

Teacher Guide

Externalities

Externality diagrams at AS level and A-level Guidance for teachers

AS level

At AS level, it is expected that students will use demand and supply diagrams to illustrate the impact of externalities on the allocation of resources. Questions will NOT be set that require students to use MSC/MSB diagrams.

The content of the AS level specification does not include marginal costs and benefits, neither does it require that students should know, or be able to explain, the rules relating to the maximisation of net private benefits ($MPC = MPB$) or net social benefits ($MSC = MSB$). Students following the AS level course are not expected to acquire an understanding of the analytical tools needed to use MSC/MSB diagrams.

The relevant extracts from the AS level specification are:

3.1.5.4 Positive and negative externalities in consumption and production

Content

- *Externalities exist when there is a divergence between private and social costs and benefits.*
- *Why negative externalities are likely to result in over-production and that positive externalities are likely to result in under-production.*

Additional information

Students should be able to illustrate the misallocation of resources resulting from externalities in both production and consumption, using demand and supply diagrams. Students are not required to use Marginal Social Cost/Marginal Social Benefit (MSC/MSB) diagrams.

3.1.5.5 Merit and demerit goods

Similarly in the case of merit goods and demerit goods the 'Additional information' in the AS level specification states that:

*Students should be able to illustrate the misallocation of resources resulting from the consumption of merit and demerit goods using demand and supply diagrams. Students are **not** required to use MSC/MSB diagrams.*

What if a student uses MSC/MSB analysis, and diagrams, in an AS level exam?

It is not expected that students will use MSC/MSB analysis when answering questions on the AS level examination papers, nevertheless, if they apply the theory appropriately to questions that are set, they will be rewarded. For example, if a student uses MSC/MSB analysis appropriately when responding to the last part of a data response question, this will be given the same credit as if they had used the corresponding demand and supply diagrams.

However, in the data response section of the paper they could be required to draw a demand and supply diagram to illustrate the impact of externalities on a market. This means that students sitting the AS level paper must be able to use demand and supply analysis to illustrate and explain why the existence of externalities is likely to result in a misallocation of resources.

Similarly, multiple choice questions testing students' understanding of externalities, merit goods and demerit goods may require students to interpret relevant demand and supply diagrams.

Multiple choice questions - AS level Paper 1

AQA has decided to limit the number of externality diagrams which are used in AS level multiple choice questions, ie questions set will involve a shift in either the demand curve or the supply curve but not both.

As is good item-writing practice, relevant assumptions will be contained within an item.

In AS level multiple choice papers, there are four possible diagrams which might be included in an item:

- (1) Negative production externalities (shifts the supply curve to the left)
- (2) Positive production externalities (shifts the supply curve to the right)
- (3) Negative consumption externalities (shifts the demand curve to the left)
- (4) Positive consumption externalities (shifts the demand curve to the right).

In order to simplify these diagrams, in case number (2), the 'spillover' benefits from production (positive externalities) are rationalised as reducing the costs of other producers.

