

4 Elasticities

those values. The range of values of PED is normally split into three categories.

- 1 **Inelastic demand:** The value of PED is less than one and greater than zero. If a product has inelastic demand, then a change in the price of the product leads to a proportionally smaller change in the quantity demanded of it. This means that if the price is raised, the quantity demanded will not fall by much in comparison, and so the total revenue gained by the firm (the number of units sold \times the price of the product) will increase. This may be shown by an example.

When the price of a carton of strawberry yoghurt is raised from \$1 to \$1.20, the firm finds that quantity demanded per week falls from 12 000 cartons to 10 800 cartons. Thus a 20% increase in price is causing a 10% fall in the quantity demanded. We can work out the PED by using the equation:

$$\text{PED} = \frac{\% \Delta \text{ in Quantity Demanded}}{\% \Delta \text{ in Price}} = \frac{10\%}{20\%} = 0.5$$

As we can see, the PED is 0.5, less than one, so the demand for the yoghurt is inelastic. Before the price increase, the total revenue gained by the firm was $12\,000 \times \$1 = \$12\,000$. After the increase, the total revenue becomes $10\,800 \times \$1.20 = \$12\,960$. The firm has increased revenue by raising the price. This is shown in Figure 4.3.

The “revenue boxes” in the diagram clearly show why a price increase causes an increase in total revenue, when the demand for a product is inelastic. In this case, before the price rise, the firm was getting revenue equal to “revenue box b” + “revenue box c”. After the price increase, the firm loses “revenue box c”, because quantity demanded falls to 10 800 cartons, but gains “revenue box a”, because the remaining cartons are now sold at \$1.20 each. Since “revenue box a” ($10\,800 \times 0.20 = \$2,160$) is clearly larger than “revenue box c” ($1,200 \times \$1 = \$1,200$), the firm’s total revenue rises by \$960.

Thus, if a firm has inelastic demand for its product and wishes to increase total revenue, it should raise the price of the product.

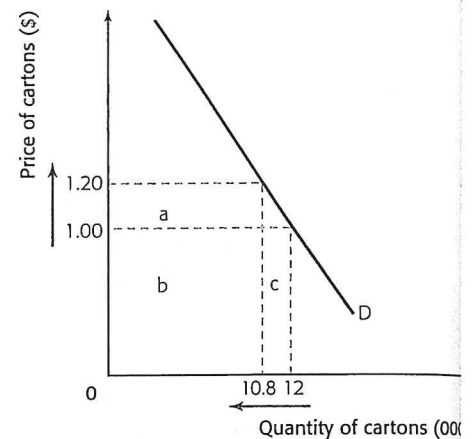


Figure 4.3 The demand for strawberry yoghurt

Student workpoint 4.1

Be a thinker—calculate, illustrate, and explain

A firm producing decorative candles lowers the price of one of its scented candles from \$4 to \$3.60 and finds that the weekly quantity demanded of the candles goes up from 600 per week to 630.

- 1 Calculate the percentage changes in price and quantity demanded.
- 2 Calculate the price elasticity of demand for the scented candles.
- 3 Calculate the change in total revenue that the firm will experience following the fall in price.
- 4 Draw a “revenue box” diagram to illustrate the effect on quantity demanded and total revenue following the price change for the scented candle.
- 5 Was the firm sensible to lower the price of the scented candles? Explain your answer.



- 2 *Elastic demand:* The value of PED is greater than one and less than infinity. If a product has elastic demand, then a change in the price of the product leads to a greater than proportionate change in the quantity demanded of it. This means that if price is raised, the quantity demanded will fall by more in comparison, and so the total revenue gained by the firm (the number of units sold \times the price of the product) will fall. This may be shown by an example.

When the price of a hot dog is raised from \$2 to \$2.10, a hot dog seller finds that quantity demanded per week falls from 200 hot dogs to 180 hot dogs. Thus a 5% increase in price is causing a 10% fall in the quantity demanded. We can work out the PED by using the equation:

$$\text{PED} = \frac{\% \Delta \text{ in Quantity Demanded}}{\% \Delta \text{ in Price}} = \frac{10\%}{5\%} = 2$$

As we can see, the PED is 2, greater than 1, so the demand for the hot dog is elastic. Before the price rise, the total revenue gained by the hot dog seller was $200 \times \$2 = \400 . After the increase, the total revenue becomes $180 \times \$2.10 = \378 . The seller has caused a fall in revenue by raising the price. This is shown in Figure 4.4.

