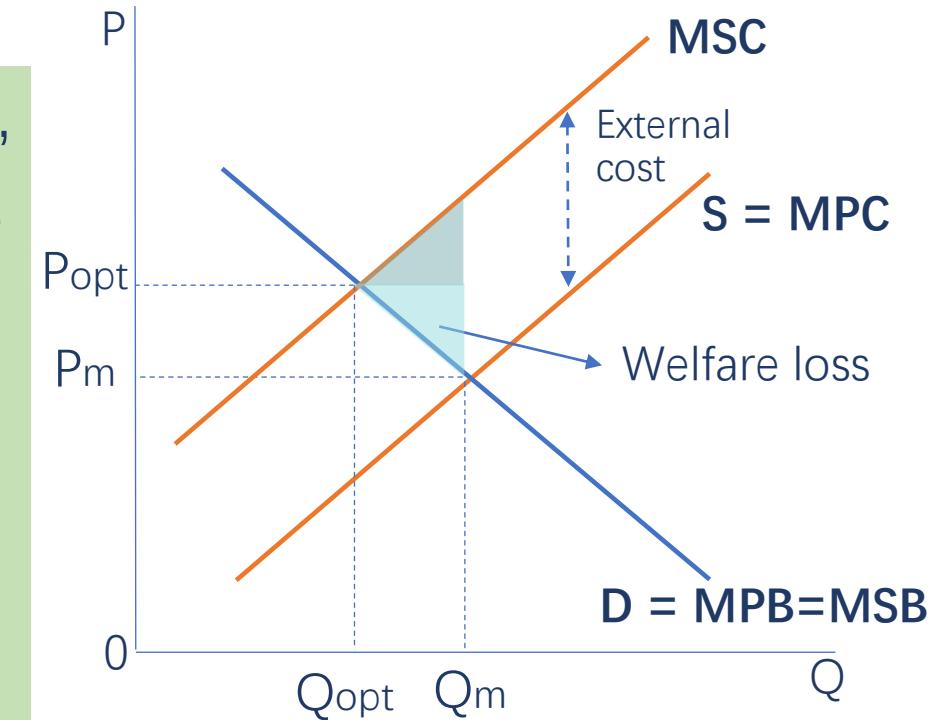
When there is a negative production externality, the free market **overallocates resources** to the production of the good and too much of it is produced relative to the **social optimum**.

$$Q_m > Q_{opt}$$

→ Welfare loss

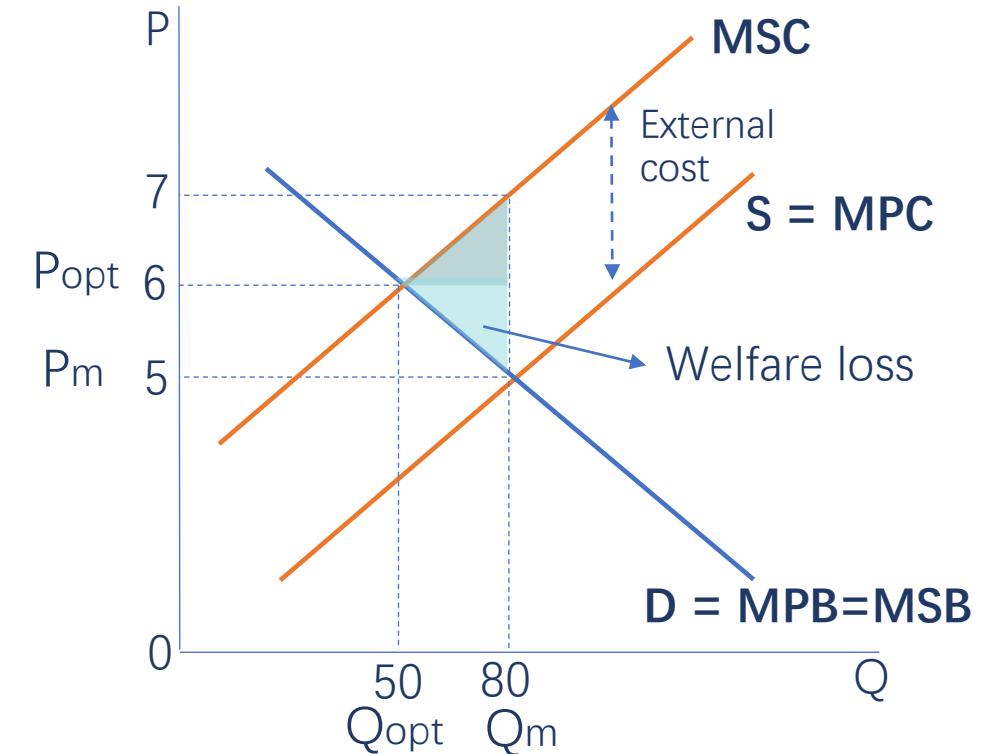
For all units of output greater than Q_{opt} , $MSC > MSB$

→ Society would be better off if less were produced.



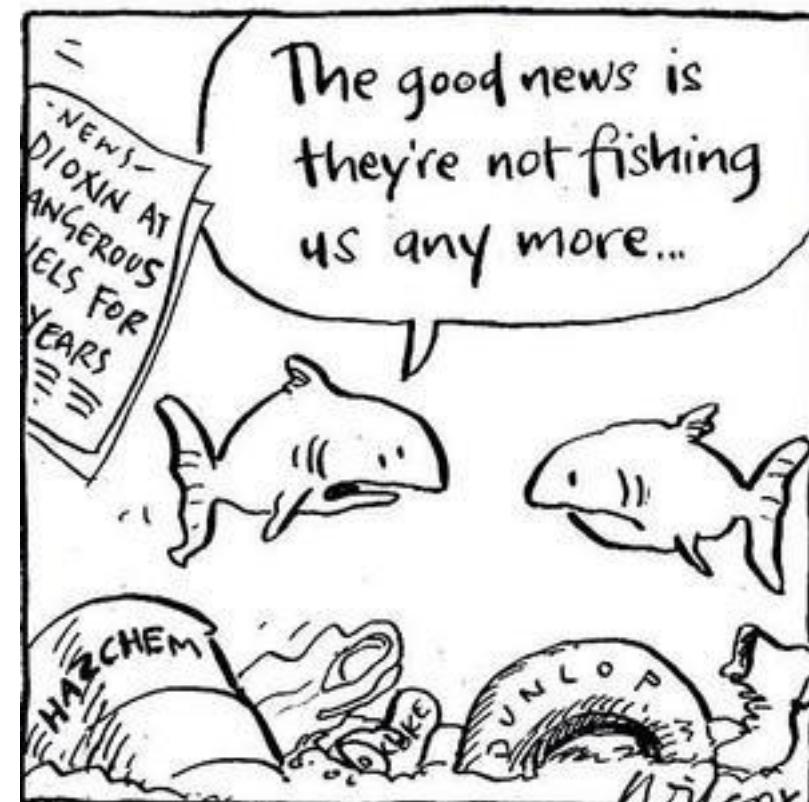
Calculation of the Welfare loss

Welfare loss = (7-5) * (80-50)/2 = 30



Policies to correct negative production externalities

1. Market-based policies
2. Government legislation and regulation
3. Education and awareness creation
4. International agreement



1. Market-based policies

- Rely on the market to correct negative production externalities and promote sustainable use of common pool resources.
- Work by changing the **incentives** faced by firms.
- **Actions:**
 - Indirect (Pigouvian) taxes
 - Carbon taxes
 - Tradable permits

Market-based policies

1. **Indirect (Pigouvian) taxes**: imposing an indirect tax on the firm **per unit of output** produced.

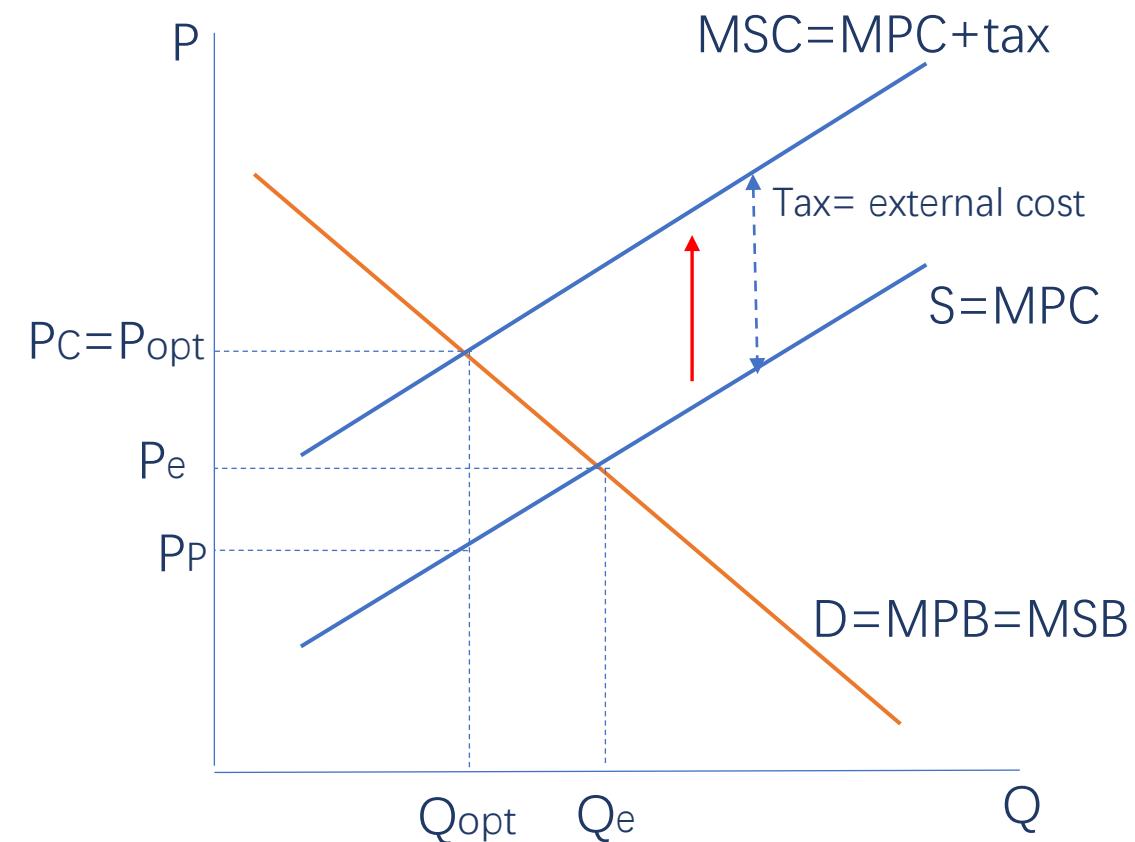
- It is used to ‘internalize’ negative externalities, in other words, the seller pays for the true costs of their actions without any burden being placed on third parties.
- Imposing a **tax = external cost**, so the MPC curve shifts upwards until it overlaps with MSC.



Market-based policies

1. Indirect (Pigouvian) taxes:

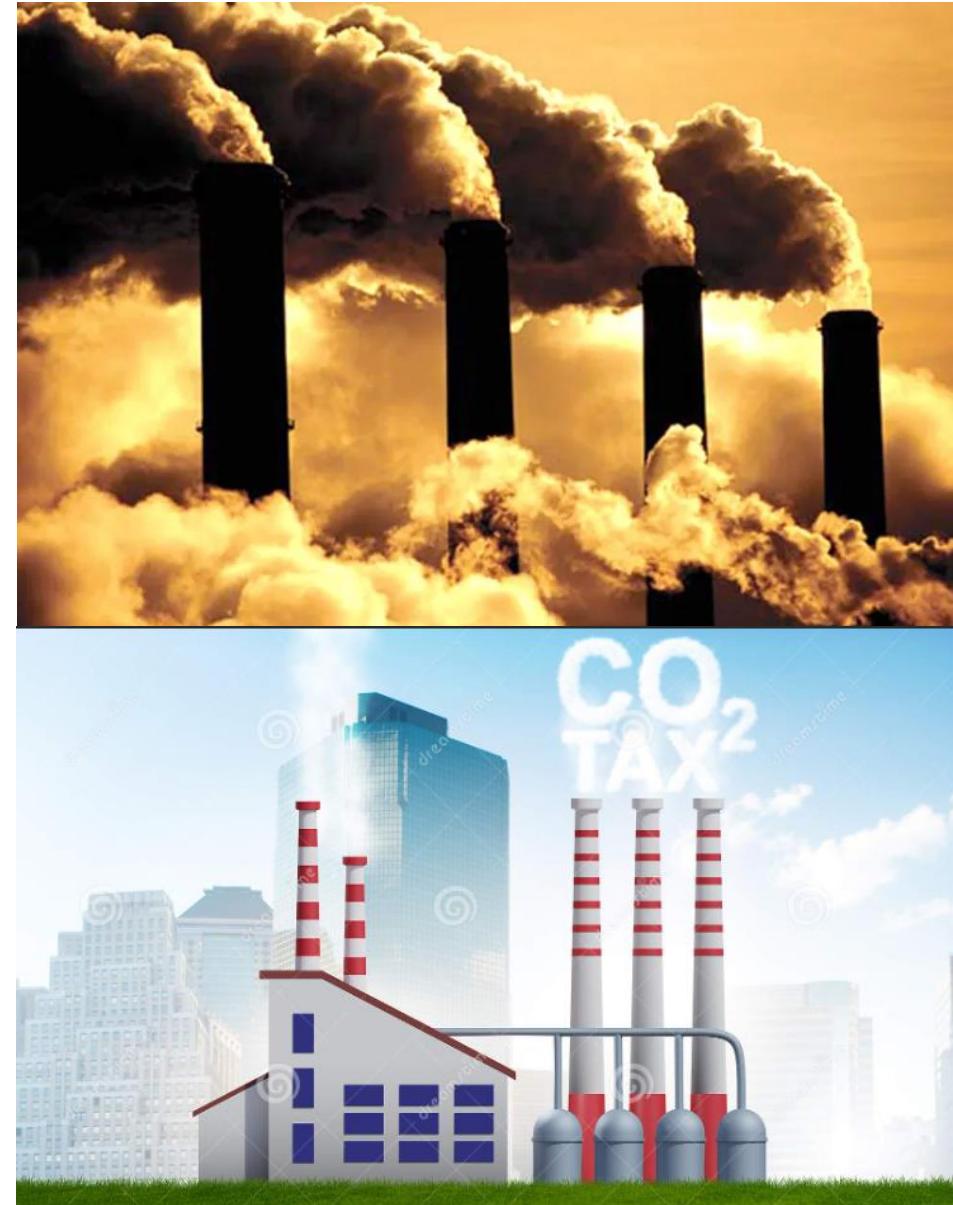
- The Pigouvian tax is imposed on a producer creating negative production externalities.
 - Tax = external cost
 - The indirect tax raises costs for the producer, thereby causing the $S=MPC$ curve to shift upward towards to the $MSC= MPC + \text{tax}$ curve.
- **Price** rise from P_e (the market equilibrium price) to P_{opt} (the social optimal price)
- **Quantity demanded** fall from Q_e (the market equilibrium quantity) to Q_{opt} (the socially optimal quantity)
- Intended to lead to allocative efficiency.



Market-based policies

2. Carbon taxes –It is a tax per unit of carbon emissions of fossil fuels.

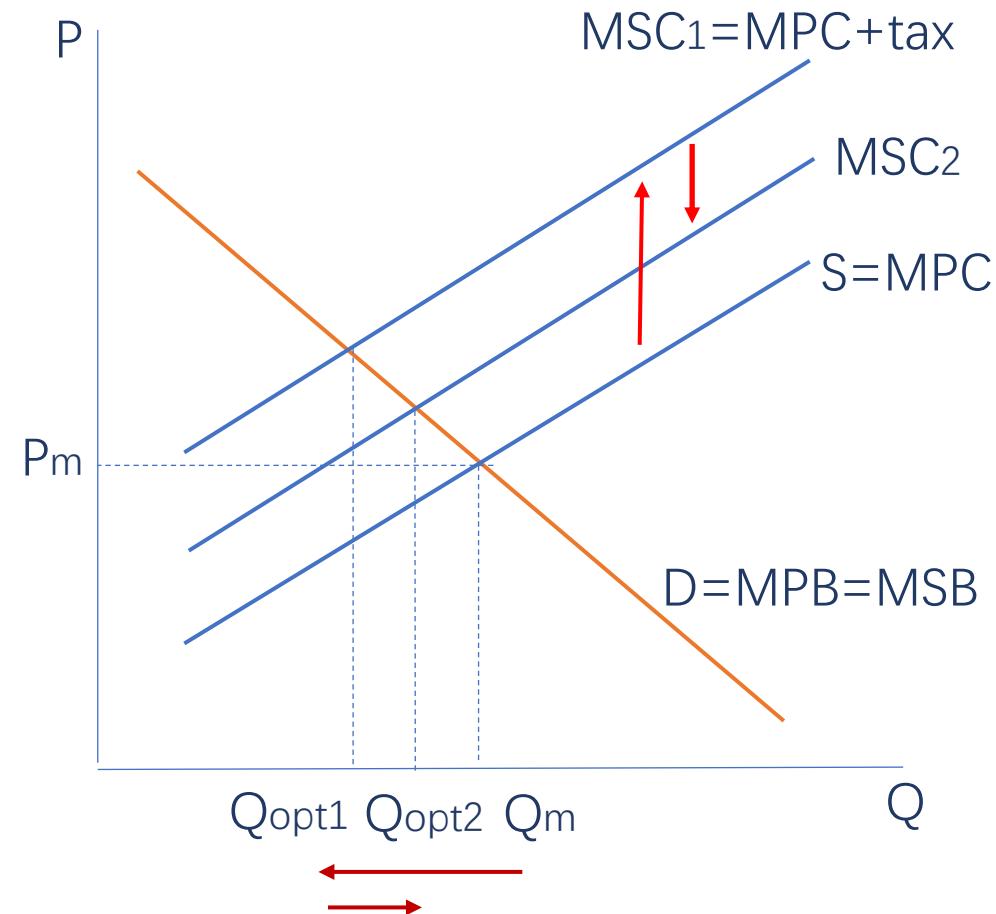
- Deal with carbon dioxide emission (greenhouse gases) by the burning of fossil fuels (oil, coal and natural gas)
- External cost: excess carbon emission are associated with global warming and climate change, which has created negative externalities such as heatwaves, flooding, landslides, storms and droughts, etc.
- Fossil fuels do not all emit the same amounts of carbon when burned, therefore the carbon tax is calculated on the basis of how much carbon the fuel emits → **the more carbon emitted, the higher the tax.**
- Objectives: Firms have higher cost of production (internalize the NEP), so it create incentives for firms to switch to other less polluting (taxed at a lower rate) or non-polluting energy sources (no tax at all).



