

# Chapter 4

## Government intervention

This chapter will study three types of government intervention in markets: indirect taxes, subsidies and price controls.

### 4.1 Indirect taxes

#### Introduction to indirect taxes

##### The meaning of indirect taxes

**Indirect taxes** are imposed on spending to buy goods and services. They are paid partly by consumers, but are paid to the government by producers (firms), and for this reason are called ‘indirect’. There are two types of indirect taxes:

- **excise taxes**, imposed on particular goods and services, such as petrol (gasoline), cigarettes and alcohol
- **taxes on spending on all (or most) goods and services**, such as general sales taxes (used in the United States) and value added taxes (used in the European Union, Canada and many other countries).

Indirect taxes differ from **direct taxes**, involving payment of the tax by the taxpayers directly to the government (see Chapter 11).

In this chapter, we will study excise taxes.

##### Indirect (excise) taxes and the allocation of resources

Taxes have the effect of changing the allocation of resources. In Chapter 2 we learned that prices act as signals and incentives, which determine the pattern of resource allocation. Since excise taxes are imposed on particular goods, they increase the price paid by consumers, causing consumers to reduce their spending on the taxed goods. Excise taxes also lower the price received by producers, causing them to produce less. Therefore, by changing price signals and incentives, excise taxes affect the allocation of resources.

The interesting question is whether excise taxes work to reduce or to increase allocative efficiency. The answer depends on the degree of allocative efficiency in the economy before the tax is imposed. If an economy

begins with an efficient allocation of resources, the excise tax creates allocative inefficiency and a welfare loss. We will see how this happens below. In an economy with an inefficient resource allocation, indirect taxes potentially have the effect of improving resource allocation, if they are designed to remove the source of allocative inefficiency. This will be studied in Chapter 5.

#### Why governments impose indirect (excise) taxes

- ♦ Explain why governments impose indirect (excise) taxes.

Governments impose excise taxes for several reasons:

- **Excise taxes are a source of government revenue.** Governments collect revenues from excise taxes. In Chapter 3 (page 57), we saw that the lower the price elasticity of demand for a good, the greater the government revenue generated. This explains why excise taxes are often imposed on goods that have a price inelastic demand (cigarettes, alcohol, petrol/gasoline).
- **Excise taxes are a method to discourage consumption of goods that are harmful for the individual.** The consumption of certain goods is considered harmful for the individual (for example, cigarette smoking, excess alcohol consumption, or gambling). Taxing these goods is likely to reduce their consumption. Taxes imposed for this purpose are referred to as ‘vice taxes’ or ‘sin taxes’. However, the extent to which these taxes are successful in reducing consumption depends on the price elasticity of demand; if it is low, an excise tax will likely result in only a relatively small decrease in quantity demanded (see Chapter 3, page 58).
- **Excise taxes can be used to redistribute income.** Some excise taxes focus on luxury goods (expensive cars, boats, furs, jewellery, and so on). The

objective is to tax goods that can only be afforded by high-income earners. Payment of a tax on the purchase of these goods reduces after-tax income, thus narrowing differences with the incomes of lower-income earners. Hence some degree of income redistribution is achieved as income inequality is narrowed.

- **Excise taxes are a method to improve the allocation of resources (reduce allocative inefficiencies) by correcting negative externalities.** If there are market imperfections (in the form of negative externalities), preventing the achievement of allocative efficiency, excise taxes can be used to try to improve the allocation of resources. This topic will be discussed in Chapter 5.

In this chapter, we assume that the economy begins with allocative efficiency, in order to see how the introduction of indirect taxes leads to allocative inefficiency.

## Indirect (excise) taxes: impacts on market outcomes and consequences for stakeholders

### Distinguishing between specific and *ad valorem* taxes

- ◆ Distinguish between specific and *ad valorem* taxes.

Indirect, excise taxes can be:

- **specific taxes**, a fixed amount of tax per unit of the good or service sold; for example, €5 per packet of cigarettes.
- ***ad valorem* taxes**, a fixed percentage of the price of the good or service; in this case, the amount of tax increases as the price of the good or service increases.

When a tax is imposed on a good or service, it is paid to the government by the firm. This means that for every level of output the firm is willing and able to supply to the market, it must receive a price that is higher than the original price by the amount of the tax. This involves a shift of the supply curve upward by the amount of the tax. (Note that this is equivalent to a leftward shift of the supply curve, meaning that for each price, the firm is willing to supply less output; this equivalence is explained in 'Quantitative techniques' chapter on the CD-ROM page 13).

