

5.4 Positive externalities of production and consumption

- ◆ Explain, using diagrams and examples, the concepts of positive externalities of production and consumption, and the welfare loss associated with 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 direct provision of goods and services.

Positive production externalities (external or spillover benefits)

Illustrating positive production externalities

Positive externalities of production refer to external benefits created by producers. If, for example, a firm engages in research and development, and succeeds in developing a new technology that spreads throughout the economy, there are external benefits because not only the firm but also society benefits from widespread adoption of the new technology. Therefore, the social costs of research and development are lower than the private costs. In Figure 5.9, the *MSC* curve lies below the *MPC* curve, and the difference between the two curves is the value of the external benefits (these can be thought of as ‘negative costs’). The demand curve represents both *MPB* and *MSB* since the externality involves only production. The market gives rise to equilibrium quantity Q_m and price P_m , determined by the intersection of the *MPB* and *MPC* curves, while the social optimum is given by Q_{opt} and P_{opt} , determined by the intersection of the *MSB* with *MSC* curves. Since $Q_m < Q_{opt}$, the market underallocates resources to research and development activities that lead to new technologies, and not enough of them are undertaken.

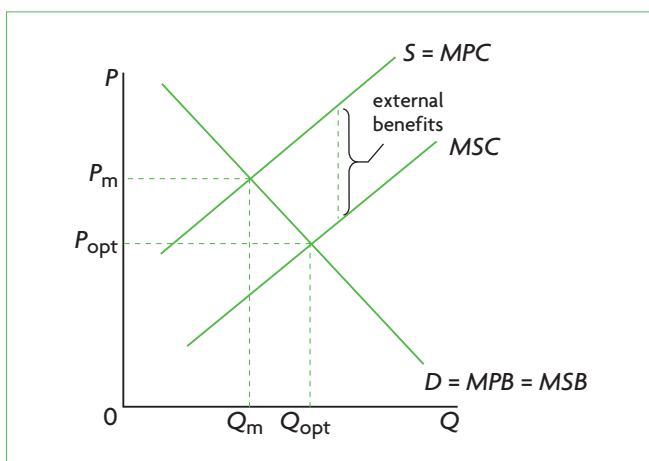


Figure 5.9 Positive production externality

When there is a positive production externality, the free market underallocates resources to the production of the good: too few resources are allocated to its production, and too little of it is produced. This is shown by $Q_m < Q_{opt}$ and $MSB > MSC$ at Q_m in Figure 5.9.

More examples of positive production externalities include:

- Firms train workers who later switch jobs and work elsewhere; external benefits are created as the new employers and society benefit from the trained workers.
- A pharmaceutical company develops a new medication that benefits not only its users but also those around them from the improved quality of life and increased life expectancy.

The welfare loss of positive production externalities

Welfare loss

The underallocation of resources to the production of a good with a positive production externality leads to a welfare loss, shown in Figure 5.10(a) as the shaded area. This loss is equal to the difference between the *MSB* and *MSC* curves for the amount of output that is underproduced relative to the social optimum ($Q_{opt} - Q_m$). It involves external benefits for society that are lost because not enough of the good is produced. If the externality were corrected, society would gain the benefits represented by the shaded area. Note that the point of the welfare loss triangle lies at the Q_{opt} quantity of output.

Welfare loss in relation to consumer and producer surplus (supplementary material)

