# The big picture



**Real-world issue 2:** When are markets unable to satisfy important economic objectives – and does government intervention help?

So far, we have largely worked on the assumption that the market will naturally reach its optimal production levels and make the most efficient use of its resources as long as we don't interfere with it. When the market is left to the forces of demand and supply, the market will tell us *what to produce*, *how to produce* and *for whom to produce* in the most efficient way.

**Figure 1.** Water pollution.

Source: "01719jfRoads Orion Pilar Limay Bataan Bridge Landmarksfvf 14 (https://commons.wikimedia.org/wiki/File:01719jfRoads_Orion_Pilar_Limay_Bataan_Bridge_Landmarksfvf_14.JPG)" by Judgefloro is in public domain.



However, this is not always true in the real world, as markets are not perfect systems. There are several factors that prevent markets from allocating resources in the optimal way from society's point of view. When this

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happens we call it market failure.

We touched upon some examples of market failure already when we discussed methods of government intervention in subtopic 2.7 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-29874/). Examples of market failure include:

- When a production process causes pollution, such as in the air or water
- When people consume goods that are harmful for them and the rest of society, such as cigarettes and illegal drugs
- When the current generation exploits or depletes resources so that they won't be available to future generations

When markets fail, governments are expected to intervene to try to correct that failure.

In this subtopic we will look into the **reasons why markets might fail** and the **different possible options** that governments have to try **to correct each situation**.

**Figure 2.** Deforestation.

Credit: Getty Images eppicphotography

Student view

## Concept

**Economic well-being**
**Intervention**

Market failure is a problem that affects our economic well-being in many different ways and in many different aspects of our lives. There can be both negative and positive consequences from market failure: we want some markets to reduce in size because of their ill-effects on others, and some markets to grow due to their good effects. The government can use certain interventions that we discussed in subtopic 2.7 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-29874/) to manage these effects.

*When people buy goods, how much time do you think people spend considering how it was made or what will happen to it once they have finished using it?*

*What do you think are some of the best ways to promote positive choices by consumers and producers?*

# Types of market failure



In subtopic 2.3 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-29864/), in which we covered market efficiency, we saw that when a market is in equilibrium, with no external disturbances, it is said to be in a state of allocative efficiency . This means that the resources are allocated in the most efficient way, from that society's point of view.

When the price of a good adjusts to make the quantity demanded equal to the quantity supplied, the equilibrium quantity reflects the optimal (best) allocation of resources to the production of that good, maximising the social/community surplus. In other words, when the marginal social benefit (MSB) equals the marginal social cost (MSC), this is the socially optimal output. This is the level of output at which there are no net positive or negative consequences for society when an additional unit of the good or service is produced or consumed.

However, in reality, the free market fails to achieve this desirable situation for a variety of reasons. For example, it might be that sometimes the private costs of production of a good do not represent the social costs of production. It might also happen sometimes that the private benefit from consuming a good causes some external effects, negative or positive, which prevent the society from achieving optimal welfare.

The market equilibrium shown in **Figure 1**, where $\mathrm{D} = \mathrm{MSB} = \mathrm{S} = \mathrm{MSC}$shows a situation where the market has achieved the optimal social welfare. This allocative efficiency will not be achieved when either $\mathrm{D} \neq \mathrm{MSB}$or $\mathrm{S} \neq \mathrm{MSC}$, which is considered a market failure .

Student view

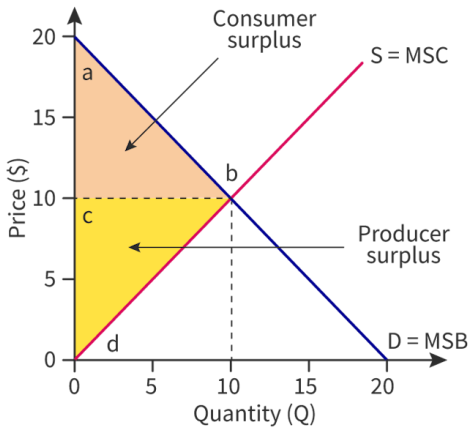


**Figure 1.** Consumer surplus and producer surplus.

More information for figure 1

This image is a graph depicting market equilibrium to illustrate consumer and producer surplus. The X-axis represents quantity (Q) from 0 to 20, and the Y-axis represents price ($) from 0 to 20. The graph features two lines: the demand curve labeled 'D = MSB' and the supply curve labeled 'S = MSC'. Both intersect at the equilibrium point.

Consumer surplus is represented by the area labeled 'a', which is a triangle above the price equilibrium line up to the demand curve. Producer surplus is shown by the area labeled 'c', a triangle below the price equilibrium line and above the supply curve. The market equilibrium price and quantity occur where demand equals supply, shown by the intersection at the point labeled 'b'. The areas under these triangles reflect the surplus values, with specific sections labeled 'a', 'b', 'c', and 'd' demarcating different regions in the surplus graph.

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**Important**

Remember:

- The marginal private cost (MPC) refers to the cost for firms to produce one more unit of a good.
- The marginal social cost (MSC) refers to the total cost to society when one more unit of a good is produced. It includes the MPC.
- The marginal private benefit (MPB) refers to the benefit to consumers of consuming one more unit of a good.

The marginal social benefit (MSB) refers to the total benefit to society when one more unit of a good is consumed. It includes the MPB .

# Existence of externalities



When a consumer buys and consumes a good, they benefit from or are satisfied by it. When a firm produces a good to be sold, it incurs costs. When these benefits or costs are passed on to those who are not involved in producing or consuming that particular good, it is called an externality.

Externalities can result either from the **consumption** or **production** of goods and services, and they create a gap or difference between the MPC and the MSC, or between the MPB and the MSB. In other words, an externality occurs when the free market leads to an outcome where MPB is equal to MPC $(\text{MPB} = \text{MPC})$, but MSB is **not** equal to MSC $(\text{MSB} \neq \text{MSC})$, and the outcome for the society is allocative inefficiency. For example, the consumption of chewing gum's MSB is made up of consumers' MPB gained from consuming the gum (the enjoyment, fresh breath, etc.) and the cost to society of cleaning up the chewing gum from the ground. The market produces while only taking into account the marginal private benefit and the marginal social costs, not the marginal social benefits.

Throughout the next two sections, we will analyse four types of externalities:

- Negative externalities of production

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- Positive externalities of production
- Negative externalities of consumption
- Positive externalities of consumption

**Important**

- All **negative externalities** (of production and consumption) create **external costs.** When there is an external cost, **MSC > MSB** at the equilibrium point of the market.
- All **positive externalities** (of production and consumption) create **external benefits.** When there are external benefits, **MSB > MSC** at the equilibrium point of the market.
- All **production externalities** (positive and negative) create a **divergence between private and social costs (MPC ≠ MSC).**
- All **consumption externalities** (positive and negative) create a **divergence between private and social benefits (MPB ≠ MSB).**

## Under-supply of merit goods

Merit goods are private goods that will be under-produced by the market as consumers do not appreciate the benefits to themselves and society of their consumption. As a result, they are **under-provided** by the market, because firms are profit driven and will only produce goods and services for consumers who can pay for them.

As these goods will be under-consumed, they will be **under-provided** with respect to the socially optimal output, and so this creates a market failure.

Merit goods are goods that are considered beneficial to both the individual and society as a whole, as in the cases of education and healthcare. As governments think that these goods **should be consumed to a greater degree**, they will tend to provide them directly or subsidise private firms to do so, increasing the supply and making them more affordable.

Student view

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**Figure 2.** Education, one of the most important merit goods.

Credit: Getty Images fstop123

# Over-supply of demerit goods

Demerit goods are private goods that will be over-consumed and therefore **over-provided** by the market for the same reason that merit goods will be under-provided: consumers do not appreciate the costs to themselves and society of their consumption. Firms are profit driven, so the market will produce and consume based on the forces of demand and supply.

As these goods will be over-consumed, they will be **over-supplied** with respect to the socially optimal output, so they also create a market failure.

Demerit goods are considered to be harmful for both the individual and society as a whole, as in the cases of cigarettes and alcohol. As governments think that they **should be consumed to a lesser degree**, or not consumed at all, they will tend to reduce or attempt to eliminate supply and/or demand.

**Figure 4.** Alcohol consumption is a demerit good.

Credit: Getty Images Epoxydude

Student view

## 3 section questions

2. Microeconomics / 2.8 Market failure — externalities and common pool resources

# Negative externalities of production

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When the production process of a good or service generates a negative effect on a third party or on society as a whole, we say that there is a negative externality of production.

This usually happens when there is a negative impact on the environment caused by a good being produced. This may be air or water pollution as a result of the production process, loud noises generated while producing or any other negative side-effects of production activities that spill over onto society and are not accounted for in the private costs for the firm.

Any negative effect of production on third parties that brings them costs is considered a negative externality of production.

**Figure 1.** Air pollution caused by harmful emissions from factories.

Credit: Getty Images kodda

When this happens, **the marginal social cost of production (MSC) is greater than the private cost of production (MPC)**, as firms do not take these extra costs into consideration when deciding how much to supply at each price level.

Student view

This results in a greater amount of the good being produced than the socially optimal output, and therefore an over-allocation of resources to the production of such goods from the society's point of view.

Look at the example in **Figure 2**. It shows the situation of a firm that pollutes the air when producing steel. Coke is a coal-based substance used in the production of steel, and its manufacturing is a significant contributor to air pollution. Steel making also requires a lot of energy, much of which will be produced by the burning of fossil fuels. China has in recent years struggled to balance the demand for steel for its growing economy against the need to place limits on the pollution for which this industry is responsible.

Through the forces of demand and supply, only taking into consideration the firm's private costs of production (MPC) and the private benefit of consumption (MPB), the market will end up producing at the point where the quantity supplied is equal to the quantity demanded of steel, $Q_2$.

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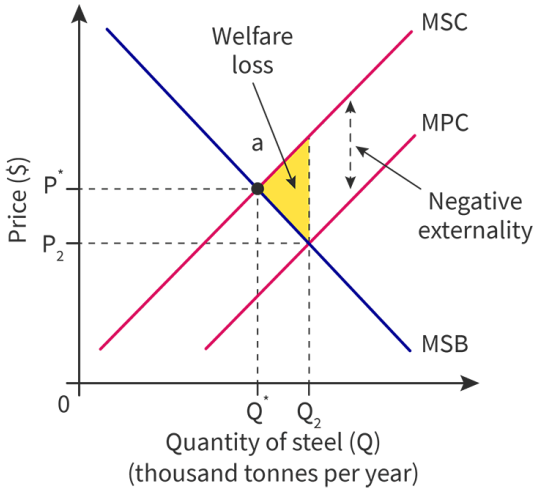


**Figure 2.** Production of steel while polluting the air.

More information for figure 2

The image is a graph illustrating the concepts of supply and demand relative to steel production. The X-axis represents the quantity of steel, while the Y-axis represents the cost/price levels. The graph shows two intersecting curves labeled as MSC (Marginal Social Cost) and MSB (Marginal Social Benefit). The private marginal cost (MPC) and private marginal benefit (MPB) are also shown. The point where the MSC and MSB intersect is labeled as the socially optimal point. The area marked as Q2 on the X-axis suggests the quantity where private cost equals private benefit, indicating overproduction from a social perspective. Shaded areas or arrows might indicate external costs or benefits not accounted for by private entities alone. This graph is useful for visualizing how market forces can lead to a divergence from socially optimal production levels due to externalities.

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### ⚠ Be aware

This type of externality involves only the production side of the market (the supply curve). The demand curve represents both the marginal private benefit (MPB) and marginal social benefit (MSB) of consuming the good, so here MPB = MSB.

Student view

As seen in **Figure 2**, the total cost of production for society (MSC) is greater than the private cost (MPC), for every level of output. The vertical difference between MSC and MPC represents the negative externality.

The optimum amount of steel produced, from the society's point of view, should be at the point where the MSC curve crosses the demand curve (the MSB curve), at Q*.

As the cost of producing steel is greater for society than for the private firm, the market outcome results in a greater amount of steel produced than what should be produced if the total social costs of production were taken into consideration – in other words, if the pollution caused by the firm **is not internalised** (see *Possible government responses*, below, for more on internalisation).

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### Important

When there is a negative externality of production, the amount produced is greater than what it should be, from the society's point of view. Therefore, more resources are allocated to the production of this good than what is optimal for society. The market over-allocates resources to the production of the good.

In the example of steel, society produces an amount $Q_2 > Q^*$ and sells it at a lower price, $P_2 < P^*$. Therefore, there is an inefficient allocation of resources from society's point of view. A welfare loss – the amount of welfare society loses through allocative inefficiency – is shown by the yellow shaded triangle in **Figure 2**. All of the units produced from $Q^*$ to $Q_2$ have a higher cost for society than the benefit they bring to it (MSC > MSB). This is why it is a market failure.

### Exam tip

Students often confuse the position of the MSC curve with respect to the MPC curve.

Remember that a 'higher social cost' means a 'lower socially optimum supply' and therefore the MSC should be above (to the left of) the MPC.

## Possible government responses

In a free market, these negative externalities of production would continue to exist because firms are profit maximisers and will only take their private costs of production into account. However, there are several possible ways in which the government can intervene to solve or reduce the externality.

To solve the problem caused by negative externalities of production, the goal is to eliminate the welfare loss by reducing the quantity produced of the good until $Q_1$ reaches $Q^*$.

