

Allocative efficiency is achieved when $MSC = MSB$. When there is no externality, the competitive free market leads to an outcome where $MPC = MSC = MPB = MSB$, as in Figure 5.1, indicating allocative efficiency. An externality creates a divergence between MPC and MSC or between MPB and MSB . When there is an externality, the free market leads to an outcome where $MPB = MPC$, but where MSB is not equal to MSC , indicating allocative inefficiency.¹

We will examine four types of externalities: negative production externalities; negative consumption externalities; positive production externalities and positive consumption externalities.

These are some points to bear in mind as you read about externalities:

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

Test your understanding 5.2

- 1 (a) What is an externality? (b) Use the concept of allocative efficiency to explain how externalities relate to market failure.
- 2 Explain the difference (a) between marginal private benefit and marginal social benefit, and (b) between marginal private cost and marginal social cost.
- 3 When there is an externality, what condition of perfect markets is violated, leading to allocative inefficiency?

5.3 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.

Negative production externalities (external or spillover costs)

Illustrating negative production externalities

Negative externalities of production refer to external costs created by producers. The problem of environmental pollution, created as a side-effect of production activities, is very commonly analysed as a negative production externality.

Consider a cement factory that emits smoke into the air and disposes its waste by dumping it into the ocean. There is a production externality, because over and above the firm's private costs of production, there are additional costs that spill over onto society due to the polluted air and ocean, with negative consequences for the local inhabitants, swimmers, sea life, the fishing industry and the marine ecosystem. This is shown in Figure 5.2, where the supply curve, $S = MPC$, reflects the firm's private costs of production, and the marginal social cost curve given by MSC represents the full cost to society of producing cement. For each level of output, Q , social costs of producing cement given by MSC are greater than the firm's private costs. The vertical difference between MSC and MPC represents the external costs. Since the externality involves only production (the supply curve), the demand curve represents both marginal private benefits and marginal social benefits.

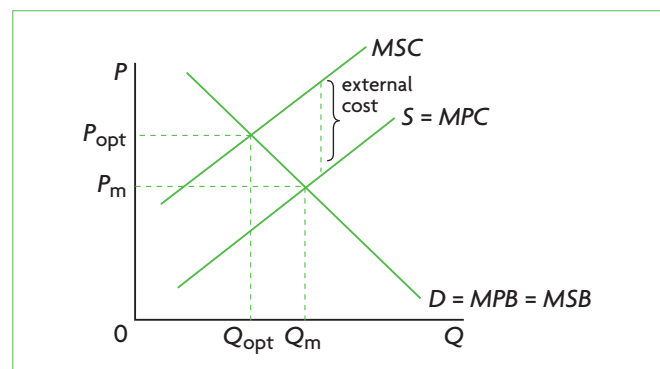


Figure 5.2 Negative production externality

¹ The condition $MSC = MSB$ is the same as $MC = MB$ when there are no externalities. In Chapters 2 and 4, we repeatedly referred to $MC = MB$

as the condition for allocative efficiency because we were considering markets with no market failures.

Figure 5.2 illustrates a general point that you should keep in mind whenever you examine (or draw) an externality diagram: the free market outcome is determined by the intersection of *MPB* and *MPC*, resulting in quantity Q_m and price P_m . The social optimum (or 'best') outcome is given by the intersection of *MSB* with *MSC*, which determines quantity Q_{opt} and price P_{opt} .

We can draw an important conclusion from the negative externality illustrated in Figure 5.2:

When there is a negative production externality, the free market overallocates resources to the production of the good and too much of it is produced relative to the social optimum. This is shown by $Q_m > Q_{opt}$ and $MSC > MSB$ at the point of production, Q_m , in Figure 5.2.

The welfare loss of negative production externalities

Welfare loss

Whenever there is an externality, there is a welfare (deadweight) loss, involving a reduction in social benefits, due to the misallocation of resources.

In Figure 5.3(a), the shaded area represents the welfare loss arising from the negative production externality. For all units of output greater than Q_{opt} , $MSC > MSB$, meaning that society would be better off if less were produced. The welfare loss is equal to the difference between *MSC* and *MSB* for the amount of output that is overproduced ($Q_m - Q_{opt}$). It is a loss of social benefits due to overproduction of the good caused by the externality. If the externality were corrected, so that the economy reaches the social optimum, the loss of benefits would disappear. It may be useful to note that the point of the welfare loss triangle always lies at the Q_{opt} quantity of output.

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

We can use the concepts of consumer and producer surplus to understand the welfare loss due to the externality. In Figure 5.3(b), in market equilibrium, consumer surplus is equal to areas $a + b + c + d$, while producer surplus is equal to areas $f + g + h$. The value of the external cost is the difference between the *MSC* and *MPC* curves up to Q_m (the quantity produced by the market), and is therefore equal to $c + d + e + g + h$. The total social benefits in market equilibrium are equal to consumer surplus plus producer surplus minus the external cost:

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

At the social optimum, or at Q_{opt} and P_{opt} , consumer surplus is equal to area a , and producer surplus is equal to area $b + f$. The external cost is now equal to zero. Therefore, the total social benefits are equal to consumer surplus plus producer surplus:

$$a + b + f$$

Comparing total social benefits at the market equilibrium and at the social optimum, we find that they are smaller at the market equilibrium by the area e . This is the welfare loss.

