4 The Effect of Price and Income on Demand Quantities

In Chapter 3 we learned to use demand curves to show the effect of the price of a good on the quantity demanded. We saw also that changes in income, or in the price of related goods, would shift demand curves, altering the quantity demanded at each price. In this chapter we examine these effects in more detail. Then, to get behind these demand relations, in the next chapter we build a model of the decision problem facing consumers who must choose how to spend their income on different goods.

In Chapter 2 we discussed the effect of tube fares on tube revenue. Other things equal, higher tube fares reduce the quantity of tube journeys demanded. If the quantity demanded is very sensitive to the price, higher fares discourage so many passengers that total revenue from tickets falls. However, if the quantity demanded is relatively insensitive to the price, higher fares more than compensate for reduced volume, and the total revenue increases.

In this chapter we introduce the concept of the *price elasticity of demand*, a measure of the sensitivity of the quantity demanded to the price. The price elasticity of demand is a key piece of information in many economic problems such as the pricing decision about tube fares that we studied in Chapter 2.

We now adopt a different example to develop the theory of demand. Suppose you are the owner of a football club. Before the season begins you have to set the price of football tickets for the season. Your sole aim is to maximize your revenue from ticket sales so you can afford to buy some better players next season. Should you set a ticket price that will ensure that the ground is full? It all depends on the sensitivity of ticket sales to ticket prices. If the quantity demanded is insensitive to the price, it will require a very low price to fill the ground and total revenue will collapse. If, however, small reductions in ticket prices lead to large increases in the quantity of tickets demanded, it makes much more sense to charge a price that will fill the ground. Higher sales volume will more than compensate for the lower ticket price. Without undertaking some empirical research to find out the price elasticity of demand for football tickets, you cannot make a sensible pricing decision.

The demand for football tickets depends also on the price of related goods. Lower admission prices for race courses, cinemas, and other ways of spending Saturday afternoon will reduce the demand for football tickets. The *cross price elasticity of demand* measures the sensitivity of the quantity demanded of one good to changes in the price of a related good. We illustrate the use of this concept later in the chapter.

The demand curve for football tickets will also be shifted by changes in consumer incomes. If people become richer they can afford more football tickets whatever the price. The *income elasticity of demand* measures the sensitivity of the quantity demanded to changes in consumer incomes. Goods for which demand grows quickly as incomes rise will have better growth prospects in an expanding economy than goods for which demand increases more slowly with income. Investors and businesses will be interested in differences in the income elasticity of demand for different goods.

4-1 THE PRICE RESPONSIVENESS OF DEMAND

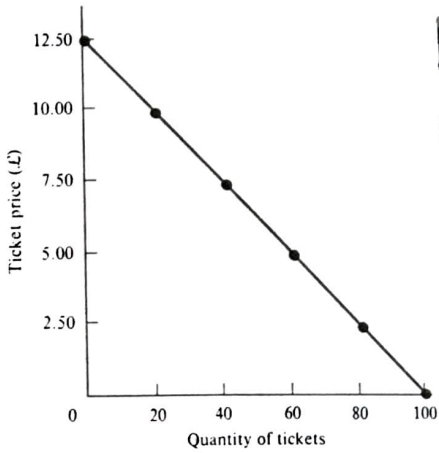
The downward slope of the demand curve shows that quantity demanded increases as the price of a good falls. Frequently we need to know by how much the quantity demanded will increase. Table 4-1 presents some hypothetical numbers for the relation between ticket price and quantity demanded, other things equal. Figure 4-1 plots the demand curve, which happens to be a straight line in this example.

How should we measure the responsiveness of the quantity of tickets demanded to the price of tickets? One obvious measure is the *slope* of the demand curve. Each price cut of £1 leads to 8000 extra ticket sales per game. Suppose, however, that we wish to compare the price responsiveness of football ticket sales with the price responsiveness of the quantity of cars demanded: clearly, £1 is a trivial cut in the price of a car and will have a negligible effect on the quantity of cars demanded.