The “revenue boxes” in the diagram clearly show why a price increase causes a decrease in total revenue, when the demand for a product is elastic. In this case, before the price rise, the hot dog seller was earning revenue equal to “revenue box b” + “revenue box c”. After the price increase, the hot dog seller loses “revenue box c”, because quantity demanded falls to 180 hot dogs, but gains “revenue box a”, because the remaining hot dogs are now sold at \$2.10 each. Since “revenue box a” ($180 \times \$0.10 = \18) is clearly smaller than “revenue box c” ($20 \times \$2 = \40), the hot dog seller’s total revenue falls by \$22.

Thus, if a firm has elastic demand for its product and wishes to increase total revenue, it should not raise the price of the product.

Student workpoint 4.2

Be a thinker—calculate, illustrate, and explain

A pizzeria lowers the price of its most popular takeaway pizza, the Margherita, from \$5 to \$4.50 and finds that the weekly quantity demanded of the pizzas goes up from 60 per week to 72.

- 1 Calculate the percentage changes in price and quantity demanded.
 - 2 Calculate the price elasticity of demand for the pizzas.
 - 3 Calculate the change in total revenue that the pizzeria will experience following the fall in price.
 - 4 Draw a “revenue box” diagram to illustrate the effect on quantity demanded and total revenue following the price change for the Margherita.
 - 5 Was the firm sensible to lower the price of the Margherita? Explain your answer.
- 3 *Unit elastic demand:* The value of PED is equal to one. If a product has unit elastic demand, then a change in the price of the product leads to a proportionate, opposite, change in the quantity demanded of it. This means that if price is raised by a certain

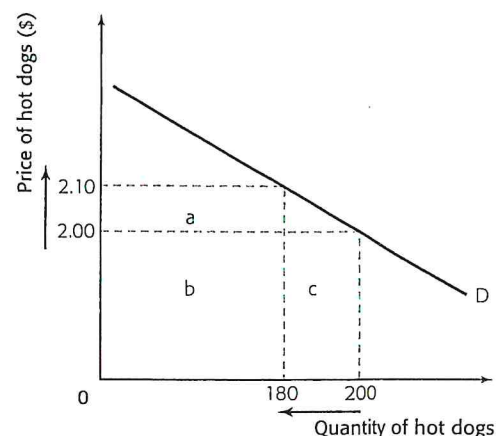


Figure 4.4 The demand for hot dogs

It is worth remembering that for many goods, necessity will change from consumer to consumer, since different people have different tastes and necessity is often a subjective view.

For example, in Malaysia, chicken is very popular among the population and so the demand for it is less elastic than it would be in Italy, where it is not valued as highly.

Necessity may go to extremes when individuals consider products to be very “necessary”, such as habit-forming goods, like cigarettes, alcohol, or hard drugs. Such products tend to have inelastic demand.

- 3** *The time period considered:* As the price of a product changes, it often takes time for consumers to change their buying and consumption habits. PED thus tends to be more inelastic in the short term and then becomes more elastic, the longer the time period it is measured over.

For example, when heating oil prices rose sharply in Austria, the demand for oil that winter changed by a proportionately smaller amount than the change in price. Demand was relatively very inelastic, since people did not really have many alternative products that they could switch to. They still needed heating oil for their central heating. However, over the next few years, the demand for heating oil began to fall as people started to change their heating systems to ones that used gas, coal, or wood. The PED, when measured over a longer time period, was certainly more elastic.

Price elasticity of demand and taxation

Governments need to be aware of the possible consequences when they impose indirect taxes, such as sales taxes, on products. If a government puts a tax on a product, then its price will usually rise. (This is dealt with in more detail in Chapter 5.) This means that the quantity demanded of the product in question is likely to fall and this will have consequences for employment in the industry concerned. If the demand for the product is very elastic, then a price increase as a result of the imposition of a tax on the product will lead to a relatively large fall in the demand for the product. This means that the demand for production workers in the industry is likely to fall significantly, increasing unemployment in the economy.

Student Workpoint 4.4

Be a thinker—calculate, consider, and explain

Estimates based on studies of the US population suggest that a 10% increase in the price of cigarettes would reduce overall consumption by adults by 3% to 5%. The same 10% increase would reduce the consumption by youths by 13%.

- 1 Calculate the price elasticity of demand for cigarettes among US adults and among US youths.
- 2 Suggest possible reasons for the different magnitude of elasticity between the two groups.
- 3 Explain two possible reasons why a government would place a tax on cigarettes.

Student workpoint 4.3

Be a thinker—identify and explain

For each of the following pairs of goods, identify the one that you would expect to have the higher price elasticity of demand and explain your choice by referring to at least one of the determinants of elasticity.