Correcting negative production externalities

Government regulations

Government regulations to deal with negative production externalities rely on the 'command' approach, where the government uses its authority to enact legislation and regulations in the public's interest (see Chapter 1, page 15, for a discussion of command decision-making).

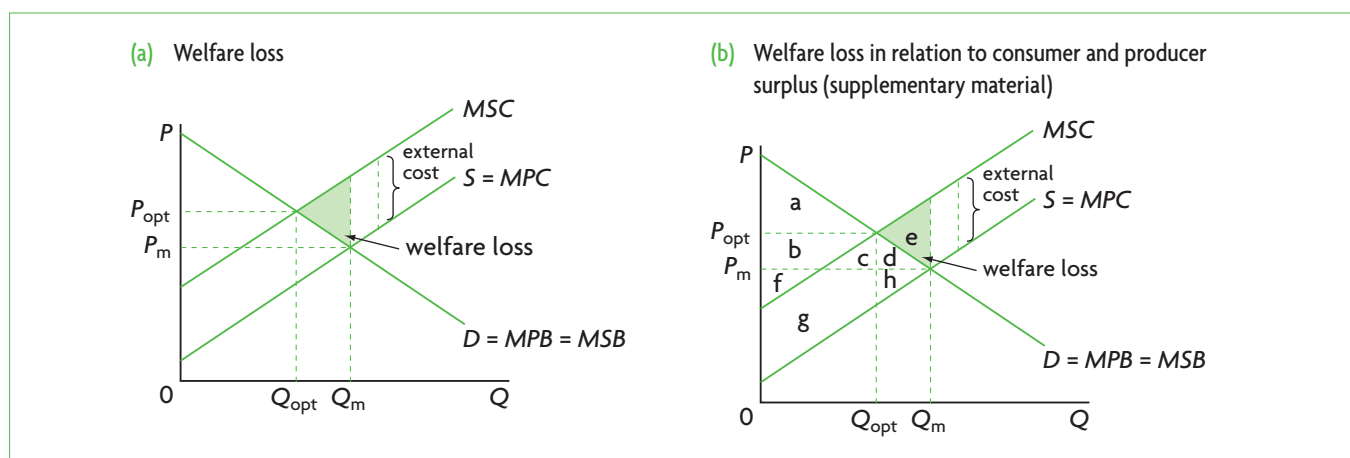


Figure 5.3 Welfare loss (deadweight loss) in a negative production externality

Regulations can be used to prevent or reduce the effects of production externalities. In the case of the polluting firm, regulations can forbid the dumping of certain toxic substances into the environment (into the rivers, oceans, and so on). More commonly, regulations do not totally ban the production of pollutants, but rather attempt to achieve one of the following:

- limit the emission of pollutants by setting a maximum level of pollutants permitted
- limit the quantity of output produced by the polluting firm
- require polluting firms to install technologies reducing the emissions.

The impact is to lower the quantity of the good produced and bring it closer to Q_{opt} in Figure 5.4 by shifting the MPC curve upward towards the MSC curve.² Pollutant and output restrictions achieve this by forcing the firm to produce less. Requirements to install technologies reducing emissions achieve this by imposing higher costs of production due to the purchase of the non-polluting technologies. Ideally, the higher costs of production would be equal to the value of the negative externality. The government's objective is to make the MPC curve shift upwards until it coincides with the MSC curve, in which case Q_{opt} is produced, price increases from P_m to P_{opt} , and the problem of overallocation of resources to the production of the good is corrected. If polluting firms do not comply with the regulations, they would have to pay fines.

Market-based policies

Governments can also pursue policies relying on the market to correct negative production externalities. We will consider two market-based policies: taxes and tradable permits.

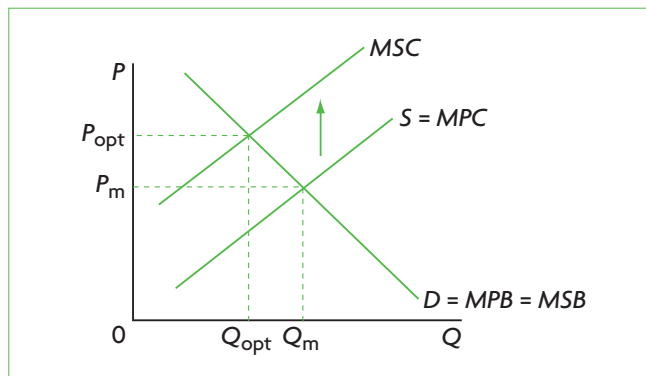


Figure 5.4 Government regulations to correct negative production externalities

Imposing a tax to correct the negative production externality

The government could impose a tax on the firm per unit of output produced, or a tax per unit of pollutants emitted. In Figure 5.5(a), the tax results in an upward shift of the supply curve, from $S = MPC$ to $MSC (=MPC + \text{tax})$. The optimal (or best) tax policy is to impose a tax that is exactly equal to the external cost, so the MPC curve shifts upward until it overlaps with MSC . The new, after-tax equilibrium is given by the intersection of MSC and the demand curve, $D = MPB = MSB$, resulting in the lower, optimal quantity of the good produced, Q_{opt} , and higher, optimal price, P_{opt} .