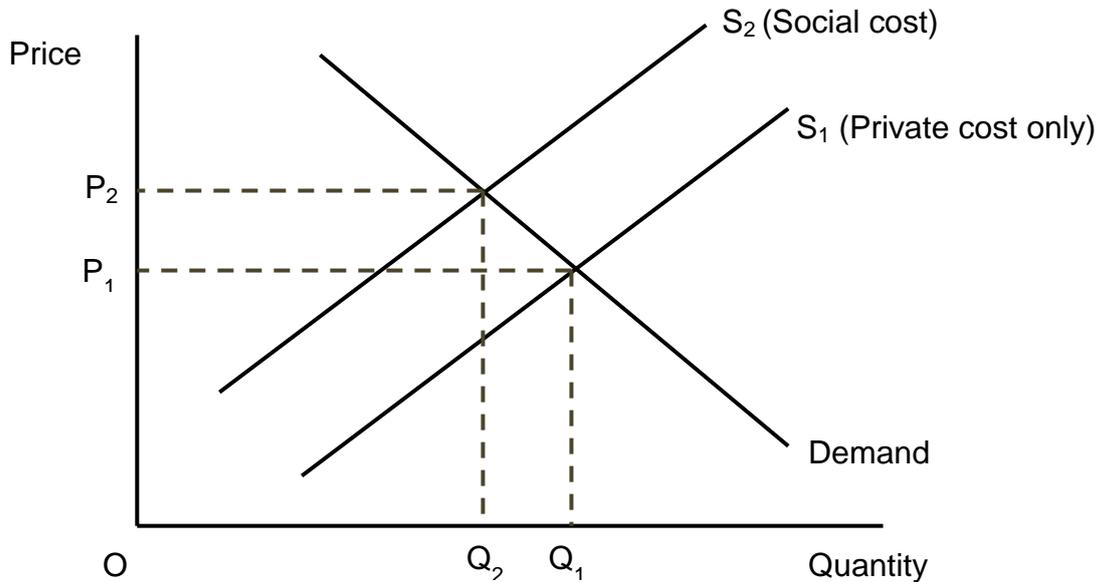
In case number (3), the costs imposed by consumers on society (negative externalities, eg arising from passive smoking) are rationalised as reducing the benefits enjoyed by non-smokers. Adopting this convention enables us to associate all **production** externalities, positive **and** negative, with **costs** (ie shifts in **supply**), and all **consumption** externalities, positive **and** negative, with **benefits** (ie shifts in **demand**).

The four diagrams are shown on the following pages.

(1) Negative externalities in production:

Example:

Pollution generated by a factory that imposes costs on others.



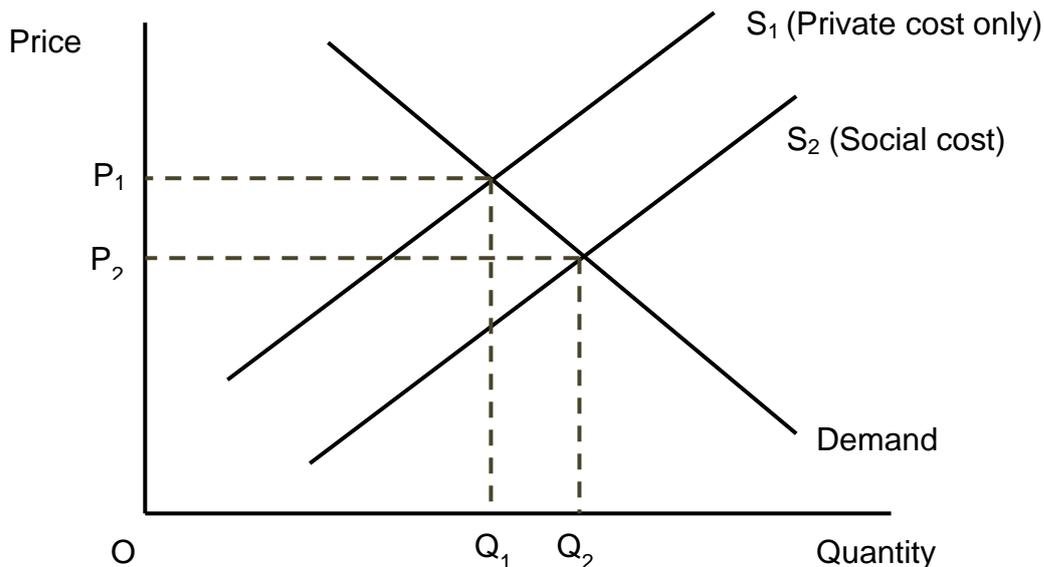
The diagram shows that in a free market, where producers only take into account the private costs of supplying the product, the price charged will be P_1 and the quantity bought and sold Q_1 . However, if producers were required to take into account the external costs, as well as the private costs, less would be supplied at each and every price, ie the supply curve would be S_2 . Hence, if all the costs were taken into account, the price would be higher at P_2 and the output lower at Q_2 . In a free market, failure to take into account the full costs of production results in overproduction and a misallocation of resources.