TABLE 4-1
THE DEMAND FOR FOOTBALL TICKETS

PRICE (£/ticket)	QUANTITY OF TICKETS DEMANDED (thousands/game)
12.50	0
10.00	20
7.50	40
5.00	60
2.50	80
0	100

FIGURE 4-1 THE DEMAND FOR FOOTBALL TICKETS. For given prices of related goods and consumer incomes, higher ticket prices reduce the quantity of tickets demanded.



In Chapter 2 we argued that when commodities are measured in different units it is often best to examine the percentage change, which is unit-free. This suggests that we think about the effect of a 1 per cent price cut on the quantity of cars and football tickets demanded. Similarly, it is not the absolute number of cars or tickets we should examine but the percentage change in quantity demanded. Not only does this solve the problem of comparing things measured in different quantity units, it also takes account of the size of the market. Presumably an extra sale of 8000 tickets is more important when ticket sales are 4000 than when they number 40 000.

Thus we reach the definition of the price elasticity of demand, which economists use to measure responsiveness to price changes.

The *price elasticity of demand* is the percentage change in the quantity of a good

demanded divided by the corresponding percentage change in its price.

Although we shall shortly introduce other demand elasticities – the cross price elasticity and the income elasticity – the (own) price elasticity is perhaps the most frequently used of the three. Whenever economists speak of *the* demand elasticity they mean the price elasticity of demand as we have defined it above.

If a 1 per cent price increase reduces the quantity demanded by 2 per cent, the demand elasticity is −2. Because the quantity *falls* 2 per cent, we express this as a change of −2 per cent, then divide by the price change of 1 per cent (a price rise) to obtain −2. If a price fall of 4 per cent increases the quantity demanded by 2 per cent, the demand elasticity is $-\frac{1}{2}$, since the quantity change of 2 per cent is divided by the price change of −4 per cent. Since demand curves slope down, we are either dividing a positive percentage change in quantity (a quantity rise) by a negative percentage change in price (a price fall), or dividing a negative percentage change in quantity (a quantity fall) by a positive percentage change in price (a price rise). The price elasticity of demand tells us about movements along a demand curve and the demand elasticity must be a negative number.[1]

[1] For further brevity, economists sometimes omit the minus sign. It is easier to say the demand elasticity is 2 than to say it is −2. Whenever the price elasticity of demand is expressed as a positive number, it should be understood (unless there is an explicit warning to the contrary) that a minus sign should be added. Otherwise, we should be implying that demand curves slope upwards, a rare but not unknown phenomenon, as we discuss in Chapter 5.

We now investigate the price elasticity of demand for football tickets. Table 4-2 reproduces in columns (1) and (2) the demand data from Table 4-1. By considering the effect of price cuts of £2.50, we then calculate the price elasticity of demand at each price, which is shown in column (3). For example, beginning at the price of £10 and a corresponding quantity of 20 000 tickets demanded, consider a price cut to £7.50. There is a price change of −25%, from £10 to £7.50, and a corresponding change in quantity demanded of 100%, from 20 000 to 40 000 tickets. The demand elasticity at £10 is thus (100/−25) = −4. Other elasticities are calculated in the same way, dividing the percentage change in quantity by the corresponding percentage change in price. Notice that when we begin from the price of £12.50 the demand elasticity is minus infinity. This is because the percentage change in quantity demanded is (20 − 0)/0. Any positive number divided by zero yields plus infinity. When we then divide by the −20 per cent change in price, from £12.50 to £10.00, we obtain minus infinity as the demand elasticity at this price.

We say that the demand elasticity is *high* when it is a large negative number. The quantity demanded is then very sensitive to the price. We say the demand elasticity is *low* when it is a small negative number and the quantity demanded is relatively insensitive to the price. 'High' or 'low' thus refer to the magnitude of the elasticity ignoring the minus sign. The demand elasticity falls when it becomes a smaller negative number and quantity demanded becomes less sensitive to the price.