(Bearing in mind our discussion of taxes in Chapter 4, you may note that P_{opt} is the price paid by consumers, or P_c , while the price received by producers is P_p , which is equal to P_c minus tax per unit. We can see, therefore, that the tax burden or incidence is shared between consumers and producers.)

Distinguishing between a tax on output and a tax on pollutants (emissions) Whereas both a tax per unit of output produced and a tax per unit of pollutants emitted appear to have the same result, shown in Figure 5.5(a),

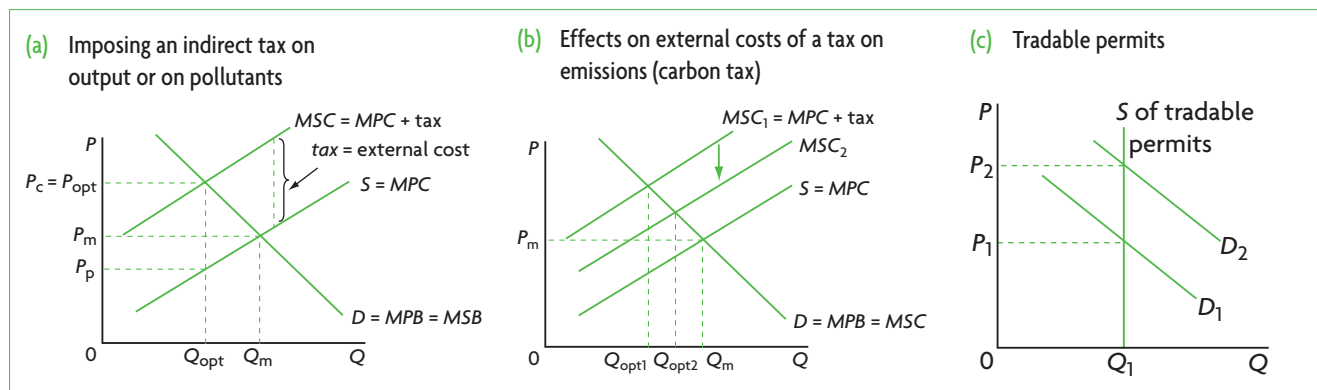


Figure 5.5 Market-based policies to correct negative production externalities

² See 'Quantitative techniques' chapter on the CD-ROM, page 13 for an explanation of the equivalence of upward and leftward shifts of the supply curve.

actually they work quite differently. A tax per unit of output is intended to work by directly correcting the overallocation of resources to the good, resulting in quantity Q_{opt} . A tax per unit of pollutants is intended to work by creating incentives for the firm to buy fewer polluting resources (such as fossil fuels), and to switch to less polluting technologies (alternative energy sources).

An example of a tax per unit of pollutants considered by many countries as a policy to deal with the problem of climate change is the **carbon tax**, which is a tax per unit of carbon emissions of fossil fuels. Fossil fuels do not all emit the same amounts of carbon when burned, therefore the carbon tax is calculated on the basis of how much carbon the fuel emits: *the more the carbon emitted, the higher the tax*. Following the imposition of the tax, firms must pay the higher price to buy the fossil fuel. This appears in Figure 5.5(a) as the familiar upward shift in $S = MPC$ toward MSC because of the firm's higher costs of production, but this has further consequences. Since there are other substitute energy sources with lower carbon emissions (thus taxed at a lower rate), or that do not emit carbon (if they are not fossil fuels, thus not taxed at all), the increase in the price of the high-carbon fuel creates incentives for firms to switch to other, less polluting or non-polluting energy sources.

The result is that if the firm switches to alternative, less polluting resources, Q_{opt} in Figure 5.2 will increase, because the external costs of producing the output will become smaller. This can be seen in Figure 5.5(b), where the MSC curve shifts from MSC_1 to MSC_2 , indicating that the external costs are lower due to the use of the less polluting resources. With the fall in external costs, the optimum quantity of output increases from Q_{opt1} to Q_{opt2} . (Note that this also involves a lower tax on pollutants, shown by the smaller distance between the demand curve and MSC_2 .)

A tax on carbon (or on emissions generally) has the effect of creating incentives for producers to reduce the amount of pollution they create by purchasing less polluting resources. This reduces the size of the negative externality and increases the optimum quantity of output. A tax on the output of the polluter does not have this effect; it only reduces the amount of output produced.