Figure 5.10(b) shows the welfare loss in relation to consumer and producer surplus and the externality. At market equilibrium, consumer surplus is area *a*, producer surplus is area *b* + *e*, and the external benefits are *c* + *f* (the difference between the *MPC* and *MSC* curves up to the point of production by the market, Q_m). The total benefits are therefore consumer surplus plus producer surplus plus external benefits:

$$a + (b + e) + (c + f) = a + b + e + c + f$$

At the social optimum, consumer surplus is *a* + *b* + *c* + *d*, producer surplus is *e* + *f* + *g*, and external benefits are zero, making a total of:

$$(a + b + c + d) + (e + f + g) = a + b + c + d + e + f + g$$

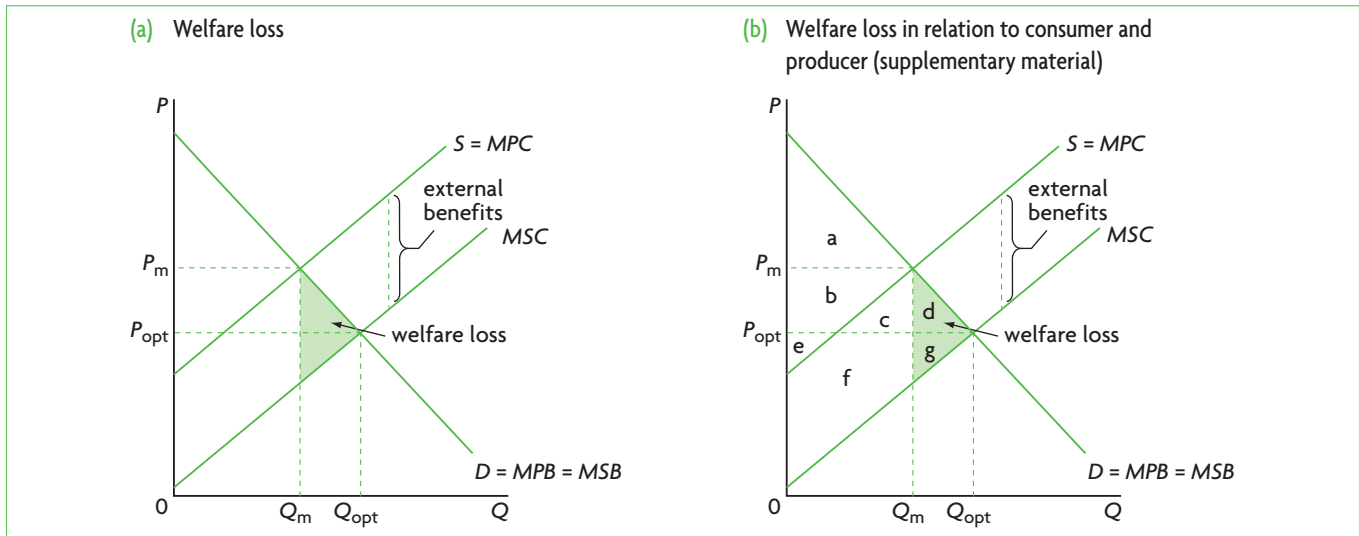


Figure 5.10 Welfare loss (deadweight loss) in a positive production externality

Comparing total benefits at market equilibrium and at the social optimum, we find that at the social optimum there are additional benefits of the amount $d + g$, corresponding to the shaded area in the figure. This is the amount of welfare that is lost at market equilibrium due to underallocation of resources arising from the positive production externality.

Correcting positive production externalities

Direct government provision

A solution often pursued by governments involves direct government provision of the good or service creating the positive production externality. For example, governments often engage in research and development (R&D) for new technology, for medicine and pharmaceuticals, and many other areas. The

government can also directly provide training for workers. Governments pay for such activities with government funds, raised through taxes. Figure 5.11(a) shows that when the government intervenes by providing goods and services itself, this has the effect of shifting the supply curve (= MPC curve) downward (or to the right), toward the MSC curve so that the optimum quantity of the good, Q_{opt} , will be produced, with price falling from P_m to P_{opt} .

Subsidies

We studied subsidies and their effects in Chapter 4, where we saw how their introduction into a perfect market (with no market failures) creates allocative inefficiency. Now, we will see how subsidies can correct allocative inefficiency by correcting a market failure.