TABLE 4-2
THE PRICE ELASTICITY OF DEMAND FOR FOOTBALL TICKETS

(1) PRICE (£/ticket)	(2) QUANTITY OF TICKETS DEMANDED (thousands/game)	(3) PRICE ELASTICITY OF DEMAND
12.50	0	$-\infty$
10.00	20	−4
7.50	40	−1.5
5.00	60	−0.67
2.50	80	−0.25
0	100	0

Although the demand curve for football tickets is a straight line with constant slope – along its entire length a £1 cut in price always leads to 8000 extra ticket sales – Table 4-2 shows that the demand elasticity falls as we move down the demand curve from higher prices to lower prices. At high prices, £1 is a small percentage change in the price but 8000 tickets is a large percentage change in the quantity demanded. Conversely, at low prices £1 is a large percentage change in the price but 8000 is a small percentage change in the quantity. When the demand curve is a straight line, the price elasticity falls steadily as we move down the demand curve.[2]

It is possible to construct curved demand schedules (still of course sloping downwards all the time) along which the price elasticity of demand remains constant. Generally, however, the price elasticity changes as we move along demand curves, and we expect the elasticity to be high at high prices and low at low prices.

In Table 4-2 we calculated demand elasticities by considering the effect of cutting the price by £2.50. We obtain identical answers if we consider raising the price by £2.50. For example, beginning from the price of £10 and the corresponding quantity of 20 000 tickets, a 25 per cent change to £12.50 leads to a change of −100 per cent in quantity demanded, from 20 000 tickets to zero. At £10.00 the demand elasticity remains −4.[3]

Because the demand curve is a straight line in this example, we get the same size of quantity response (20 000 tickets) whether we raise or lower the price by £2.50. That is why it does not matter whether we use price rises or price cuts to calculate the demand elasticity. When, as in Figure 4-2, the demand curve is not a straight line we encounter a minor difficulty. Beginning at point *A* where the price is P_0, moves to points *B* and C represent percentage price changes of equal magnitude but opposite sign. Figure 4-2 makes clear that the size of quantity response (from Q_0 to either Q_1 or Q_2) differs for price rises and price falls when the demand curve is not a straight line.

When dealing with nonlinear demand curves, economists resolve this ambiguity about the definition of price elasticity of demand by defining it with respect to *very small* changes in price. If we move only a short distance to either side of the point *A*, the demand curve hardly has time to bend round. Over the very short distance corresponding to a small percentage price rise or fall, the demand curve is as near a straight line as makes no difference. With this amendment we can continue to use the old definition. When demand curves

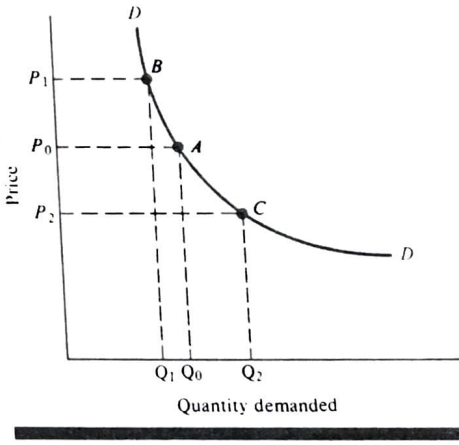


FIGURE 4-2 A NONLINEAR DEMAND CURVE
DD. When the demand curve *DD* is nonlinear, price rises and price cuts of equal size lead to quantity changes that differ in size. Beginning from the point *A*, a price rise leads to a smaller reduction in quantity than the quantity increase induced by an equivalent price cut.

[2] This conclusion stems from the fact that both price and quantity change as we move down a demand curve. There are two special cases of linear demand curves where this is not true. A horizontal or infinitely elastic demand curve has an elasticity of $-\infty$ at all points since the *price* never changes. A vertical or completely inelastic demand curve has an elasticity of zero at all points since the *quantity* never changes.

[3] You may be puzzled about the elasticity at a zero price. Raising the price to £2.50 induces a change in quantity of −20 per cent. The change in price is (2.50 − 0)/0 per cent, which is ∞ per cent. However, any number divided by infinity yields zero. Hence the demand elasticity is (−20/∞) = 0 at this price.

genuinely curve, the price elasticity of demand at a particular price is the (small) percentage change in quantity divided by the corresponding (small) percentage change in price. By considering sufficiently small price changes, we can get our answer to the formula for demand elasticity to be the same for price rises as for price falls.