Market-based policies

2. Carbon taxes –diagram illustration

- The government imposes carbon tax, so higher cost of production → upward shift in $S=MPC$ toward MSC
 - If the firm switches to alternative, less polluting resources, the the external costs of producing the output will become smaller. MSC curve shift from MSC_1 to MSC_2 . the optimum quantity of output increases from Q_{opt1} to Q_{opt2} .
- Carbon taxes reduces the size of the NEP and increases the optimum quantity of output
→ Correct or partially correct the overallocation of resources to the good, reducing the quantity of output produced.



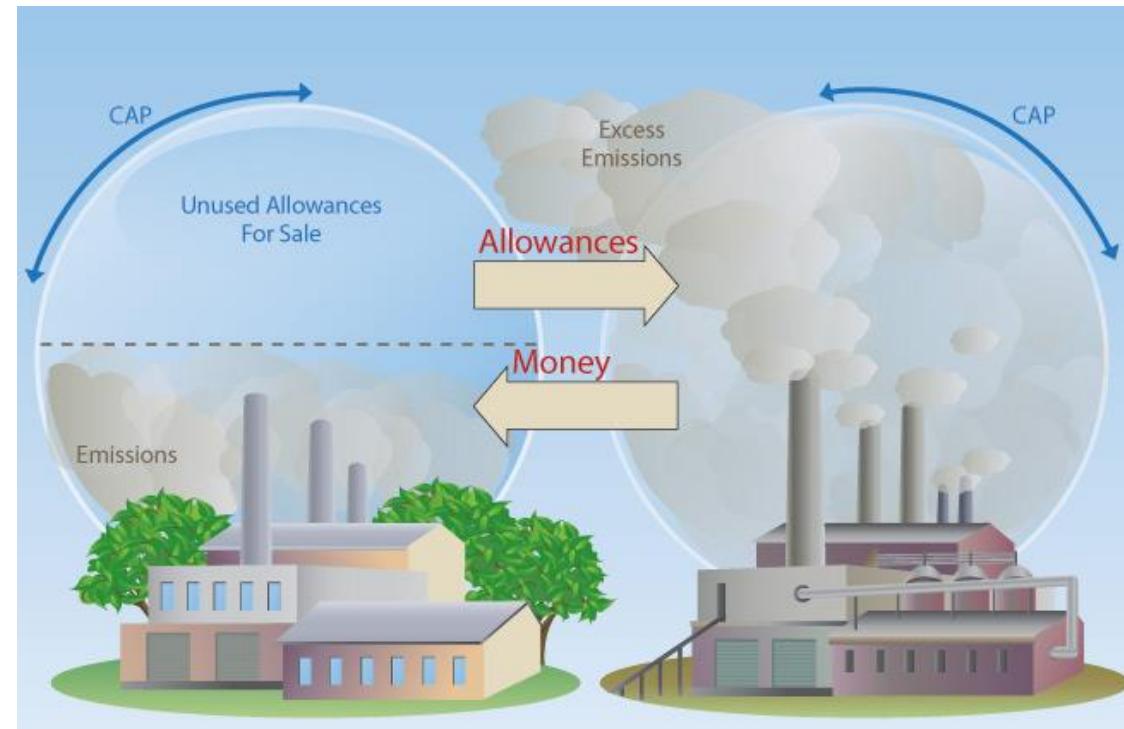
Market-based policies

3. Tradable permits (Cap & trade schemes)

- policy involving **permits to pollute** issued to firms by a government or an international body.
- the total level of pollution is determined by the government. Fixed supply of permits is distributed to firms.
- It can be freely traded in a market, the price of permits being decided by supply and demand.
- Emissions Trading System (EU ETS)

→ If a firm can produce its product by emitting a lower level of pollutants than the level set by its permits, it can sell its extra permits in the market.

→ If a firm needs to emit more pollutants, it can buy more permits in the market.



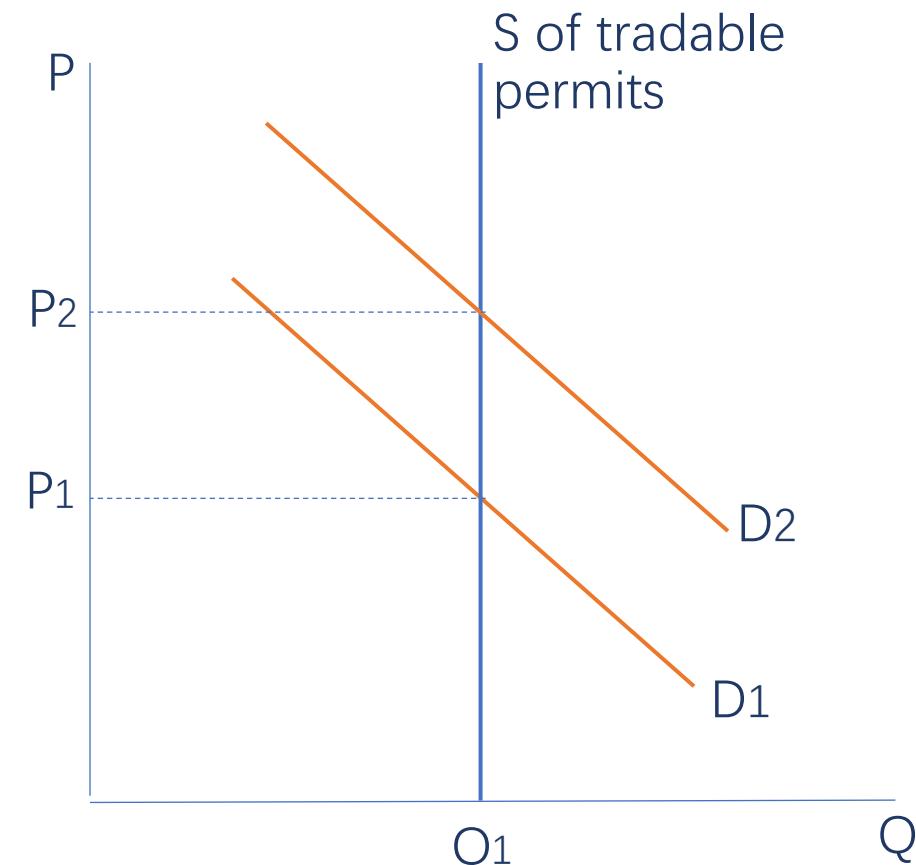
Market-based policies

3. Tradable permits (Cap & trade schemes)

- Perfect inelastic supply: Fixed Quantities of supply set by government – vertical S curve
- The position of the demand-for-permits curve determines the equilibrium price.
- When the economy grows and the firm increase their output levels, the demand for permits increases, demand curve shift from D₁ to D₂.
- With supply fixed, the price of permits increases from P₁ to P₂.

✓ The largest polluters have to purchase more permits, which increases their costs of production, so makes them less competitive and profitable. The more environmentally friendly producers can gain extra revenue from selling their surplus permits, thereby making them more competitive and profitable.

✓ Tradable permits schemes create an incentive for firms to develop greener technologies in the long run, thereby leading to a fall in the demand for and supply of pollution permits.



Advantages of market-based policies

| Pigouvian tax | Carbon Taxes | Tradable Permits |
|---|--|-----------------------------|
| Internalizing the externality: the costs that were previously external are made internal, they are now paid for by producers and consumers. | Government tax revenue, which can be used to raise public funds to deal with the external costs of negative externalities or to fund other interventionist measures, such as providing subsidies for firms to adopt green technologies or to fund government provision of merit and public goods and services. | Possible Government revenue |
| It increases the price of the product and therefore should decrease the quantity demanded. | It provides incentive for producers to reduce pollution (technological development or renewable resources), and to be more efficient, it leads to lower pollution levels at a lower overall cost to society. | |

Disadvantages of market-based policies

Pigouvian tax

Carbon Taxes

Tradable Permits

Firms may shift production to other countries → not favorable for local economy → less employment, less government revenue.

| Monitoring cost | | |
|---|---|---|
| Hard to quantify the external cost and decide an appropriate tax rate. | <p>Difficulties in designing effective carbon taxes. In order to design a tax equal in value to the amount of the pollution, it requires answers to:</p> <ol style="list-style-type: none"> What production methods produce pollutants? Which pollutants are harmful? What is the value of the harm (monetary value)? What is the appropriate amount of tax? How will consumers be affected? | <p>Difficulties in designing effective tradable permit schemes. It require the government or international body to set a maximum acceptable level for each type of pollutant. (CAP)</p> <ul style="list-style-type: none"> Too high: no desired effect on cutting pollution level. Too low: permits become very costly, causing hardship for firms. |
| It is politically difficult to impose tax amount that are high enough to make the necessary difference. | | Tradable permits have been developed for just a few pollutants (CO ₂ , SO ₂) |
| If the tax is too low → risk of polluting firm continue to pollute the environment even though they pay a tax. | | Hard to distribute permit, Possibility of Political favoritism: governments give preferential treatment to some firms. |
| If the demand is price inelastic, firms are able to charge higher prices. So consumers bear a greater proportion of the carbon tax burden. Carbon taxes have been criticized for being regressive, as they account for a larger proportion of the income of poor households. | | Anti-competitive: Large firms purchase permits from small firms, more concentration of the market. |
| | | Hard to supervise the emission. |

2. Government legislation and regulation

- Rely on the ‘command’ approach
- The government uses its authority to enact legislation and regulations in the public’s interest.
 - Emissions standards, quotas, licenses, permits or outright restrictions.

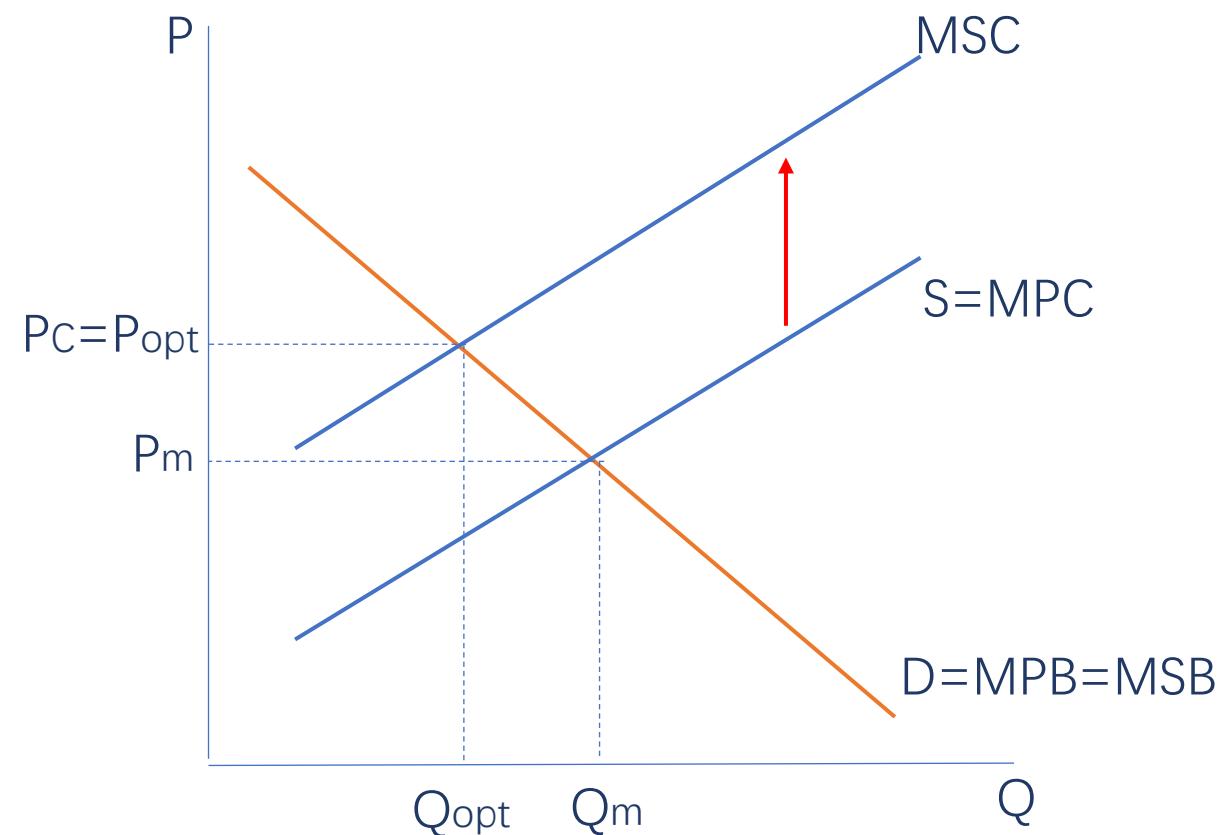


Action: Government legislation and regulation

1. Setting a maximum level of pollutants permitted.
2. Requirements for steel mills and electricity generating plants to install smokestack scrubbers.
3. Banning the use of harmful substances. (e.g. Asbestos)
4. Issue licenses or permits for particular activities (e.g. hunting)
5. Prohibiting construction or industry or agriculture in protected areas.
6. Restrictions on the quantity of logging.
7. Restrictions in the form of quotas for fishing.
8. Establishment of protected areas for the protection of biodiversity and endangered ecosystems.

Illustration in diagram

- Aim: lower the quantity of the good produced by shifting the MPC curve upward towards the MSC curve.



Effect of legislation and regulations

Advantages:

1. Easier to implement with less technical difficulties
2. Simple to put into effect and oversee.
3. Regulations force firms to comply and reduce their harmful activities.

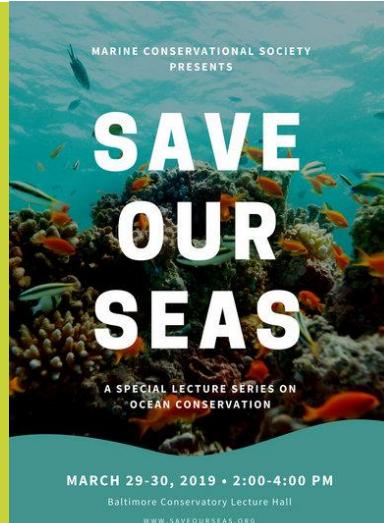
Disadvantages:

1. No incentives for firms to reduce emissions by using less polluting resources, to increase energy efficiency and to switch to alternative fuels.
2. The pollution is reduced at a higher overall cost. (no distinguish between companies with diff. cost of reducing pollution)
3. Lack of sufficient technical information on types and amounts of pollutants emitted.
4. Costs of monitoring and supervision to detect possible violations. Problems with enforcement.

3. Education and awareness creation

Education of the public and provision of information regarding the polluting activities of firms.

- Consumers turn away from the products
- Negative effects on the firms' sales → reduce the externalities
- E.g. Advertising about the importance of environmental protection.



4. Education and awareness creation

Advantages:

Firms have to consider their customer's opinion and reduce the negative production externalities.

Disadvantages:

It can only make a small difference in terms of solving the problems of production externalities and sustainability.



5. International agreements

- Negative production externalities and the overuse of common pool resources very often have international repercussions, it requires co-operation among governments and international agreement to control and prevent the negative consequences.
- E.g. more than 3000 international environmental agreements have been registered, covering areas of environmental governance such as freshwater resources, hazardous substances, global marine environments, nature conservation and nuclear safety.

Examples:

- Montreal Protocol, 1987
- European Union Emissions Trading System (EU ETS)
- Kyoto Protocol of 2005-2012
- The Paris Agreement





Negative consumption externalities

Negative consumption externalities

- External costs created by consumers.
- **Definition:** Negative effects suffered by a third party whose interests are not considered when a good or service is consumed, so the third party are therefore not compensated.
- E.g. Smoke in public places, uses of fossil fuels for home heating and car driving.



Examples of Negative consumption externalities



Vehicle pollution



Household waste



Noise pollution from neighbours



Air pollution from smokers



Traffic congestion



Gambling addiction



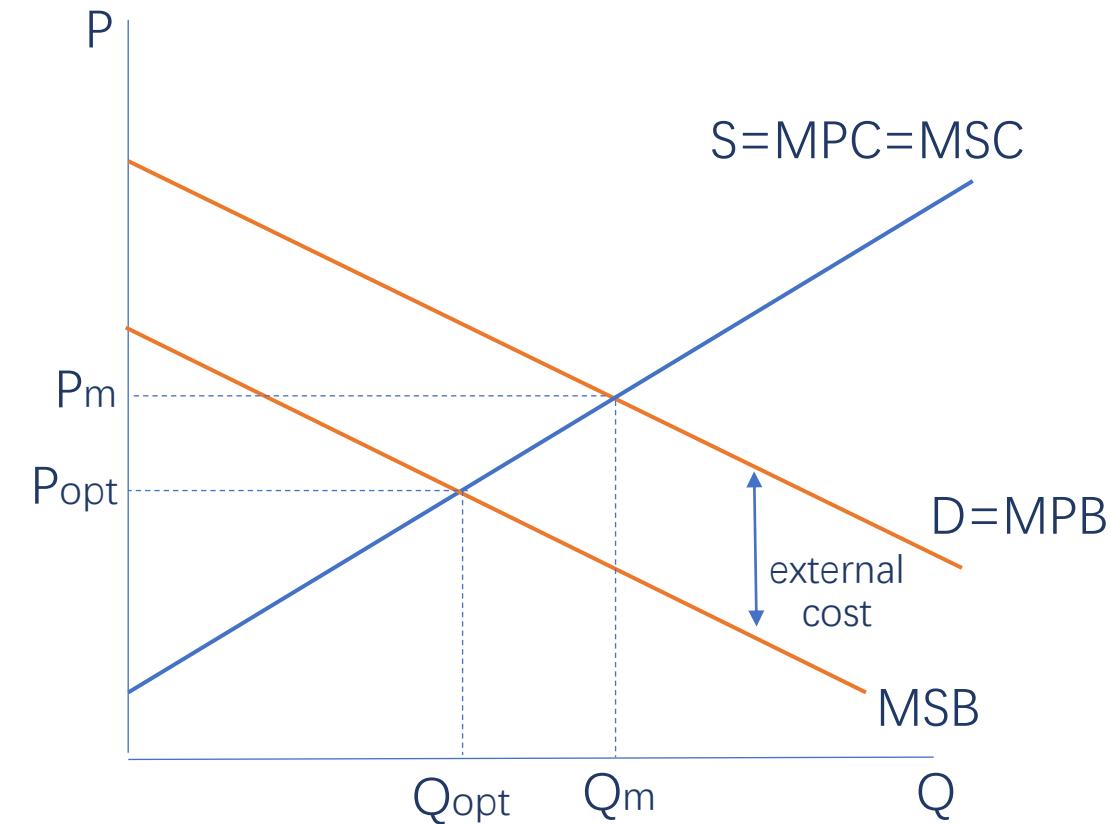
Litter from tourists



Spillover costs from obesity

Illustration of negative consumption externalities

- When there is a consumption externality (say smoking), it creates **external costs** for non-smokers and higher than necessary health care costs that are additional burden upon society.
- $S=MPC=MSC$
- When there is a consumption externality, the **MPB curve does not reflect social benefits**.
- $MPB \neq MSB$, the external cost cause the MSB curve to lie below the MPB curve. The vertical difference between MPB and MSB is the external cost.
- $Q_m > Q_{opt}$, $MSC > MSB$ at Q_m
 - The free market overallocates resources to the production of the good, too much of it is produced relative to what is socially optimum.
 - Allocative inefficiency.