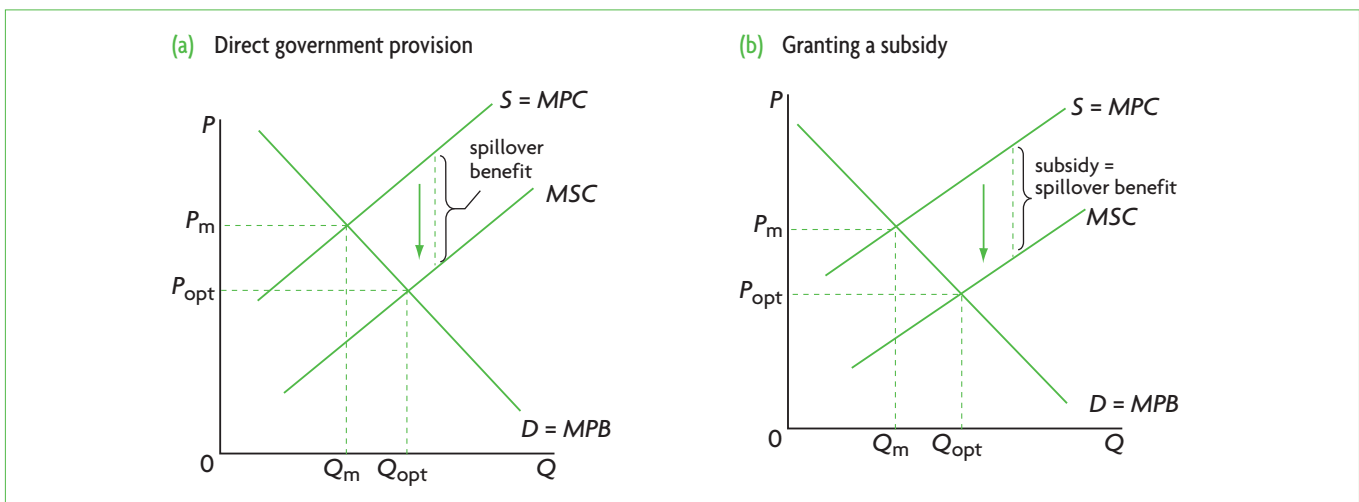


Figure 5.11 Correcting positive production externalities

If the government provides a subsidy to a firm per unit of the good produced that is equal to the external benefit, then the marginal private cost ($MPC = \text{supply}$) curve shifts downward (or rightward⁴) until it coincides with the MSC curve, as shown in Figure 5.11(b). The result is to increase quantity produced to Q_{opt} and to lower the price from P_m to P_{opt} . The problem of underallocation of resources and underprovision of the good is corrected, and allocative efficiency is achieved.

You may note that direct government provision and subsidies have the same market outcomes.

Correction of positive production externalities involves shifting the MPC curve downward toward the MSC curve through direct government provision or by subsidies. For allocative efficiency to be achieved, the quantity produced and consumed must increase to Q_{opt} as price falls to P_{opt} .

Evaluating policies to correct positive production externalities

This topic will be discussed together with policies to correct positive consumption externalities below (see page 118) because of similarities of the policies involved.

Test your understanding 5.5

- (a)** Using diagrams, show how marginal private costs and marginal social costs differ when there is a positive production externality. **(b)** How does the equilibrium quantity determined by the market differ from the quantity that is optimal from the point of view of society's preferences? **(c)** What does this tell you about the allocation of resources achieved by the market when there is a positive production externality? **(d)** Show the welfare loss created by the positive production externality in your diagram, and explain what this means.
- Provide some examples of positive production externalities.
- For each of the examples you provided in question 2, explain some methods that can be used to correct the externality.