Student view

The solutions below aim to make the contaminating firms **internalise** – meaning they **absorb** – part of the cost they are generating for society, or to prevent firms from using polluting methods of production. This can be done through different options:

- Imposing a carbon tax on polluting firms
- Legislation
- Tradable emission permits

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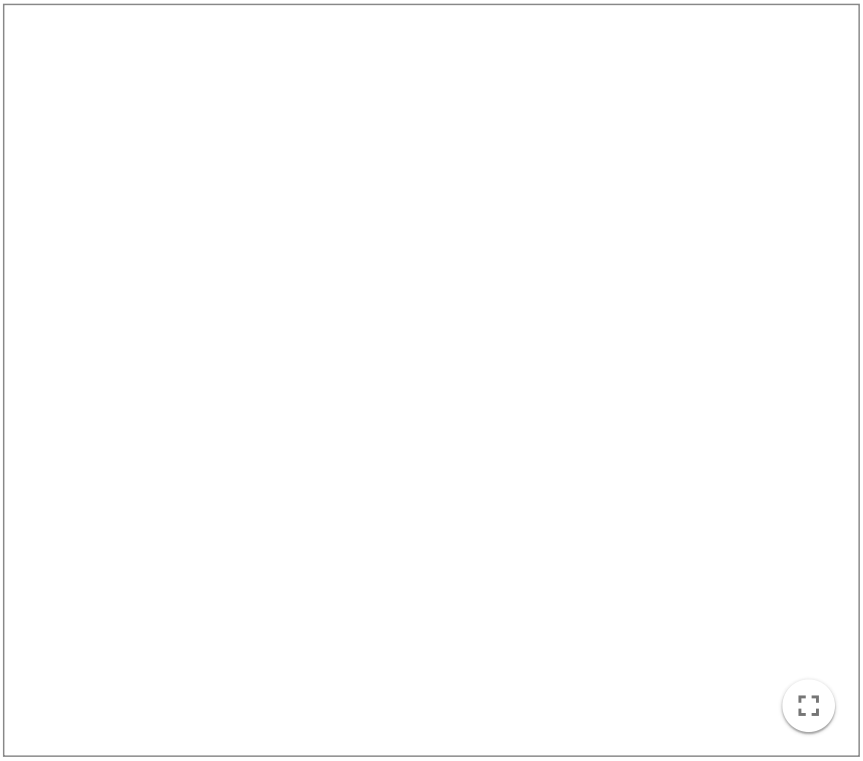

**Figure 3.** Solutions to negative externalities of production.

More information for figure 3

This interactive graph represents the concept of externalities and welfare loss in economic markets. The horizontal axis represents the quantity of steel produced in the market. As production increases, external costs may rise, leading to inefficiencies. The vertical axis represents the price of steel, which is determined by the interaction of supply and demand. Price levels change depending on costs, taxes, and market equilibrium shifts. By adjusting the MPC slider, users can see how private costs shift, influencing equilibrium price and quantity. It focuses on the divergence between marginal private costs, marginal social costs, and marginal social benefits, allowing users to analyze how government interventions, such as taxation, impact market equilibrium. The graph highlights key economic concepts, such as market failures due to negative externalities and the role of corrective taxes in addressing them.

If marginal private cost increases, the curve shifts upward, reflecting higher private costs per unit. The new marginal private cost plus tax line moves further from the original marginal private cost line, indicating that firms now incur additional costs. The welfare loss decreases as the market moves closer to the socially optimal quantity, reducing overproduction and negative externalities.

If marginal private cost decreases, the curve shifts downward, meaning firms face lower private costs per unit. The marginal private cost plus tax line moves closer to the original marginal private cost, indicating a reduced financial burden on producers. This results in a lower price and a higher equilibrium quantity. The welfare loss increases as overproduction leads to greater negative externalities.

The interactive chart helps users visualize these effects dynamically, enhancing their understanding of economic policies and externalities.

Student view

## Imposing a carbon tax on polluting firms

The government could impose a tax on the firm per unit of output produced, or a tax per unit of pollutants emitted, to increase the private costs of production. Have a look at this CBS News website (https://www.cbsnews.com/news/carbon-tax-hot-stuff-heres-how-they-would-work/), which gives a lot of

information about carbon taxes and discussion of how they might be implemented in the US. You can also take a look here (https://www.carbontax.org/where-carbon-is-taxed/), to see where carbon taxes have been imposed.

As seen in **Figure 3**, the tax results in an upward shift of the supply curve from MPC to MPC + tax, nearer to the point of social efficiency. If the tax is equal to the external cost of production, then the externality would be internalised. If not, although the welfare loss for society would be reduced, it would not be eliminated completely. There is still a welfare loss, but it will be less than with no government intervention at all.

**Benefits of this solution:**

- Carbon taxes on polluting firms are much easier to apply than other measures, such as tradable emission permits.
- Tax revenues from carbon tax will be collected, and can be invested in promoting innovation and new technologies, such as renewable sources of producing energy.

**Problems with this solution:**

- It is often difficult to measure the pollution created and put a value on it to establish the amount of the tax.
- It is also difficult to identify which firms are polluting and to what extent each firm is responsible for the pollution.
- Taxes make firms pay for the pollution they create but do not actually stop the pollution from taking place.



### Theory of Knowledge

Consider the problems explored above when imposing carbon taxes. For a carbon tax to be successful, it must be the correct size to offset the social costs associated with pollution.

Guyana, in South America, is considering imposing a carbon tax on crude oil (https://www.stabroeknews.com/2020/06/29/news/guyana/ugs-green-institute-urges-carbon-tax-on-extracted-crude-oil/)that is currently extracted by ExxonMobil. The tax has the potential to earn the government of Guyana billions each year. How does Guyana decide how large the tax should be? How canGuyana calculate the social costs associated with offshore drilling to ensure the tax can offset them?

The government of Guyana argues that in a six-month period Exxon flared over nine billion cubic feet of natural gas. A forest the size of 4642 hectares of forest would be required to soak up the carbon in the air from the flares.

How can we calculate what the forest is worth? How can we place a price on a forest? How can we fully measure all of its benefits? Its lumber, its biodiversity, the oxygen it creates, not just for our generation, but for all future generations as well.

According to the government of Guyana, such a forest is worth USD 25 million. They used that figure as a measure for the carbon tax on Exxon.

Do you think the government of Guyana can accurately measure the value of a forest?

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**Knowledge question:** To what extent can we use economic models accurately and with precision to solve practical problems?

## Legislation

The government could pass laws relating to environmental standards that firms must comply with in the production process, such as using specific types of machinery, air filters, water processes and disposal methods. To meet these standards, a firm's cost of production would increase, shifting the supply curve upwards, as shown in **Figure 3**.

In this case, the effect on the market outcome would be similar to the one of taxes, as the MPC would increase nearer to the MSC, reducing the externality and hence the welfare loss for society. In case of companies breaching the environmental legislation, the costs for cleaning the pollution created are passed on to the polluting company and thus internalised. For example, in 2017, the UK Environmental Agency imposed fines to major polluting firms (https://www.theguardian.com/environment/2017/jan/30/companies-pay-out-more-than-15m-for-breaking-environment-laws)such as Heineken UK, Filippo Berio and others.

An extreme intervention could also be to ban polluting firms altogether.

**Problems with this solution:**

- The ban or restriction may lead to unemployment in the corresponding industry, as jobs would be lost if firms are closed or the market reduced.
- Banning a firm would create non-consumption of the good that was being produced, which might be a good necessary or desirable to consumers.
- The cost of setting and then enforcing the policy standards may be very difficult to implement, and/or have a greater cost than the pollution itself.

## Tradable emission permits

Student view

This type of solution was agreed upon in the Kyoto Protocol, made under the United Nations Framework Convention on Climate Change, which came into force in February 2005. The objective was to reduce the global emission of greenhouse gases. In this particular example, the agreement was between countries, but a similar procedure could be applied to individual market cases. Look at **Figure 4** to see which countries currently employ emissions trading schemes.

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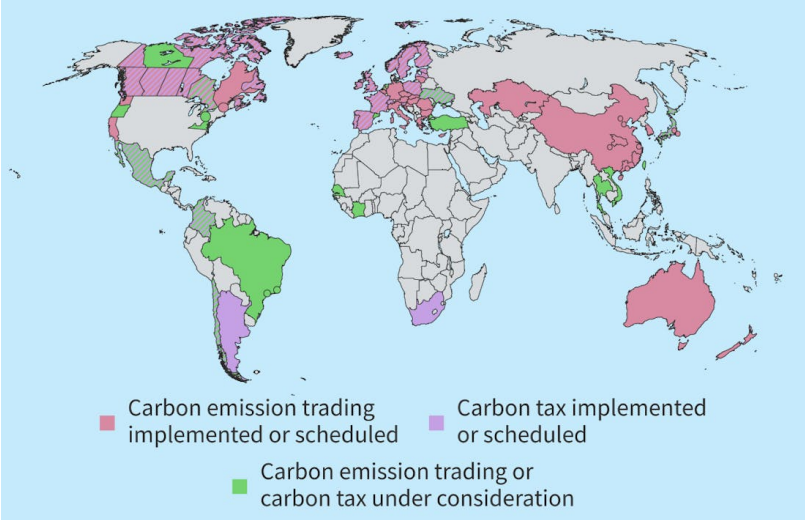




**Figure 4.** A map showing the carbon taxes and emissions trading schemes employed in various countries.

More information for figure 4

The image is a world map indicating the status of carbon emission trading and taxation schemes across various countries. Areas colored in pink represent regions where carbon emission trading is implemented or scheduled. Light purple indicates regions where a carbon tax is implemented or scheduled. Areas marked in green show regions where either carbon emission trading or a carbon tax is under consideration. Countries in North America, South America, Europe, Asia, and Oceania are highlighted in different colors according to their status in carbon emission control measures. The map uses a color code legend located at the bottom, explaining the meaning of each color used to denote the status of carbon policies in different countries.

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Student view

The government sets the level of 'admitted pollution' per year and splits the 'permission to pollute' into a number of **tradable emission permits**. These are allocated to individual firms, which now have a quota of emissions that they are allowed to produce. Firms that pollute less can sell their remaining quota to other firms who need to pollute more. This is why they are called 'tradable'.

**Benefits of this solution:**

- It encourages firms to seek lower-cost methods of reducing emissions, such as better energy efficiency, which will lower their overall production costs.
- It helps achieve the environmental objective of reduced emissions at lower costs.
- The price of permits is determined by the free market, which allows greater flexibility to firms, because in a period of recession the price will fall due to falling output and in periods of economic boom the price will rise. This flexibility will allow firms to benefit from reducing emissions.
- It provides a way for international cooperation to tackle the global challenge of emissions.

**Problems with this solution:**

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- To start with, it is difficult to set an acceptable level of pollution.
- It is also difficult to measure a firm's pollution production in order to establish the amount of permits per firm.
- Firms pay for the pollution they create but it does not lead to a reduction in pollution once the allowed limit has been set.

## 3 section questions



# Positive externalities of production

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Contrary to what we saw in section 2.8.2 (/study/app/pp/sid-186-cid-754025/book/negative-externalities-of-production-id-30600/), when the production process of a good or service generates a *positive* effect on a third party or on society as a whole, it is called a positive externality of production.

This usually happens when there is an external benefit to third parties when producing a good. Examples include private companies investing in research and development of a new technology that spreads throughout the economy, training provided by private firms to their employees, private involvement in bee-keeping or the building of a flood defence.

Let’s consider the example of bee-keeping and the beneficial effects to society. The individual bee-keeper will benefit from the production and sale of honey and other by-products. Society will also benefit from bee-keeping, as bees are famous pollinators and they will pollinate agricultural plants that will later result in a more abundant harvest for farmers and more vegetables and fruits for consumers at farmers’ markets. This shows the positive effects produced during the process of honey production. Those additional benefits of bee-keeping on third parties are considered a positive externality of production.

Any positive effects of production on third parties, which are not paid for by them, are considered a positive externality of production.

Student view

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**Video 1.** Bee-keeping.

Credit: Getty Images Onfokus

More information for video 1

A video provides a way to explore bee-keeping and its externalities, illustrating the effects on the bee-keeper and society. The video shows a bee-keeper in a jacket and a veiled hood tending to a beehive, lifting a frame with bees and honeycomb. The bees are buzzing around wildflowers, linking honey production to pollination.

When this happens, **the marginal social cost of production (MSC) is smaller than the marginal private cost of production (MPC)**, as the bee-keepers are the ones who pay for the costs of honey production, rather than the society as a whole.

This results in a smaller amount produced than the socially optimal output, and therefore an under-allocation of resources to bee-keeping from the society's point of view.

Student view

**Figure 1** shows the market for honey and other by-products. Bee-keepers will be incurring costs to maintain a certain number of beehives, which will equal the marginal private costs (MPC). By the forces of demand and supply, the market will be producing at $Q_2$, where the quantity supplied is equal to the quantity demanded (MPC = MSB).

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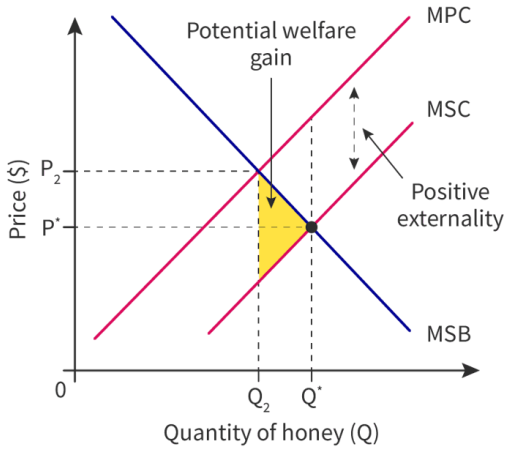


**Figure 1.** Positive externality of production: beekeeping has a lower social cost than private cost.

More information for figure 1

The graph illustrates a positive externality in the market for honey production. The X-axis represents the quantity of honey (Q), and the Y-axis represents the price in dollars ($). Three lines are depicted in the graph: the Marginal Private Cost (MPC), the Marginal Social Cost (MSC), and the Marginal Social Benefit (MSB).

The MPC and MSC lines are upward-sloping, but MSC is positioned above MPC, indicating a lower social cost compared to the private cost. The MSB line slopes downward, intersecting with the other two lines.

The market equilibrium is shown at point Q2, where the MPC equals the MSB. The socially optimal level of production is shown at point Q, *where the MSC equals the MSB. The area between Q2 and Q*, enclosed by the three curves, is shaded to represent a potential welfare gain due to the positive externality in beekeeping.

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Student view

### ⚠ Be aware

As with the previous section, the externality discussed here involves the production side of the market (the supply curve), and therefore the demand curve represents both the marginal private benefits (MPB) and marginal social benefits of consuming the good (MSB). In other words, MPB = MSB.

As seen in **Figure 1,** as the cost of honey production is paid for by the private bee-keeper, the total cost of production for society (MSC) is smaller than the private cost (MPC) for every level of output since bees help with the pollination of flowers. The vertical difference between MSC and MPC represents the externality. This is because bee-keeping will bring additional benefits to society in the process of honey production.