Elastic and Inelastic Demand

Although elasticity typically falls as we move down the demand curve, an important dividing line occurs at the demand elasticity of -1.

> Demand is *elastic* if the price elasticity is more negative than -1. Demand is *inelastic* if the price elasticity lies between -1 and 0.

In Table 4-2 demand is elastic at all prices of £7.50 and above and inelastic at all prices of £5.00 and below. If the demand elasticity is exactly -1, we say that demand is *unit-elastic*.

Later in this section we show that a cut in prices raises revenue from football ticket sales if demand for football tickets is elastic but lowers revenue if demand is inelastic. Whether or not demand is elastic is the key piece of information required in setting tube fares in the example of Chapter 2 and in setting the price of football tickets in the example we are currently studying.

Although the price elasticity of demand typically changes as we move along demand curves, economists frequently talk of goods with high or low demand elasticities. For example, they will say that the demand for oil is price-inelastic (price changes have only a small effect on quantity demanded) but the demand for foreign holidays is price-elastic (price changes have a large effect on quantity demanded). Such statements implicity refer to parts of the demand curve corresponding to prices (adjusted for inflation) that are typically charged for these goods or services. They do not necessarily describe the demand elasticity at points on the demand curve corresponding to real prices which have never been observed historically.

The Determinants of Price Elasticity

What determines whether the price elasticity of demand for a good is high (say, -5) or low (say, -0.5)? Ultimately the answer must be sought in consumer tastes. If it is considered socially essential to own a television, higher television prices may have little effect on quantity demanded. If televisions are considered a frivolous luxury, the demand elasticity will be much higher. Psychologists and sociologists may be able to explain more fully than economists why tastes are as they are. Nevertheless, as economists, we can identify some considerations likely to affect consumer responses to changes in the price of a good. *The most important consideration is the ease with which consumers can substitute another good that fulfils approximately the same function.*

Consider two extreme cases. Suppose first that the price of all cigarettes is raised 1 per cent, perhaps because the cigarette tax has been raised. Do you expect the quantity of cigarettes demanded to fall by 5 per cent or by 0.5 per cent? Probably the latter. People who can easily quit smoking have already done so. A few smokers may try to cut down but this effect is unlikely to be large. In contrast, suppose the price of one particular brand of cigarettes is increased by 1 per cent, all other brand prices remaining unchanged. We should now expect a much larger quantity response from buyers. With so many other brands available at unchanged prices, consumers will switch away from the more expensive brand to other brands that basically fulfil the same function of nicotine provision. For a particular cigarette brand the demand elasticity could be quite high.

Ease of substitution implies a high demand elasticity for a particular good. In fact, our example suggests a general rule. The more narrowly we define a commodity (a particular brand of cigarette rather than cigarettes in general, or oil rather than energy as a whole), the larger will be the price elasticity of demand.

Measuring Price Elasticities

To illustrate these general principles we report estimates of price elasticities of demand in Table 4-3. The table confirms that the demand for general categories of basic commodities, such as fuel, food, or even household durable goods, is inelastic. As a category, only services such as haircuts, the theatre, and sauna baths, have an elastic demand. Households simply do not have much scope to alter the broad pattern of their purchases.

TABLE 4-3
ESTIMATES OF PRICE ELASTICITIES OF DEMAND IN THE UK

GOOD (GENERAL CATEGORY)	DEMAND ELASTICITY	GOOD (NARROWER CATEGORY)	DEMAND ELASTICITY
Fuel and light	−0.47	Dairy produce	−0.05
Food	−0.52	Bread and cereals	−0.22
Alcohol	−0.83	Entertainment	−1.40
Durables	−0.89	Expenditure abroad	−1.63
Services	−1.02	Catering	−2.61

Sources: The left-hand column is taken from John Muellbauer, 'Testing the Barten Model of Household Composition Effects and the Cost of Children', *Economic Journal*, September 1977, Table 7. The right-hand column is taken from Angus Deaton, 'The Measurement of Income and Price Elasticities', *European Economic Review*, Volume 6, 1975.