Note: another way of explaining the leftward shift in the supply curve, which may be preferred by some teachers, is that 'if the producers were required to take into account the full social cost of production, the price they would charge to produce any given level of output would be higher'.

(2) Positive externalities in production

Example:

When producing goods and services, companies may develop new technologies that benefit other companies, leading to lower costs for other firms. These spillover effects are not taken into account by the firms who develop the new technologies.



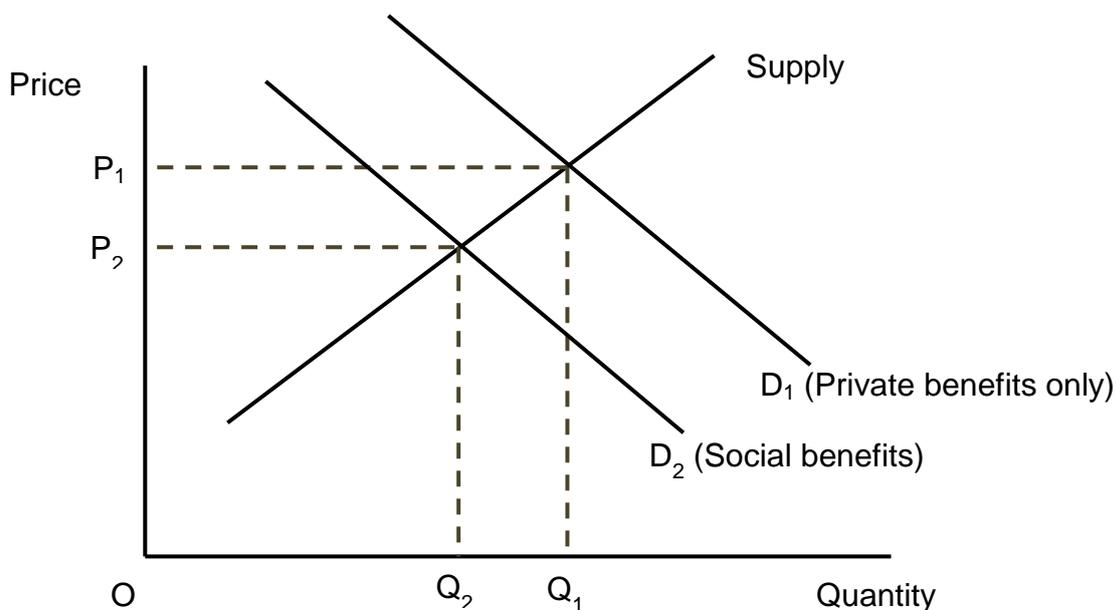
The diagram shows that in a free market, where producers take into account the private costs of supplying the product, the price charged will be P_1 and the quantity bought and sold Q_1 . However, if there are positive externalities in production, the private cost exceeds the true cost to society. Firms take into account the cost they incur in developing the new technologies, and in producing the product, but they do not take into account the cost reductions achieved by other firms that also benefit from the new technologies. The social cost of production is, therefore, less than the private cost. If firms accounted for the social cost of production, rather than the private cost, more would be supplied at each and every price, ie the supply curve would be S_2 ; the price would be lower at P_2 and the output higher at Q_2 . In a free market, where there are positive externalities in production, there is underproduction and a misallocation of resources.

As in example 1 above, another way of explaining the rightward shift in the supply curve, which may be preferred by some teachers, is that 'if the producers were to take into account the social costs of production, rather than the higher private costs, the price they would charge to produce any given level of output would be lower'.