For example, the UNDP Aral Sea Programme (https://www.undp.org/content/undp/en/home/ourwork/ourstories/bee-keeping-_-good-for-families--good-for-communities--good-for-.html)helped communities in Uzbekistan address their needs by keeping bees when the Aral Sea started drying up. It not only helped families to find alternative sources of income for their needs, but also brought additional benefits to others engaged in agriculture. And while in this example we only consider honey bees, wild bees also need to be taken into consideration, with their beneficial effect to the environment. Planting a garden of wild flowers, instead of hybrid and pollen-free plants, helps save the increasingly diminishing numbers of wild bee species, which are also crucial for agriculture.

The optimal amount of bee-keeping, from the society's point of view, should be at the point where the MSC curve crosses the demand curve (the MSB curve), at Q*.

As the cost of production is greater for the private firm than the total cost to society as a whole, the market outcome results in a smaller amount produced than what should be produced if the net social costs of production were taken into consideration (private costs minus the external social benefit this production generates).

✓ **Important**

When there is a positive externality of production, the amount produced is smaller than what it should be, from the society's point of view. Therefore fewer resources are allocated to the production of this good than what is optimum for society. The market under-allocates resources to the production of the good.

In the example of bee-keeping, society is producing an amount, $Q_2 < Q^*$, and selling it a higher price, $P_2 > P^*$. Therefore, there is an **inefficient allocation of resources** from the society's point of view and the **potential welfare gain** – the maximum amount of welfare society could gain if resources were allocated efficiently – is shown by the yellow shaded triangle in **Figure 1**. All of the units not being produced from $Q_2$ to Q* have a lower cost for society than the benefit that they bring to it (MSC < MSB). This is why it is a market failure.

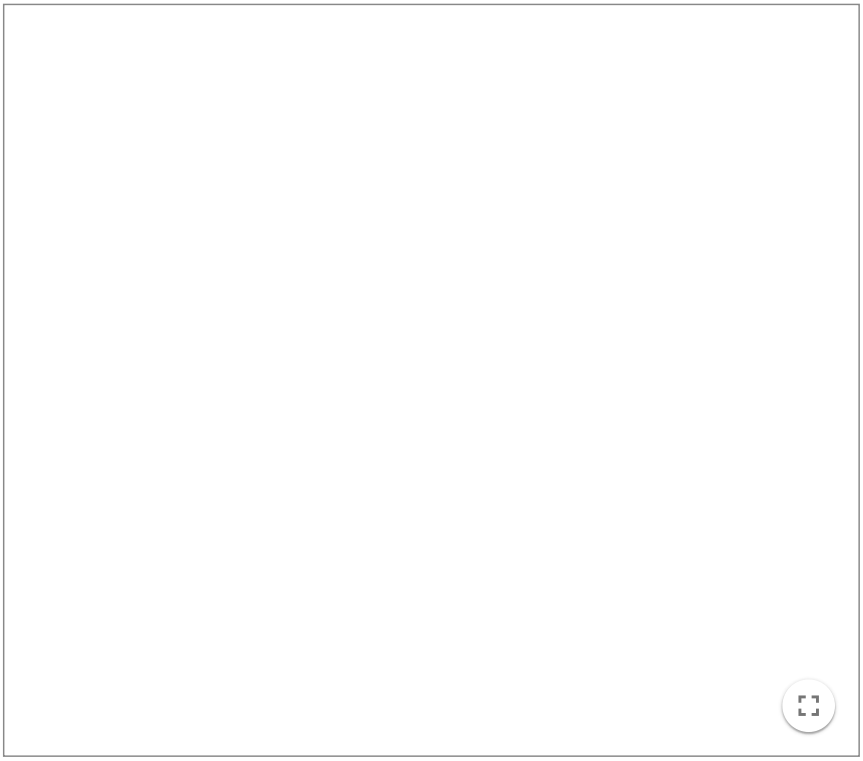


# Possible government responses

In this case, 'to solve the externality' means to gain the extra potential welfare for society by increasing the quantity produced of the good until $Q_1$ reaches Q*.

The solutions now point to the government motivating firms to invest more in those production processes whose side-effects benefit society, or for the government to invest in them itself. This can be done in two different ways:

- Subsidising firms
- Direct government provision



**Interactive 1.** Solutions to positive externalities of production.

More information for interactive 1

This interactive line graph illustrates the concept of positive externalities in markets, focusing on professional development. It shows the relationship between marginal private cost (MPC), marginal social cost (MSC), and marginal social benefit (MSB) to demonstrate how the free market underprovided goods or services that generate positive spillover effects.

The x-axis represents the quantity of professional development provided in the market, while the y-axis represents its price, influenced by cost and demand factors. Without intervention, the market equilibrium occurs at a lower quantity (Q1) and a higher price (P1) than the socially optimal level (Q* and P*). This underprovision results in a potential welfare gain, as shown by the shaded area.

A subsidy shifts the MPC curve downward to MPC + subsidy, lowering the price to P2 and increasing the quantity to Q2, bringing the market closer to the socially optimal level. This reduces the welfare loss caused by underproduction and enhances societal benefits such as workforce skill development and increased productivity.

The interactive feature includes an MPC slider, which allows users to adjust the marginal private cost and observe how changes affect equilibrium price and quantity. Increasing the MPC shifts the curve upward, raising costs, lowering the quantity of professional development, and widening the welfare gap. Decreasing the MPC shifts the curve downward, reducing costs, increasing the quantity, and moving the market toward the optimal level.

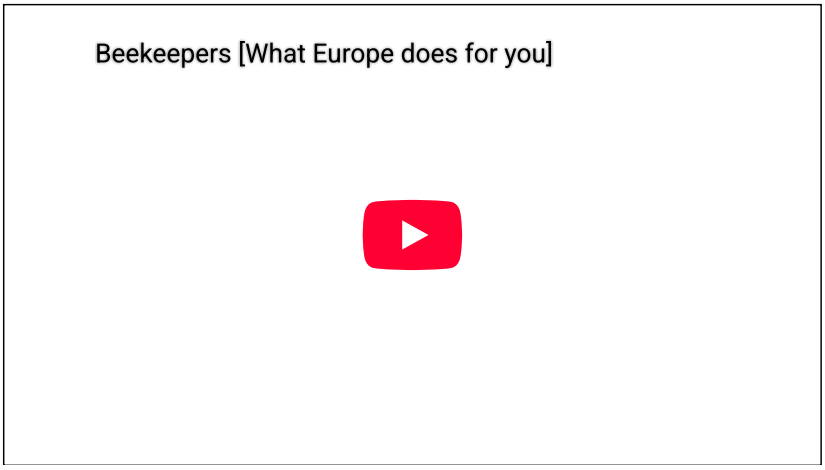
The second graph includes an additional price level (P2), emphasizing the effect of subsidies on reducing costs and increasing output. This allows for a more detailed exploration of policy interventions and their impact on market efficiency. Users can engage dynamically with the graph to understand how different economic policies influence externalities and market outcomes.

Student view

## Subsidise firms

The government could grant subsidies to the firms that provide training or research and development. Firms involved in provision of professional training or research and development will be willing to provide more opportunities to other businesses at more affordable prices as now their costs of production will be partially covered by the subsidy.

The government could grant subsidies to producers involved in bee-keeping. An example of such subsidies is the EU (https://epthinktank.eu/2017/10/24/the-eus-beekeeping-sector/): an overall 2017-2019 budget of €216 million (half from the EU budget) allocated according to the number of beehives in each country.




As seen in **Interactive 1**, the subsidy results in a downward shift of the supply curve from MPC to MPC + subsidy, nearer to the point of social efficiency, A. As firms' costs of production are reduced, they are willing and able to produce more at every price level, and the society gains from the positive external benefits this production generates. In turn, this reduces the unrealised potential welfare gain. In other words, the social welfare gained from this production process has increased.

**Problems with this solution:**

- It is very difficult for the government to estimate the level of subsidy deserved by every firm.
- Each subsidy uses government funds and therefore they have an opportunity cost; the government would have to cut back on other expenditures that might be important, such as health care.

## Direct government provision



Governments often fund research and development into many areas, including new technologies, medicine and pharmaceuticals, bee-keeping and agriculture. The government can also directly provide those goods and services that present positive externalities of production, for example flood defences (https://www.gov.uk/government/news/building-flood-defences-fit-for-the-future).

The effect on the market outcome would be similar to the effect of subsidies: the MPC would shift outwards towards the MSC, reducing the externality, as the government would pay for such investment, reducing firms' costs of production.

**Problems with this solution:**

- The cost for the government might be high and create an opportunity cost, as in the case of subsidies.
- The government might lack the expertise found in firms, which are specialised in their area of knowledge.
- Private firms might be dissuaded from investing in these areas themselves because of this government policy.

# Negative externalities of consumption



In the two preceding sections, we looked at externalities caused by the production side of the market. Now we will be looking into cases where the external effect on third parties is caused by the consumption of a good or service. These are called externalities of consumption.

Negative externalities of consumption occur when an individual's consumption of a good generates a negative effect on third parties who were not factored into the decision to consume that good. For example, when people consume goods like cigarettes around other people, the non-smokers will be affected by the second-hand smoke; people also drive cars that pollute the air for everyone, and when someone listens to very loud music, it can cause discomfort to others around them.

**Figure 1.** Car congestion in Istanbul.

Credit: Getty Images sandsun

When this happens, the **marginal social benefit (MSB) is smaller than the marginal private benefit (MPB)**, as the benefit of the private use, creates a negative impact suffered by the third party.

This results in a greater amount consumed of the good than the socially optimal output, and therefore an over-consumption of such goods, from the society's point of view.

Look at the example of the use of cars that produce carbon emissions, shown in **Figure 2.**

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By the forces of demand and supply, only taking into consideration the individual's private benefit of using cars (MPB) and the cost of producing cars (MPC = MSC), the market will end up consuming at $Q_1$.

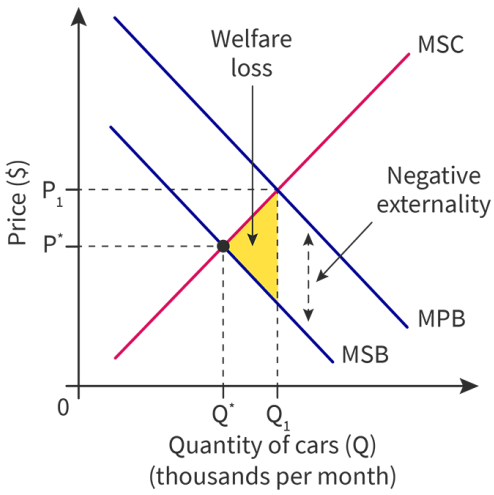


**Figure 2.** Negative externality of consumption: market of petrol-run cars.

More information for figure 2

The graph illustrates the concept of negative externality in the consumption of petrol-run cars. The X-axis represents quantity, and the Y-axis represents price. There are two main curves: the marginal private benefit (MPB) curve, shown in pink, and the marginal private cost (MPC) curve, equivalent to marginal social cost (MSC), shown in blue. The equilibrium point without considering external costs is at quantity Q1 and price P1 where MPB equals MPC. However, the negative externality suggests a social cost that is not reflected in this equilibrium, suggesting an optimal quantity Q2, where a new equilibrium considering social cost is established. An arrow highlights this shift from Q1 to Q2, indicating the reduction in consumption to account for the external costs. The shaded yellow area between the MPC and MSC curves illustrates the external costs associated with petrol consumption.

[Generated by AI]

Student view

### Be aware

When the externality is on the demand side of the market, and not generated by the production process, the social and private costs of production are equal: MPC = MSC.

As seen in **Figure 2**, if the air pollution generated while consuming cars is considered, the total benefit for society (MSB) is lower than the private benefit (MPB) for every level of output. The vertical difference between MSB and MPB represents the externality.

The optimal amount of cars consumed and produced from the society's point of view should be at the point where the MSC curve crosses the MSB curve, at Q*.

As the benefit to society is smaller than the benefit to the individual, the market outcome results in a greater amount of polluting cars being consumed than should be consumed if the total social costs of consumption were taken into consideration.

### Important

When there is a **negative externality of consumption**, the amount of the good consumed is greater than what it should be, from the society's point of view. Therefore, more resources are allocated to the consumption of this good than what is optimum for society. **The market over-allocates resources to the consumption of the good.**

In the example of cars in **Fig. 2**, society is consuming an amount $Q_1 > Q^*$ and not taking in consideration the negative externalities of this consumption while paying $P_1$. Therefore, there is an **inefficient allocation of resources** from the society's point of view and the **welfare loss** is shown by the yellow shaded triangle. All of the units consumed from $Q^*$ to $Q_1$ have a higher cost for society than the benefit they bring to it (MSC > MSB). This is why it is a market failure.

### Exam tip

Students very commonly confuse negative externalities of consumption with negative externalities of production when having to draw the situation on a diagram.

Always think first **what causes** the external negative effect: is it the production process of the good or the consumption of the good? Once you have identified whether the problem is on the supply side (production) or the demand side (consumption) of the market, you can easily distinguish which diagram representation is the correct one.

When the externality is produced on the **demand** side of the market, then:

**MSB ≠ MPB .**

When the externality is produced on the supply side of the market, then:

**MSC ≠ MPC .**



# Possible government responses

There are several possible ways in which the government can intervene to solve or reduce negative externality of consumption.

To 'solve the externality' in this case, like in the case of a negative externality of production, means to eliminate the welfare loss by reducing the quantity consumed of the good until $Q_1$ reaches $Q^*$.