### Illustrating and analysing impacts of specific and *ad valorem* taxes on market outcomes

- ◆ Draw diagrams to show specific and *ad valorem* taxes, and analyse their impacts on market outcomes.

Figure 4.1 shows how the supply curve shifts when a specific tax and an *ad valorem* tax is imposed. A specific tax causes a parallel upward shift, because the tax is a fixed amount for each unit of output. Therefore, in Figure 4.1(a)  $S_2$  is parallel to  $S_1$ . With an *ad valorem* tax, shown in part (b), the new supply curve  $S_2$  is steeper than  $S_1$ . Since the tax is calculated as a percentage of price, the amount of tax per unit increases as price increases. For example, if an *ad valorem* tax of 10% is imposed, when the price of the good is \$20, the amount of tax per unit sold is \$2 ( $= 0.1 \times \$20$ ); but if the price is \$30, the amount of tax per unit sold increases to \$3 ( $= 0.10 \times \$30$ ). Therefore, as the price rises, the amount of tax per unit increases.

The impacts of specific and *ad valorem* taxes on market outcomes are shown in Figure 4.2. The supply curves in both parts (a) and (b) are the same as in Figure 4.1; a demand curve has been added in each diagram. In part (a), the pre-tax equilibrium is determined by the intersection of the demand curve  $D$  and the supply curve  $S_1$ , so the price paid by consumers and received by producers is  $P^*$  and quantity demanded and supplied is  $Q^*$ . If the government imposes a specific tax on the good, the supply curve shifts upwards to  $S_2 (= S_1 + \text{tax})$ . The

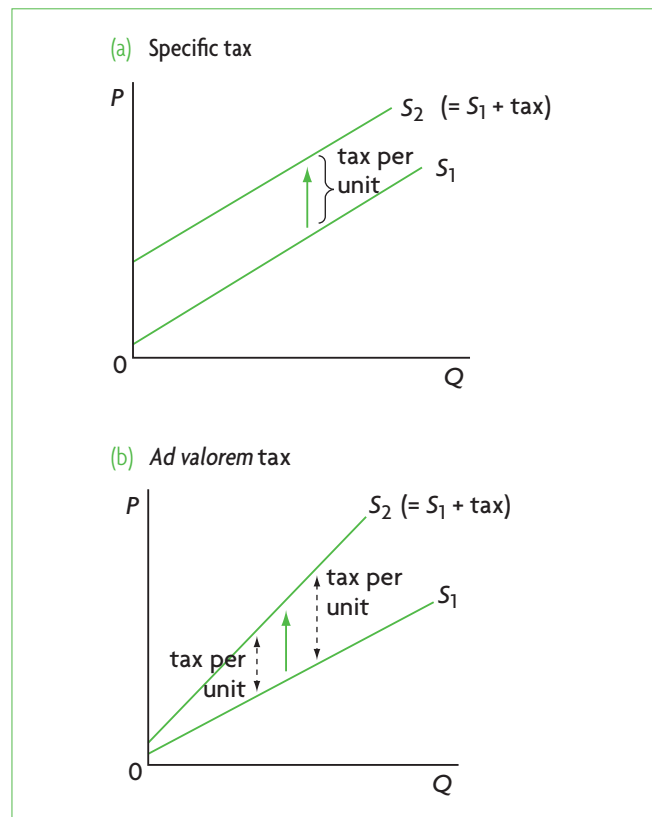
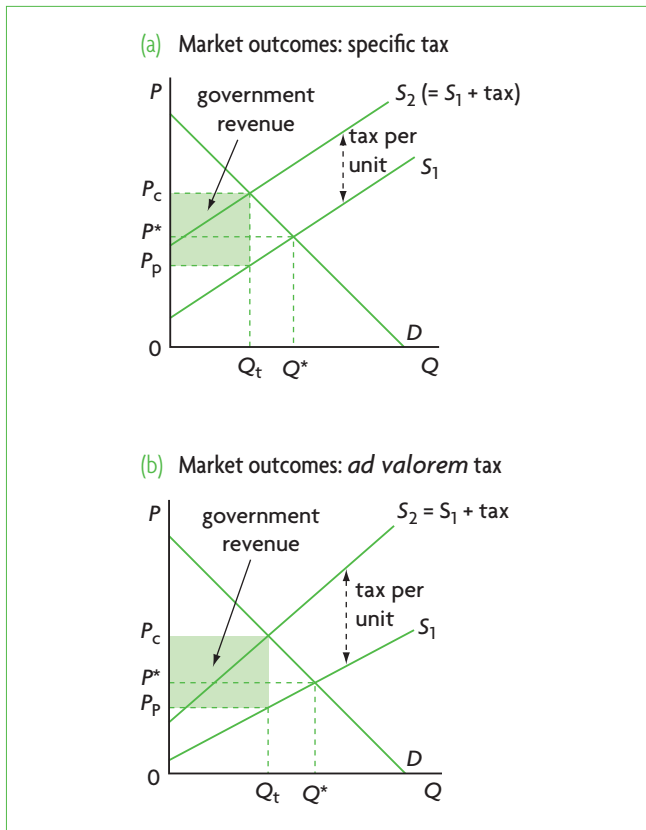