(3) Negative externalities in consumption

Example:

Where the consumption of a demerit good leads to adverse consequences for third parties, eg smoking



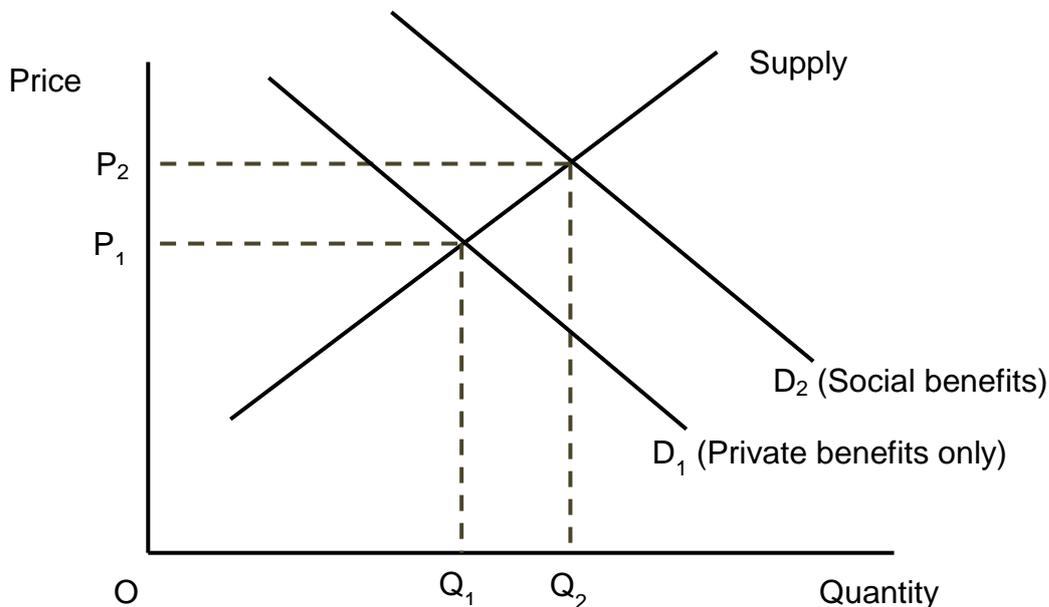
The diagram shows that in a free market, where consumers only take into account the private benefits derived from consuming the product, the price charged will be P_1 and the quantity bought and sold Q_1 . However, if consumption of the product reduces benefits enjoyed by third parties, the benefits to society are less than the benefits obtained by the individuals consuming the product. The result is too much demand. Smoking at a party or in a restaurant means that the pleasure non-smokers obtain from their evening out is reduced. If the demand for the product reflected the overall benefit to society, D_2 , the market price would be lower at P_2 and the quantity bought and sold lower at Q_2 . Thus, in a free market there is a misallocation of resources because negative externalities lead to overconsumption and hence overproduction.

In the case of demerit goods, there are often information failures too. Smokers generally underestimate the long-term costs of smoking; this also results in too much demand for tobacco products leading to overconsumption and overproduction.

(4) Positive externalities in consumption

Example:

Where the consumption of a merit good generates benefits for third parties, eg vaccinations



The diagram shows that in a free market, where consumers only take into account the private benefits derived from consuming the product, the price charged will be P_1 and the quantity bought and sold Q_1 . However, if consumption of the product provides benefits for third parties, the benefits to society are more than the benefits obtained by the individuals consuming the product. The result is too little demand. If an individual decides to pay for a vaccination to reduce their risk of contracting an infectious disease, not only do they benefit but they also reduce the risk of other people contracting the disease. If the benefits to third parties were taken into account, the demand would be D_2 rather than D_1 . Hence, in a free market, the failure to take into account positive externalities results in a misallocation of resources because there is underproduction and underconsumption of the product. If the full social benefits were captured and reflected in the demand for the product, both the price and output would be higher at P_2 and Q_2 respectively.

A-level

At A-level, students are expected to use the more sophisticated MSC/MSB analysis to explain why the existence of externalities is likely to result in a misallocation of resources. Students taking the A-level course are required to understand marginalist principles and the associated rules for maximising, for example, profits and social welfare. They should be able to explain why, in a free market, profit-maximising firms are likely to produce a level of output where marginal private cost (MPC) = marginal private benefit (MPB), whereas the socially optimal output is where marginal social cost (MSC) = marginal social benefit (MSB).