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The solutions aim to make people aware of the risks associated with their consumption, or to demotivate people from consuming the good by increasing the cost of the good itself. This can be done through different methods:

- Banning or regulating the good
- Imposing an indirect tax on the good
- Negative advertising

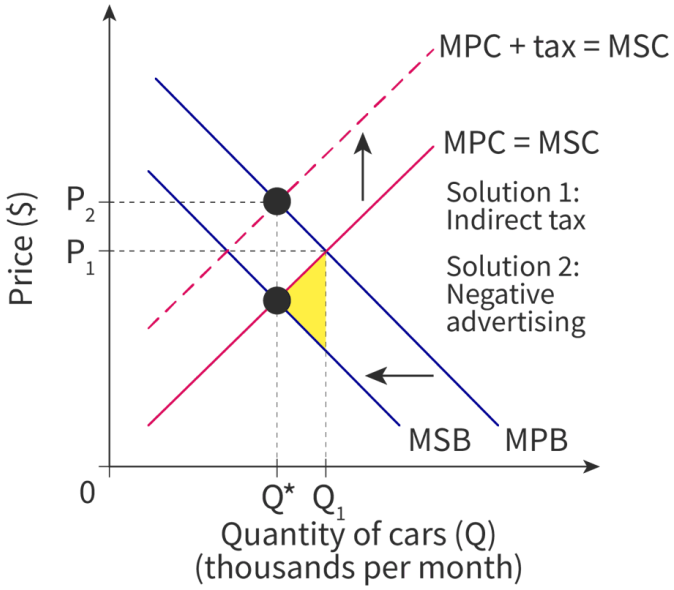


**Figure 3.** Possible solutions to negative externalities of consumption.

More information for figure 3

The graph represents the possible solutions to negative externalities of car consumption. It displays the relationship between the price of cars in dollars, labeled on the Y-axis, and the quantity of cars in thousands per month on the X-axis. The graph shows two main supply curves: "MPC = MSC" (marginal private cost equals marginal social cost) in red and "MPC + tax = MSC" in dashed red, indicating the effect of an indirect tax. The demand curves are "MSB" (marginal social benefit) and "MPB" (marginal private benefit) in blue. Two equilibrium points are marked along with an area labeled "Solution 1: Indirect tax" and "Solution 2: Negative advertising" which is shown by a yellow-shaded triangle indicating overconsumption. At price level P1, the quantity produced is above the socially optimal level at Q* compared to Q1 under the imposition of a tax. Arrows indicate a shift caused by implementing taxes or advertising solutions to address the externalities.

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Student view

## Ban or regulate the good

The government could directly stop the consumption of goods by making them illegal. This would make the externality disappear completely, as the good would no longer exist on the market, unless a black market arose (depending on the nature of the good). Alternatively, the government could regulate the consumption of the product by introducing legislation. For example, in the case of cigarettes, many governments have restricted where people can smoke, have introduced uniform packaging or have tightened up on who can buy cigarettes in an attempt to reduce demand and shift the MPB closer to the MSB.

In France, Paris has in recent years limited the number of vehicles that are allowed to drive in the city during weekdays (https://www.thelocal.fr/20190701/old-diesel-cars-to-be-banned-from-paris-from-july-1st). Measures taken include having car-free Sundays and restricting the passage of vehicles of a particular age. This would reduce the demand for cars locally. Another example of regulation of the car industry is in the Netherlands (https://www.dutchnews.nl/news/2020/03/max-speed-limit-of-100kph-on-some-roads-from-friday/), where they have reduced the maximum speed limit to 100 km/h (previously it was 130 km/h) on highways in order to reduce emissions from vehicles.

**Problems with this solution:**

- This would have a large effect on the corresponding industry in terms of shareholders and employment.
- It might have a big effect on the government's revenue as it would receive fewer or no taxes from this market.
- Banning the good might cause a negative reaction from consumers if they perceive the banning of the good as restrictions on their liberties and rights. This could have a negative effect on the government's future election prospects, as consumers are also voters, which makes it unlikely that governments will choose this option.
- Regulations will need to be enforced and this may impose an additional cost on the government.

## Impose an indirect (Pigouvian) tax on the good

The government could impose an indirect tax on the good itself to increase the private costs of consumption by increasing the price of the good. When indirect taxes are used in this way, to resolve negative externalities, they are called Pigouvian taxes. However, the government must bear in mind that not all goods can be effectively taxed in this way, as we learned when we covered price elasticity of demand in subtopic 2.5 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-29882/).

As seen in **Figure 3**, the tax results in an upward shift of the supply curve, from MSC to MSC + tax, which reduces the quantity demanded nearer to Q*, as the price in the market increases from $P_1$ to $P_2$. Because consuming the good has become more expensive, people will tend to consume less of it, due to the law of demand.



Depending on the amount of the tax, the externality could be completely eliminated. If it isn't there will still be a welfare loss, but it will be less than with no government intervention.

On the other hand, the government will gain some revenue from the tax, which can be used to correct or mitigate some of the negative effects caused by the consumption of the good.

### ⚠ Be aware

Many cities have introduced charges for drivers entering the city. Students often interpret this as a tax. If you choose to discuss congestion charges in an exam or your IA, you need to be clear about who is paying the charge and what the market is (through your axis labels). If the market is for car sales, then congestion charges do not reduce supply, but they will reduce demand. If the market you are showing is for delivery services, then yes, these charges would act like an indirect tax.

**Problems with this solution:**

- When the good is addictive, such as cigarettes, its demand tends to be price inelastic and an increase in price will not reduce the quantity consumed very much.
- If taxes are raised too much, consumers might look for other illegal sources of supply, causing black markets to appear.
- Taxes make people pay for the external cost they create but do not stop the negative effect from taking place, as there will still be people using or consuming the good.

## Negative advertising

The government could create awareness about the risks and dangers that consuming these harmful goods creates for others, or for the consumer themselves. In other words, the government could fund negative advertising in order to reduce demand, as shown in **Figure 3**.

In this case, the demand curve would shift inwards, closer to the MSB curve, thereby reducing the externality and the welfare loss for society because less of the good would be consumed.

### Activity

Watch the following video showing an advertisement discouraging drink driving.




**Video 1.** New Garda Drink Drive Advert March 2016.

More information for video 1

As a class, consider the following discussion points:

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- Do you think this video is effective in discouraging drink driving? Why/why not?
- Does it do enough to convince you that drink driving is not worth the risk? If not, how could it be improved?

In groups, come up with your own ideas for a drink driving advert.

**Problems with this solution:**

- The costs of these solutions might be high and generate an opportunity cost for the government. However, if these goods were taxed as well, then the revenue generated could be used to fund these measures.
- There is always a level of doubt about how effective advertising is at reducing demand, especially in cases such as cigarette consumption within certain age groups. Many studies show that advertising does not have a great effect on teenagers in reducing cigarette consumption.

### Be aware

When evaluating measures to reduce negative externalities, be careful that your evaluative points make sense for the example that you are discussing. For example, when discussing the negative consumption externality produced by the driving of cars with petrol (gas) engines and the potential benefits of driving electric vehicles, you should keep in mind that the potential benefits of electric vehicles largely depend on the proportion of electricity produced by renewables in the specific country (https://theconversation.com/climate-explained-the-environmental-footprint-of-electric-versus-fossil-cars-124762).

## 3 section questions

Student view



# Positive externalities of consumption

Section Student... (0/0) Feedback Print (/study/app/pp/sid-186-cid-754025/book/positive-externalities-of-consumption-id-30603/print/) Assign

When the consumption of a good or service generates a positive effect on a third party or on society as a whole, we say that there is a positive externality of consumption.

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This is the case for merit goods and any other good or service that has a positive side-effect on third parties when being consumed.

Education and health care are the most common examples that come to mind. When an individual gets a vaccine, for example, he or she is not the only one who benefits from its consumption. Vaccines prevent the individual consumer from getting sick, but this has the secondary effect of preventing others from getting sick because vaccinations reduce the spread of illness.

**Figure 1.** Vaccines are an example of positive externalities of consumption.

Source: " Woman Being Vaccinated (https://commons.wikimedia.org/wiki/File:Woman_Being_Vaccinated.jpg) " by ames Gathany, Judy Schmidt, USCDCP is licensed under CC0 1.0 (https://creativecommons.org/publicdomain/zero/1.0/deed.en)

When this happens, **the marginal social benefit of consumption (MSB) is greater than the marginal private benefit (MPB)**, as the demand for the good or service does not take into consideration the positive external effects it has on the society as a whole, but only the benefits to the private individual that consumes it.

This results in a smaller amount consumed of the good than the socially optimal output, and therefore an under-allocation of resources to the production of the good, from the society's point of view.

Student view

**Figure 2** shows the example of the market of health care services.

As with the other types of externalities, the market will produce and consume where the demand is equal to the supply, only taking the private costs and benefits into consideration. This will result in a quantity $Q_1$ smaller than the social optimum Q*. The MSB is greater than the MPB at every output level and therefore a potential welfare gain is created, as shown by the yellow shaded triangle.

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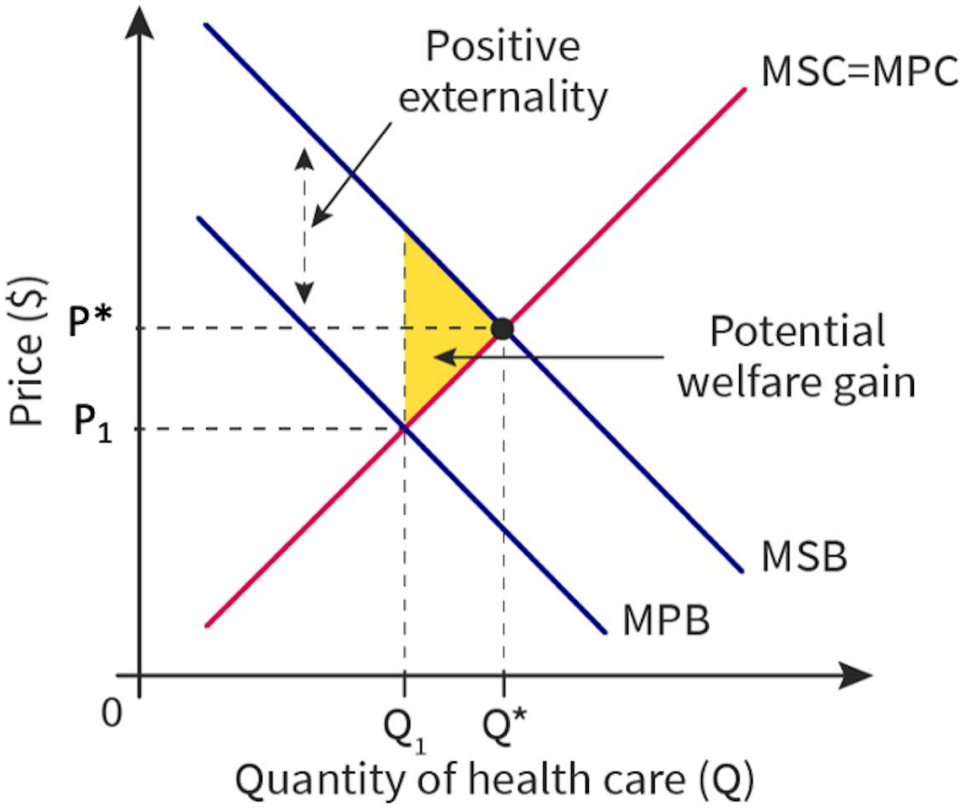


**Figure 2.** Positive externality of consumption: health care services.

More information for figure 2

This graph illustrates the positive externality of consumption related to healthcare services. The X-axis represents the 'Quantity of health care (Q)', while the Y-axis represents 'Price ($)'. There are multiple lines and points labeled as follows:

1. **MSC=MPC (Marginal Social Cost equals Marginal Private Cost):** A red upward-sloping line.
2. **MSB (Marginal Social Benefit):** A blue line above the MPB.
3. **MPB (Marginal Private Benefit):** Another blue line parallel to MSB.
4. **P** *and* $P_1$ *are prices.* *P* is the social optimum price and $P_1$ is the private market price.
5. **Q** *and* $Q_1$ *show quantities.* *Q* is the social optimum quantity and $Q_1$ is the private market quantity.
6. The **yellow shaded triangle** represents the 'Potential welfare gain', showing the benefit that is not realized in a market without intervention.
7. The 'Potential welfare gain' is indicated by a bold dot where the MSB and MSC lines intersect, demonstrating the optimal point for maximizing welfare.
8. An arrow indicates 'Positive externality', showing the additional benefits provided by the healthcare service beyond what private demand covers.

This visualization highlights discrepancies between private and social costs and benefits, emphasizing the need for market correction.

[Generated by AI]

Student view

### Exam tip

Students often draw the potential welfare gain triangle in the wrong place when analysing positive externalities of consumption. It is a very common mistake to shade the triangle below the MSC curve and above the MPB curve between $Q_1$ and Q*.

Conceptually, the correct potential welfare gain triangle is the one formed below the MSB curve and above the MSC curve, although these areas are mathematically equal when using linear equations.

By definition, this externality exists because there is a greater benefit to consuming those extra units for society than the cost of producing them, and this is why the potential gain is shown by this specific triangle and not the other way around.

Once again, we see that the market allocating resources in a way that does not agree with the most efficient allocation of resources from the society's point of view is the reason why this, too, is a market failure. The society would be better off if more of these goods were consumed and therefore produced.

### Important

When there is a **positive externality of consumption**, the amount consumed is **smaller** than what it should be, from the society's point of view. Therefore, **fewer** resources are allocated to the production of this good than what is optimal for society. The **market under-allocates resources to the production of the good.**



## Possible government responses

In this case, 'to solve the externality' means to gain the extra potential welfare for society by increasing the quantity consumed of the good until $Q_1$ reaches Q*.

The solutions now point at the government motivating people to consume these goods. This can be done using different methods:

- Subsidising firms
- Direct government provision
- Positive advertisement
- Legislation to make consumption compulsory

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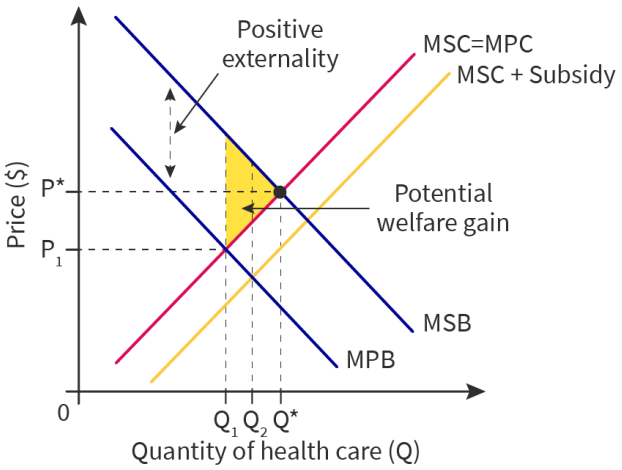


**Figure 3.** Possible solutions to positive externalities of consumption (Subsidy).

More information for figure 3

The graph illustrates the concept of positive externalities in consumption, specifically focusing on subsidies. The X-axis represents the quantity of healthcare (Q), ranging from 0 to Q, *with specific points marked at Q1 and Q2. The Y-axis represents the price in dollars ($), with key price points noted as P1 and P*. Two main supply and demand curves intersect on the graph. The marginal social benefit (MSB) is shown as an upward-sloping line, indicating the social value of an additional unit of healthcare consumed. The marginal private benefit (MPB) is a line below the MSB, indicating the private value. Another curve, marked as marginal social cost (MSC), is initially aligned with the marginal private cost (MPC) but shifts down to show MSC + Subsidy. The area between these curves represents a potential welfare gain, highlighted in a shaded triangle, demonstrating the benefit of subsidies to align private incentives with social benefits. The diagram includes annotations for positive externality, potential welfare gain, and MSC adjustments, showing how subsidies can address discrepancy between private and social benefits.