- | | | |
|----------|--|----------------------------------|
| 1 | Heineken beer | Beer |
| 2 | A prescription tablet to reduce blood pressure | A tablet to reduce headache pain |
| 3 | Milk | Orange juice |

4 Elasticities

If the value of XED is negative, then the two goods in question may be said to be complements for each other. Products that are very close complements will have a lower negative value than products that are not so close. A computer gaming machine and the games that are played on it may be very close complements for consumers. A rise in the price of the gaming machine may lead to a significant fall in the quantity demanded of it and so a large fall in the demand for the games. Thus there would be a strong negative value for XED.

Some products, such as matchsticks and houses, are not connected. Thus an increase in the price of matchsticks would have no effect on the demand for housing and so the value of XED for the two products would be zero. We say that the two goods are unrelated.

Firms need to be aware of the XED for the products that they produce. It is essential that firms are aware of the possible impact on the demand for their products that may arise if there is a change in the price of a close rival's products. In the same way, they need to be aware of the impact of any change in price that they make on the demand for their close rival's products.

In addition, firms that produce complementary products, such as power tools and accessories, need to be aware of the effect that any price change they make on one product might have on the demand for complementary products that they also produce.

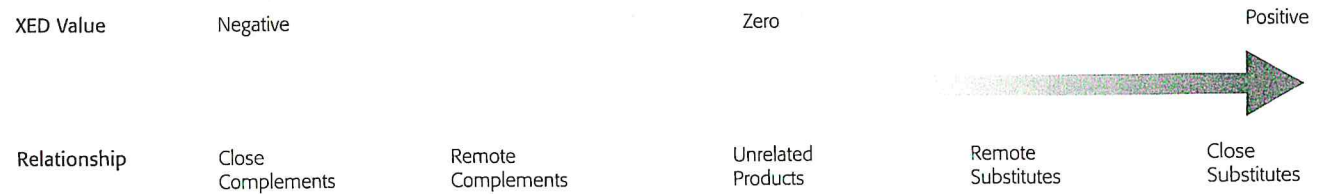


Figure 4.8 XED values and the strength of the relationship between products

Student workpoint 4.5

Be a thinker—calculate and explain

"Light-Bites", a sandwich shop, finds that when its rival, "Super-Snack", reduces the price of its chicken wraps from \$5 to \$4.60, the demand for "Light-Bites" sandwiches falls from 400 sandwiches a week to 340 sandwiches a week. In addition, "Super-Snack" finds that following the fall in price of their chicken wraps, the demand for soft drinks rises from 600 cans to 630 cans per week.

- 1 Calculate the cross elasticity of demand between "Light-Bite" sandwiches and "Super-Snack" chicken wraps.
- 2 Explain the relationship above in terms of cross elasticity of demand.
- 3 Calculate the cross elasticity of demand between "Super-Snack" sandwiches and the "Super-Snack" soft drinks.
- 4 Explain the relationship above in terms of cross elasticity of demand.

For inferior goods, the value of YED is negative, because the demand decreases as income increases. People start to switch their expenditure from the inferior goods that they had been buying to superior goods, which they can now afford. For example, the demand for inexpensive jeans falls as income rises because people switch to buying branded jeans.

An *Engel Curve* shows the relationship between income and the demand for a product over time. It is named after Ernst Engel, a nineteenth-century German economist. Such a curve is shown in Figure 4.9. We can see that as the income in a country rises over time, the demand for potatoes may increase, then become constant, and then begin to fall as people begin to buy superior products instead, such as pasta.

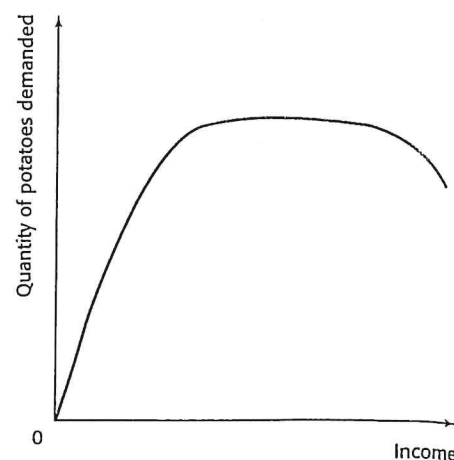


Figure 4.9 An Engel Curve showing the relationship between income and the demand for potatoes

Student workpoint 4.6

Be a thinker—calculate and explain

A consumer had an increase in income, following a salary rise, from \$80,000 per year to \$100 000 per year. In the following year, her expenditure on holidays increased from \$8,000 to \$10 000, her expenditure on gym membership remained the same, and her expenditure on locally produced clothes fell from \$2,000 to \$1,500.