Figure 4.1 Supply curve shifts due to indirect (excise) taxes



**Figure 4.2** Impacts of specific and *ad valorem* taxes on market outcomes

demand curve remains constant at  $D$  since demand is not affected. The new market equilibrium is determined by the demand curve  $D$  and the new supply curve  $S_2$ , so the price paid by consumers increases to  $P_c$ , and the quantity purchased falls to  $Q_t$ . The amount of tax per unit of output is shown on the vertical axis by  $P_c - P_p$ , or the vertical difference between the two supply curves. Whereas producers receive from consumers  $P_c$  per unit, they must pay the government  $P_c - P_p$  per unit (tax per unit). Therefore,  $P_p$  is the final price received by producers after payment of the tax.

The tax is said to ‘drive a wedge’ between the price  $P_c$  paid by consumers and the price  $P_p$  received by producers.

The market outcomes due to the tax are the following:

- equilibrium quantity produced and consumed falls from  $Q^*$  to  $Q_t$
- equilibrium price increases from  $P^*$  to  $P_c$ , which is the price paid by consumers
- consumer expenditure on the good is given by the price of the good per unit times the quantity of units bought; it therefore changes from  $P^* \times Q^*$  to  $P_c \times Q_t$

- price received by the firm falls from  $P^*$  to  $P_p$ , which is  $P_p = P_c - \text{tax per unit}$
- the firm’s revenue falls from  $P^* \times Q^*$  to  $P_p \times Q_t$
- the government receives tax revenue, given by  $(P_c - P_p) \times Q_t$ , or the amount of tax per unit times the number of units sold; this is the shaded area in Figure 4.2
- there is an underallocation of resources to the production of the good:  $Q_t$  is less than the free market quantity,  $Q^*$ .

Figure 4.2(b) shows market outcomes due to the imposition of an *ad valorem* tax; these are exactly the same as in a specific tax (you can re-read the paragraphs above and relate them to Figure 4.2(b)).

### Consequences of indirect excise taxes for various stakeholders

- ◆ Discuss the consequences of imposing an indirect tax on the stakeholders in a market, including consumers, producers and the government.

‘Stakeholders’ are individuals or groups of individuals who have an interest in something and are affected by it. The consequences for stakeholders are the same for both specific and *ad valorem* taxes.

#### Consumers

Consumers are affected in two ways: by the increase in the price of the good (from  $P^*$  to  $P_c$ , shown in Figure 4.2) and by the decrease in the quantity they buy (from  $Q^*$  to  $Q_t$ ). Both these changes make them worse off, as they are now receiving less of the good and paying more for it.

#### Producers (firms)

Producers are affected in two ways: by the fall in the price they receive (from  $P^*$  to  $P_p$ ), and by the fall in the quantity of output they sell (from  $Q^*$  to  $Q_t$ ). These effects translate into a fall in their revenues, from  $P^* \times Q^*$  before the tax to  $P_p \times Q_t$ . Firms are therefore worse off as a result of the tax.

#### The government

The government is the only stakeholder that gains, as it now has revenue equal to  $(P_c - P_p) \times Q_t$  in Figure 4.2. This is positive for the government budget.

#### Workers

A lower amount of output, from  $Q^*$  to  $Q_t$ , means that fewer workers are needed to produce it; therefore, the tax may lead to some unemployment. Workers are worse off if they become unemployed.