[Generated by AI]

## Subsidise firms

Student view

The government could grant subsidies to firms that provide, for example, health care, and in this way increase the supply curve.

The subsidy results in a downward shift of the supply curve, from MSC to MSC + subsidy (**Figure 3**), increasing the provision of health care services from Q1 to Q2 and making it nearer to the point of social efficiency at Q*. As firms' costs of production would be reduced, they would be willing and able to produce the good or service at a lower price, so that more people can afford it. The society would benefit from the positive external benefits generated by consumption of the good, therefore reducing the unrealised potential welfare gain by gaining extra social welfare.

**Problems with this solution:**

- The main problem with this solution is the cost for the government. Each subsidy uses government funds and therefore has an opportunity cost because the government would have to cut back on alternative expenditures that might be important.

Overview (/study/ap 186- cid- 754025/

- Another problem is that subsidies can generate production inefficiencies in private firms because part of their revenue is guaranteed by the government.

## Direct government provision

Governments often provide goods and services that have positive externalities of consumption. These goods are usually free of charge to all consumers, as is the case with state schools and public hospitals in most countries in the world.

As we have seen, education and health care have such large and important benefits for society as a whole that they cannot be left to the private sector alone. However, in most countries where there is direct state provision of these services, there is also provision by the private sector for those who are willing and able to pay privately for school or health care. Although this can alleviate some pressure from public services (something that features in the news media in most countries), private provision of such services can also raise several questions about fairness, equal opportunities, social mobility and quality of provision.

### Activity

Read the following articles and answer the questions that follow.

Debate: Private schools shouldn't be abolished, The Oxford Student, 15 October 2019 (https://www.oxfordstudent.com/2019/10/15/private-schools-shouldnt-be-abolished/)

Private schools criticise plans to get more poor students into university, The Guardian, 29 January 2020 (https://www.theguardian.com/education/2020/jan/29/private-schools-criticise-plans-to-get-more-poor-students-into-university)

1. Outline the arguments that the articles make for and against private schools in the UK.

2. Discuss the measures that governments can take to reduce the problem of positive externalities of consumption.

Student view

The effect this has on the market is similar to the effect from subsidies: the supply curve MSC (MPC = MSC) will increase, shifting downwards, therefore decreasing the price and increasing the quantity consumed nearer to the socially optimal point Q*.

**Problems with this solution:**

- The cost to the government might be very high and create an opportunity cost, as in the case of subsidies.
- The government might be less efficient than private firms at providing these services, and the quality of the good or service might not be as good.
- Private firms might be dissuaded from investing in these areas because the government will provide these goods or services anyway.

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## Positive advertisement

The government could educate people and create awareness through advertising campaigns about the benefits to the consumer and others of consuming such goods, in order to increase demand towards the MSB curve.

**Problems with this solution:**

- The costs might be high and generate an opportunity cost for the government, as with any other government expenditure.

## Legislation

The government could pass laws to make the consumption of these goods compulsory. This is the case for education up to a certain age in many countries, and certain vaccinations in some countries.

This solution increases the demand for the good or service (for example, vaccines), shifting the demand curve outwards towards the MSB curve, as in the case of positive advertising. Ideally, it will shift until it reaches the MSB curve, where Q* is produced and consumed, eliminating the externality as society gains the maximum potential welfare.

**Problems with this solution:**

- This solution is less likely to be successful unless the government provides the goods and services free of charge.
- Some people might resent laws of this type if they see them as an infringement of their civil liberties.
- There is the additional cost of enforcing the law.

## 3 section questions

Student view



# Calculating welfare loss (HL)

Section Student... (0/0) Feedback Print (/study/app/pp/sid-186-cid-754025/book/calculating-welfare-loss-hl-id-30604/print/) Assign

As you have seen in subtopic 2.7 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-29874/) with the diagrams showing examples of government intervention, we can also calculate the welfare loss for externalities diagrams.

Overview (/study/ap 186- cid- 754025/

In the case of negative externalities, there is a straightforward welfare loss. In the case of positive externalities, there is a potential welfare gain due to the positive effects on the consumer and society, but this is a welfare loss until it has become realised. This is the 'welfare loss' you may be asked to calculate.

For example, if vaccines cost EUR 10, there are positive benefits to society due to individuals purchasing vaccines, because there are some unvaccinated people who are protected by not catching illnesses from the vaccinated people. However, there is a welfare loss in the form of a potential additional gain that is not occurring and could occur if the positive externality were incorporated into the price of the vaccine and more vaccines were therefore consumed, thus protecting an even greater proportion of society.

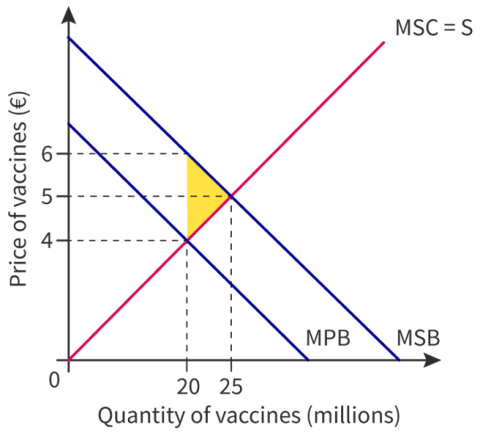


**Figure 1.** A market with positive externalities of consumption.

More information for figure 1

This graph illustrates a market with positive externalities of consumption, specifically for vaccines. The X-axis represents the quantity of vaccines (in millions), ranging from 0 to 25 million, while the Y-axis indicates the price of vaccines in Euros, ranging from €0 to €6.

The graph displays three key lines: 1. MSC = S (Marginal Social Cost equals Supply), depicted as an upward-sloping line. 2. MPB (Marginal Private Benefit), shown as a downward-sloping line. 3. MSB (Marginal Social Benefit), also shown as a downward-sloping line, but above MPB.

Between MSB and MPB, there is a yellow triangle representing the welfare loss or unrealized potential additional welfare gain. The socially optimal level of vaccine consumption is indicated at the intersection of MSC and MSB, at 25 million vaccines. The current market equilibrium, at the intersection of MSC and MPB, occurs at a lower quantity of about 20 million vaccines. The graph visually demonstrates how incorporating positive externalities into pricing could increase vaccine consumption to the socially optimal level and reduce welfare loss.

[Generated by AI]

Student view

**Figure 1** shows a market with positive externalities of consumption. As we have discussed, vaccines provide society with benefits beyond those only experienced by the people who have the vaccines, so the socially optimal level of output is higher than the current level of output. In this diagram, the socially optimal level of output is 25 million vaccines, and the welfare loss (unrealised potential additional welfare gain) is shown by the yellow triangle.

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### Making connections

You need to be able to draw on your maths skills in economics, which does require some flexible thinking. After all, maths is a way of communicating that can be applied to many different disciplines. For this subtopic, though, you only need to draw on some maths lessons from several years ago.

To calculate a welfare loss (or unrealised potential welfare gain), we need to use the formula for a triangle:

Area of a triangle $= \frac{1}{2}$ base × height

Potential welfare gain $= \frac{1}{2}(6-4) \times 5$ million

$= \frac{1}{2} \times 2 \times 5$ million

$= \frac{1}{2}$ 10 million

= EUR 5 million

### Exam tip

When performing calculations, it is important to show every step of your calculations and write the answer out in full. This is true in maths and science too. It is easy to rush during the exam, and think these things aren't important, but being careful will result in you gaining the highest number of marks possible.

Student view

3 section questions

2. Microeconomics / 2.8 Market failure — externalities and common pool resources

# Common pool resources

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## What are common pool or common access resources?

Fish in the ocean, the air we breathe and open grazing land are all examples of common pool resources or **common access resources.** Common pool resources refers to natural resources that are freely available to anyone to use, at zero price. More examples include: oysters found in open seas, clean air, lakes, rivers,

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wildlife, hunting grounds, forests, fertile soil from common land, the ozone layer, the stable global climate and many others.

**Figure 1.** Wild trout fishing.

Credit: Getty Images DieterMeyrl

Common pool resources are both rivalrous, and non-excludable.

A good is considered rivalrous if, once it has been consumed, it cannot be consumed again by another person. When we catch a fish, no one else can catch that exact same fish. Over time, there will be fewer fish left available to catch. And as a result, overfishing can be a problem in most seas and oceans. Common pool resources such as fish are rivalrous.

Common pool resources are non-excludable because it is not possible to exclude anyone from its use. Common access resources are non-excludable because **they have no price** and anyone can use them without payment. It is usually very expensive, or almost impossible to exclude people from deep sea fishing.

Student view

## The Tragedy of the Commons

Historically, English villages had a common plot of land that villagers could use to graze their cattle and other livestock. Many still do have their commons, but you will rarely see any cows on them anymore. While it was in the interest of all those using the common to ensure it was not overgrazed, it was also in the interest of each individual user to use as much of the available land for their animals as possible. It is likely that users will act in their own self-interest instead of preserving the common land. This problem captures the heart of the issue with common pool resources, which is referred to as the ‘tragedy of the commons’.

### ⚠ Be aware

**Common access resources** are unlike private goods in that they are **non-excludable**, and unlike public goods in that they are **rivalrous**.

### Important

Common access resources are a case of **market failure** because the individual benefits of consuming or using the resource are much greater than the private cost of doing so, and this gives the individual an incentive to keep consuming it. Therefore, there is an over-consumption with respect to what is optimal for society.

## The market failure or externalities that arise from common pool resources

Common pool resources, such as fish stocks, grazing land, and hunting grounds are often overused (or over-consumed). Individuals have economic incentive to consume as much of a free common pool resource as they can. However, the social cost of this action is high, as the common pool resource may be depleted very quickly. In 1870, there were approximately 14 000 000 buffalo grazing the plains of North America. Even though people found the buffalo very valuable for meat, leather, clothing and tools, and no one wanted the resource depleted, and yet by 1889 only 150 buffalo remained. Due to the non-excludable nature of buffalo, they were over-consumed and almost completely disappeared from the plains of North America. The very nature of common pool resources can lead to resource depletion, or very **serious environmental degradation.** This means that many common pool resources will not be available to future generations.


**Figure 2.** Unsustainable fishing practice.

For a common pool resource to be sustainable it must be consumed at the same rate of replenishment. This means that the fishing industry should fish at the rate of natural replacement. If fish stocks have the capacity to reproduce at a rate of 20% per year, then the fishing industry should fish less than 20% of the total stock each year. This sounds obvious, and yet we consistently overfish. Why is this the case?



### Activity

Following this link to an online game:

https://cloudinstitute.org/fish-game (https://cloudinstitute.org/fish-game)

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# Take the challenge! Can you fish sustainably? Play the fish game to find out!

## Case study

According to the Minderoo Foundation, 'half of the world's assessed fish stocks are overfished and nearly 10 percent are on the point of collapse — threatening not only ocean ecosystems but also the livelihoods and food security of millions of people.' Overfishing is a result of the fishing industry catching faster than fish stocks can replenish themselves. The World Wide Fund for Nature (WWF) argues that the cause of the collapse of global fish stocks can be fairly placed on unsustainable fishing practices. Driftnet fishing for instance, involves fishing boats dropping kilometres of very fine fishing nets, catching everything in their path. Often the nets are filled with marine life outside the targeted species of fish, such as undesirable or poisonous fish, turtles, or even dolphins. Every fishing vessel has economic incentive to catch as many fish as they can, as any fish they leave in the ocean, will simply be caught by another fishing vessel. There is no incentive for an individual fishing vessel to conserve fish.

The problem of the decline of fish stocks is compounded each year by many countries actually offering financial support for unsustainable fishing practices.

1. Using an appropriate diagram, explain why countries subsidise their fishing industries.
2. Explain what will happen in the short run, and the long run as a result of these subsidies.
3. What do you think might be a possible solution to stop overfishing?

You can find out more about overfishing from these articles:

https://www.smh.com.au/national/it-s-not-too-late-tenth-of-global-fish-populations-on-brink-of-collapse-20211117-p599nb.html (https://www.smh.com.au/national/it-s-not-too-late-tenth-of-global-fish-populations-on-brink-of-collapse-20211117-p599nb.html)

https://datatopics.worldbank.org/sdgatlas/archive/2017/SDG-14-life-below-water.html (https://datatopics.worldbank.org/sdgatlas/archive/2017/SDG-14-life-below-water.html)

Student view

## Making connections

Sustainability is a topic that is covered across disciplines, including geography, environmental systems and societies, and biology. In economics, we consider the unintended consequences of markets, but our impact on our environment can be explored on a range of different stakeholders.

Countries should act in sustainable ways, and should not deplete or degrade natural resources, thereby ensuring that future generations will be left with the resources they need to develop. The subject of development will be covered in more depth in topic 4 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-30650/), where we will analyse the consequences of growth and its relationship with economic development. This is a challenge in developing countries, where the existence of poverty can lead to over-exploitation of the land for agriculture.

**Be aware**

The **overuse** of common access resources could be thought of as an **intergenerational negative externality of consumption.**

# Government responses to threats to sustainability

It can be challenging to solve the problems associated with the overuse or degradation of common access resources. We will discuss the following approaches:

- Carbon taxes and cap and trade systems
- Subsidies
- Legislation
- Collective self-governance

**Figure 3.** Oil pumps.





# Carbon taxes and cap and trade systems

Carbon dioxide emissions continue to be a central threat to sustainability. One solution is to place a **price on carbon dioxide emissions** to reduce emissions, and encourage the development of more sustainable alternatives.

How can governments place a price on carbon?