Positive consumption externalities (external or spillover benefits)

Illustrating positive consumption externalities

When there is a **positive externality of consumption**, external benefits are created by consumers. For example, the consumption of education benefits the person who receives the education, but in addition gives rise to external benefits, involving social benefits from a more productive workforce, lower unemployment, higher rate of growth, more economic development, lower crime rate, and so on. Similarly, the consumption of health care services benefits not only the person receiving the services but also society and the economy, because a healthier population is more productive, enjoys a higher standard of living and may have a higher rate of economic growth. In Figure 5.12, we see that the marginal social benefit (MSB) curve lies above the marginal private benefit (MPB) curve, and the difference between the two consists of the external benefits to society. The socially optimum quantity, Q_{opt} , is given by the point where $MSB = MSC$, and the quantity produced by the market is given by the point where $MPB = MPC$. Since $Q_{\text{opt}} > Q_m$, the market underallocates resources to education, and too little of it is produced.

When there is a positive consumption externality, the free market underallocates resources to the production of the good, and too little of it is produced relative to the social optimum. This is shown by $Q_m < Q_{\text{opt}}$ and $MSB > MSC$ at Q_m in Figure 5.12.

In general, positive externalities (external benefits), whether these arise from production or consumption activities, lead to an underallocation of resources to the good in question, and therefore to its underprovision.

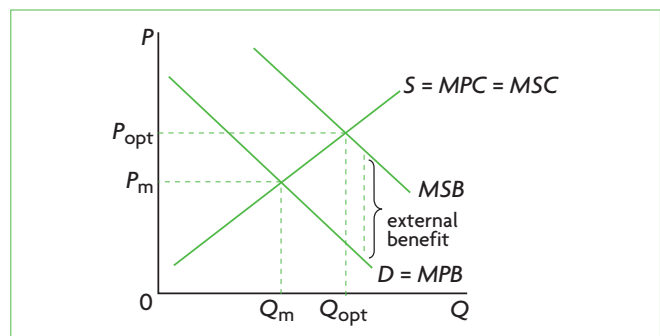


Figure 5.12 Positive consumption externality

⁴ See 'Quantitative techniques' CD-ROM, page 13 for an explanation of the equivalence of downward and rightward shifts of the supply curve.

The welfare loss of positive consumption externalities

Welfare loss

The welfare loss arising from a positive consumption externality is the shaded area in Figure 5.13(a), and is the difference between the *MSB* and *MSC* curves for the amount of output that is underproduced relative to the social optimum ($Q_{opt} - Q_m$). It represents the loss of social benefits due to underproduction of the good. If this externality were corrected, society would gain the benefits represented by the shaded area. Once again, we see that the point of the welfare loss triangle lies at the Q_{opt} quantity of output.⁵

Welfare loss in relation to consumer and producer surplus (supplementary material)

In Figure 5.13(b) we see how the welfare loss arises in relation to consumer and producer surplus and the external benefits. In market equilibrium, consumer surplus is equal to areas $b + d$, producer surplus is area g , and the external benefits are $a + e$ (or the difference between *MSB* and *MPB* up to production at Q_m by the market). The total social benefits in market equilibrium are equal to consumer surplus plus producer surplus plus the external benefits:

$$(b + d) + g + (a + e) = b + d + g + a + e = a + b + d + e + g$$

At the social optimum, consumer surplus is given by $a + b + c$, producer surplus is $d + e + f + g$, and the

external benefits are zero. Therefore the total social benefits are:

$$(a + b + c) + (d + e + f + g) = a + b + c + d + e + f + g$$

Comparing the total social benefits at market equilibrium with those at the social optimum, we find that at the social optimum they are greater by the amount $c + f$. This is the welfare loss that arises when production occurs at market equilibrium as a result of an underallocation of resources due to the positive consumption externality.