- 1 Calculate her income elasticity of demand for holidays.
- 2 Explain what the value of her income elasticity of demand for holidays means.
- 3 Calculate her income elasticity of demand for gym membership.
- 4 Explain what the value of her income elasticity of demand for gym membership means.
- 5 Calculate her income elasticity of demand for locally produced clothes.
- 6 Explain what the value of her income elasticity of demand for locally produced clothes means.

Elasticity of supply

Price elasticity of supply (PES)

Formula and definition

Price elasticity of supply is a measure of how much the supply of a product changes when there is a change in the price of the product. It is usually calculated by using the equation below.

$$\text{PES} = \frac{\text{Percentage change in quantity supplied of the product}}{\text{Percentage change in price of the product}}$$

For example, a publishing firm realises that they can now sell their monthly magazine for \$5.50 instead of \$5.00. In light of this, they increase their supply from 200 000 to 230 000 magazines per month. With this information, we can calculate the price elasticity of supply for the magazine in question.

Normal products have values between zero and infinity and we will now look at those values. The range of values of PES is normally split into three categories:

- 1 Inelastic supply:** The value of PES is less than one and greater than zero. If a product has inelastic supply, then a change in the price of the product leads to a less than proportionate change in the quantity supplied of it, and so the value of PES is greater than zero and less than one.
- 2 Elastic supply:** The value of PES is greater than one and less than infinity. If a product has elastic supply, then a change in the price of the product leads to a greater than proportionate change in the quantity supplied of it, and so the value of PES is greater than one and less than infinity.
- 3 Unit elastic supply:** The value of PES is equal to one. If a product has unit elastic supply, then a change in the price of the product leads to a proportionate change in the quantity supplied of it and so the value of PES is equal to one.

Examples of supply curves with different values of PES are shown in Figure 4.12.

In Figure 4.12, curves S_1 and S_2 have a PES value of one along their entire length. This is because the percentage change in price is always equal to the percentage change in quantity supplied. For mathematical reasons, it is correct to say that any straight-line supply curve, passing through the origin, has an elasticity of supply of one.

Curve S_3 has a PES value of less than one along its entire length. This is because the percentage change in price is always greater than the percentage change in quantity supplied. For mathematical reasons, it is correct to say that any straight-line supply curve starting from the x-axis has a PES value less than one.

Curve S_4 has a PES value of greater than one along its entire length. This is because the percentage change in quantity supplied is always greater than the percentage change in price. For mathematical reasons, it is correct to say that any straight-line supply curve starting from the y-axis has a PES value greater than one.

Determinants of price elasticity of supply

Different products will have different values for PES. For example, the supply of cans of a soft drink may have a PES value of 2, i.e. the supply is elastic, whereas the supply of electricity may have a PES value of 0.5, which is inelastic. What actually determines the value of PES for a product? There are a number of determinants:

- 1 How much costs rise as output is increased:** If total costs rise significantly as a producer attempts to increase supply then it is likely that the producer will not raise the supply and so the elasticity of supply for the product will be relatively inelastic. It would take large price rises to make increasing the supply worthwhile.

If, however, total costs do not rise significantly then the producer will raise the quantity supplied and take advantage of the low increase in costs to benefit from the higher prices, thus making

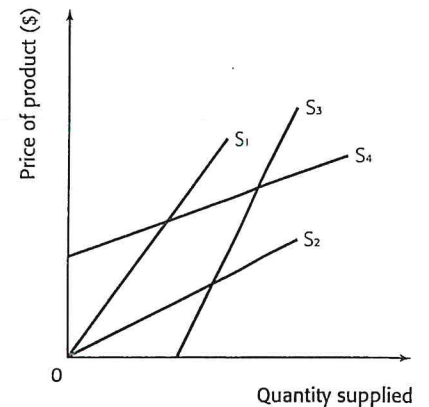


Figure 4.12 Supply curves with different values of PES

Student workpoint 4.7

Be a thinker—illustrate, explain, and calculate

A firm producing stuffed toys experiences an increase in the demand for its main product, a cuddly dog, because of an increase in its popularity. The price of the toy rises from \$15 to \$18. In response, the firm increases its output of the toy from 5,000 per week to 5,500 per week.

- Using a demand and supply diagram, explain why the price of the toy dog has increased.
- Calculate the elasticity of supply for the toy dog.