Tradable permits **Tradable permits**, also known as **cap and trade schemes**, are a relatively new policy involving permits to pollute issued to firms by a government or an international body. These permits to pollute can be traded (bought and sold) in a market. Consider a number of firms whose production pollutes the environment. The government grants each firm a particular number of permits (or rights) to

produce a particular level of pollutants over a given time period. The permits to pollute can be bought and sold among interested firms, with the price of permits being determined by supply and demand. If a firm can produce its product by emitting a lower level of pollutants than the level set by its permits, it can sell its extra permits in the market. If a firm needs to emit more pollutants than the level set by its permits, it can buy more permits in the market.

Figure 5.5(c) shows a market for tradable pollution permits. The supply of permits is perfectly inelastic (i.e. the supply curve is vertical), as it is fixed at a particular level by the government (or an international authority if several countries are participating). This fixed supply of permits is distributed to firms. The position of the demand-for-permits curve determines the equilibrium price. As an economy grows and the firms increase their output levels, the demand for permits is likely to increase, as shown by the rightward shift of the demand curve from D_1 to D_2 . With supply fixed, the price of permits increases from P_1 to P_2 .

Tradable permits are like taxes on emissions in that they provide incentives to producers to switch to less polluting resources for which it is not necessary to buy permits. If a firm finds a way to reduce its emissions, it can sell its permits thus adding to profits. Permits therefore are intended to reduce the quantity of pollutants emitted, thus reducing the size of the negative externality, and increasing the optimum quantity of output produced, by shifting the MSC curve downward toward MPC , as shown in Figure 5.5(b).

We will come back to both carbon taxes and tradable permits later in this chapter (page 125).

Correction of negative production externalities involves shifting the MPC curve upward toward the MSC curve through government regulations or market-based policies. For allocative efficiency to be achieved, the quantity of the good produced and consumed must fall to Q_{opt} as price increases to P_{opt} .

Evaluating government regulations and market-based policies

Advantages of market-based policies

Economists usually prefer market-based solutions to government regulations to deal with negative production externalities. Both taxes and tradable permits have the effect of *internalising the externality*, meaning that the costs that were previously external are made internal, because they are now paid for

by producers and consumers who are parties to the transaction. (Consumers also pay for external production costs, since they share with producers the burden or incidence of the tax, as we know from Chapter 4, page 74.)

In the case of taxes, taxes on emissions are superior to taxes on output. Taxes on output only provide incentives to producers to reduce the quantity of output produced with a given technology and given polluting resources, but not to reduce the amount of pollution they create or to switch to less polluting resources.

Taxes on pollutants emitted provide incentives to firms to economise on the use of polluting resources (such as fossil fuels) and use production methods that pollute less. Firms do not all face the same costs of reducing pollution; for some, the costs of reducing pollution are lower than for others, and these will be the ones most likely to cut their pollution emissions to avoid paying the tax. Firms that face the highest costs of reducing pollution will be the ones least likely to cut their pollutants, and so will pay the tax. The result is that *taxation leads to lower pollution levels at a lower overall cost*. Similarly, in the case of tradable permits, the system creates incentives for firms to cut back on their pollution if they can do so at relatively low cost. If it is a relatively low cost procedure for a firm to reduce its pollutant emissions, it will be in its interests to do so and sell excess permits. Firms that can only reduce pollution at high cost will be forced to buy additional permits. Therefore, both taxes and tradable permits are methods to reduce pollution more efficiently (at a lower cost).

We will consider the relative advantages of taxes versus tradable permits later in this chapter (page 126).

Disadvantages of market-based policies

Whereas taxes and tradable permits as methods to negative externalities are simple in theory, in practice they are faced with numerous technical difficulties.

Taxes Taxes face serious practical difficulties that involve designing a tax equal in value to the amount of the pollution. An effective tax policy requires answers to the following questions:

- **What production methods produce pollutants?** Different production methods create different pollutants. It is necessary to identify what methods produce which pollutants, which is technically very difficult.
- **Which pollutants are harmful?** It is necessary to identify the harmful pollutants, which is also

technically difficult, and there is much controversy among scientists over the extent of harm done by each type of pollutant.

- **What is the value of the harm?** It is then necessary to attach a monetary value to the harm: how much is the harm done by each pollutant worth? This raises questions that have no easy answers: who or what is harmed; how is the value of harm to be measured?

Aside from the technical difficulties, there is also a risk that even if taxes are imposed some polluting firms may not lower their pollution levels, continuing to pollute even though they pay a tax.

Tradable permits Tradable permits face all the technical limitations listed above for taxes. In addition, tradable permits require the government (or international body) to set a maximum acceptable level for each type of pollutant, called a 'cap'. This task demands having technical information on quantities of each pollutant that are acceptable from an environmental point of view, which is often not available. If the maximum level is set too high, it will not have the desired effect on cutting pollution levels. If it is set too low, the permits become very costly, causing hardship for firms that need to buy them. To date, tradable permits have been developed for just a few pollutants (CO₂, SO₂).

In addition, a method must be found to distribute permits to polluting firms in a fair way. Issues of political favouritism may come into play, as governments give preferential treatment to their 'friends' and supporters.

In practice, the most that can be hoped for is a shift of the *MPC* curve toward the *MSC* curve, as well some reduction in the size of the externality, but it is unlikely that these policies can achieve the optimal results.