The case of merit goods

Merit goods are goods that are held to be desirable for consumers, but which are underprovided by the market. (Note that the term ‘good’ in the expression ‘merit good’ applies to both goods and services.) Reasons for underprovision include:

- **The good may have positive externalities.** In this case too little is provided by the market. Examples of merit goods include education (for the reasons noted above in the discussion of externalities); immunisation programmes (which benefit not only those who have received them but also the broader population by wiping out a disease).
- **Low levels of income and poverty.** Some consumers may want certain goods or services but cannot afford to buy them. Remember demand shows the quantities of a good or service that

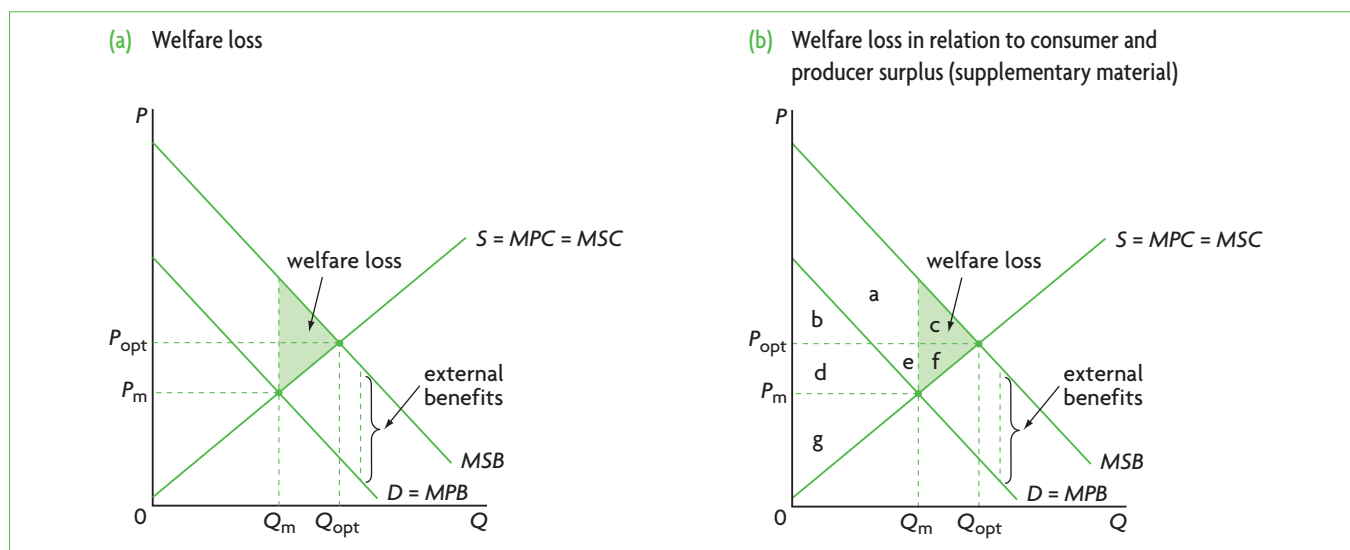


Figure 5.13 Welfare loss (deadweight loss) in a positive consumption externality

⁵ You may have noticed that in the case of negative externalities of production and consumption, where $Q_{opt} < Q_m$, the welfare loss triangle always points leftward. By contrast, in the case of positive externalities of

production and consumption, where $Q_{opt} > Q_m$, the welfare loss triangle always points rightward

consumers are willing and able to buy at different prices. If they have low incomes, they may be willing but not able to buy something, in which case their desire does not show up in the market, and market demand (the sum of all individual demands) is too low. Examples include health care services, medicines, education and recreational facilities, which people on low incomes often cannot afford to buy in the market.

- **Consumer ignorance.** Consumers may be better off if they consume certain goods and services but they may be ignorant of the benefits, and so do not demand them. For example, preventive health care (such as immunisation, annual health check-ups) can prevent serious diseases, but lack of knowledge about the benefits may lead consumers to demand too little of these services.

Note that more than one factor may be at work simultaneously; for example, the underprovision of health care services can result from all three reasons listed above.