Firstly, governments must calculate the social costs associated with carbon dioxide emissions. This includes the costs society must pay for the destruction of coral reefs, crops damaged by flooding, or drought, property lost to unseasonal bushfires and rising sea levels. These costs can be internalised by placing a price on their

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cause – carbon dioxide emissions. A price for carbon will shift the burden of paying for the costs of climate change back to its cause. By forcing polluters to pay to emit carbon dioxide, they will have an incentive to reduce emissions and invest in cleaner alternatives.

There are two ways the government may choose to place a price of carbon; a carbon tax, or a cap and trade system.

# Carbon taxes

A carbon tax is a per unit tax paid on carbon emissions from burning fossil fuels. It is placed on firms that produce carbon dioxide through their production processes. For example, in 2019, Canada initially placed a $16 per tonne tax on carbon dioxide emissions, which was increased to $39 per tonne in 2022. The tax can reduce emissions in two ways. Firstly, the tax will increase the cost of using fossil fuels, and in doing so will incentivise firms to move into cleaner alternatives such as solar or wind energy. Secondly, the tax will encourage consumers to become more energy efficient.

## Limitations of carbon taxes

There are several limitations on imposing carbon taxes:

- As discussed in section 2.8.2 (/study/app/pp/sid-186-cid-754025/book/negative-externalities-of-production-id-30600/) it can be difficult to measure in dollar terms the cost of the pollution, and therefore calculate the size of the tax. The Interagency Working Group on Social Costs of Carbon in the USA has estimated the hidden cost of carbon dioxide emissions at $40 per metric tonne. However, as climate change continues and severe weather events become more frequent, this estimate will become more inaccurate over time.
- Taxing carbon may encourage the production of alternative energy such as nuclear power. Nuclear energy has issues and impacts of its own, especially the generation of waste that takes a very long time to decompose while remaining radioactive.
- Fossil fuels are generally very price inelastic. A carbon tax will increase the price, but will lead to a smaller than proportionate fall in quantity demanded. Hence, even a large tax will not decrease carbon dioxide emissions significantly. To increase the effectiveness of the tax, governments should attempt to make fossil fuels more elastic by developing affordable substitutes. For example, cheap biofuels allow car owners to switch out of using petrol very quickly and easily at almost no cost.
- Lastly, a carbon tax is very regressive. Fossil fuels used to produce electricity and petrol/gasoline are often necessities for families. Poor families must pay a higher proportion of their incomes to cover their electric bills and petrol/gasoline. So any tax targeting fossil fuels will be felt more by the poor than the rich. To solve this issue and offset the regressive nature of carbon taxes, Canada refunds the revenue from the carbon tax back to families through their tax returns.

Student view

## Strengths of carbon taxes

As mentioned in section 2.8.2 (/study/app/pp/sid-186-cid-754025/book/negative-externalities-of-production-id-30600/), the revenues from the carbon tax can be used to promote renewable sources of energy.

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**Carbon taxes are most effective** when the size of the tax is exactly equal to the externality (or the social costs associated with climate change). A tax can incentivise firms to produce at the social optimum. Referring to **Figure 6a**, internalising the externality with a carbon tax increases price from $P_0$ to $P_1$ indicating the true cost to society of carbon emissions. At the same time, quantity decreases from $Q_0$ to $Q_1$ – the social optimum. Of course it is extremely difficult to measure the ever-changing size of the externality and the cost to society from climate change.

# Cap and trade system

Another possible solution is to set up a **cap and trade** system by **issuing tradable emission permits.** (see section 2.8.2 (/study/app/pp/sid-186-cid-754025/book/negative-externalities-of-production-id-30600/)). **A cap and trade system** is where the government sets emission reduction targets and encourages firms to meet them by creating economic incentives. **A tradable emission permit** is a permit to pollute. Firms may purchase permits to give them the right to pollute (for example) one tonne of $CO_2$ emissions. If the government wishes to reduce the amount carbon emissions, they can reduce the number of permits for sale from $Q_1$ to $Q_2$, and in doing so drive up the price of the permits from $P_1$ to $P_2$. Firms with production plants using clean technology will pollute less, and have little need to buy permits. They will enjoy lower costs of production, and will benefit from a cap and trade system. Firms with excess permits can even sell them on to other firms, and earn an additional revenue stream. However, firms with production plants that generate large amounts of pollution must buy many permits. This will lead to a significant increase to the cost of production. Such firms will find it difficult to compete and will be driven from the market. A cap and trade system will benefit and reward those firms that do not pollute, while punishing those that do pollute.

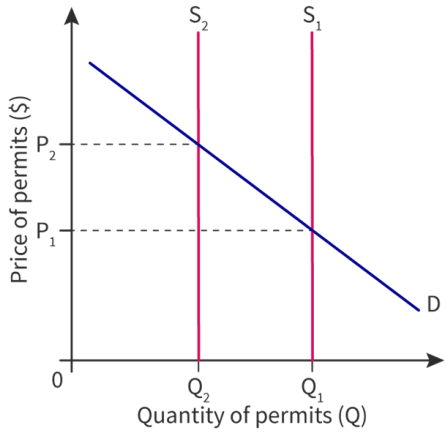


**Figure 4.** The market for pollution permits.

More information for figure 4

The graph illustrates the market for pollution permits using a standard supply and demand model. The X-axis represents the quantity of permits (Q), while the Y-axis represents the price of permits ($). Two vertical supply curves are shown: S1 and S2. The initial supply curve, S1, intersects the demand curve D at price P1 and quantity Q1. A reduction in the number of permits shifts the supply curve inwards to S2, resulting in a new equilibrium at price P2 and quantity Q2. This demonstrates how limiting the number of permits increases their price, thereby reducing overall emissions as firms strive to purchase fewer permits. The intersection of the supply and demand curves highlights how the market regulates permit prices based on supply limitations.

Student view

[Generated by AI]



**Figure 4** shows how the government can use tradable permits to limit and, over time, reduce pollution. The government issues a fixed number of permits, which is represented by the vertical supply curve $S_1$. This intersects the demand curve for tradable permits such that a price is set at $P_1$. The government can reduce the number of permits, which will reduce the amount of pollution that can be produced. This causes the supply curve to shift inwards from $S_1$ to $S_2$ and the price per permit to increase from $P_1$ to $P_2$.

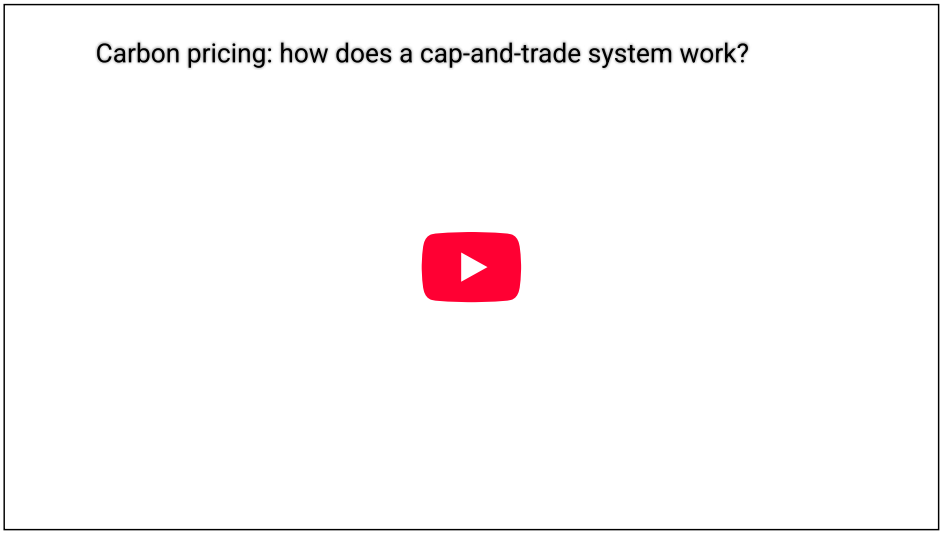


**Figure 5.** Carbon pricing with cap and trade.

## Strengths of cap and trade

- The cost of the permits encourages firms to buy or develop technology to reduce their emissions. In this way, market forces create incentives to firms to act in a more sustainable manner. As stated in section 2.8.2 (/study/app/pp/sid-186-cid-754025/book/negative-externalities-of-production-id-30600/) firms are encouraged to seek lower cost methods of reducing their emissions
- Although enforcing a cap and trade system can be challenging, governments earn revenue from the sale of the permits that can be used to finance monitoring equipment and fund enforcement with the court system.



## Limitations of cap and trade

- It may be difficult to monitor and enforce carbon emissions.
- As it is difficult to measure the cost of excess carbon emissions on society, it is also difficult to place a socially optimal price on the permits. If the permits are priced too high, too many firms may be driven from the market, and electricity will be underproduced. If the permits are too cheap, then firms have no incentive to start to switch over to greener production techniques.
- If the permits can be sold on the open market, then traders can drive up the prices of permits. Because the supply of permits is fixed, they are perfectly supply inelastic. Traders will have economic incentive to

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buy permits, hoping to sell them as price increases. The best way to solve this issue is for the government to pass laws to ensure that only carbon emitting firms can buy and sell permits.

# What is the difference between a carbon tax and cap and trade?

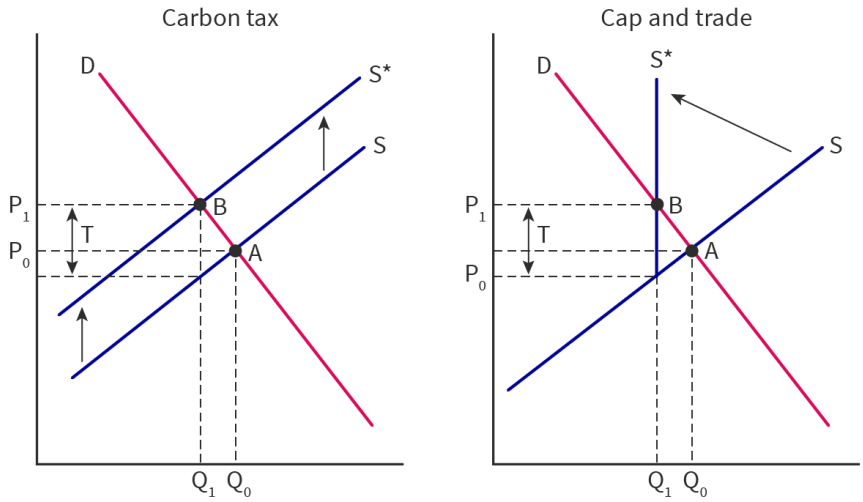


**Figure 6. a.** Carbon tax. **b.** Cap and trade.

More information for figure 6

The image consists of two side-by-side diagrams comparing the economic impacts of a carbon tax and a cap-and-trade system. On the left is the carbon tax diagram, showing demand (D) and supply (S) curves intersecting at equilibrium point A with initial price P0 and quantity Q0. The supply curve shifts upward to S *after the tax is imposed, creating a new equilibrium at point B, with a higher price P1 and a lower quantity Q1. The tax amount is represented as T, the vertical difference between P0 and P1. On the right is the cap-and-trade diagram, also showing demand (D) and supply (S) curves intersecting at equilibrium point A. The supply curve shifts vertically to* S due to the cap, leading to a new equilibrium at point B with similar changes in price P1 and quantity Q1. Both diagrams illustrate shifts and intersections that visualize the effects of the respective policies on price and quantity.

[Generated by AI]

Student view

Although there is a significant difference in the way carbon taxes and a cap and trade system are implemented, the outcomes are similar.

Let's say the government levies a tax on carbon emissions. According to **Figure 6a**, the tax will shift back the supply of carbon emissions from S to S*. In doing so, the price of carbon will increase from $P_0$ to $P_1$. The higher price will encourage users to become more energy efficient, or switch into clean energy and the quantity of carbon emissions will fall from $Q_0$ to $Q_1$. The government earns revenue from the tax. For a carbon tax, the government **sets the price for carbon**, and the **market responds by decreasing emissions.**

Alternatively, lets say the government implements a cap and trade system. In a cap and trade system, the government is able to directly target a quota for carbon dioxide emissions. In **Figure 6b**, the supply curve represents the supply of emission permits and Q refers to the quantity of carbon dioxide emissions. If the government wishes to introduce emission permits, and fix the quantity of carbon dioxide emitted at $Q_1$, supply will become perfectly inelastic. Regardless of price, the quantity supplied of $CO_2$ will be fixed at $Q_1$. As firms compete to purchase emission permits, the price will be bidded up from $P_0$ to $P_1$. If firms are purchasing permits from the government, then the government will gain from this revenue. However, if the permits are sold in a tradeable market, then the revenue from the sale of the permits will be allocated by market forces. In a cap and trade system, the government can set a quota for carbon emissions, and the market responds by **increasing** the price.

Clearly, if the government uses a carbon tax, it **can set the price for carbon**, but **cannot set a quota for carbon emissions**. However, with a cap and trade system, the government **sets the quota for carbon emissions**, but **cannot set the price for carbon**.

## Subsidies

Since the extraction and use of fossil fuels causes the externalities discussed above, societies have been looking for alternative sources of energy as a solution.

**Renewable** sources of energy include solar power, wind power, hydropower and biofuels. These are called **clean technologies**. Governments tend to intervene in the market and promote the development and use of these technologies by subsidising them or giving tax credits to those who invest in them. According to the OECD (https://www.oecd.org/cgfi/forum/The-governments-role-in-mobilising-investment and-innovation-in-renewable-energy-Insights.pdf), there has been a strong and steady increase in investment in clean technology by governments. **Figure 7** below shows that total investment across different types of renewables increased approximately nine times between 2000 and 2014.