Advantages of government regulations

Regulations have the advantage that they are simple compared to market-based solutions, and can be implemented more easily. The technical difficulties discussed above often make it more practical to impose regulations limiting the amounts of pollution firms can emit. In some situations, the practical difficulties in implementing market-based solutions may be so great that there is no alternative but to use regulatory methods. Moreover, regulations force polluting firms to comply and reduce pollution levels (which taxes may not always do). For these reasons, regulations are far more commonly used as a method to limit negative externalities of pollution in countries around the world.

Disadvantages of government regulations

As they do not allow the externality to be internalised, regulations create no market-based incentives, and therefore are unable to make distinctions between firms that have higher or lower costs of reducing pollution. They are also unable to provide incentives for firms to use less polluting resources, and are thus unable to lower the size of the externality. The result is that pollution is reduced at a higher overall cost. In addition, although they can be implemented more easily, they suffer from similar limitations as the market-based policies (lack of sufficient technical information on types and amounts of pollutants emitted), and so can at best be only partially effective in reducing the pollution created. Finally, there are costs of policing, and there may be problems with enforcement. Therefore, such measures can only attempt to partially correct the problem.

Test your understanding 5.3

- (a)** Using diagrams, show how marginal private costs and marginal social costs differ when there is a negative 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 negative production externality? **(d)** Show the welfare loss created by the negative production externality in your diagram, and explain what this means.
- Provide examples of negative production externalities.
- For each of the examples you provided in question 2, state and explain some method(s) that could be used to correct the externality.
- Using diagrams, show how the negative externality can be corrected by use of **(a)** taxes, and **(b)** legislation and regulations that limit the quantity of pollutants. **(c)** What are some advantages and disadvantages of each of these types of policy measures?
- Explain how tradable pollution permits can contribute to correcting negative production externalities.
- (a)** What does it mean to 'internalise an externality'? How can this be achieved?

(b) Why do economists prefer market-based methods that internalise negative production externalities to command methods (such as legislation and regulations)? **(c)** What are some difficulties that governments face in designing market-based methods?

- (a)** In what way are taxes on emissions, and tradable permits similar with respect to their objectives? (*Hint: think about incentives.*) **(b)** How do they differ from taxes on output of the firms creating negative externalities? **(c)** What policy is preferable from the point of view of reducing the external costs of a negative environmental externality: a tax on output or a tax on emissions?

Negative consumption externalities (external or spillover costs)

Illustrating negative consumption externalities

Negative externalities of consumption refer to external costs created by consumers. For example, when consumers smoke in public places, there are external costs that spill over onto society in the form of costs to non-smokers due to passive smoking. In addition, smoking-related diseases result in higher than necessary health care costs that are an additional burden upon society. When there is a consumption externality, the marginal private benefit (demand) curve does not reflect social benefits. In Figure 5.6, the buyers of cigarettes have a demand curve, MPB , but when smoking, create external costs for non-smokers. These costs can be thought of as 'negative benefits', which therefore cause the MSB curve to lie below the MPB curve. The vertical difference between MPB and MSB represents the external costs. Note that since the

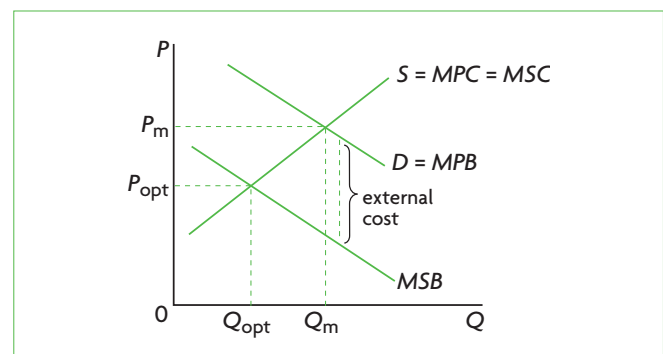


Figure 5.6 Negative consumption externality

externality involves consumption (i.e. the demand curve), the supply curve represents both marginal private costs and marginal social costs. The market determines an equilibrium quantity, Q_m , and price P_m , given by the intersection of the MPB and MPC curves, but the social optimum is Q_{opt} and P_{opt} , determined by the intersection of the MSB and MSC curves.

Other examples of negative consumption externalities include:

- heating homes and driving cars by use of fossil fuels that pollute the atmosphere
- partying with loud music until the early hours of the morning, and disturbing the neighbours.

When there is a negative consumption externality, the free market overallocates resources to the production of the good, and too much of it is produced relative to what is socially optimum. This is shown by $Q_m > Q_{opt}$ and $MSC > MSB$ at Q_m in Figure 5.6.

In general, negative externalities, whether these arise from production or consumption activities, lead to allocative inefficiency arising from an overallocation of resources to the good and to its overprovision.