Welfare loss in relation to CS & PS

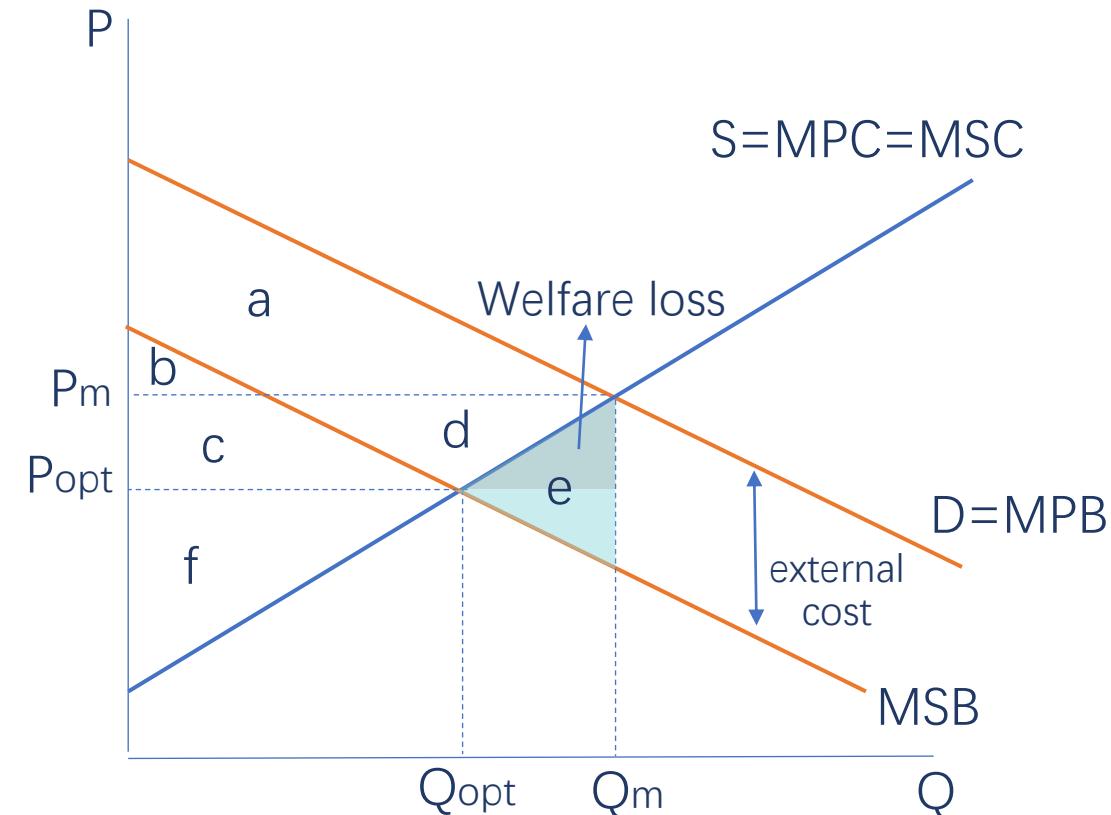
At market equilibrium:

- CS = a+b
- PS = c+d+f
- External costs = a+d+e
- Social benefits = CS+PS-external cost
 $= (a+b)+(c+d+f)-(a+d+e) = b+c+f-e$

At social optimum:

- CS = b
- PS = c+f
- Social benefit= b+c+f

→ Difference **e** is the welfare loss.



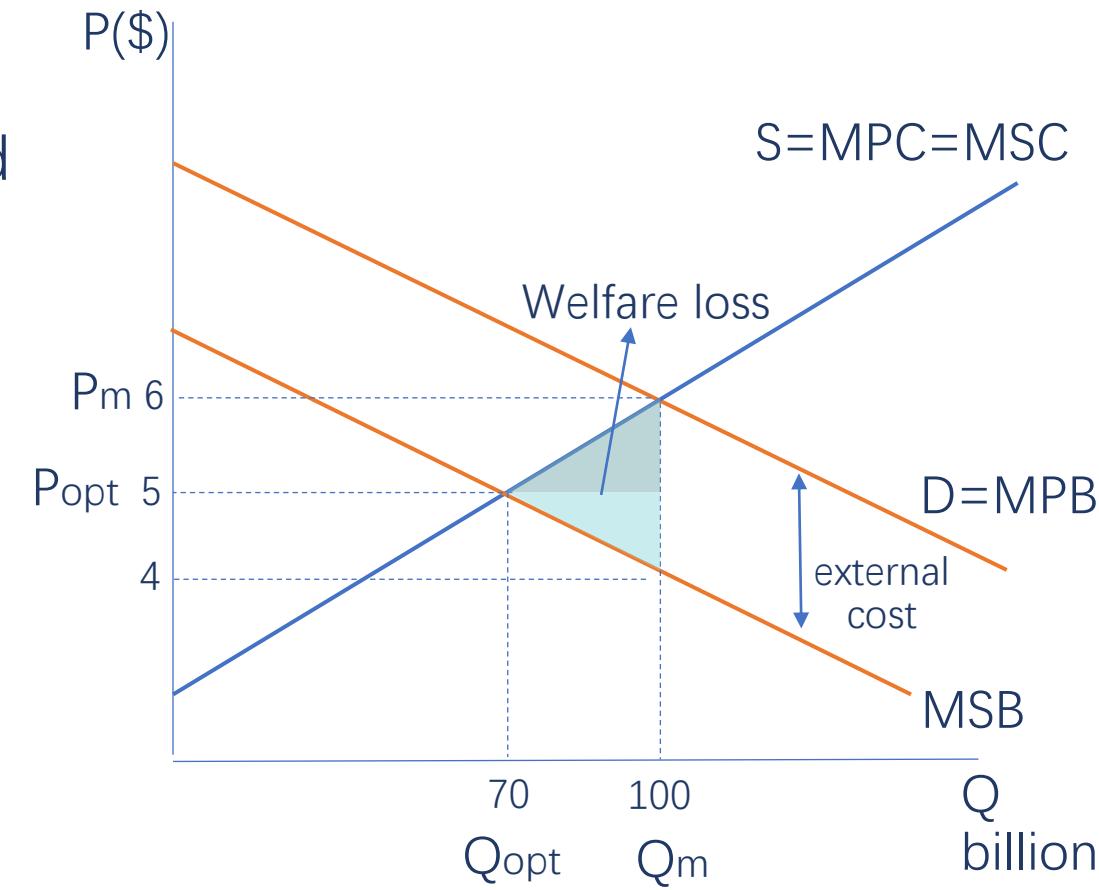
The welfare loss of negative consumption externalities

- The **welfare loss** represents the reduction in benefits for society due to the overallocation of resources to the production of the good.
- For all units of output greater than Q_{opt} , $MSC > MSB$, indicating that too much of the good is produced.
- **Welfare loss** = the difference between the MSC and MSB curves for the amount of output that is overproduced relative to the social optimum. $(Q_m - Q_{opt})$
- If this externality were corrected, society would gain the benefits represented by the shaded area.

Calculation:

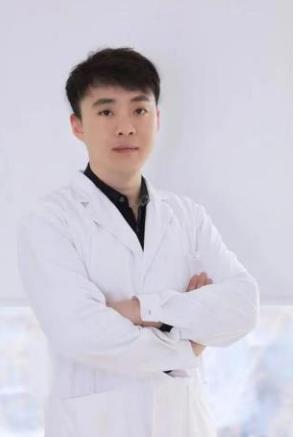
$$(MPB - MSB) * (Q_m - Q_{opt}) / 2$$

$$= (6 - 4) * (100 - 70) / 2 = \$ 30 \text{ billions}$$



Merit goods & Demerit goods

Merit goods are goods that are held to be desirable for consumers, but which are underprovided by the market.



Demerit goods are goods that are considered to be undesirable for consumers, but which are overprovided by the market.



Distinguish between merit/demerit goods with NEC/PEC:

- Merit/demerit goods are desirable/undesirable for consumers, in many cases, they also have effects on third parties, therefore bring NEC/PEC (not necessarily).
- NEC/PEC brings external cost/benefit to third parties, it may not harm consumer itself.



Reason for underprovision of merit goods

1. The good may have positive externalities – too little is provided by the market. E.g. Education, immunization programs.
2. Low levels of income and poverty.
 - willing but not able to buy something
 - their desire does not show up in the market demand curve
 - E.g. health care services, medicines, education.
3. Consumer ignorance of the benefits, and so do not demand them.
 - Immunization, annual health check-up

Reason for overallocating resources to demerit goods

- Consumer ignorance about its negative effects or indifference.
- Consumers may not be aware of the harmful effects upon others of their action, or they may not care.

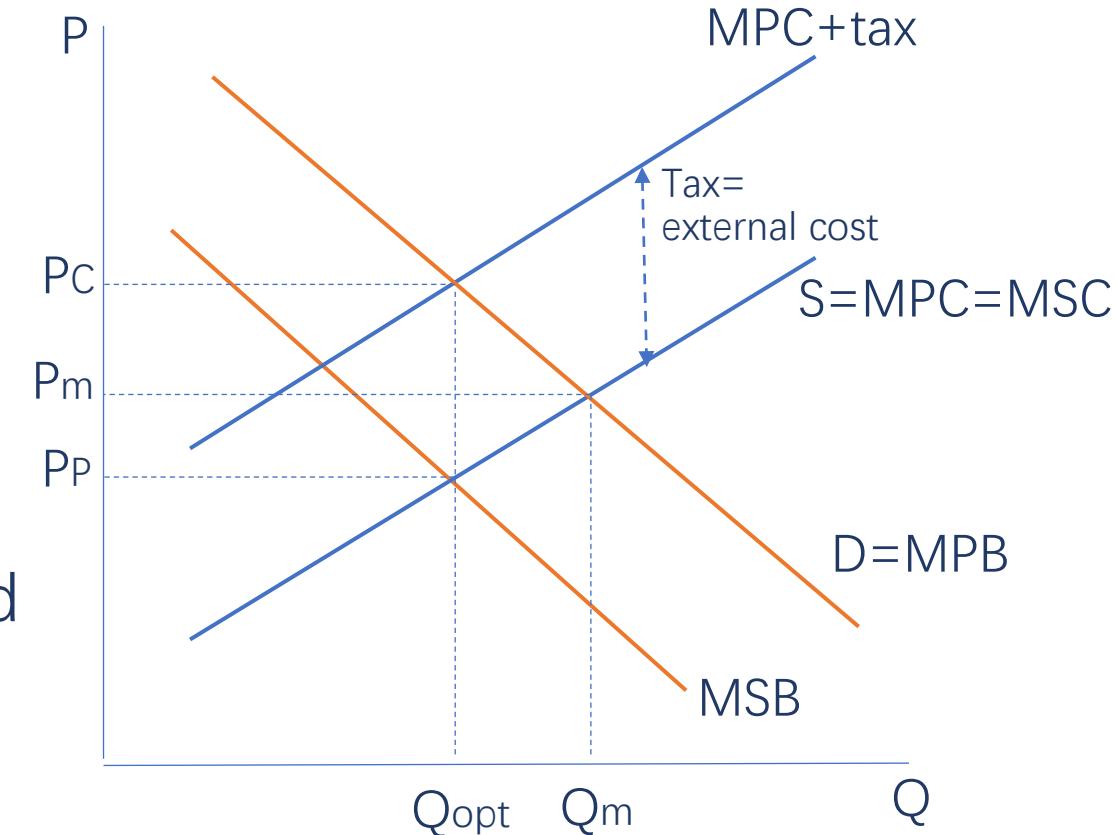


Policies to correct negative consumption externalities and prevent overuse of common pool resources

1. Market-based policies
2. Government legislation and regulation
3. Education and awareness-creation
4. Nudges

1. Market-based policies

- Imposition of indirect Pigouvian taxes on the good whose consumption creates external costs.
- An indirect tax imposed
- Increased cost of production for producers
→ A decrease in supply and an upward shift of the supply curve from MPC to MPC+tax, tax=external cost.
- The MPC+tax curve intersects MPB at the Q_{opt} level of output, quantity produced and consumed drops to Q_{opt} . Price increases from P_m to P_c
- The tax permits allocative efficiency to be achieved.



Effect of market-based policies

Advantages:

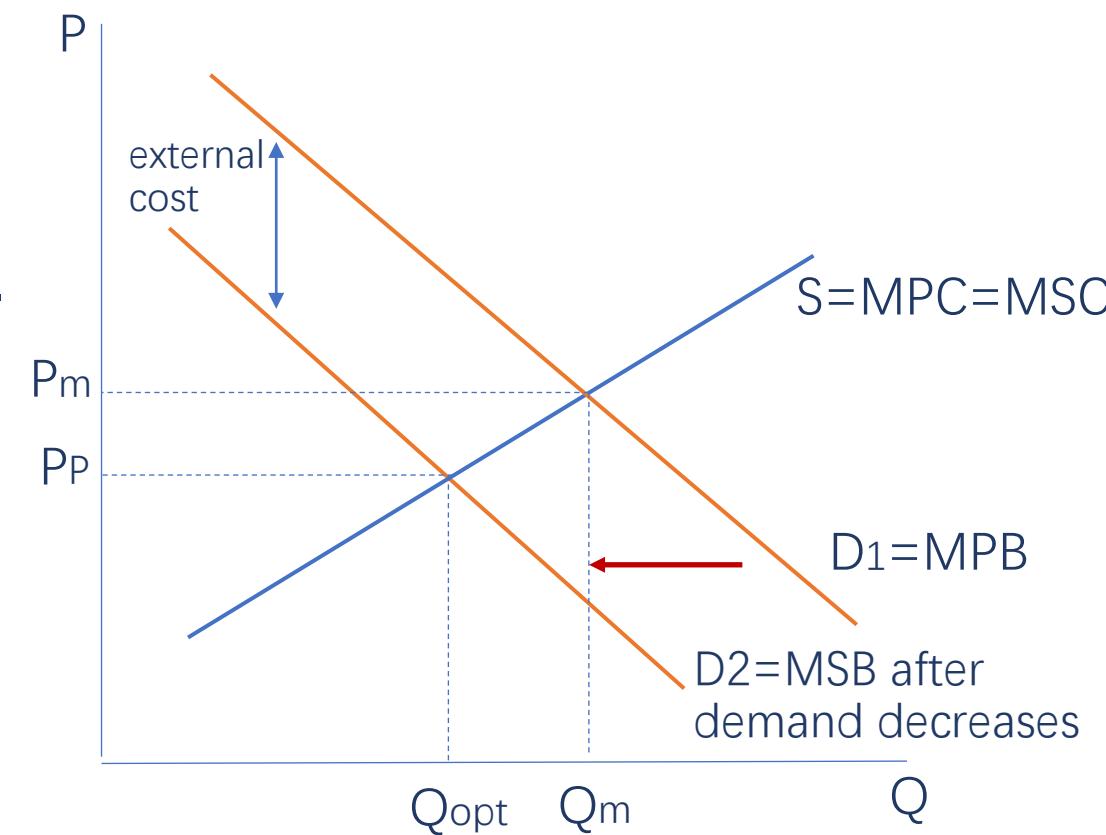
1. It internalize the externality and create incentives for consumers to change their consumption patterns.
2. The tax revenue can be used to finance education programmes to discourage consumption of particular goods.

Disadvantages:

1. Difficulties in measuring the value of the external costs.
2. Some goods with negative consumption externalities have an inelastic demand. (cigarette, alcohol, gasoline) – very high indirect tax may lead to politically unacceptable.
3. Underground market
4. Consumption downgrading

2. Government legislation and regulation

- Government setting the regulations to prevent or limit consumer activities that impose costs on third parties.
- E.g. Smoking bans in public areas, such as restaurants, the workplace, etc.
- Shifting $D_1=MPB$ curve towards the MSB curve until it overlaps with MSB .
- Eliminate the externality with Q_{opt} and P_{opt}
→ Allocative efficiency



Effect of Government legislation and regulation.