Relevant extracts from the A-level specification are:

4.1.8.4 Positive and negative externalities in consumption and production

- *Externalities exist when there is a divergence between private and social costs and benefits.*
- *Why negative externalities are likely to result in over-production and that positive externalities are likely to result in under-production.*
- *Why the absence of property rights leads to externalities in both production and consumption and hence market failure.*

Additional information

Students should be able to illustrate the misallocation of resources resulting from externalities in both production and consumption, using diagrams showing marginal private and social cost and benefit curves.

In the case of merit goods and demerit goods, the 'Additional information' in the A-level specification states that:

4.1.8.5 Merit and demerit goods

Additional information

Students should be able to illustrate the misallocation of resources resulting from the consumption of merit and demerit goods using diagrams showing marginal private and social cost and benefit curves. It should be understood that not all products that result in positive or negative externalities in consumption are either merit or demerit goods.

Multiple choice questions – A-level Paper 3

Multiple choice questions set at A-level will require that students understand MSC/MSB analysis and the associated diagrams. Any question on the multiple choice paper that is designed to test students' understanding of externalities will NOT use demand and supply diagrams.

As is good item-writing practice, relevant assumptions will be contained within the item. Good students will be able to determine from the information provided whether there is a divergence between the MSC and MPC curve, or between the MSB and MPB curve, or both.

Unlike at AS level, items set may include a divergence between both private and social costs **and** between private and social benefits.

Similar to AS level:

- all externalities generated in production, eg increased journey times for other road users resulting from more lorries in town centres, will be assumed to create a divergence between the marginal social cost curve (MSC) and the marginal private cost curve (MPC)
- all externalities generated in consumption, eg extra litter dropped by people consuming take-away meals, will be assumed to create a divergence between the marginal social benefit curve (MSB) and the marginal private benefit curve (MPB).

What if students use demand and supply analysis when answering externality questions on the A-level papers?

It is expected that students will use MSC/MSB analysis when answering questions on the A-level examination papers. However, unless the question specifies that MSC/MSB analysis/diagrams should be used, if they use demand and supply analysis/diagrams and apply the theory correctly to questions that are set, they will be rewarded appropriately.

Co-teachability at AS and A-level

As indicated above, any student sitting the AS level examination will be expected to be able to use demand and supply analysis to answer 'externality questions' whereas at A-level the expectation is that MSC/MSB analysis will be employed. However, the link between the two is quite straightforward and any student who, for example, sits the AS level examination at the end of Year 1 and the A-level examination at the end of Year 2 should find it easy to understand how the two approaches are connected.

Having studied the model of perfect competition, A-level students should appreciate that the market supply curve is the sum of the individual firms' marginal cost curves, ie the marginal private cost curve. Therefore, a simple connection can be made between the market supply curve and the marginal private cost curve.

Similarly, to understand why, given certain assumptions, that allocative efficiency is achieved where price = marginal cost, students need to appreciate that the price charged reflects the marginal private benefit derived from consuming the product (ie the benefit/satisfaction obtained by the last consumer). This indicates that the demand curve is equivalent to the marginal private benefit curve. Hence, this provides a simple association between the use of the demand curve at AS level and the MPB curve at A-level. Some teachers may also wish to make a connection between the downward-sloping marginal private benefit curve, a downward-sloping demand curve and the hypothesis of diminishing marginal utility.

Some other important issues for A-level students

A-level students should be able to use marginalist analysis to explain why in a free market output is likely to settle where $MPC = MPB$, whereas an optimum allocation of resources occurs where $MSC = MSB$. They should also understand that the difference between the MPC and MSC curves reflects any externalities in production, ie the divergence between private and social costs. For example, if the MSC curve is above the MPC curve, there is a negative externality in production and the vertical distance between the two curves, at any particular level of output, shows the marginal external cost of producing that unit of output.

Similarly, when there are externalities in consumption, the marginal private benefit curve does not equal the marginal social benefit curve. If there are positive externalities in consumption, the MSB curve is greater than the MPB curve. Negative externalities in consumption are illustrated by showing the MPB curve above the MSB curve.