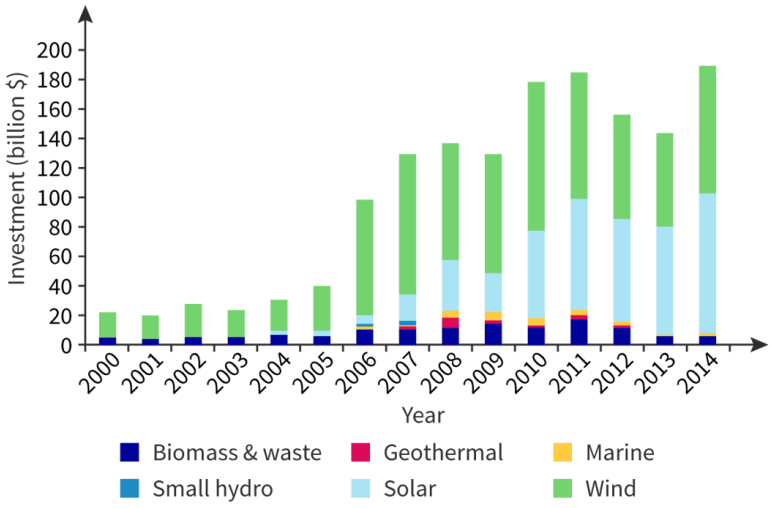


**Figure 7.** Trends in investment flows in renewable-power sources in OECD and G20 countries.

More information for figure 7

The image is a stacked bar chart illustrating investment trends in various renewable energy sources from 2000 to 2014. The X-axis represents the years, and the Y-axis represents investment in billions of dollars. The different colors in each bar represent different types of renewable energy: blue for Biomass & Waste, dark blue for Small Hydro, light blue for Solar, green for Wind, red for Geothermal, orange for Marine.

- In 2000, the total investment was relatively low with a dominance of wind investments.
- From 2000 to 2014, there is a notable increase in overall investment, with a sharp rise between 2010 and 2014.
- Wind and solar investments show significant growth over the years, particularly solar, which becomes a major part of the investment mix from 2010 onwards.
- Wind maintains the largest individual share throughout the period.

[Generated by AI]

Since electricity from these sources is a substitute for fossil fuel-produced electricity or energy, resources will be allocated away from burning fossil fuels and towards producing these cleaner, renewable forms of energy. **Figure 8** shows the example of a firm that produces electricity using wind power from turbines on a wind farm.

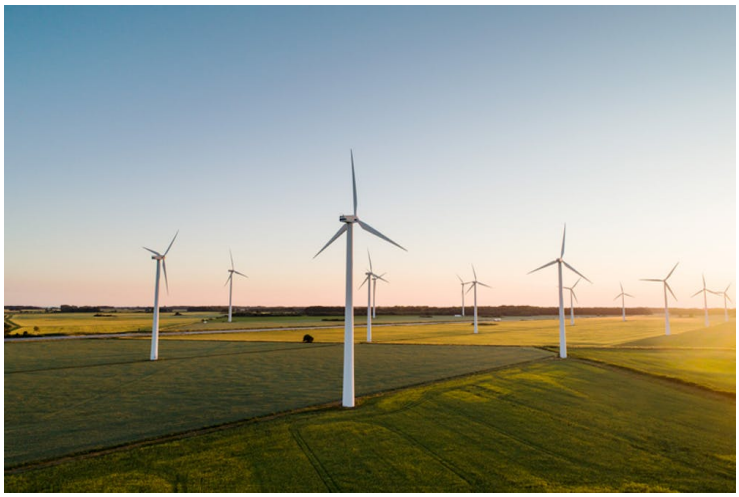

**Figure 8.** Wind turbines on a wind farm.

Credit: Getty Images Kentaroo Tryman



When a government subsidy is granted to a firm generating power from wind farms, the supply curve increases from $S_1$ to $S_1$ + subsidy as it lowers the firm's costs of production. This will result in a lower price of electricity to consumers ($P_2 < P_1$) and increase the amount of electricity demanded ($Q_2$ to $Q_1$).

The cost of this policy to the government is shown by the orange rectangle on **Figure 9**, while the cost to consumers is represented by the yellow rectangle.

Subsidising clean technologies creates an opportunity cost for the government, as these funds cannot be used for alternative government objectives. However, if the government is strongly committed to reducing carbon emissions, then it is worthwhile to subsidise clean energy, as an increase in the use of cleaner forms of energy can only be possible if the prices to consumers are affordable.

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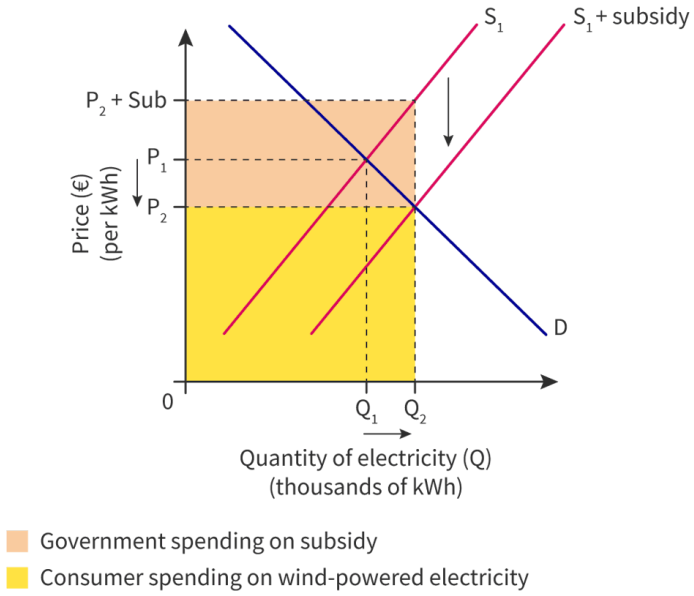


**Figure 9.** Production of electricity using wind turbines.

More information for figure 9

The graph illustrates the impact of subsidies on the production of electricity using wind turbines. The X-axis represents the Quantity of electricity (Q) in thousands of kWh, with notable points at Q1 and Q2. The Y-axis shows the Price (in €) per kWh with significant levels at P1 and P2. Two supply lines are marked: S1 (without subsidy) and S1 + subsidy (with subsidy), intersecting with a demand curve labeled D. Without subsidies, the equilibrium price is P1 and quantity is Q1. When subsidies are added, the supply curve shifts to S1 + subsidy, resulting in a new equilibrium price of P2 and quantity of Q2. The area between P1 and P2 on the price axis, shaded, represents consumer spending on wind-powered electricity, while the area above this, up to the line P2 + Sub, signifies government spending on subsidies. This demonstrates how subsidies can lower consumer prices and increase electricity production.

[Generated by AI]

### Worked example 1

Student view

Explain, using negative externalities diagrams, why economic activity requiring the use of fossil fuels such as petrol (gasoline) to satisfy demand poses a threat to sustainability.

To answer this question, draw a diagram showing that the MSB of using fossil fuels is smaller than the MPB at every level of output.

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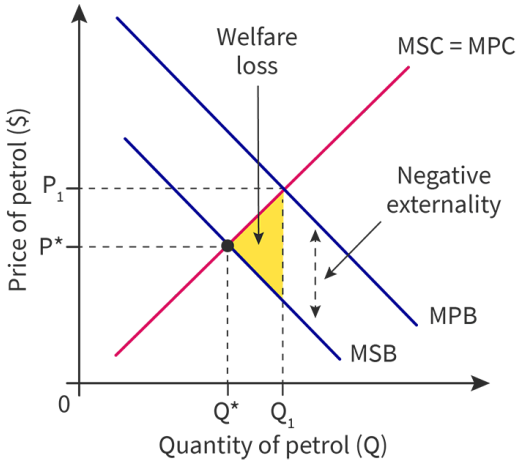


**Figure 10.** The MSB and MPB for fossil fuels.

Because this is a question about the negative externalities of consumption, your explanation should show how the market is allocating more resources to the production and consumption of petrol than the socially optimal output. The social benefit is lower than the private benefit because you need to take into consideration the external cost to future generations; they won't have enough of this resource because the current generation is overusing it.

## Legislation

Governments can pass laws to stop resource depletion of common pool resources. For example, in Western Australia the government has created a strict legislative network to protect the stock of crayfish (they are like lobsters – but without front claws), crabs and fish.

The government limits the fishing of crayfish by ensuring that all the people fishing them must be licensed. The licenses are limited to reduce the number of people fishing. In addition, each boat can only have carry a certain number of 'pots' to catch crayfish.

Student view

There are distinctive 'seasons' for crabbing. Crabs can only be caught within three months of the year. This restricts the number of crabs caught, and gives the crab population time to replenish itself. Only male crabs can be caught, female crabs must be thrown back. The government sets a 'bag limit' on the number of crabs that can be caught by each boat each day (currently 24 crabs).

Governments often create laws to restrict the range of methods to catch fish. The Australian government has banned drift net fishing. A drift net is a very large net that has very small holes and it is left in the ocean for a few days. Drift nets are non-discriminatory and catch more than just fish for the table. Dolphins, penguins, and turtles often get caught in drift nets.

Legislation has wider applications and can also be used to control:

- Airport noise. Governments can dictate the maximum decibels emitted from an airport.

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- Car emissions. Governments can legislate maximum emissions from cars. They can make catalytic converters mandatory on all cars.
- Emission limits on chimneys. Governments can control the amount of pollutant parts per million released into the air.

### Strengths of legislation

Legislation is most effective when laws are passed that are very specific and easy to enforce. For example, airport noise is relatively easy to monitor. There is only one airport, and many householders nearby are ready to complain if the noise exceeds a certain level.

### Weaknesses of legislation

It is difficult for a government to create legislation that balances the costs of legislation to industry and the benefits to the environment. For example, if the legislation is too tough, then the fishing industry will not be able to catch enough fish, and will stagnate. Alternatively, if the legislation is not strict enough, and too many fish are caught, fish stocks will decline and again the fishing industry will suffer. As stated in section 2.8.2 (/study/app/pp/sid-186-cid-754025/book/negative-externalities-of-production-id-30600/), legislation can lead to increased unemployment.

It is costly to the government to monitor, enforce, and prosecute those firms that break the law. In 2021, Southern Water (a UK water company) was discovered to have dumped 21 billion litres of raw sewage into the ocean. The government must fund a department to monitor firms like Southern Water, and then provide further funds for enforcement through the court system. Often it is cheaper for large firms to hire lawyers and continue to fight the case in court (and continue to pollute) than it is to pay the fine and stop polluting. Southern Water was a particularly stubborn polluter. Since 2015, Southern water has had 168 previous offenses, and yet had not altered its behaviour.

In addition, any fines need to be of optimum size to incentivise the polluter to stop. A fine that is too small may mean it is cheaper for the firm to continue to pollute – and pay the fine, rather than spending huge funds retooling the production plant to reduce pollution. Conversely, if the fine is too high – this may drive the firm out of business, leading to unemployment and loss of services. Southern Water was fined £90 million GBP. This may seem like a significant amount of money, but in 2019, the firm made a profit of £213 million GBP. Will this fine be enough for Southern Water to finally change its behaviour?

Student view

## Collective self-governance

Collective self-governance is defined as those who contribute to the environmental issue being involved in all the processes, such as working with local communities and governments, that lead to the improved use of that resource or location (Ostrom, 1999 (https://www.tandfonline.com/doi/full/10.1080/09669582.2017.1291653#)).

**Figure 11.** The cruise industry is a good example of an industry participating in collective self-governance.

Credit: Getty Images Daniel Piraino/EyeEm

Collective self-governance is based on the premise that if you wish to keep a forest sustainable that if you ask all stakeholders to work together – wood cutters, firewood gatherers, bird watchers, mushroom gatherers – they will self-organise to ensure the survival of the forest. It is argued that they will work together to devise rules and enforcement to ensure the forest survives as that is in their best interest. Forest users are the experts on the forest, and are the most likely to have current knowledge of the conditions of the forest and can adjust their behaviour accordingly. Self-organisation is most likely to occur when all stakeholders communicate well and have an equal voice. If the wood cutters are able to listen and negotiate with the bird watchers and the mushroom pickers, the forest will be sustainable.

Another interesting example of an industry that poses a threat to sustainability of common access resources is the cruise industry. Due to the transient nature of cruises, it is difficult to manage the activities of ships when they have negative impacts on their surroundings. Tourists today are increasingly concerned about environmental issues, and cruise companies can market themselves for their sustainability policies. Local marine communities concerned with the impact of cruises on the environment can legislate to work with companies that promise to operate within certain boundaries. For example, the Svalbard Environmental Protection Act allows companies to visit the Svalbard archipelago of islands (https://www.visitnorway.com/places-to go/svalbard-islands/) (islands belonging to Norway) as long as they promise to look after the area. The Association of Arctic Expedition Cruise Operators (AECO) (https://www.aeco.no/about-aeco/) exists to balance the needs of the environment and local culture with the needs of the tourist industry in the area. In this example, all interested parties work together to promote sustainability in a self-governing way.



## Strengths of collective self-governance

- Stakeholders (the users of the common pool resource) have expert knowledge on the state of the forest or ocean floor etc. They know if a forest is being over exploited, and are able to act quickly and in a coordinated manner to save the resource upon which all of them are dependent for their livelihoods.
- Collective self-governance works best when all stakeholders communicate with each other clearly, and have strong agreements on monitoring and enforcement.

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## Limitations of collective self-governance

- Some stakeholders will always have more power than others. In a forest, industrial wood chippers may have greater say than bird watchers. Stakeholders may also have conflicting objectives. Woodcutters, pastoralists aim to cut down trees, while mushroom pickers and birdwatchers wish to keep the forest as it is. How can such diverse group create and maintain agreements that will benefit everyone?

3 section questions



# The importance of international cooperation

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In many cases of positive and negative externalities, solutions require countries to work together and come to an international agreement to secure a sustainable future.

### International Mindedness

A lot of what will be discussed on this page covers the need for countries to work together to achieve common goals. This doesn't happen easily, and requires politicians to put those common goals ahead of any political interests they may have. Consumers also need to consider their impacts on the environment globally and be willing to make changes.

## The global nature of sustainability issues

Student view

International cooperation is required in order to find sustainable solutions to global issues; for example, the widespread use of vaccinations. A sufficient percentage of people must be vaccinated globally for viral diseases to be eradicated. After Edward Jenner developed the smallpox vaccine in 1796, vaccination programmes were steadily employed from the mid- to late-1800s in European and North American countries. A major international push led by the World Health Organization, starting in 1967, resulted in the last case of smallpox occuring in 1977. For a country to benefit from herd immunity, the WHO advises that 90 per cent of the population must be inoculated (https://www.who.int/news-room/fact-sheets/detail/measles).

Vaccines are an example of positive externalities of consumption. The external benefits of people consuming vaccinations are not just limited to people in the local area, but in the entire country and in other countries too. Therefore, a global effort is required in order to roll out a sustainable vaccine programme successfully.