Advantages:

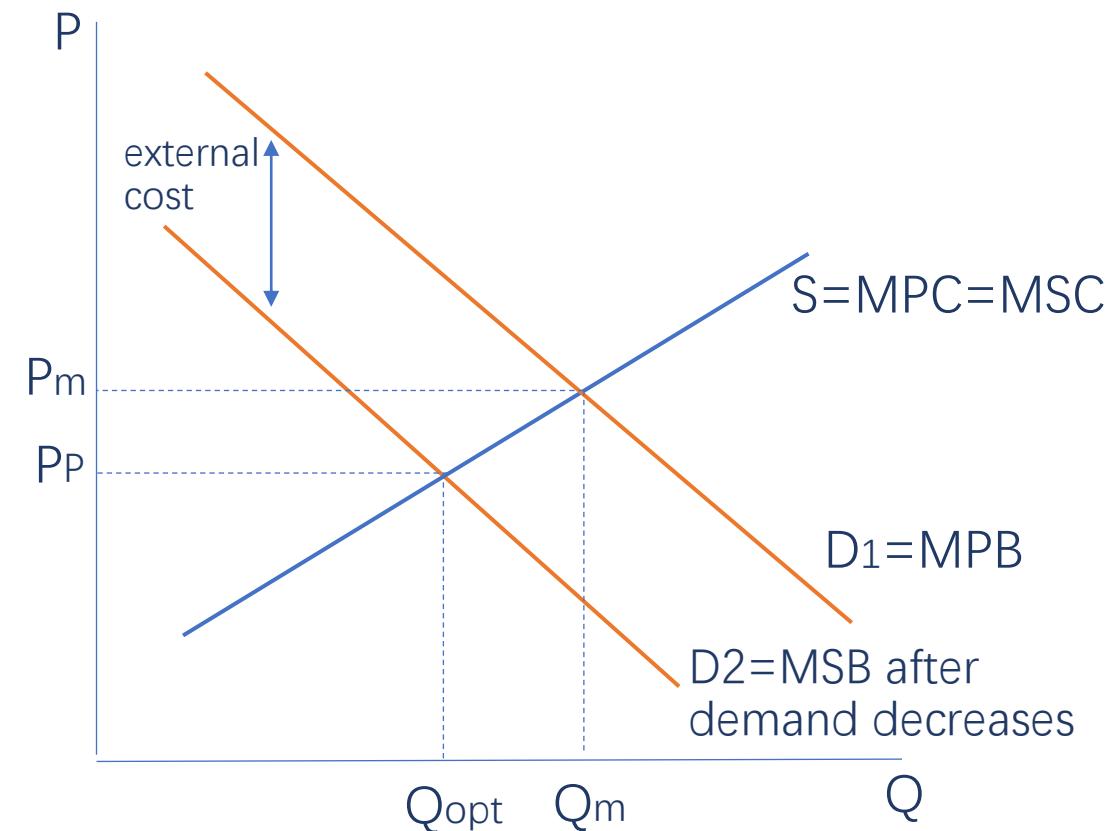
1. Effective in reducing external cost. E.g. prohibiting smoking on public places; restrictions on cars entering city centers.

Disadvantages:

1. Difficulties to dealing with some special negative consumption externalities, like gasoline.
2. It can cause underground (illegal) markets to develop where the demerit good or service can be purchased, often at a very high price.
3. Unless the penalties are extremely high and consistency enforced, people may choose to break the rules and regulations. Such as under-age smoking, drinking and gambling.

3. Education and awareness-creation

- Educating the general public about the costs of consuming demerit goods. Try to persuade consumers to buy fewer goods with negative externalities → change the consumer behavior.
- E.g. anti-smoking campaigns, reduce fossil fuel use campaigns, etc.



Effect of Education and awareness-creation

Advantages:

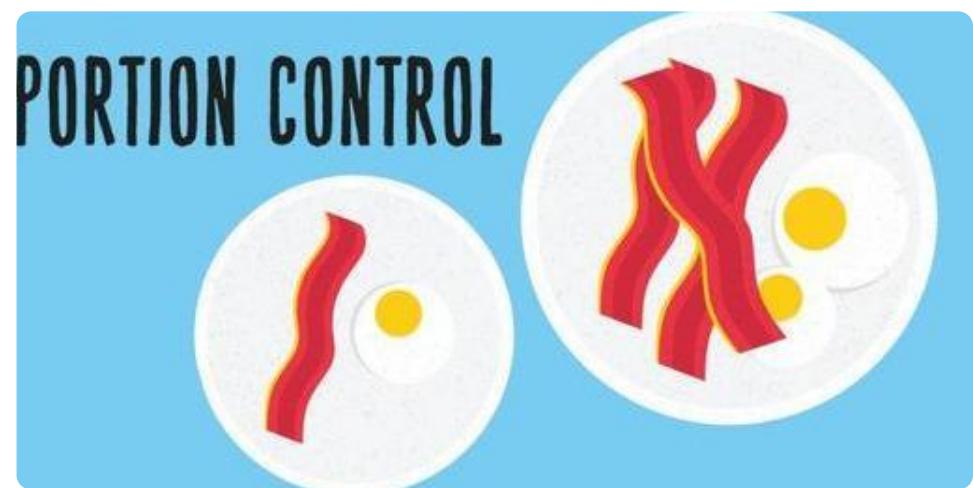
1. Simpler than other methods.

Disadvantages:

1. The cost to the government of campaigns. (opportunity cost)
2. It may not be effective enough in reducing the negative externality.

Nudges

- Use behavioural economic theory to design some methods to influence consumer's behavior.



Positive consumption externalities



Positive consumption externality

- A **positive externality** caused by **consumption activities**, leading to a situation where marginal social benefits are greater than marginal private benefits (**MSB>MPB**).
- External benefits created by consumers.
 - E.g. Consumption of education
→ productive workforce, lower unemployment, higher rate of growth, more economic development, lower crime rate, etc.
 - Consumption of health care service
→ healthier population, productive, higher standards of living

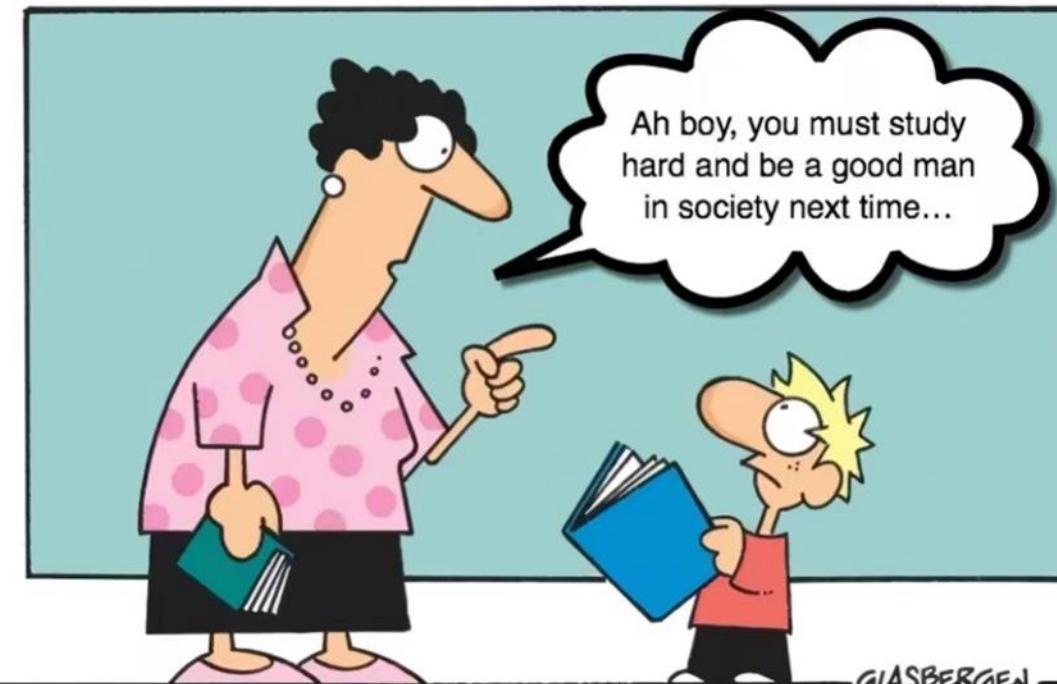
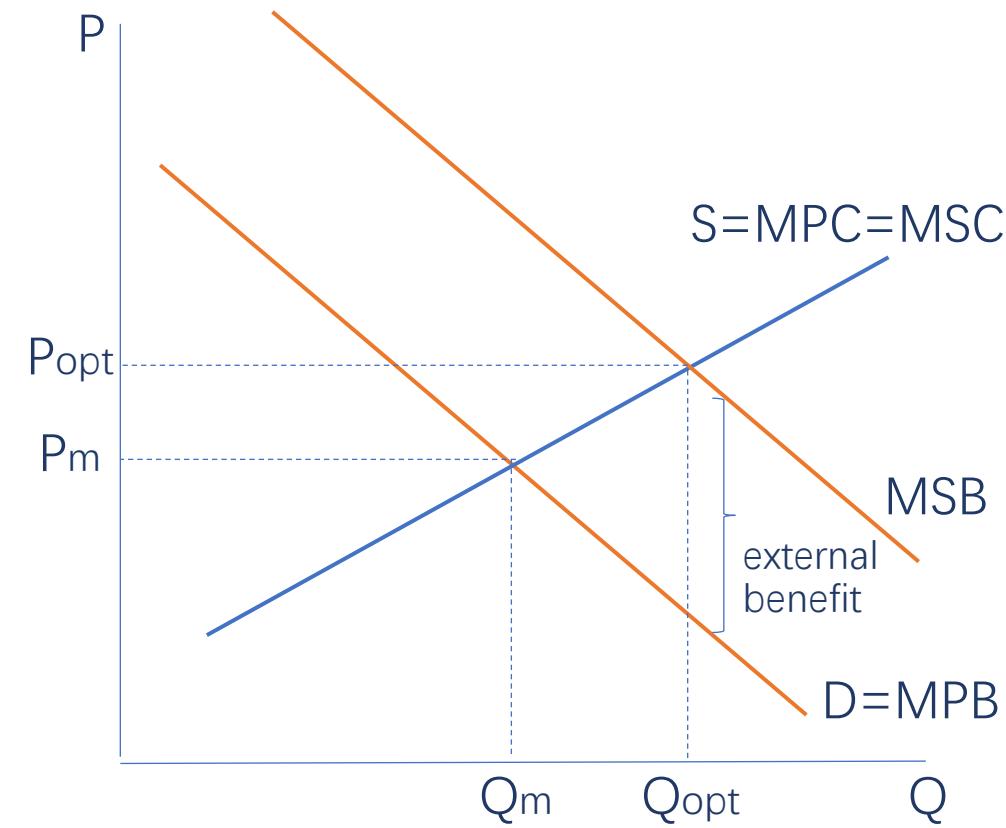


Illustration in diagram

- Market equilibrium at P_m and Q_m
- Education have positive consumption externality
- The MSB curve lies above the MPB curve with the differences of external benefits to society.
- The socially optimum quantity, Q_{opt} , is given by the point where $MSB=MSC$
- The quantity produced by the market, P_m , is given by the point where $MPB=MPC$
- $Q_{opt} > Q_m$
- The market underallocates resources to the good/services, too little of it is produced relative to the social optimum.
- $Q_m < Q_{opt}$, $MSB > MSC$ at Q_m .



The welfare loss in relation to CS & PS

At market equilibrium:

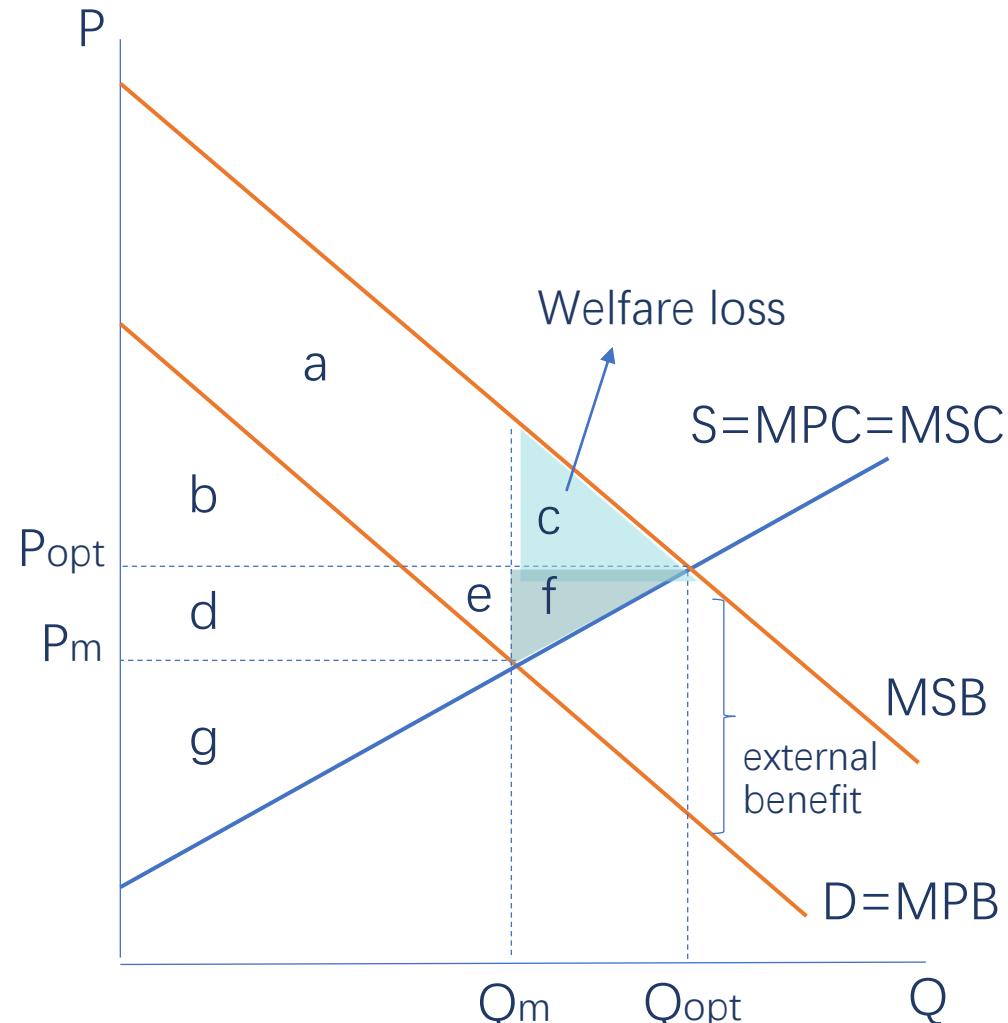
- CS = b+d
- PS = g
- External benefit = a+e
- Total benefits = a+b+d+e+g

At social optimum:

- CS = a+b+c
- PS = d+e+f+g
- Total social benefit= CS+PS
= a+b+c+d+e+f+g

→ Difference **c+f** is the welfare loss.

(additional benefit if social optimum is achieved)

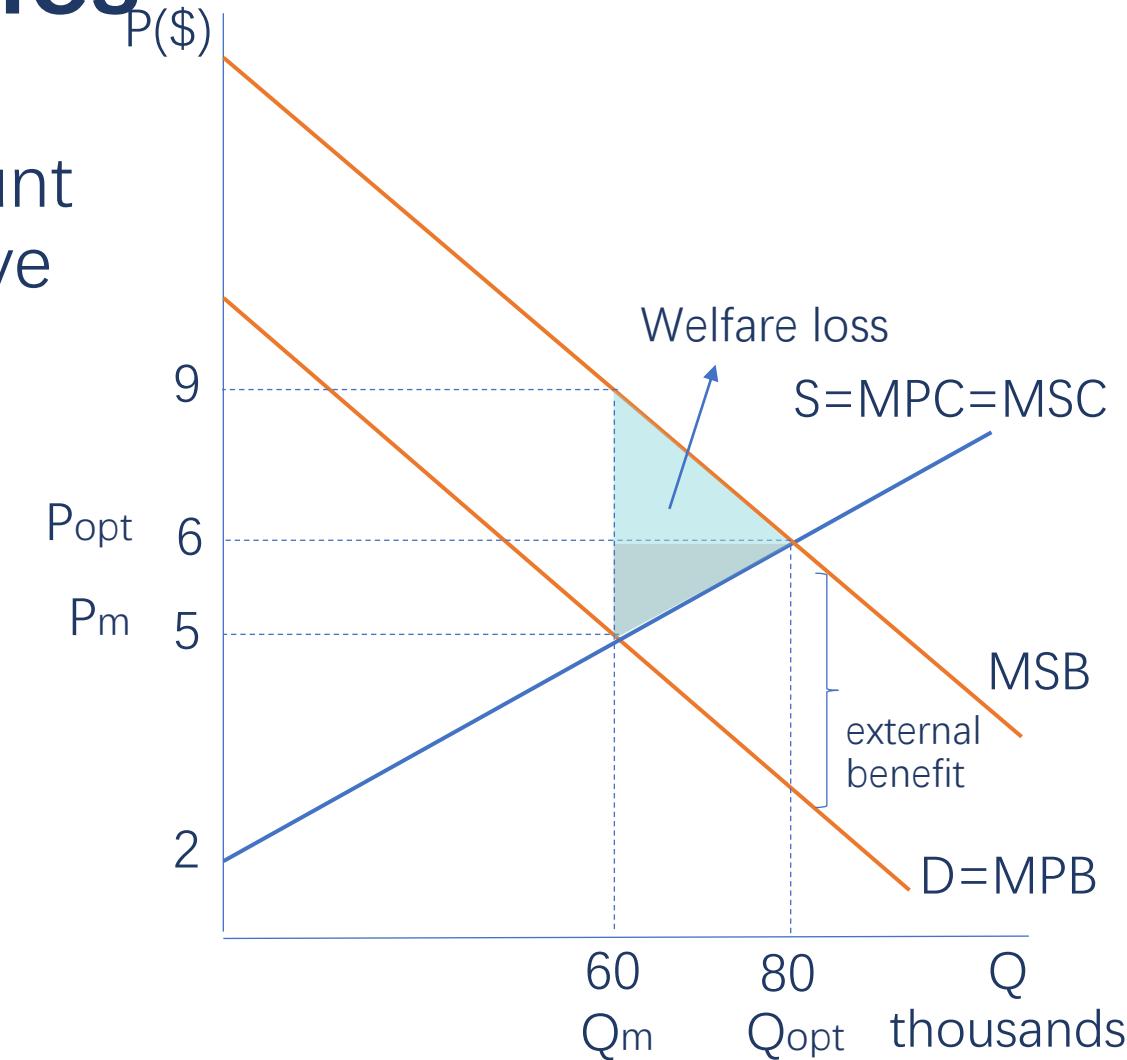


The welfare loss of positive consumption externalities

- Welfare loss is the difference between the MSB and MSC curves for the amount of output that is underproduced relative to the social optimum ($Q_{opt} - Q_m$)
- It represents the loss of social benefits due to underproduction of the good.