### Society as a whole

Society is worse off as a result of the tax, because there is an underallocation of resources to the production of the good ( $Q_t < Q^*$ ).

#### Test your understanding 4.1

- 1 Explain the meaning of indirect taxes. Why are they called 'indirect'?
- 2 Explain some reasons why governments impose indirect (excise) taxes.
- 3 Why do indirect taxes affect the allocation of resources?
- 4 Using diagrams, **(a)** explain the difference between specific and *ad valorem* taxes, and **(b)** provide examples of each.
- 5 The government is considering imposing a €0.50 tax per litre of petrol (gasoline). **(a)** Explain whether this is a specific or *ad valorem* tax. **(b)** Draw a diagram for the gasoline market before the imposition of the tax, showing the price paid by consumers, the price received by producers and the quantity of petrol (gasoline) that is bought/sold. **(c)** Draw a diagram for the petrol (gasoline) market after the imposition of the tax, showing the price paid by consumers, the price received by producers, and the quantity of petrol (gasoline) bought/sold.
- 6 For question (5), **(a)** analyse the impacts on the market of the tax on petrol (gasoline), and **(b)** discuss the consequences for stakeholders.

### Linear demand and supply functions and indirect (excise) taxes

Suppose we are given the following demand and supply functions:

$$Q_d = 60 - 2P$$

$$Q_s = -4 + 2P$$

where  $Q_d$  and  $Q_s$  show quantities of stimples demanded and supplied in units per day, and  $P$  is price in euros (€). Since at equilibrium  $Q_d = Q_s$ , we set  $60 - 2P = -4 + 2P$  and solve for  $P$ , finding  $P = €16$ . Substituting into the demand or supply function, we find  $Q = 28$ , i.e. 28 units.

To plot the demand curve, we find the  $P$  and  $Q$  intercepts of the demand function. Setting  $Q_d = 0$  in the demand function, we find  $P = 30$ . Setting  $P = 0$ , we find  $Q_d = 60$ . We can now plot the demand curve. This is shown in Figure 4.3.

To plot the supply curve, we use the supply function and set  $Q_s = 0$ , finding  $P = 2$ ; this is the  $P$  intercept  $(0,2)$ . To find a second point on the supply curve, we set  $Q_s = 10$  (any other point will do as well) and solving for  $P$ , we have  $P = 7$ . We thus have a second point  $(10,7)$ . We can now plot the supply curve, which is shown as  $S_1$  in Figure 4.3. The demand curve,  $D$ , and supply curve,  $S_1$ , intersect at  $P = €16$  and  $Q = 28$   $(28,16)$  confirming our solution to the demand and supply equations.

Suppose the government imposes an indirect (excise) tax on stimples of €6 per unit. This means that the supply curve will shift upward by €6 for each level of output  $Q$ .

#### How to graph the new supply curve, $S_2$

In Figure 4.3, the new supply curve,  $S_2 (= S_1 + \text{tax})$ , lies €6 above the initial supply curve,  $S_1$ . We can count €6 upward along the vertical axis from the  $P$  intercept of  $S_1$ , which is  $(0,2)$  to find the  $P$  intercept of  $S_2$ , which is  $(0,8)$  and then draw a line parallel to  $S_1$  from this new  $P$  intercept. This gives us the new supply curve,  $S_2$ .

#### How to find the new price paid by consumers, the price received by producers and the quantity bought and sold, following the imposition of the tax

After the tax is imposed, the demand curve  $D$  and the new supply curve,  $S_2$ , determine a new equilibrium price, which is  $P_c$  or the price paid by consumers, a new equilibrium quantity,  $Q_t$ , and  $P_p$  or the price received by producers ( $P_p = P_c - \text{tax per unit}$ ) (see also Figure 4.2). We could try to read these off the graph, however it may be difficult to do so accurately. To get accurate values, we must find the new post-tax supply function, solve for  $P_c$  and  $Q_t$ , and then use  $P_p = P_c - \text{tax per unit}$  to find  $P_p$ .

## HL 4.2 Indirect (excise) taxes: market outcomes, social welfare and tax incidence (higher level topic)

### Linear demand and supply functions: calculating effects of specific (excise) taxes on markets and social welfare

- ◆ Plot demand and supply curves for a product from linear functions and then illustrate and/or calculate the effects of the imposition of a specific tax on the market (on price, quantity, consumer expenditure, producer revenue, government revenue, consumer surplus and producer surplus).