Externality diagrams at A-level

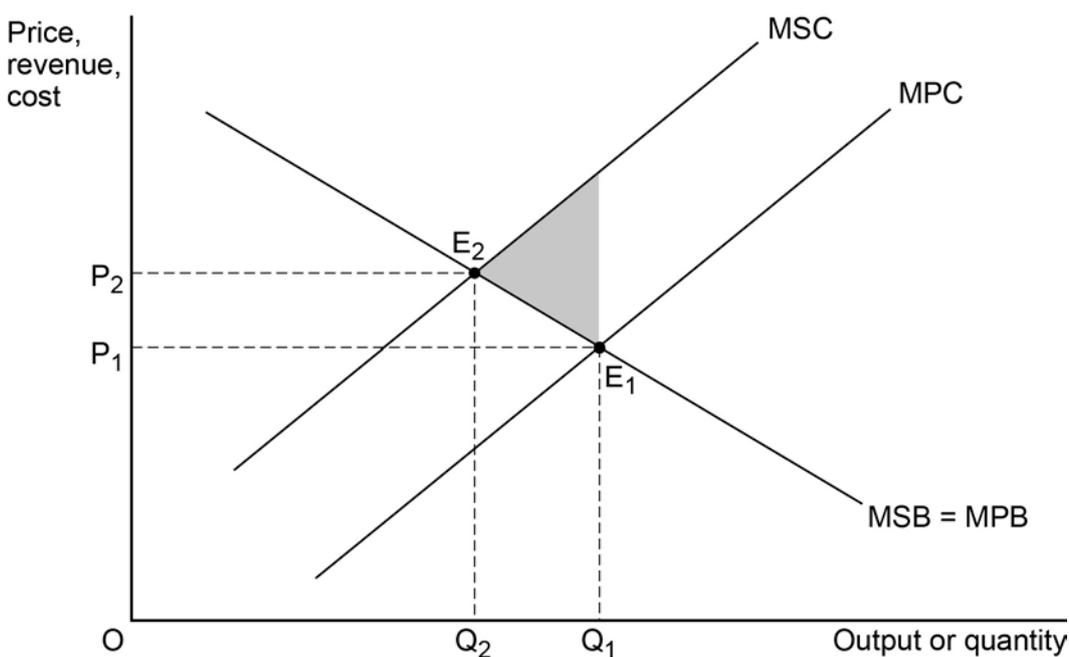
The following four diagrams illustrate how MSC/MSB diagrams can be used to illustrate negative and positive externalities in production, and negative and positive externalities in consumption. These MSC/MSB diagrams are equivalent to the AS level demand and supply diagrams, shown above.

Please note that the vertical axis can also be labelled as costs and benefits.

(1) Negative externalities in production:

Example:

Pollution generated by a factory that imposes costs on others.