Calculation:

$$\text{Welfare loss} = (9-5)*(80-60)/2 = \$40 \text{ K}$$



Correcting positive consumption externalities

By Increasing Demand

1. Government legislation and regulation

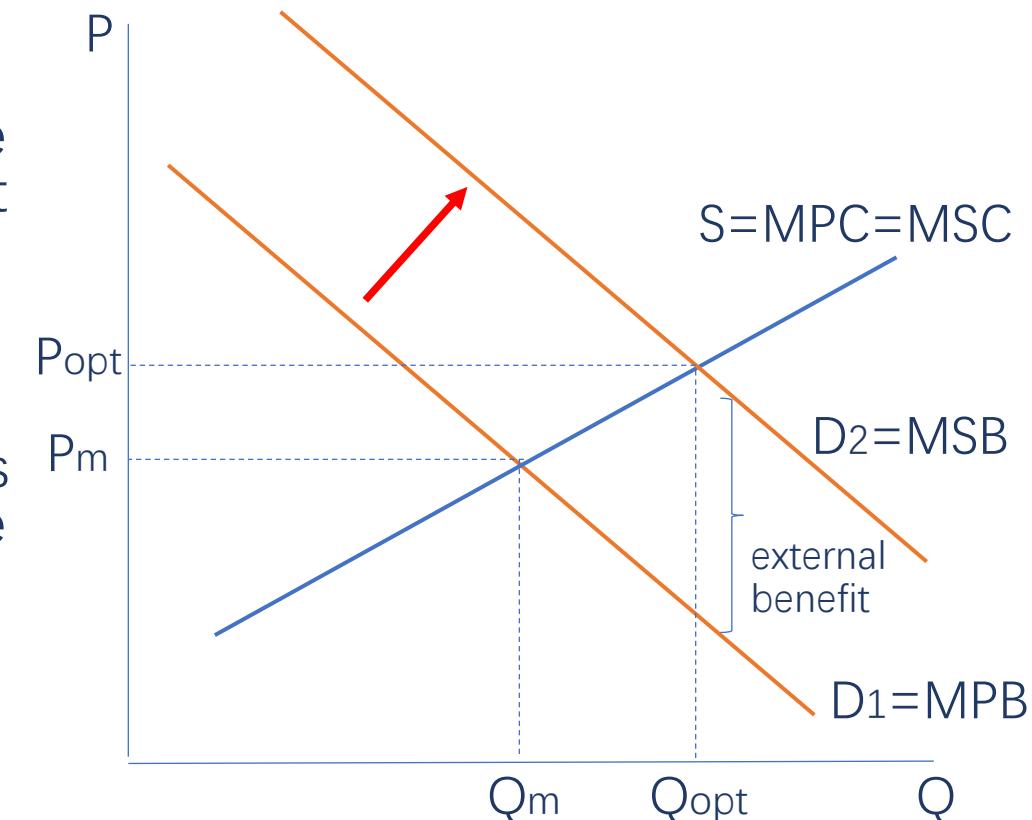
- Compulsory education up to a certain age in most countries.
- Demand for education increases, the demand curve $D_1=MPB$ shifts to the right. Ideally, it will shift until it reaches the MSB curve, and Q_{opt} is produced and consumed.

2. Education and awareness creation

- Government use education of the public, awareness creation, to try to persuade consumers to buy more goods with positive externalities. E.g. education on the importance of good nutrition

3. Nudges

- Use nudge to encourage the consumption of NEC. E.g. Creation of bicycle lanes to encourage the use of bike riding.



Correcting positive consumption externalities

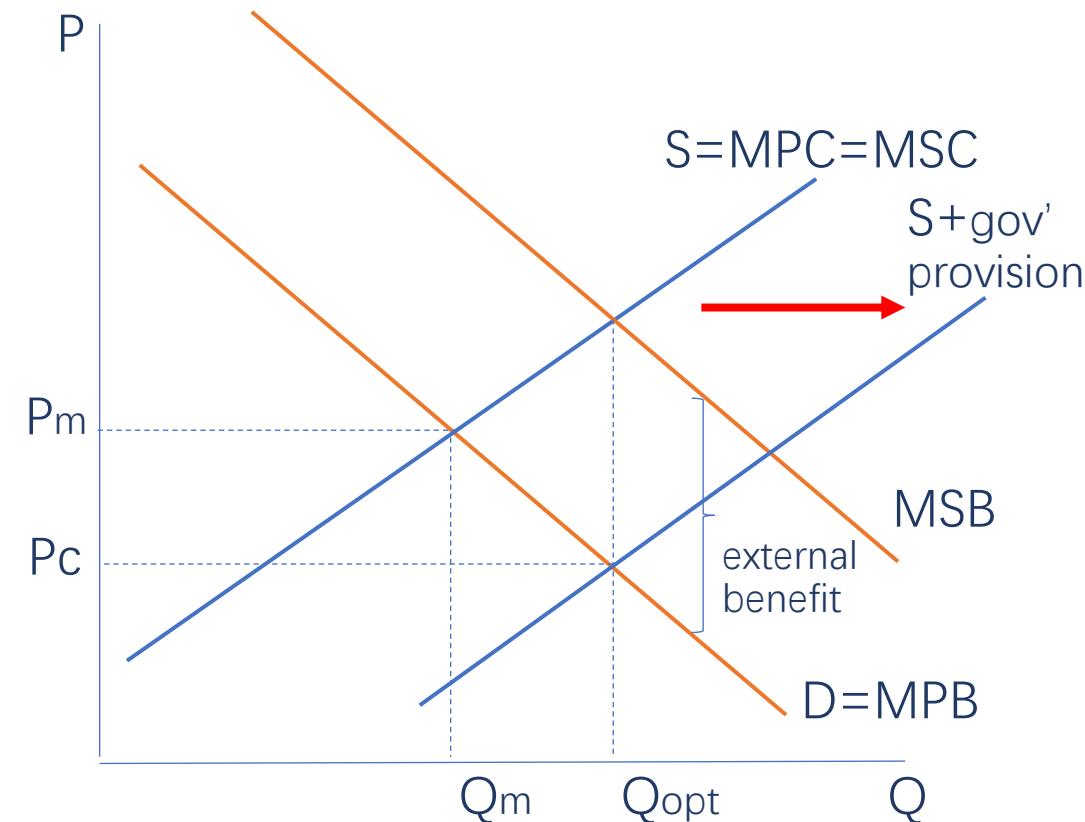
By Increasing supply

4. Direct government provision

- Government direct provision of goods and services with positive consumption externalities.
- E.g. Education and health care are merit goods with external benefits so large and important that it is widely believed that they must not be left to private section provision along.

✓ Government increase the supply and shift the supply curve rightwards(downwards) to $S+govern\text{ment}$ provision.

✓ The new supply curve must intersect MPB at the level of social optimum output Q_{opt} .

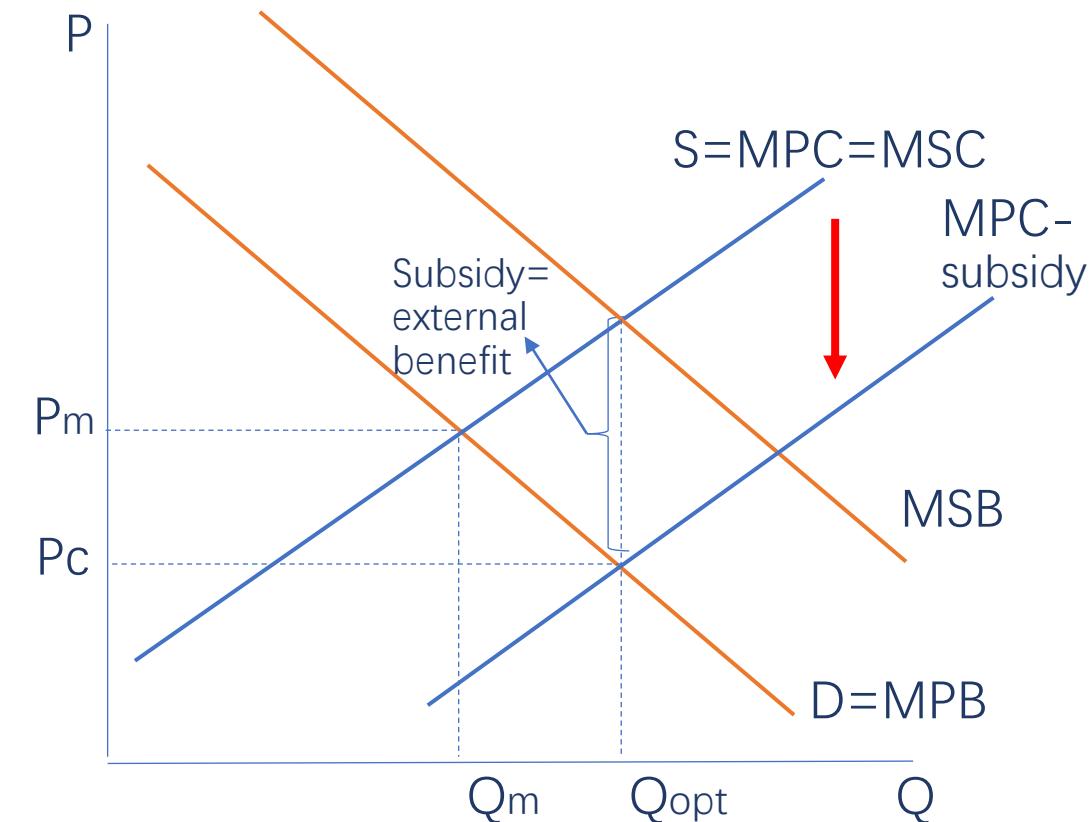


Correcting positive consumption externalities

5. Subsidy

- The subsidy has an effect of increasing the supply and shift the supply curve rightwards(downwards).
- Subsidy = external benefit
- The new supply curve MPC-subsidy will intersect MPB at the level of output Q_{opt} .
- $P_m \rightarrow P_c$
- $Q_m \rightarrow Q_{opt}$
- Allocative efficiency is achieved

By Increasing supply



Evaluating policies to correct positive production/consumption externalities

Direct government provision & subsidies:

Advantages

- Effective in increasing the quantity of the good produced and consumed.
- Lower the price of the good to consumers.

Disadvantages

- Difficulties to achieve the optimum results of $MSC=MSB$.
- Hard to measure the size of the external benefits → difficult to calculate the level of support they should receive.
- Use of government funds (opportunity cost)
- Hard to make a choice of which goods and by how much they should be supported.
- Political pressures on government. Different groups compete with each other over who will receive the most benefits.

Evaluating policies to correct positive production/consumption externalities

Legislation, education and awareness creation

Advantages

- Effective in increasing the quantity of the good produced and consumed in certain cases. E.g. compulsory education for children; legal requirement for school-aged children to be vaccinated against certain diseases.

Disadvantages

- Difficulties to achieve the optimum results of $MSC=MSB$.
 - Hard to measure the size of the external benefits. They can only help shift the MPB curve in the right direction, rather than achieve a demand increase that will bring the economy to the Q_{opt} level of output.
- Effect of raising the price of the good to consumers, which may make the good unaffordable for some consumer groups.

→more effective if they are implemented together with direct provision and subsidies.

Positive production externalities



Positive production externalities

Positive production externalities refer to external benefits created by producers. E.g.:

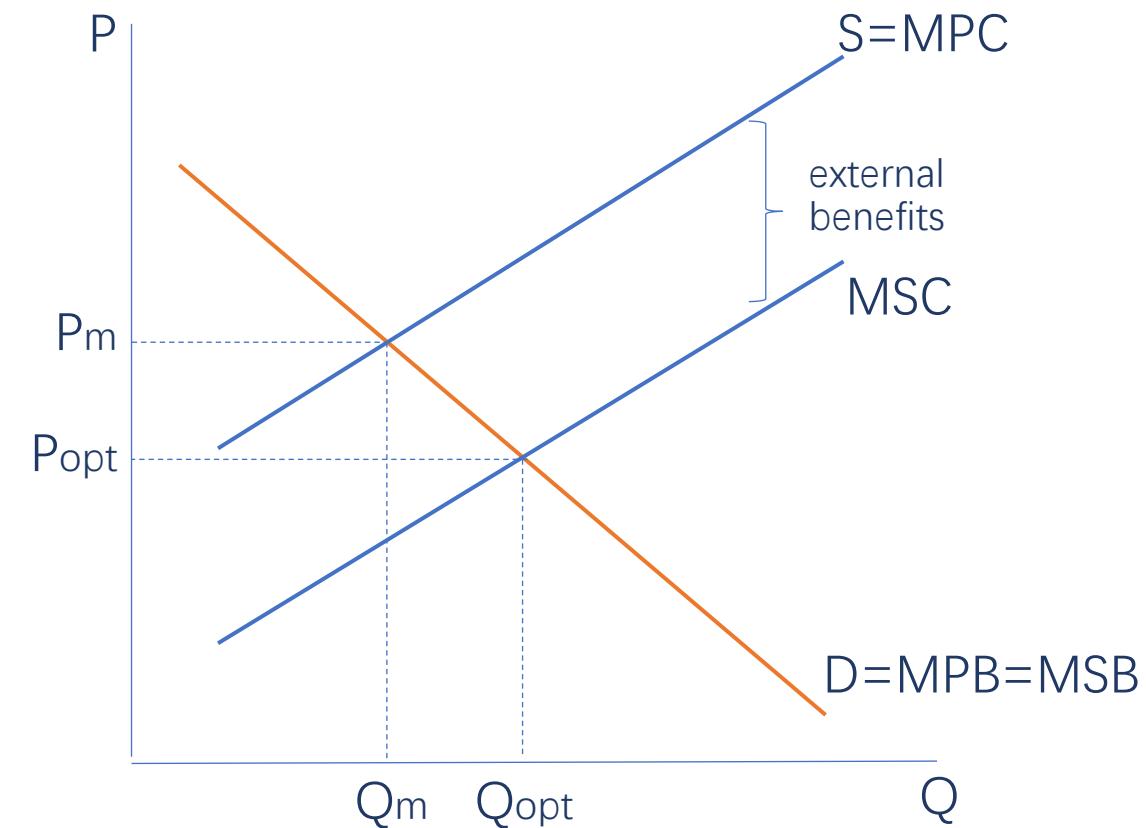
- Beekeeper produce honey – external benefit of plant pollination
- technology spillover - the impact of one firm's research and production efforts on other firms' access to technological advance.

→The new technology may benefit not only this firm but society as a whole because the design will enter society's pool of technological knowledge.



Illustration of positive production externalities

- Market equilibrium with Q_m and P_m .
- Producers do R&D to develop new technologies, which create external benefits. (Diff. between MPC and MSC) that not only the firm but also society benefits from it.
- → the social costs(MSC) are lower than the private costs(MPC).
- $Q_{opt} > Q_m$, $MSB > MSC$ at Q_m
→ the market underallocates resources to the production of the good, too little of it is produced.



Welfare loss in relation to CS and PS

At market equilibrium:

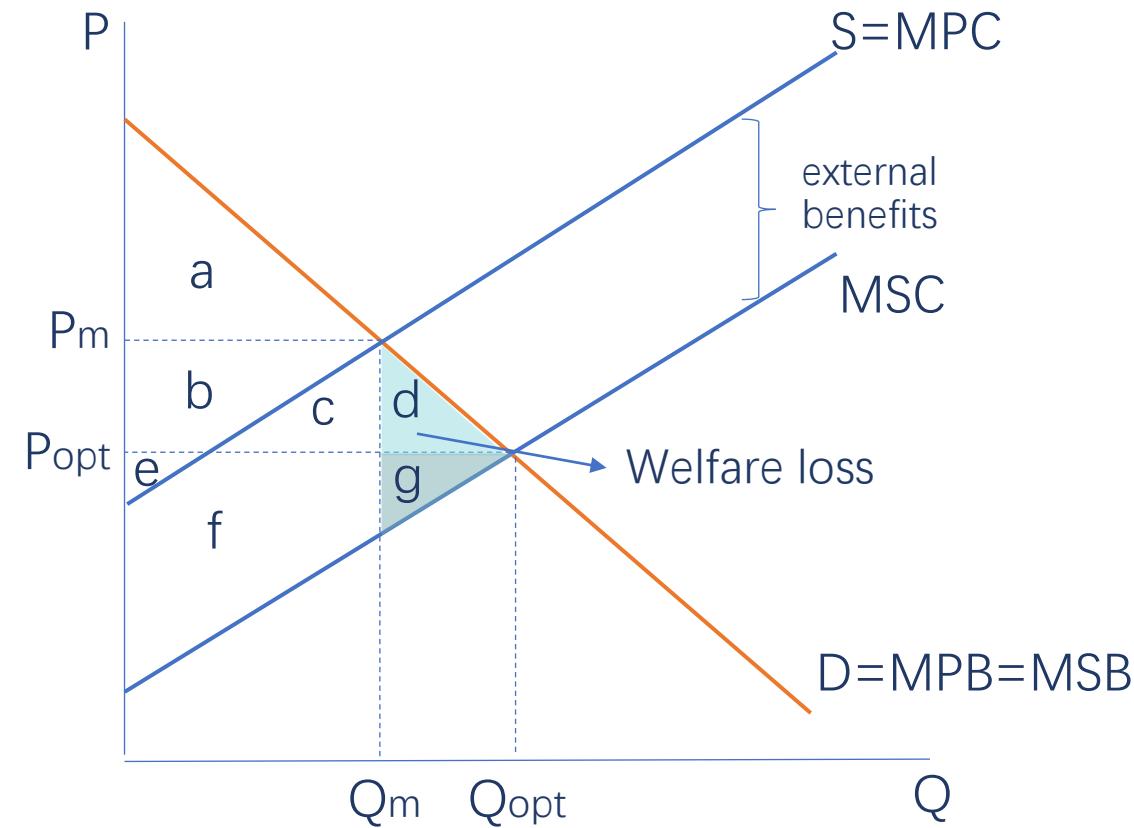
- CS = a
- PS = b+e
- External benefit = c+f
- Total benefits = a+b+e+c+f

At social optimum:

- CS = a+b+c+d
- PS = e+f+g
- Total social benefit= CS+PS
= a+b+c+d+e+f+g

→ Difference **d+g** is the welfare loss.