The welfare loss of negative consumption externalities

Welfare loss

The welfare (deadweight) loss resulting from negative consumption externalities is the shaded area in Figure 5.7(a), and represents the reduction in benefits for society due to the overallocation of resources to the production of the good. For all units of output greater than Q_{opt} , $MSC > MSB$, indicating that too much of the good is produced. The welfare loss is equal to the difference between the MSC and MSB curves for

the amount of output that is overproduced relative to the social optimum ($Q_m - Q_{opt}$). It represents the loss of social benefits from overproduction due to the externality. If this externality were corrected, society would gain the benefits represented by the shaded area. Note that, once again, the point of the welfare loss triangle lies at the Q_{opt} quantity of output (as in the case of negative production externalities; see page 104).

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

Figure 5.7(b) shows how the welfare loss of a negative consumption externality is related to consumer and producer surplus and the external cost. In market equilibrium, consumer surplus is equal to the areas $a + b$, while producer surplus is equal to the areas $c + d + f$. The cost of the externality is represented by $a + d + e$ (it is the difference between the MPB and MSB curves up to Q_m). The total social benefits are therefore consumer surplus plus producer surplus minus the external cost:

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

At the social optimum, consumer surplus is equal to $b + c$, and producer surplus is equal to f , while external costs are zero. Therefore, the total social surplus is equal to producer plus consumer surplus:

$$b + c + f$$

Comparing the total social benefits at market equilibrium and at the social optimum, we see they are smaller at market equilibrium by the area e , which is the welfare loss.

The case of demerit goods

Demerit goods are goods that are considered to be undesirable for consumers, but which are overprovided by the market. Examples of demerit goods include cigarettes, alcohol and gambling. One important

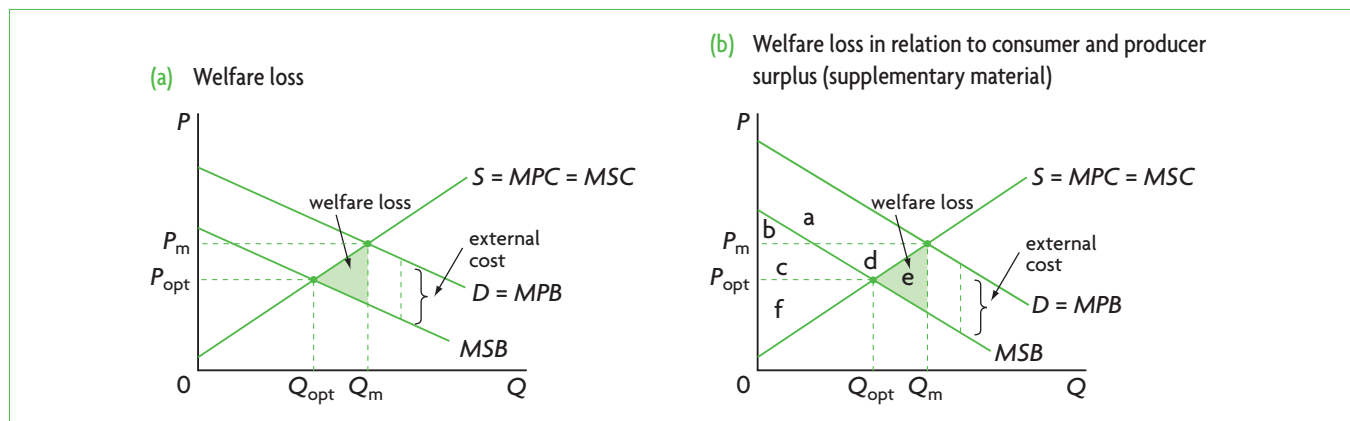


Figure 5.7 Welfare loss (deadweight loss) in a negative consumption externality

reason for overprovision is that the good may have negative consumption externalities, in which case the market overallocates resources to its production. Another reason for overprovision could be consumer ignorance about its negative effects, or indifference: consumers may not be aware of the harmful effects upon others of their actions, or they may not care.

Correcting negative consumption externalities

Government regulations

If negative consumption externalities were corrected, Q_{opt} quantity of the good would be produced, reflecting allocative efficiency. Regulations can be used to prevent or limit consumer activities that impose costs on third parties, such as legal restrictions on activities as smoking in public places. This has the effect of shifting the $D_1 = MPB$ curve towards the MSB curve in Figure 5.8(a), until D_2 overlaps with MSB . This would eliminate the externality, with production and consumption occurring at Q_{opt} and price falling to P_{opt} .

Advertising

Advertising and campaigns by the government can be used to try to persuade consumers to buy fewer goods with negative externalities, such as anti-smoking campaigns or campaigns to reduce the consumption of goods based on fossil fuel use (for example, campaigns to use public transportation to economise on petrol (gasoline) use, and to improve home insulation to reduce oil consumption for heating). The objective is to try to decrease demand for such goods, and the effects are the same as with government regulations, shown in Figure 5.8(a). The MPB curve shifts to D_2 after the campaign, where it coincides

with MSB , where Q_{opt} is produced and consumed, and the price falls from P_m to P_{opt} .

Market-based policies

Market-based policies to correct negative consumption externalities involve the imposition of indirect (excise) taxes (see Chapter 4, page 73). Indirect taxes can be imposed on the good whose consumption creates external costs (for example, cigarettes and petrol/gasoline). Note that whereas the indirect taxes discussed in Chapter 4 *introduced allocative inefficiency*, indirect taxes in the present context are intended to *lead to allocative efficiency*.