Correcting positive consumption externalities

Legislation

Legislation can be used to promote greater consumption of goods with positive externalities. For example, many countries have legislation that makes education compulsory up to a certain age (note that education is a merit good). In this case, demand for education increases, and the demand curve $D_1 = MPB$ shifts to the right (or upward), as in Figure 5.14(a). Ideally, it will shift until it reaches the MSB curve, where $D_2 = MSB$, and Q_{opt} is produced and consumed.

Advertising

Governments can use advertising to try to persuade consumers to buy more goods with positive externalities. For example, they can try to encourage the use of sports facilities for improved health. The objective is to increase demand for such services, and the effect is the same as with legislation, shown in Figure 5.14(a): D_1 shifts to $D_2 = MSB$ and Q_{opt} is produced and consumed, while price increases to P_{opt} .

Direct government provision

Governments are frequently involved in the direct provision of goods and services with positive consumption externalities. The most important examples include government (public) provision of education and health care in virtually all countries in the world. Education and health care are merit goods

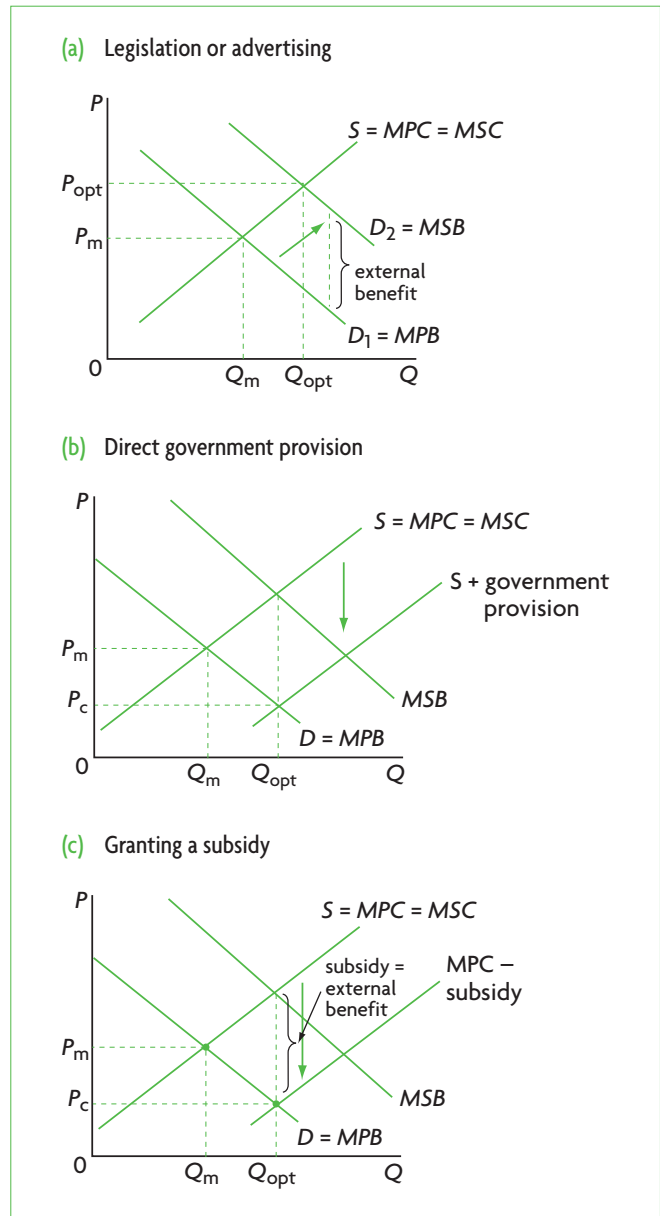


Figure 5.14 Correcting positive consumption externalities

with external benefits so large and important that it is widely believed that they must not be left to private sector provision alone. In most countries where there is government provision of health care and education, there is also private sector provision of these services (though to varying degrees).