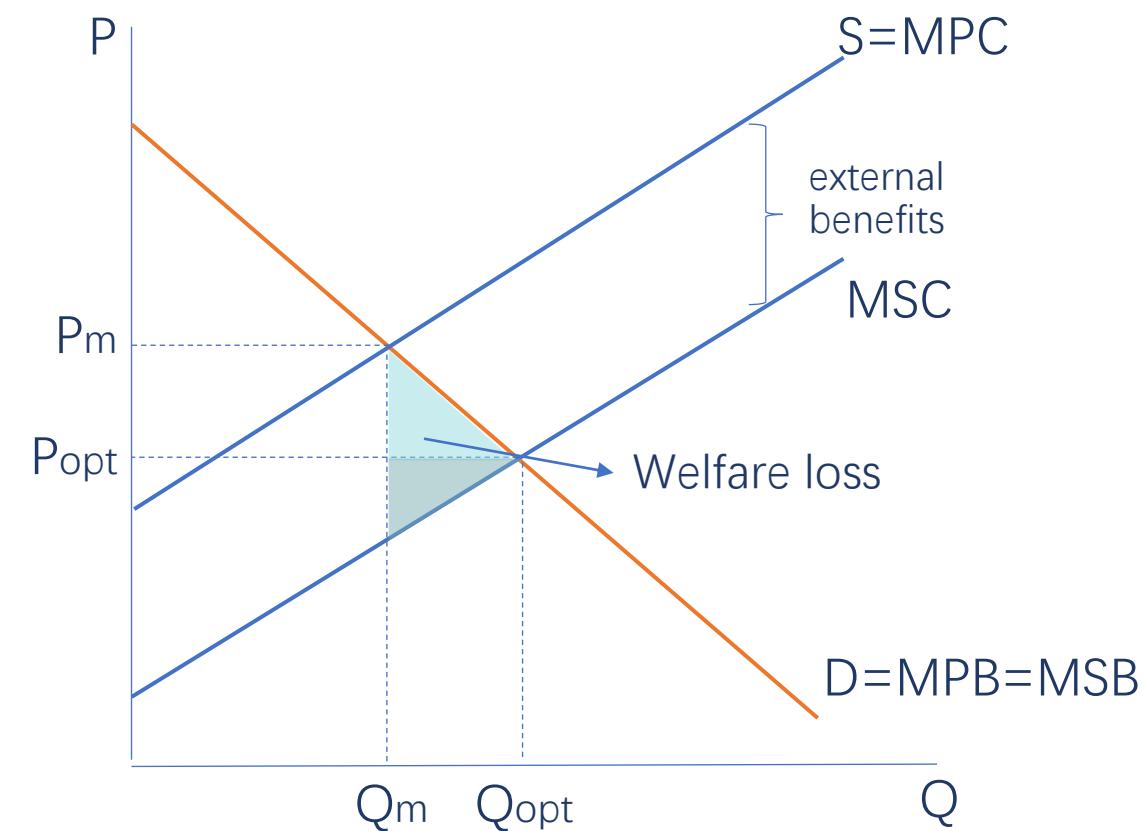
(additional benefit if social optimum is achieved)



The welfare loss of positive production externalities

Welfare loss equals to the difference between the MSB and MSC curves for the amount of output that is underproduced relative to the social optimum. ($Q_{opt} - Q_m$)

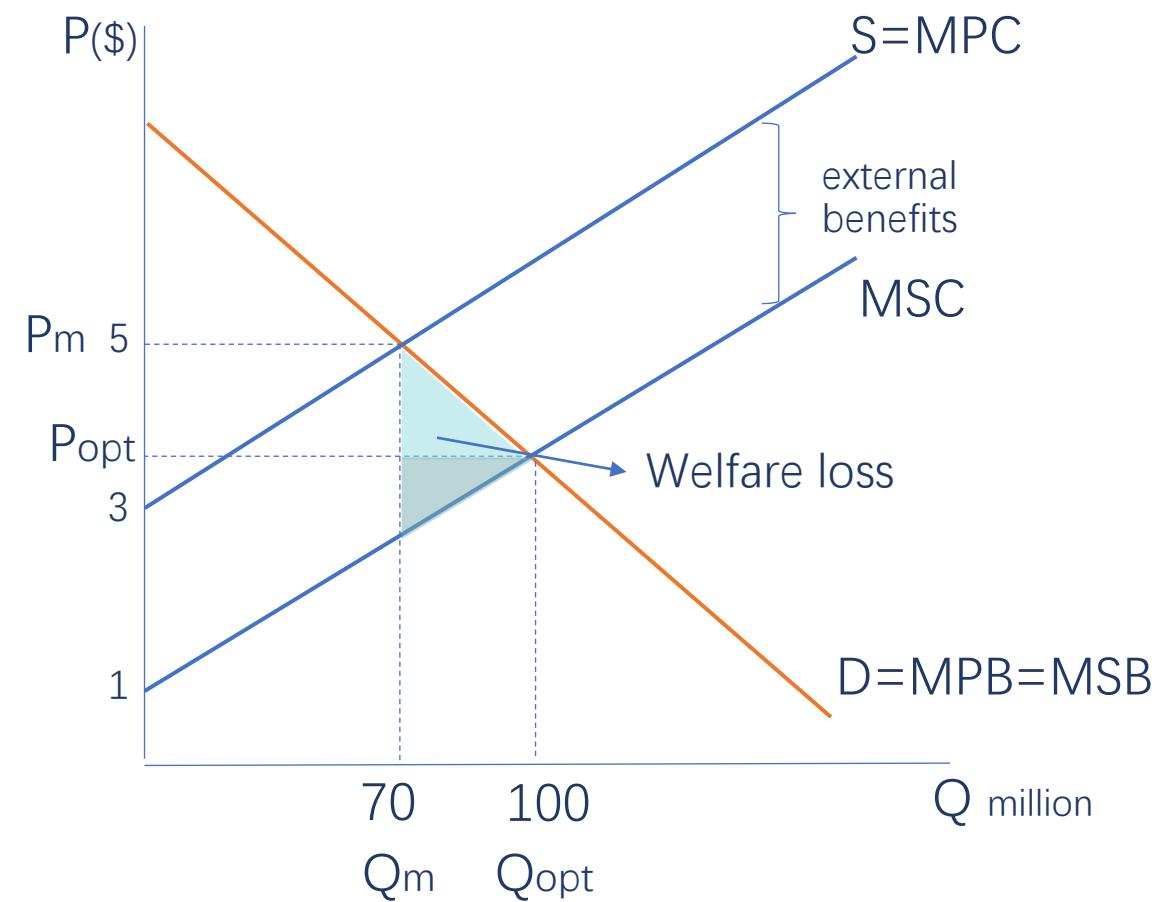
→ lost external benefit because not enough of the good is produced.



Calculating welfare loss

Welfare loss

$$= (5-3)*(100-70)/2 = \$30 \text{ million}$$

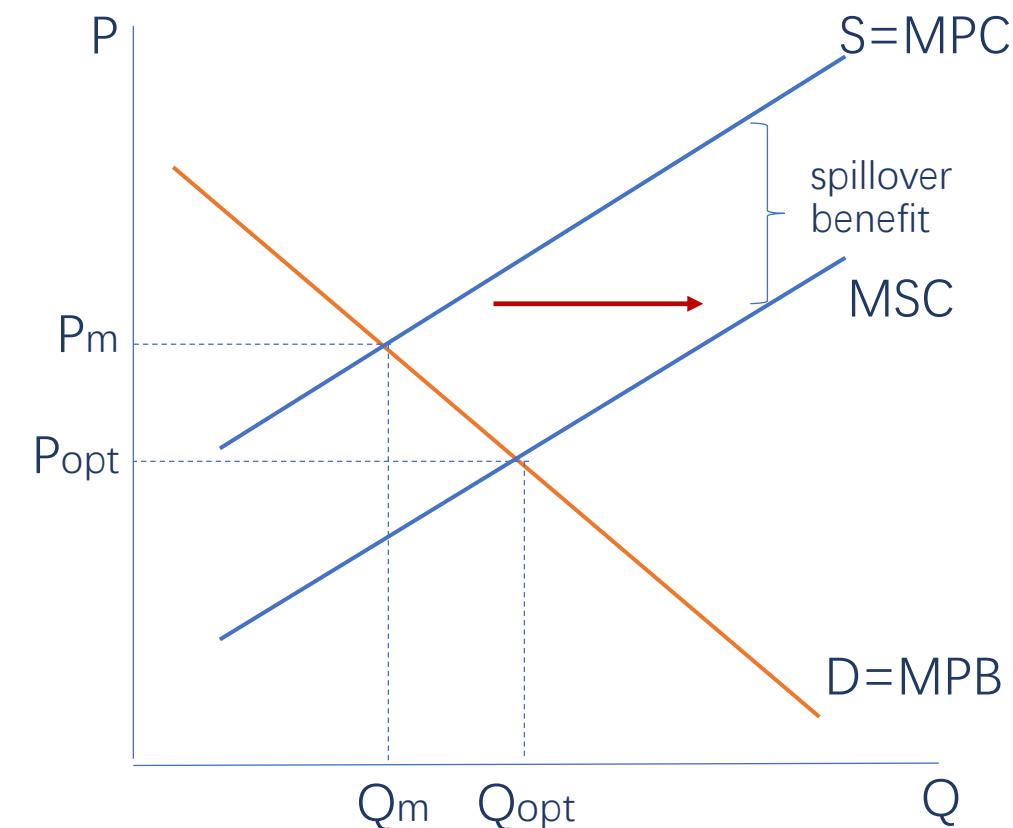


Correcting positive production externalities

1. Direct government provision:

Government intervenes by providing goods and services itself.

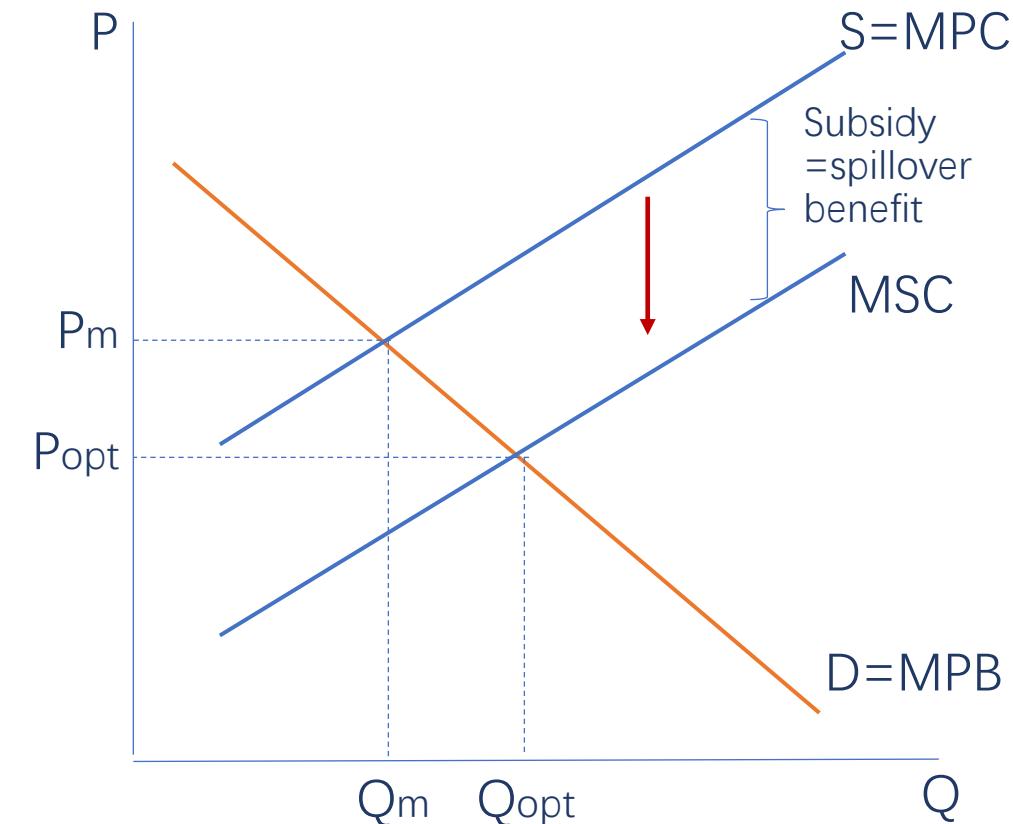
- Government engage in R&D for new technology (medicine, pharmaceuticals, etc)
 - Provide training for workers.
- Shifting the supply curve (MPC) downwards towards the MSC.
- Optimum quantity Q_{opt} will be produced with lower price P_{opt} .



Correcting positive production externalities

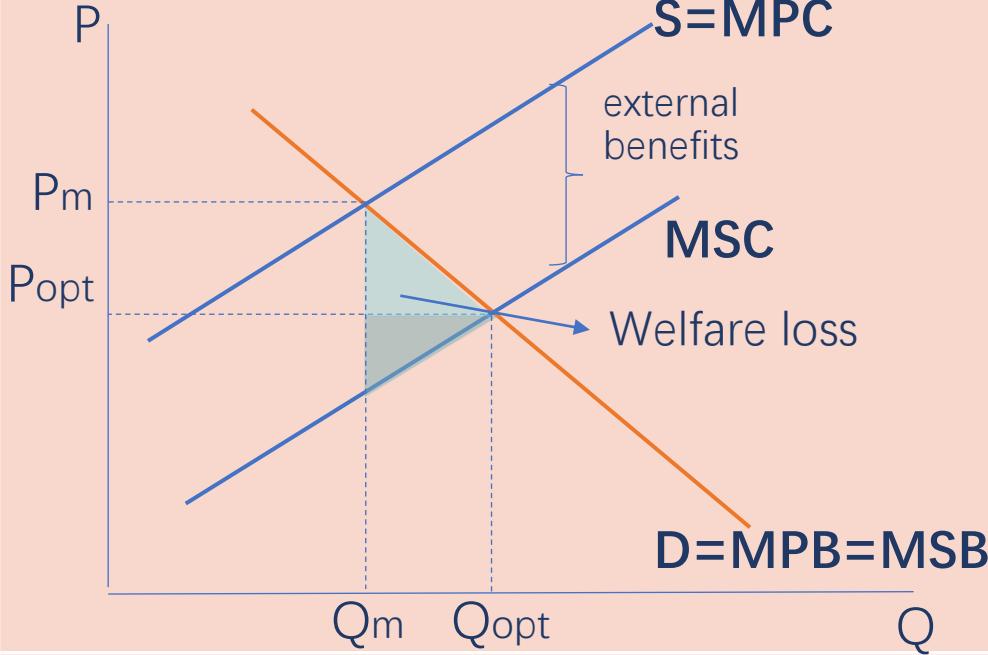
2. Subsidies - (same effect as the provision)

- When government grant a subsidy to a firm, the marginal private cost (MPC) shifts downward until it coincides with the MSC curve.
- $Q_m \rightarrow$ higher Q_{opt}
- $P_m \rightarrow$ lower P_{opt}
- Fix the underallocation of resources, achieve allocative efficiency.



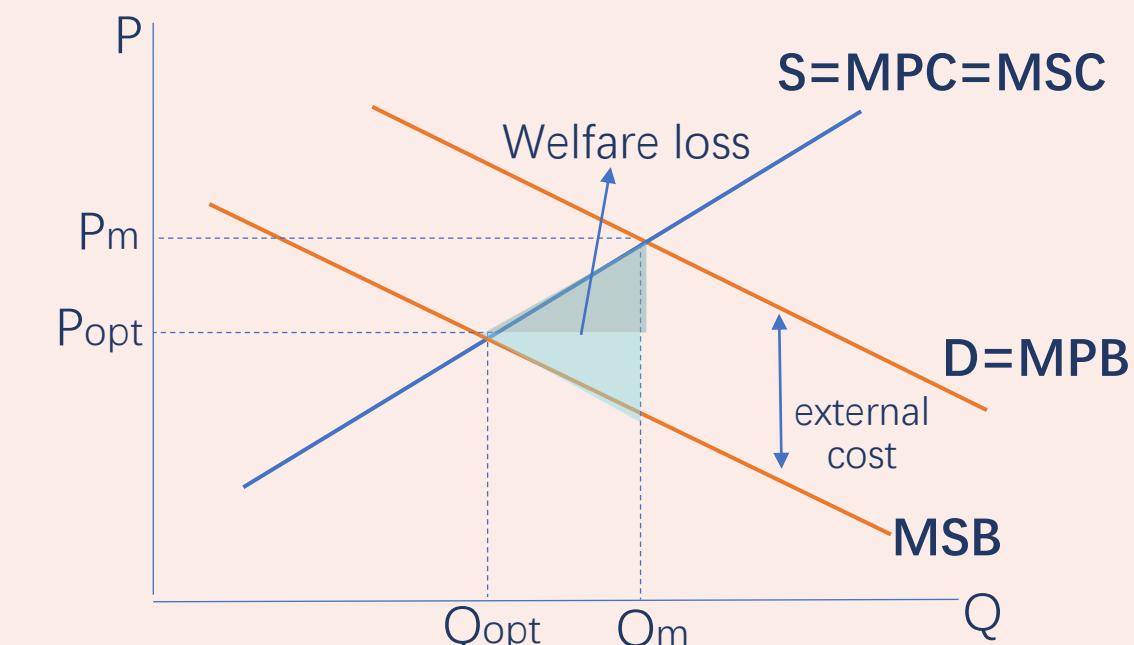
Production

Positive



Consumption

Negative



Negative

A photograph of a lighthouse at night, its warm yellow light reflecting brightly on the dark blue water. The lighthouse is situated on a long pier extending into the sea. In the foreground, dark, silhouetted rocks are visible. The background shows a dark blue sky and a distant shoreline or bridge.