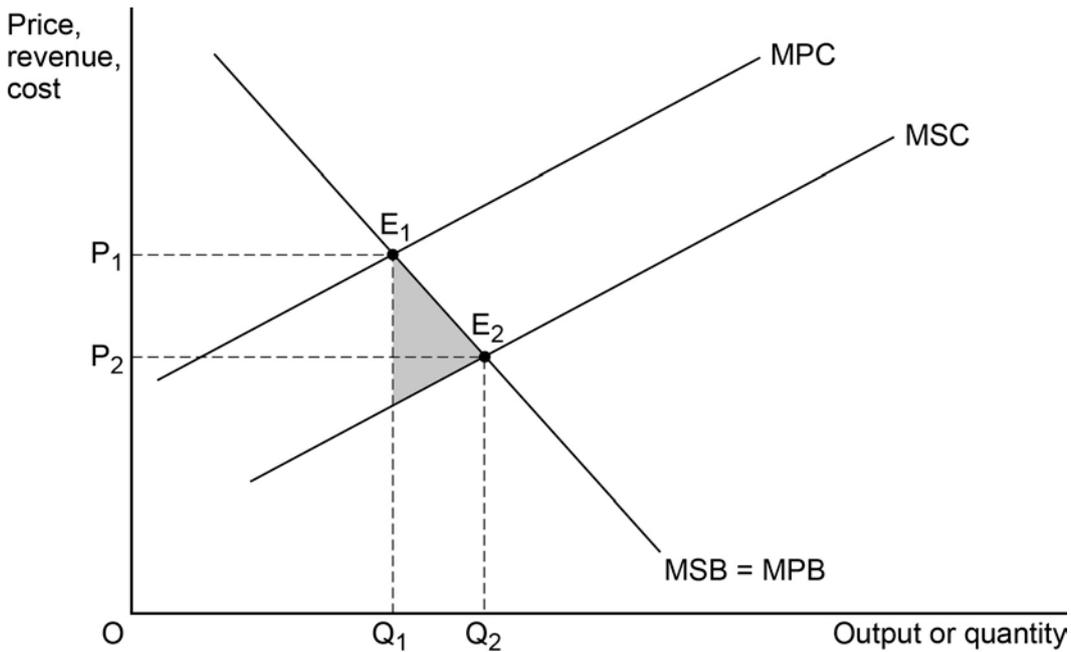


The shaded area illustrates the 'loss' of welfare or deadweight welfare loss (DWL), which exists at the free market output, Q_1 (where $MPC = MPB$). The socially optimum output is Q_2 (where $MSC = MSB$). At outputs between Q_1 and Q_2 , the MSC is greater than MSB and hence there is a net welfare loss on each of these items. Social welfare would be higher if these items weren't produced and resources were reallocated to producing other goods and services. When production takes place at the socially optimal output, ie where $MSB = MSC$, the DWL is eliminated.

(2) Positive externalities in production

Example:

When producing goods and services, companies may develop new technologies that benefit other companies, leading to lower costs for other firms. These spillover effects are not taken into account by the firms who develop the new technologies.