Direct government provision is shown in Figure 5.14(b), and has the effect of increasing supply and therefore shifting the supply curve S rightward (or downward) to $S + \text{government provision}$. To achieve the social optimum Q_{opt} , the new supply curve must intersect MPB at the level of output Q_{opt} , as seen in the figure. At the new equilibrium, price falls to P_c , Q_{opt} is produced and allocative efficiency is achieved. (However, note that P_c is not P_{opt} ; it lies below P_{opt} .)

Subsidies

A subsidy to the producer of the good with the positive externality has the same effects as direct government provision. It results in increasing supply and shifting the supply curve rightward (or downward), as shown in Figure 5.14(c) (which is the same as Figure 5.14(b)). If the subsidy is equal to the external benefit, the new supply curve is $MPC - \text{subsidy}$, and it intersects MPB at the P_{opt} level of output. Again, price falls from P_m to P_c , Q_{opt} is produced and allocative efficiency is achieved.

Correction of positive consumption externalities involves either increasing demand and shifting the MPB curve towards the MSB curve through legislation or advertising; or increasing supply and shifting the MPC curve downward by direct government provision or by granting a subsidy. Both demand increases and supply increases can lead to production and consumption at Q_{opt} and the achievement of allocative efficiency. The price paid by consumers increases when demand increases, and falls when supply increases.

Note that the problem of underprovision of merit goods by the market (defined above, see page 116) can be addressed by all the methods noted above: legislation, advertising, direct government provision and granting of subsidies. All are intended to increase the amount of the good produced and consumed, as increased consumption of such goods is held to be desirable for society.

Evaluating policies to correct positive production and consumption externalities

Both direct government provision and subsidies are widely used as methods to deal with positive consumption externalities, and to a lesser extent also with positive production externalities. Both methods are very effective in increasing the quantity of the good produced and consumed, and both have the added advantage of lowering the price of the good to consumers (though P_{opt} is not achieved).

There are, however, difficulties involved in achieving the optimum results (where $MSC = MSB$). First, both direct government provision and granting of subsidies involve the use of government funds that rely on tax revenues. Governments generally have very many possible alternative uses for these funds, each of which has an opportunity cost. As it is not possible for the government to directly provide or subsidise all goods and services with positive externalities, choices must be made on (a) which goods should be supported, and (b) by how much they should be supported. Ideally,

choices should be made on the basis of economic criteria, which would specify the amount of social benefits expected in relation to the cost of providing them, the objective being to maximise the benefits for each good and service to be provided or subsidised for a given cost. However, in practice it is very difficult to measure the size of the external benefits, and therefore to calculate precisely which goods and services should be supported and the level of support they should receive. In addition, both direct provision and subsidies are often highly political in nature, as different groups compete with each other over who will receive the most benefits. Governments are often susceptible to political pressures and sometimes make choices based on political rather than economic criteria.

Therefore, in the real world it is very unlikely that governments are able to shift the MPC or MPB curves by the amount necessary to correct the positive externalities. The most that can be hoped is that the policies in question will be a step in the right direction.

Legislation and advertising are subject to similar limitations concerning calculating the size of external benefits. Only sometimes can they be effective, and then can only help shift the MPB curve in the right direction, rather than achieve a demand increase that will bring the economy to the Q_{opt} level of output. For example, they can have very positive effects in certain cases (such as legislation requiring schooling up to a minimum age or advertising on the importance of good nutrition), but in other cases are ineffective (for example, they cannot on their own increase consumption of health care services and education to the optimum level). Moreover, they have the further effect of raising the price of the good to consumers, which may make the good unaffordable for some consumer groups. Therefore, legislation and advertising sometimes can be used more effectively if they are implemented together with direct provision and subsidies. A good example is education, where compulsory schooling up to a certain age (legislation) goes together with direct government provision.

Test your understanding 5.6

- (a)** Using diagrams, show how marginal private benefits and marginal social benefits differ when there is a positive consumption externality.

(b) How does the equilibrium quantity determined by the market differ from the quantity that is optimal from the point of view of society's preferences? **(c)** What does