The effects of an indirect tax are shown in Figure 5.8(b). When such a tax is imposed on the good whose consumption creates the external cost, the result is a decrease in supply and an upward shift of the supply curve from MPC to $MPC + tax$. If the tax equals the external cost, the $MPC + tax$ curve intersects MPB at the Q_{opt} level of output, and quantity produced and consumed drops to Q_{opt} . (The demand curve does not shift but remains at $D = MPB$.) Q_{opt} is the socially optimum quantity, and price increases from P_m to P_c . The tax therefore permits allocative efficiency to be achieved.³

Correction of negative consumption externalities involves either decreasing demand and shifting the MPB curve toward the MSB curve through regulations or advertising; or decreasing supply and shifting the MPC curve upward by imposing an indirect tax. Both demand decreases and supply decreases can lead to production and consumption at Q_{opt} and the achievement of allocative efficiency. The price paid by consumers falls to P_{opt} when demand decreases, and rises when supply decreases.

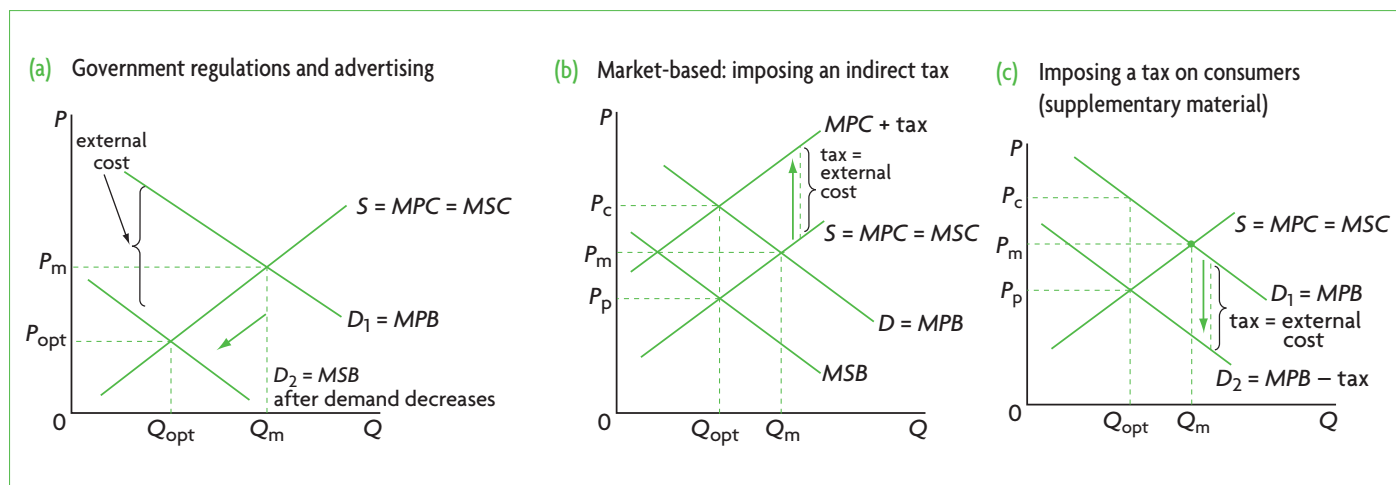


Figure 5.8 Correcting negative consumption externalities

³ Note that the new equilibrium price, P_c , is the price paid by consumers; the price received by producers is $P_p = P_c$ minus tax per unit; see Chapter 4, page 74).

Note that the problem of overprovision of demerit goods by the market (discussed on page 109) can be addressed by all the policies discussed above to correct negative consumption externalities: regulations, advertising and indirect (excise) taxes. The objective of all these policies in the case of demerit goods is to decrease their consumption, as they are held to be undesirable.

A tax on producers or consumers? (supplementary material)

You may be wondering why the tax to correct negative consumption externalities should affect producers, shifting the supply curve upward in Figure 5.8(b), and not consumers by shifting the demand curve downward, who after all are the ones creating the externality through consumption. The reason is that *these two shifts produce identical market outcomes*.

We have seen in Figure 5.8(b) that when an indirect (excise) tax is imposed on the good causing the negative externality, the supply or MPC curve shifts upward. At the new equilibrium, Q_{opt} will be produced, and will be sold at the price P_c , which is the price paid by consumers, while the price received by producers is P_p .

If instead a tax per unit bought is imposed on consumers, which they pay directly to the government, this would cause a downward shift of the demand curve, as in Figure 5.8(c), from D_1 to D_2 . The reason for this shift is that for each quantity consumers are willing and able to buy, the 'price' they pay includes the price of the good plus the tax per unit. This means that for each quantity, the price of the good must be lower by the amount of the tax.

The new equilibrium is determined by the intersection of the new demand curve, D_2 , with the supply curve (which has not been affected), giving rise to Q_{opt} . When consumers buy Q_{opt} quantity, they pay the tax per unit plus price P_p (determined by their demand D_2), making a total price of P_c . The price P_p is the price received by producers.