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## Case study

### The climate crisis in Tuvalu

Tuvalu is an island nation in the Pacific Ocean. Its land mass occupies 26 $km^2$ and its population is 11 000. Its gross domestic product is USD 39 million.

**Figure 1.** Funafuti, the main island of Tuvalu.
Credit: Getty Images Ashley Cooper

The climate crisis will affect this country in one of the most extreme ways: by making it disappear entirely. Already, the sea water level is rising so that it floods much of the country's arable land regularly. Nothing can grow when the ground is saturated with salt. Tuvalu's highest point is only 4.6 metres above sea level. Some scientists estimate that Tuvalu will disappear within the next 50 years.

None of this is Tuvalu's fault, however. It produces no significant carbon emissions and barely contributes anything to the climate emergency.

Consider the following questions:

- What do you think Tuvalu's government can do in the coming years to mitigate some of the effects of climate change?
- What role should Tuvalu play in climate negotiations?

Student view

Countries have also had to cooperate in order to try and agree to a set of policies that will halt and reverse the effects of climate change. The first of such meetings was the 1992 Earth Summit held in Rio de Janeiro, Brazil. Countries subsequently adopted the Kyoto Protocol in 1997, which was largely seen as unsuccessful due to China and the United States not participating. Current promises as agreed by the Paris Agreement (https://ec.europa.eu/clima/policies/international/negotiations/paris_en)(Conference of the Parties 21, or COP21) will limit the temperature increase to 2°C compared to pre-industrial levels. To limit warming further, much more commitment is needed.

Overview (/study/ap 186- cid- 754025/

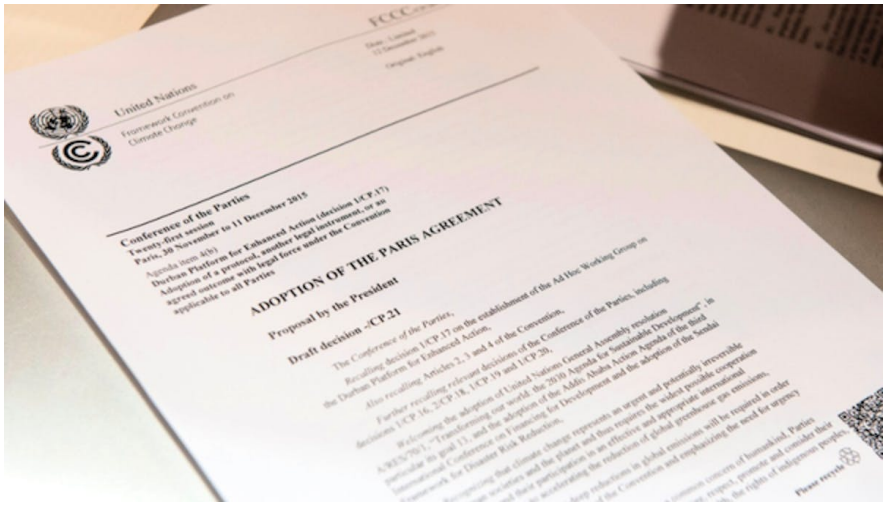


**Figure 2.** A copy of the 2015 Paris Climate Agreement, signed by 196 nations, given to a French astronaut by the then French President François Hollande.

Credit: TT.se MIGUEL MEDINA

Carbon emissions cause air pollution, which is a negative externality of production with the marginal social costs being experienced by the whole planet. Island nations in the Pacific Ocean are suffering from rising sea level that they are not responsible for in any way.

# Challenges faced in international cooperation

## Lack of shared responsibility

Not all countries are responsible for the carbon emissions that have caused climate change. Some countries will experience the consequences of climate change much more than others, particularly those with low-lying coastal regions, like the Netherlands, Bangladesh and the Pacific Islands. This makes coming to an agreement on how to approach the problem very difficult. The countries most affected will want the biggest international response, and the countries most to blame will likely drag their feet.

Student view

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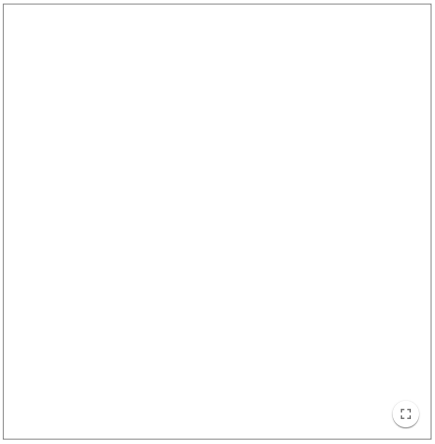

**Figure 3**. Carbon dioxide emissions in 2014.

More information for figure 3

This interactive map represents annual carbon dioxide emissions worldwide using a color-coded system. The emissions are measured in tonnes per year, showing the contribution of different countries to global carbon dioxide output. Users can explore emission levels across countries, with darker shades representing higher emissions. The interactive feature allows toggling between total emissions and per capita emissions, adjusting the data to reflect emissions relative to population size.

The color scale differentiates emissions levels. Countries with low emissions, ranging from 0 to 50 million tonnes, appear in light beige. Moderate emitters, ranging from 100 million to 1 billion tonnes, are shown in yellow to orange. High emitters, exceeding 2.5 billion tonnes, are represented in red and dark brown.

A reset button allows users to revert the map to its default state. This map provides insights into the distribution of global carbon dioxide emissions, helping identify major contributors. It enables comparisons between total emissions and per capita emissions, highlighting countries with high overall emissions versus those with high emissions per person. Users can observe patterns and trends across different regions and explore possible environmental policies and solutions to reduce carbon footprints.

Student view

## Inequality of resources

In the case of climate change, the inequality of resources between countries is to blame for the slow policy response since the 1990s. At the time, China did not have to adhere to the Kyoto Protocol because it was considered a developing country, despite being a major polluter. Developing countries were exempt from the agreement, and only developed countries were bound to restrict emissions. Developing countries were not considered to have the resources to dedicate to the effort. In total, there were 41 countries and the European Union who participated in the agreement.

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Countries with significant poverty challenges often argue that it is difficult to choose between climate change prevention measures and development policies such as increased electricity provision. For example, approximately 304 million people in India live without electricity (Washington Post (https://www.washingtonpost.com/graphics/world/world-without-power/)). It would be difficult to transition away from existing coal or other polluting energy industries without significant investment.

### Political disagreements

As with all economic interventions in markets, there will be disagreements in what methods should be employed and which will be most effective. Governments always have different views as to whether taxes should be used or whether the government should legislate. Some governments are more committed than others to reducing environmental damage with appropriate taxation policies.

## Monitoring and enforcement

As highlighted by the global experience of the Kyoto protocol, it is difficult to get all countries to work together. Supranational organisations, such as the Intergovernmental Panel on Climate Change (IPCC) and the United Nations, can play a vital role.

The IPCC was formed in 1988 in order to provide all governments with 'scientific information that they can use to develop climate policies'. The reports that they produce usually serve as the basis for discussions during international policy negotiations, such as the Paris Climate Agreement. Most countries are members of this organisation. Take a look at one of its reports here (https://www.ipcc.ch/sr15/). In 2007, the IPCC was awarded the Nobel Peace Prize for their work on publishing and sharing information about climate change, as well as helping to facilitate the measures that need to be taken to prevent climate change.

While the IPCC has done a lot to improve the transparency of information surrounding the climate debate, there are still some criticisms of the organisation:

- Some argue that the estimate put together by the IPCC are conservative.
- The IPCC does not carry out its own research.
- There have been some incidents of misrepresentation of data (https://www.forbes.com/sites/realspin/2014/03/31/the-ipccs-latest-report-deliberately-excludes-and-misrepresents-important-climate-science/#ec7deb428eb2).

Student view

Case study

The European Union's emissions trading scheme

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**Figure 4.** The current president of the European Commission, Ursula von der Leyen. The EU promises to be carbon neutral by 2050.
Source: "EPP Summit, Brussels, 12 December 2019 (49208409236) (https://commons.wikimedia.org/wiki/File:EPP_Summit,_Brussels,_12_December_2019_(49208409236).jpg)" by European People's Party is licensed under CC BY 2.0 (https://creativecommons.org/licenses/by/2.0/deed.en)

The European Union has implemented an emissions trading scheme since 2005. Countries agree to national caps of emissions, which are approved by the EU. Each country is responsible for monitoring the emissions by industries in their respective countries. Firms are allowed to trade permits privately, using a broker or on a climate exchange. The EU must be informed when permits are sold.

Consider these questions:

- Do you think this is an effective system? Why/why not?
- Can you suggest any improvements?
- What does its effectiveness depend on?

## 3 section questions

Student view

2. Microeconomics / 2.8 Market failure — externalities and common pool resources

# Checklist

Section Student... (0/0) Feedback Print (/study/app/pp/sid-186-cid-754025/book/checklist-id-30607/print/) Assign

### What you should know

By the end of this subtopic **2.8 Market failure — externalities and common pool resources**, you should be able to:

- Be familiar with the following terms: market failure, allocative efficiency, merit goods, externality, demerit goods, negative externalities of production, positive externalities of production, positive externalities of consumption, negative externalities of consumption, emissions trading or cap and trade schemes, sustainability, sustainable development, common pool (or access) resources, carbon tax, pigouvian taxes, collective self-governance, tradable emissions permits, welfare loss.

The meaning of market failure and externalities

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- Analyse the concept of market failure as a failure of the market to achieve allocative efficiency, resulting in an over-allocation of resources (over-provision of a good) or an under-allocation of resources (under-provision of a good).
- Describe the concepts of marginal private benefits (MPB), marginal social benefits (MSB), marginal private costs (MPC) and marginal social costs (MSC).
- Describe the meaning of externalities as the failure of the market to achieve a socially optimal output where MSB = MSC.

Negative externalities of production and consumption

- Explain, using diagrams and examples, the concepts of negative externalities of production and consumption, and the welfare loss associated with the production or consumption of a good or service.
- Explain that demerit goods are goods whose consumption creates external costs.
- Evaluate, using diagrams, the use of policy responses, including market-based policies (taxation and tradable permits) and government regulations, to the problem of negative externalities of production and consumption.

Positive externalities of production and consumption

- Explain, using diagrams and examples, the concepts of positive externalities of production and consumption, and the welfare gain associated with the production or consumption of a good or service.
- Explain that merit goods are goods whose consumption creates external benefits.
- Evaluate, using diagrams, the use of government responses, including subsidies, legislation, advertising to influence behaviour and create awareness, and the direct provision of goods and services.
- Calculate the welfare gain from a diagram (HL).

Common access resources and the threat to sustainability

- Describe, using examples, common access resources.
- Describe sustainability.
- Explain that the lack of a pricing mechanism for common access resources means that these goods may be overused/depleted/degraded as a result of activities of producers and consumers who do not pay for the resources that they use, and that this poses a threat to sustainability.
- Explain, using negative externalities diagrams, that economic activity requiring the use of resources such as fossil fuels to satisfy demand poses a threat to sustainability.
- Explain that the existence of poverty in economically less-developed countries creates negative externalities through over-exploitation of land for agriculture, and that this poses a threat to sustainability.
- Evaluate, using diagrams, possible government responses to threats to sustainability, including legislation, carbon taxes, cap and trade schemes, and funding for clean technologies.
- Explain, using examples, that government responses to threats to sustainability are limited by the global nature of the problems and the lack of ownership of common access resources, and that effective responses require international cooperation, monitoring and enforcement.

Student view

# Investigation



**Real-world issue 2:** When are markets unable to satisfy important economic objectives – and does government intervention help?

**Figure 1.** Plastic pollution on a beach.

Credit: Getty Images kittisun kittayacharoenpong

The issue of microplastics has only gained prominence in the last few years (https://www.nytimes.com/2019/04/18/science/what-are-microplastics.html). For a long time, we were blissfully unaware of the damage we were inflicting on the environment when using everyday items, such as face scrub products, plastic bags or drinking straws.



These plastics used to be, and in many ways still are, considered extremely convenient, and they are cheap to manufacture. They have helped to make many products more accessible to lower-income families around the world, such as clothing, dinnerware and cosmetics.

These products contain small plastic particles, or ‘soft’ plastic, that breaks down into smaller parts, which find their way into our water system and litter the oceans. It has now been discovered that fish and other sea organisms ingest the microplastic, which then ends up in the food chain. We have also discovered the role that plastics can play in disrupting our hormones, and so we definitely don’t want plastic in our food and water. Watch the video below to learn more about the issue of microplastics and how pervasive they have become.

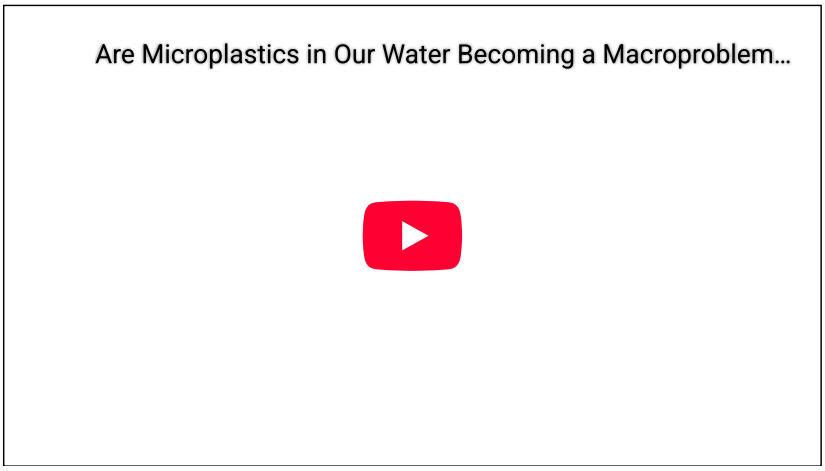


**Figure 2.** Are microplastics becoming a macro-problem?

Credit: Getty Images dottedhippo

Create a display or presentation about microplastics that covers the following points:

- Consider the concept of positive and negative externalities that you have learnt. How can they help to explain the problem of microplastics?
- What methods are available to help solve the problem of microplastics?



You might find the following articles helpful:

- You eat thousands of bits of plastic every year, National Geographic, 6 June 2019 (https://www.nationalgeographic.co.uk/environment/2019/06/you-eat-thousands-bits-plastic-every-year)
- Microplastics: what they are and how you can reduce them, The Natural History Museum, 21 January 2020 (https://www.nhm.ac.uk/discover/what-are-microplastics.html)