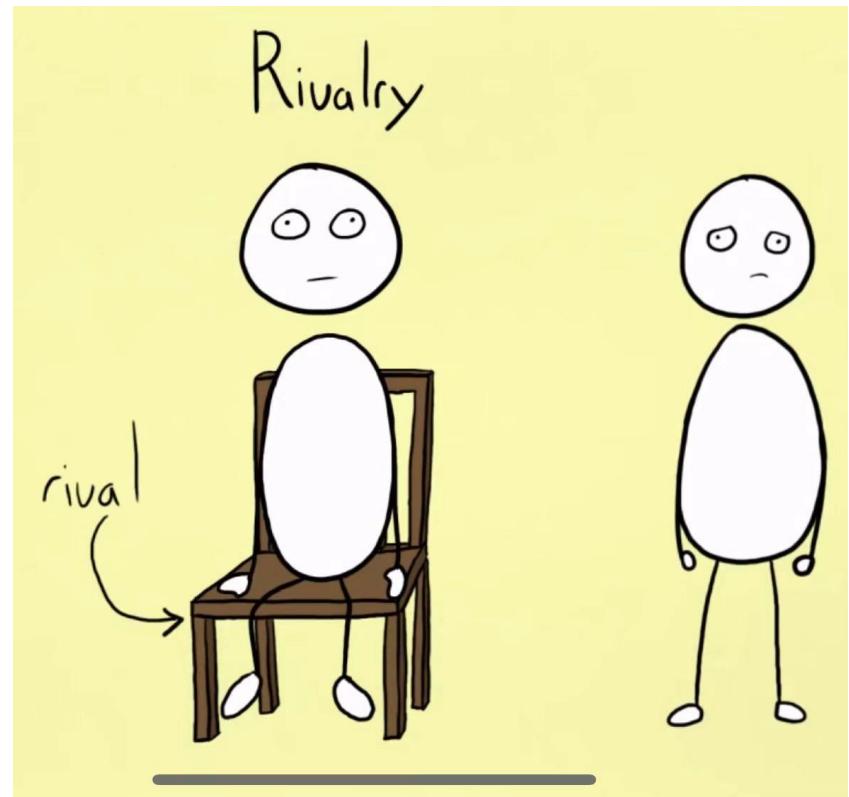
Public goods



Two characteristics for different goods

• Excludability?

- Is it possible to exclude someone from using the good?



• Rivalry in consumption?

- Will the consumption by one person reduce its availability for someone else?

Classification of different goods

| | Rivalrous (the consumption by one person <u>reduces</u> its availability for someone else) | Non-rivalrous (the consumption by one person <u>does not reduce</u> its availability for someone else) |
|--|--|--|
| Excludable <small>(Can exclude someone from using the good)</small> | Private goods Computers, books, clothes, education, petrol, cars, other consumer goods | Quasi-public goods (club goods) <ul style="list-style-type: none">- large positive externalities- may be provided by the government or private firms (with government support) E.g. public museum with entrance fee, toll roads. Private parks, concert/sports stadium, etc. |
| Non-excludable <small>(Cannot exclude someone from using the good)</small> | Common pool resources <ul style="list-style-type: none">-not owned by anyone-not sold in markets-not having a price →overuse, depletion and degradation. E.g. forests, rivers, soil quality, fish in the oceans. | Public goods <ul style="list-style-type: none">-people use them without having to pay.- Socially desirable-produced by government |

Public goods

- A good that is **non-rivalrous** (its consumption by one person does not reduce consumption by someone else) and **non-excludable** (it is not possible to exclude someone from using the good).

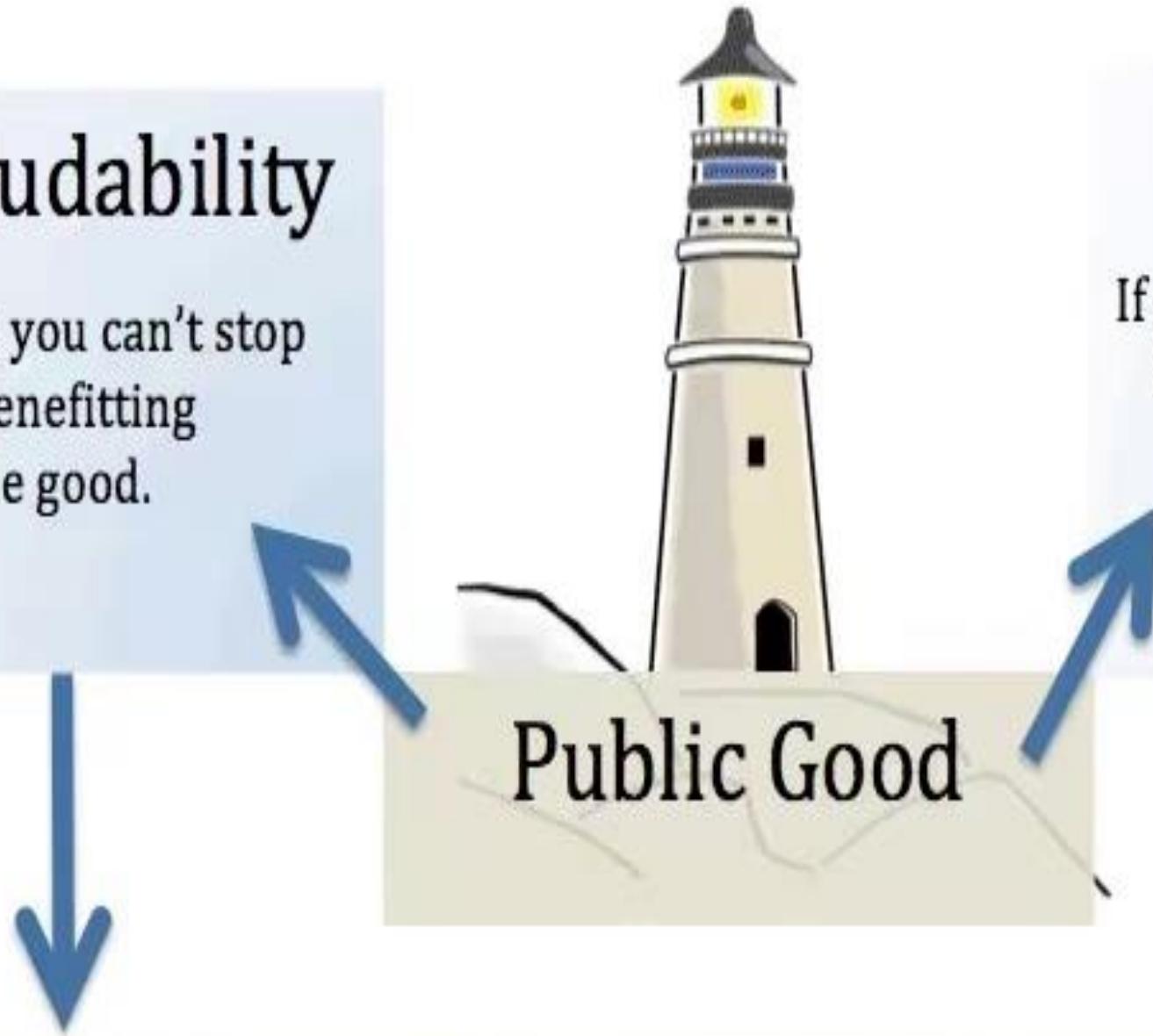


Non-excludability

Once provided you can't stop anyone benefitting from the good.

Non-rivalry

If somebody benefits from good, it doesn't reduce the amount available for others



Free Rider Problem - Individuals have an incentive to use good without contributing towards cost.



Example of firework

Town population: 1000 people

Value of fire work perceived: 10 rmb/person

Total value: 10,000 RMB.

Cost of firework: 1000 RMB

Firm A can provide the firework show and sell the ticket.

→ No one will buy the ticket.

→ Firm A won't provide the service.

Solution: Government pay 2000 RMB to firm A to provide the firework show, and charge 2 RMB tax from all the town residents.
Social surplus: $10,000 - 2000 = 8000$ RMB.

Public goods and the free rider problem

- Public goods illustrate the **free rider problem**, occurring when people can enjoy the use of a good **without paying for it**. The free rider problem arises from **non-excludability**: people cannot be excluded from using the good.
- Public goods are a type of **market failure** because, due to the free rider problem, private firms **do not have an incentive to produce** these goods: the market fails to allocate resources to their production.
- Public goods are therefore **produced by the government** and provided **free of charge**.



Important public goods provided by government:

- National defense (one of the most expensive public goods)
- Fundamental research
- Anti-poverty

Government intervention to provide public goods

1. Direct government provision

The market fails to allocate resources to the production of public goods
→ Government must ensure that public goods are produced at **socially desirable levels**.

- Financed out of tax revenues
- Made available to the public free of charge (or nearly free of charge)

→ With limited government funds, which public goods should be provided?
Each choice involves opportunity costs.

- The government must use **economic criteria** to decide which public goods will provide the greatest social benefits for a given amount of money.
- Difficulty in calculating expected benefits, as public goods are not produced by private firms and have no price.

Government intervention to provide public goods

The government must try to estimate the demand (or 'price') of public goods through **cost-benefit analysis** (ask how much a good would be worth to people through votes or surveys)

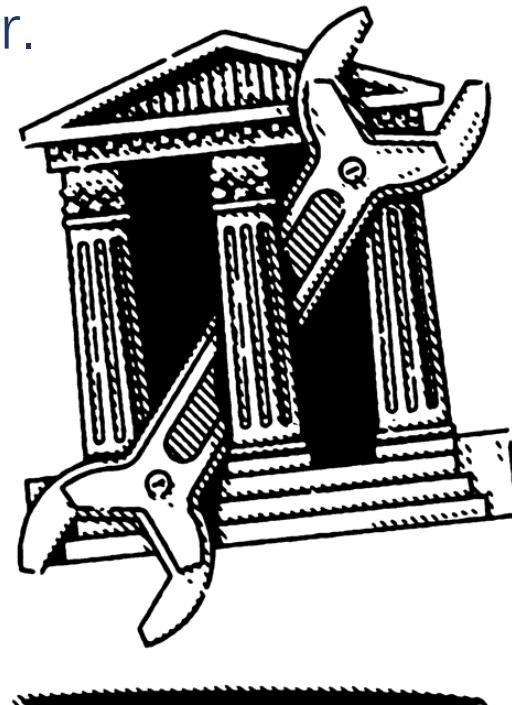
- Cost-benefit analysis compares the estimated benefits to society of a particular good with its costs.
 - Decide what to produce: Cost-benefit analysis
 - If total benefit > total costs → worth to provide it
 - If total benefit < total costs → not worth to provide it
 - Decide how much of it to produce: it should be provided up to the point where $MB = MC$



Government intervention to provide public goods

Disadvantages

- Hard to decide which good and in what quantities it should be provided.
- Easy to estimate the cost, but hard to calculate expected benefits.
- Political pressure: different groups competing against each other.



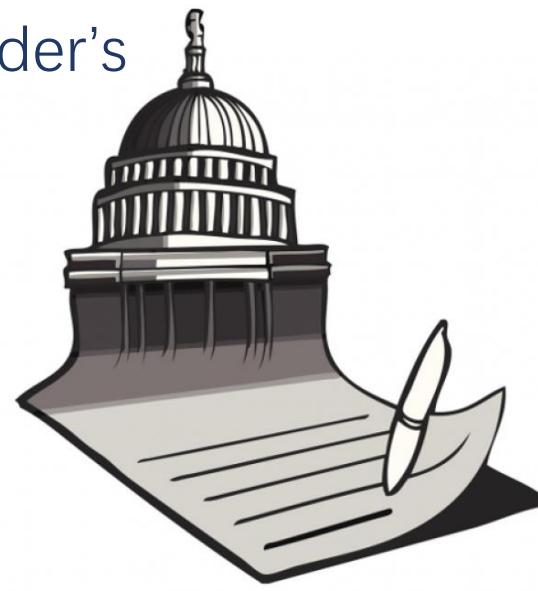
Government intervention to provide public goods

2. Contracting out to the private sector

- A government makes an agreement with a private firm to carry out an activity that the government was previously doing itself.

Advantages:

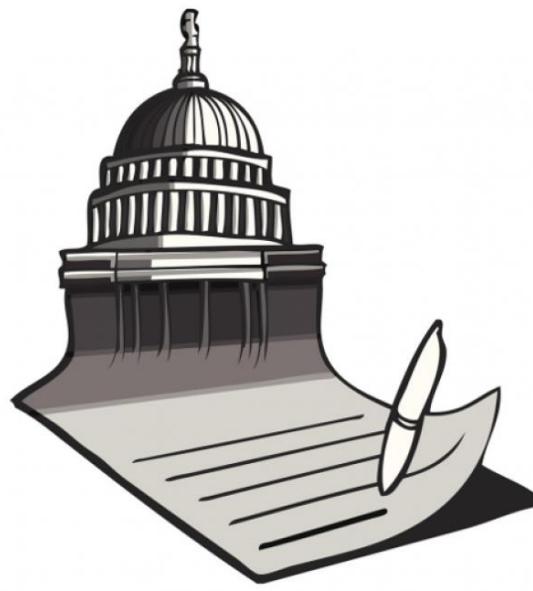
- Competitive tendering to select provider with **lowest cost**.
- Detailed specifications with criteria for measurement of the provider's performance, thus lead to **better quality** control.
- Broader range of **skills and technology**.
- Private firm may be more **flexible and innovative**.
- Government **less responsible** for complaints.



Government intervention to provide public goods

Disadvantages

- The government become **less accountable** for the public goods.
- Lose of **control**.
- Higher overall cost
- Risk of lower quality
- It requires **monitoring work**, which adds to costs.



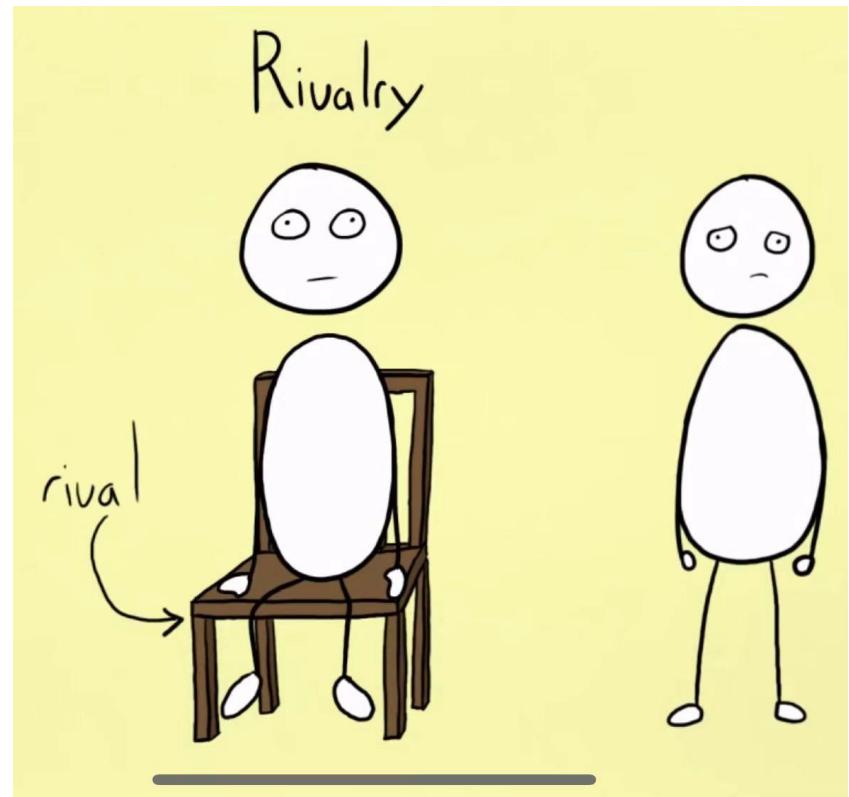


Common pool resources

Two characteristics for different goods

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• Rivalry in consumption?

- Will the consumption by one person reduce its availability for someone else?

Classification of different goods

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Common Pool Resources

- **Definition:** Resources that are not owned by anyone, do not have a price and are available for anyone to use without payment or any other restriction.
 - Typically natural resources. E.g. Clean air, lakes, rivers, fish in the open seas, wildlife, hunting grounds, forests, biodiversity, the fertility of the soil that occurs in nature, open grazing land, the ozone layer, the stable global climate, etc.



Why common pool resources are a type of market failure?

Common pool resources possess a special combination of characteristics:

- **Rivalrous**: its use by some people reduces availability for others.
 - If we use up clean air, there is less left over for use by others;
 - when we catch fish in the open sea, there are fewer fish left over for others to catch;
 - if we destroy the stability of the global climate, it will not be available for use by future generations.
- **Non-excludable**: they have no price and anyone can use them without payment or other restriction.



- consumers and producers use them abundantly, because they have **no price**, consuming that good provides a **benefit for the individual at a cost for society**.
→ Common pool resources are used and overused, leading to serious **environmental degradation and depletion**.

The **tragedy of the commons** is a story about cattle that feed on a fertile pasture that is owned in common by a group of herders.

- The fertile pasture is **rivalrous** because whatever grass is eaten by one animal is not available for another.
- It is also **non-excludable** since one herder cannot exclude others from using it.

Tragedy of the Commons



Figure 29.2
Environmental Science for AP[®], Second Edition
© 2015 W.H. Freeman and Company

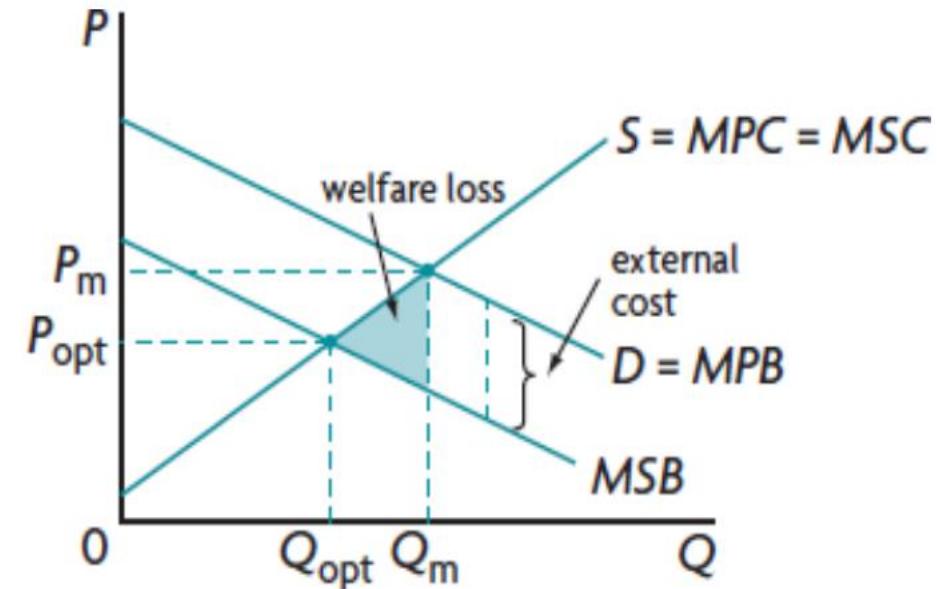
The tragedy of the commons. If the use of common land is not regulated in some way—by the users or by a government agency—the land can easily be degraded to the point at which it can no longer support that use.