Comparing Figure 5.8(b) with Figure 5.8(c), we see that the market outcomes are identical. Q_{opt} has been achieved, consumers pay price P_c , and producers receive price $P_p = P_c - \text{tax}$. Also, the incidence is shared between consumers and producers (as we learned in Chapter 4). The only difference between the two situations is who pays the tax to the government. In practice, excise taxes on goods are paid to the government by firms, because it is administratively far easier for the government to collect taxes this way.

Evaluating market-based policies, government regulation and advertising/persuasion

As with negative production externalities, economists prefer market-based solutions to the problem of negative consumption externalities; therefore, indirect taxes are the preferred measure, as they internalise the externality. Indirect taxes create incentives for consumers to change their consumption patterns by changing relative prices; the good that is taxed becomes relatively more expensive and consumption is reduced. However, there are a number of difficulties in this approach. The first involves difficulties in measuring the value of the external costs. Take, for example, the case of passive smoking, an external cost created by smokers, or the case of petrol (gasoline) consumption, which creates external costs in the form of environmental pollution. There are many technical difficulties involved in trying to assess who and what is affected, as well as determine the value of the external costs, on the basis of which a tax can be designed.

A further difficulty is that some of the goods whose consumption leads to negative consumption externalities (for example, petrol/gasoline and cigarettes) have an inelastic demand. As you may remember from Chapter 3, page 49, when demand is inelastic, the percentage decrease in quantity demanded is smaller than the percentage increase in price (due to the tax). Therefore, it is possible that imposing taxes on such goods as petrol (gasoline) and cigarettes (both of which have an inelastic demand) works to increase government tax revenues while not significantly decreasing the quantity demanded of these goods. This could mean that in order to achieve Q_{opt} , a very high indirect tax would have to be imposed, which would very likely be politically unacceptable.

Advertising and persuasion have the advantage that they are simpler, but they too have their disadvantages. One of these involves the cost to the government of advertising campaigns, which are funded out of tax funds, meaning there are less funds available for use elsewhere in the economy (there are opportunity costs). There is also the possibility that such methods may not be effective enough in reducing the negative externality. In addition, while regulations (such as prohibiting smoking in public places) can be very effective in reducing the external costs of smoking, they cannot be used to deal with other kinds of negative consumption externalities. For example, it would be very difficult to regulate petrol (gasoline) consumption; on the other hand, imposing indirect

taxes on such goods may be more effective (though subject to the limitations noted above on inelastic demand). Governments must therefore be selective in the methods they use to reduce consumption externalities, depending on the particular good that creates the external costs.

In general, given the limitations above, with all policies (regulation, advertising and taxes), it is only possible to move the economy in a direction towards correction of the externality, rather than achieving a precise allocation of resources where Q_{opt} is produced and consumed.

Test your understanding 5.4

- 1 **(a)** Using diagrams, show how marginal private benefits and marginal social benefits differ when there is a negative 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 this tell you about the allocation of resources achieved by the market when there is a negative consumption externality? **(d)** Show the welfare loss created by the negative consumption externality in your diagram, and explain what this means.
- 2 Provide some examples of negative consumption externalities.
- 3 For each of the examples you provided in question 2, explain some methods that could be used to correct the externality.
- 4 Using diagrams, show how a negative consumption externality can be corrected by use of **(a)** legislation and regulations that limit the external (spillover) costs, **(b)** advertising and persuasion, and **(c)** indirect taxes. **(d)** What are some advantages and disadvantages of each of these policy measures?
- 5 **(a)** Explain the meaning of a demerit good, and provide examples. **(b)** How can overprovision of demerit goods be corrected?
- 6 How does a negative consumption externality differ from a negative production externality?
- 7 **(a)** What kinds of measures do economists prefer to correct negative consumption externalities? **(b)** Why might these not be very effective?

Real world focus

Could a tax on chocolate help fight obesity?

A UK doctor has suggested that chocolate should be taxed like alcohol and cigarettes if the UK is to deal with its obesity epidemic. Excessive consumption of chocolate is leading to very high rates of heart disease and diabetes. Some people eat their entire daily calorie requirement in chocolate.

A chocolate tax would make people healthier. Revenues from the chocolate tax could be used to help pay for the treatment of diseases resulting from obesity. There is a lot of negative publicity about other junk food, but an exception is made for chocolate, which has not been

identified as responsible for a big part of poor health and additional health care costs that burden society.

Opponents to the tax say there is no evidence that such 'fat taxes' would work in practice. Some people point to the health benefits of eating chocolate. A Cadbury spokesperson said, 'We've known for a long time that there's good stuff in chocolate.'

Source: Adapted from Daniel Martin, 'Could a tax on chocolate help tackle obesity?' in the *Daily Mail*, 13 March 2009.

Applying your skills

Using diagrams, in each case:

- 1 explain what kind of externality the article is referring to
- 2 explain how a tax on chocolate might correct the externality
- 3 evaluate the desirability of a tax on chocolate.