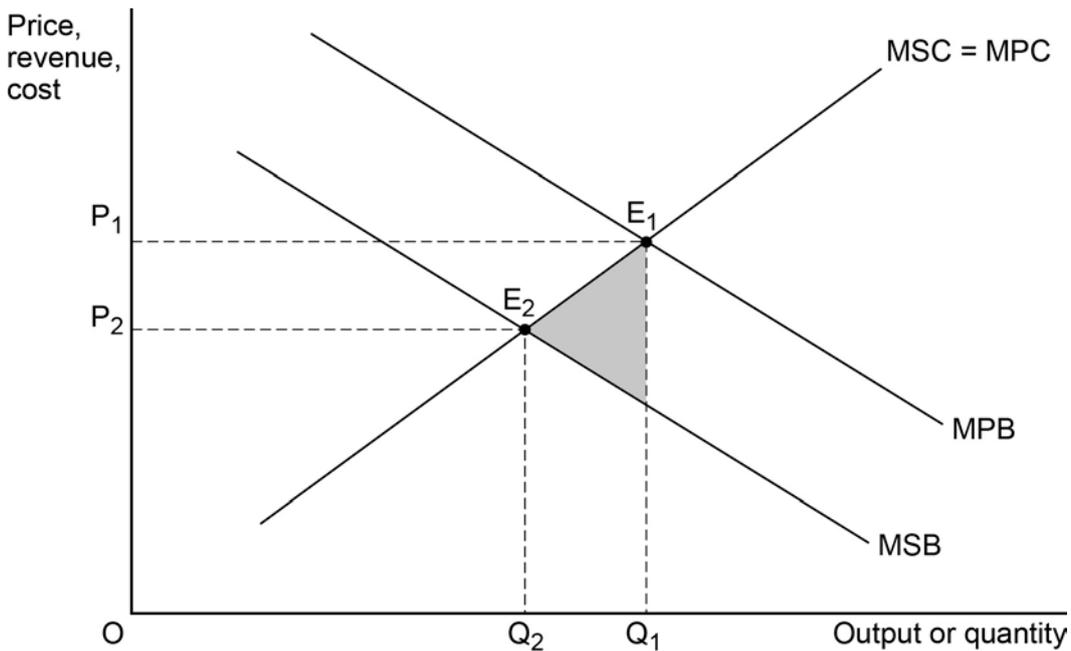


The shaded area illustrates the 'loss' of welfare or deadweight welfare loss (DWL), which exists at the free market output, Q_1 (where $MPC = MPB$). When production takes place at the socially optimal output, ie where $MSB = MSC$, the DWL is eliminated. This is sometimes referred to as a 'welfare gain'. Increasing output from Q_1 to Q_2 increases social welfare because the MSB derived from consuming each of these items is greater than the MSC.

(3) Negative externalities in consumption

Example:

Where the consumption of a demerit good leads to adverse consequences for third parties, eg smoking.

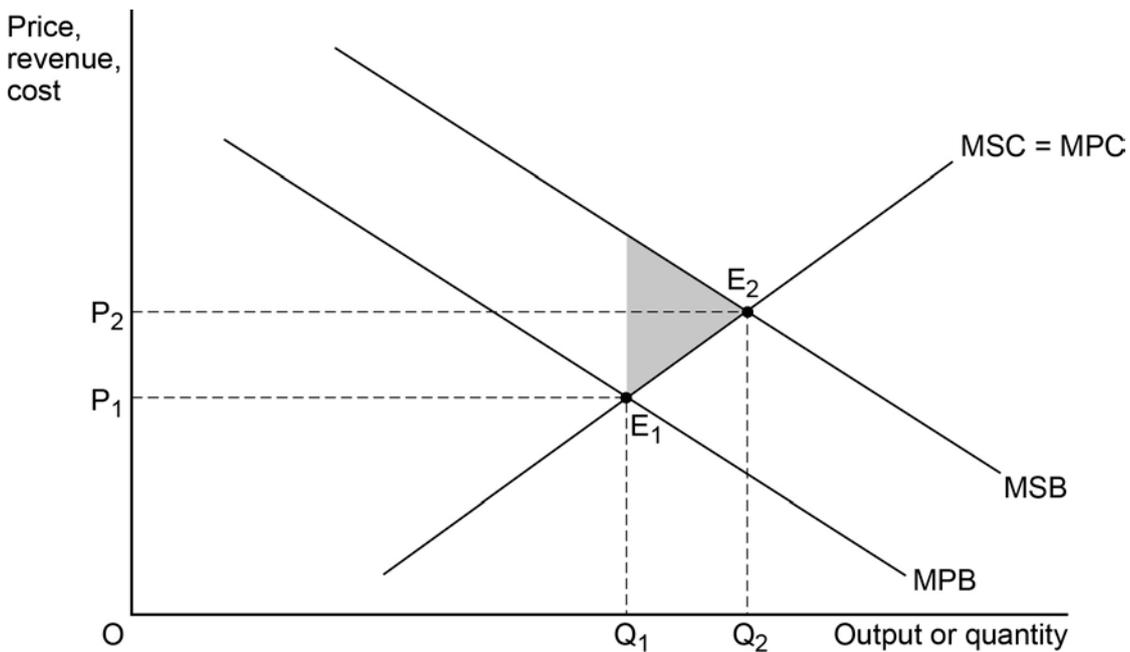


The shaded area illustrates the 'loss' of welfare or deadweight welfare loss (DWL), which exists at the free market output, Q_1 (where $MPC = MPB$). When consumption takes place at the socially optimal output, ie where $MSB=MSC$, the DWL is eliminated.

(4) Positive externalities in consumption:

Example

Where the consumption of a merit good generates benefits for third parties, eg vaccinations



The shaded area illustrates the 'loss' of welfare or deadweight welfare loss (DWL), which exists at the free market output, Q_1 (where $MPC = MPB$). When consumption takes place at the socially optimal output, ie where $MSB = MSC$, the DWL is eliminated. This is sometimes referred to as a welfare gain.