Real world Overuse of common pool resources



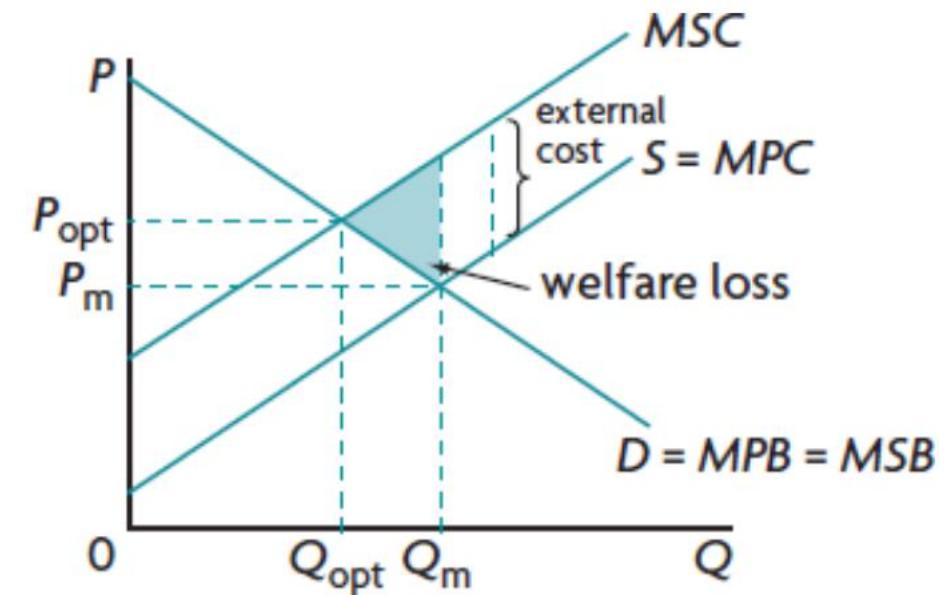
Example of deforestation

- People live near the forests cut the woods for their source of fuel or house construction, therefore use the common pool resources without payment.
- there are consequences to the third party or society in terms of soil erosion and land degradation, loss of biodiversity and threats to wildlife and the ozone layer.
- We can use the diagram of negative consumption externality to illustrate it.



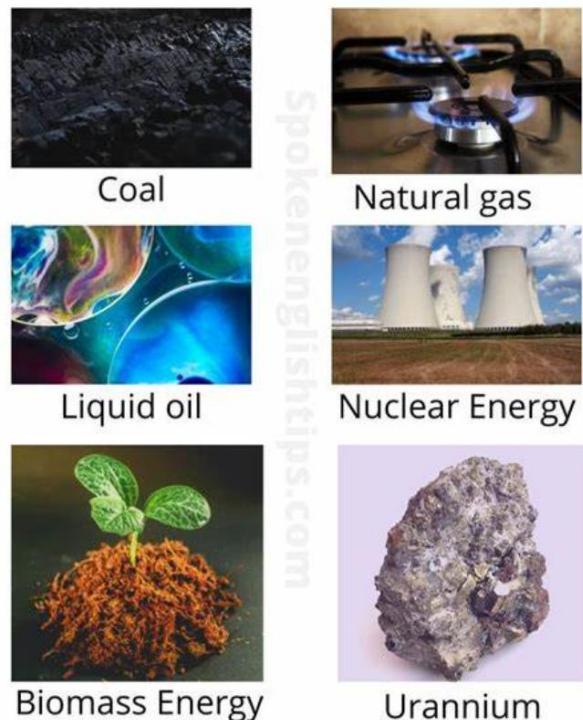
Example of deforestation

- If forests are cleared for the sale of timber by the lumber industry, the lumber company may only consider their private cost without taking the external cost of loss of biodiversity, land degradation, flooding and soil erosion into consideration.
- There would be overproduction ($Q_m > Q_{opt}$) and underpricing ($P_m < P_{opt}$) of the wood products.
- We can use the diagram of negative production externality to illustrate it.



Renewable and non-renewable resources

- **Renewable resources:** resources that can last indefinitely if they are managed properly. (reproduced over relatively short periods of time by natural processes.)
 - Forests, wildlife, fish, biomass, water resources, geothermal power, soil fertility, biodiversity



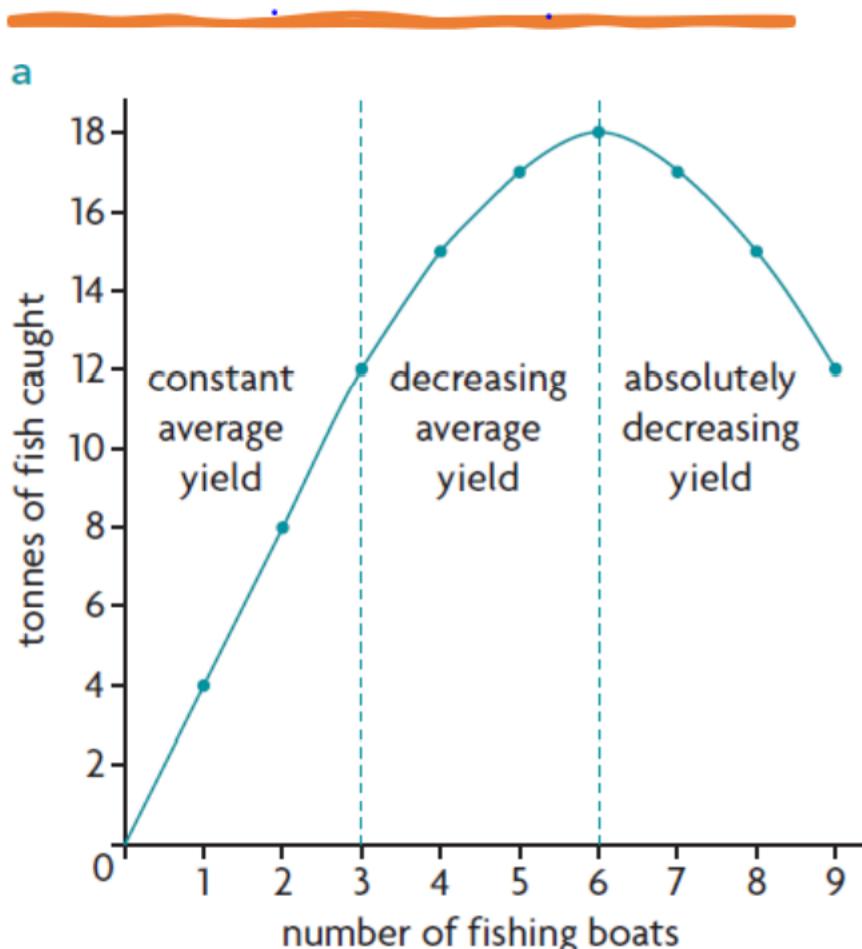
- **Non-renewable resources:** resources that do not last indefinitely, because they have a finite supply. (reproduced over relatively long period of time)
 - Metals, minerals, fossil fuels (oil, natural gas and coal)

Sustainability

- **Sustainability**: the use of resources in ways that do not result in fewer or lower quality resources for future generations.
 - For the environment it refers to environmental preservation (lack of destruction)
 - For the economy, it refers to the preservation of humankind's ability to provide goods and services to satisfy needs and wants into the future.
 - The problem of sustainability arises because of conflicts between environmental and economic goals.
- **Unsustainable production**: production that uses resources unsustainably, depleting or degrading them.
- **Important question** → How to strike a balance between environmental and economic goals, so that both can be satisfied into the future.
- The idea of **sustainable resource use** applies mainly to renewable resources, because given appropriate management, these resources can be made to last forever.



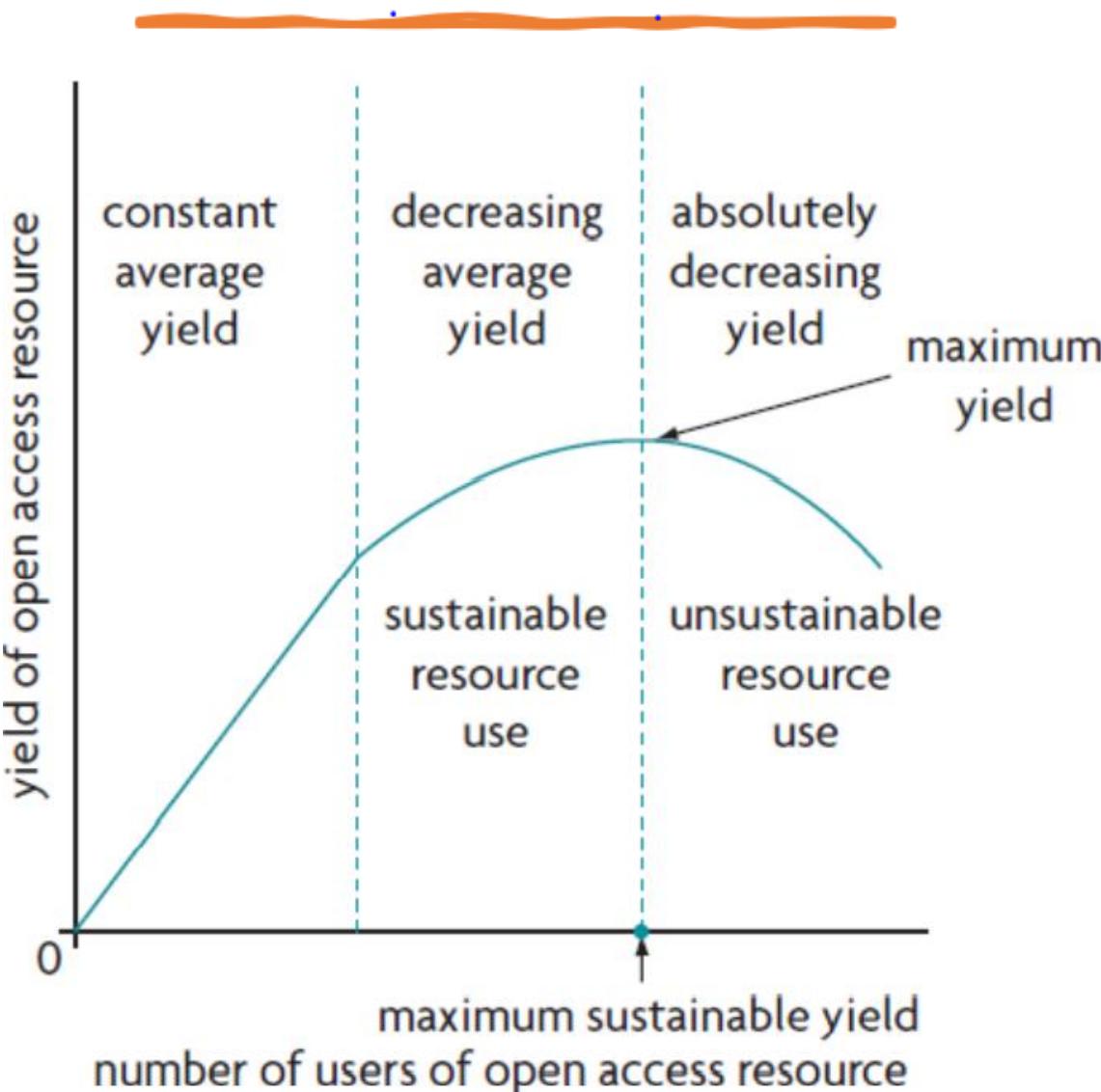
Sustainable & unsustainable resource use



| No. of boats | Total fish tonnes caught | Average tonnes caught | |
|--------------|--------------------------|-----------------------|-----------------------------|
| 1 | 4 | 4 | Constant average yield |
| 2 | 8 | 4 | |
| 3 | 12 | 4 | |
| 4 | 15 | 3.75 | Decreasing average yield |
| 5 | 17 | 3.4 | |
| 6 | 18 | 3 | |
| 7 | 17 | 2.43 | Absolutely decreasing yield |
| 8 | 15 | 1.88 | |
| 9 | 12 | 1.33 | |

Fish in the open sea are a common access resource that anyone has access to without payment.

Sustainable & unsustainable resource use



- **Maximum sustainable yield:** the maximum use that can be made of the resource that is also sustainable, in that the resource can reproduce itself.
- **Sustainable resource use:** resources are used at a rate that allows them to reproduce themselves, so that they do not become degraded or depleted.
 - * Note that while it is an easy matter to discuss the maximum sustainable yield of a resource in theoretical terms, it is very difficult in practice to determine what this actually is for any resource.

Government responses to threats to sustainability (overuse of common pool resources)

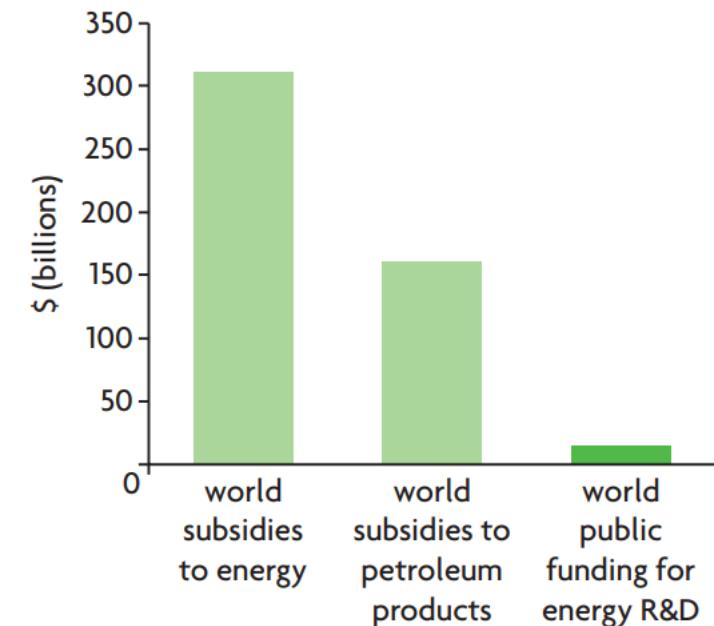
- **Legislation** (laws and regulations)
 - Emission standards
 - Quotas
 - Licenses
 - Permits
 - Outright restrictions
- **Indirect taxes (including carbon tax)**
- **Tradable permits**
- **Funding for clean technologies**
- **Collective self-governance (common pool resources only)**
- **International agreements**

Solution: Funding for clean technologies

- **Clean technologies** aim toward a more responsible and productive use of natural resources, which also reduce negative environmental impacts.
 - E.g.: Wind power, solar energy, biofuels, geothermal energy, nuclear power, fuel efficiency, recycling, etc.

Actions:

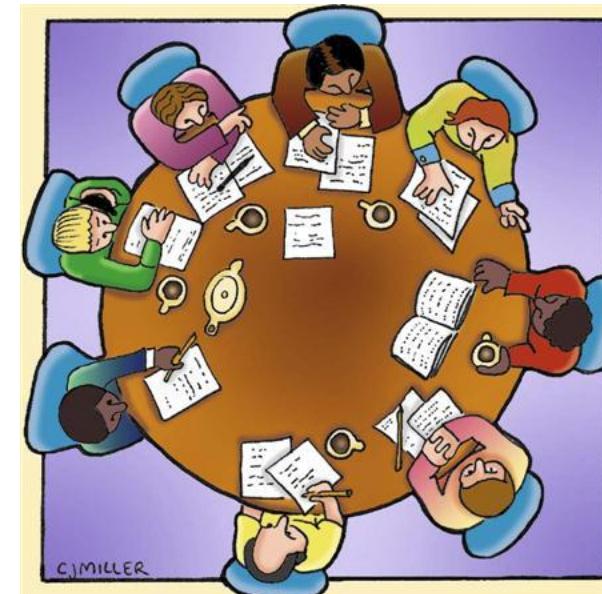
- Funding for clean technologies (by government and private sector)
- Eliminating environmental harmful subsidies
 - Subsidies to industrial forestry encourage commercial logging, resulting in destruction of forests.
 - Subsidies to production of fossil fuel energy result in a greater amount of fossil fuel production.
 - Consumption subsidies are commonly imposed on fossil fuel energy, agricultural inputs (such as fertilizers and pesticides)
→ “policy failure” – the pursuit of a policy for one purpose that creates problems in another area (environmental destruction)



Solution: Collective self-governance

— by Elinor Ostrom

- Collective self-governance refers to a solution to the **use of common pool resources** where the users take control of the resources and use them in a sustainable way.
- It's not a policy imposed by the government.
- It's an approach to manage resources **undertaken by communities of resource users** by themselves, because they realize that it is in their own best interests to work collectively for the preservation of resources that are vital to their livelihood.
- E.g. fish stocks, woods, lakes, pastures and groundwater basins.
- **Requirements:**
 - There must be boundaries of an area (a pasture, a wood or a lake, etc.)
 - Good methods of communication between the resource users.



Collective self-governance

Advantages:

By working cooperatively, people can find solutions to the problem of overuse of common pool resources by themselves

- without top-down solutions imposed by governments.
- In the absence of private ownership of resources
- In the absence of government-owned property

Disadvantages:

- Two important conditions must be met:
 - a. Producers must be able to communicate with each other to create rules.
 - b. There must be a boundary for the resource.
- It is not suitable for dealing with global problems such as the oceans and climate change.



Tragedy of the Commons