In contrast, there is a much wider variation in the demand elasticities for narrower definitions of commodities. Even then, the demand for some commodities, such as dairy produce, is very inelastic. However, particular kinds of services such as entertainment and catering have a much more elastic demand. Small changes in the relative price of restaurant meals and theatre tickets may lead households to switch in large numbers between eating out and going to the theatre, whereas the demand for getting out of the house on a Saturday evening may be relatively insensitive to the price of all Saturday night activities taken as a whole.

Using Price Elasticities

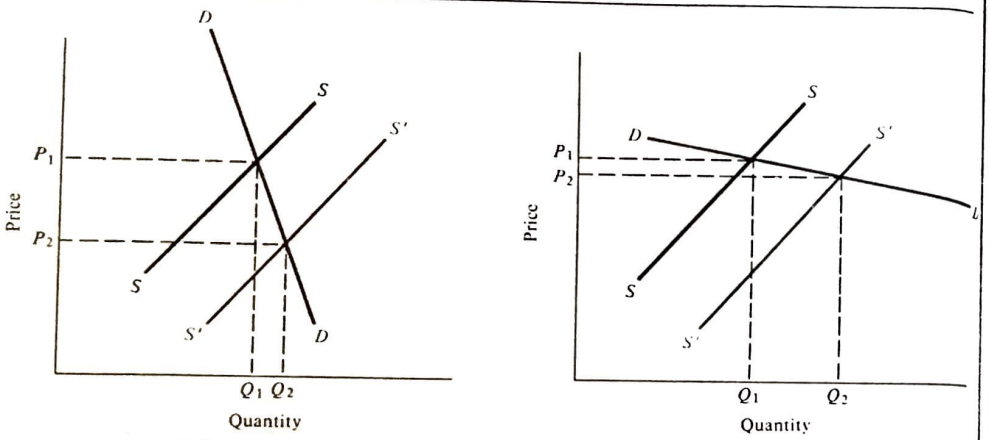
Suppose the demand elasticity for municipal car parks is -1.5. Other things equal, a 1 per cent rise in hourly parking charges lowers parking hours demanded by 1.5 per cent. At the current charge of £1 per hour there is a shortage of parking space of 15 per cent. Long queues build up in front of car parks and roads become congested. How much should charges be raised to eliminate the queues?

Since the demand elasticity is -1.5, a 10 per cent rise in parking charges will reduce hours demanded by 15 per cent, eliminating the queues. Some people will now use the bus, others will park outside the shopping centre and walk, yet others will form car pools. The demand elasticity summarizes all these possibilities for substituting for the use of municipal car parks. Had the substitution possibilities been less good, the demand elasticity might only have been -0.5. It would then have required a 30 per cent rise in parking charges to eliminate the queues.

Thus, price elasticities of demand are useful in calculating the price rise required to eliminate a shortage (excess demand) or the price fall required to eliminate a surplus (excess supply). One important source of surpluses and shortages is shifts in the supply curve. Harvest failures (and bumper crops) are a central feature of many agricultural markets. Because the demand elasticity for many agricultural products is very low, harvest failures produce very large increases in the price of food. Conversely, bumper crops induce very large falls in food prices. When demand is very inelastic, shifts in the supply curve lead to large fluctuations in price but have little effect on equilibrium quantities.

Figure 4.3(a) illustrates this point. We can interpret SS as the supply curve in an agricultural market when there is a harvest failure and $S'S'$ as the supply curve when there is a bumper crop. These extremes lead the equilibrium price to fluctuate between P_1 (harvest failure) and P_2 (bumper crop) but induce little fluctuation in the corresponding equilibrium quantities. Contrast this with Figure 4.3(b), which shows the effect of

FIGURE 4-3 THE EFFECT OF DEMAND ELASTICITY ON EQUILIBRIUM PRICE AND QUANTITY FLUCTUATIONS. In each case, the supply curve fluctuates between SS and $S'S'$. In case (a) demand is inelastic, and supply shifts lead to large changes in equilibrium price but little change in equilibrium quantity. In case (b) demand is elastic, and the same supply shift now leads to large changes in equilibrium quantity but little change in equilibrium price.



similar supply shifts in a market with very elastic demand. Price fluctuations are much smaller but quantity fluctuations are now much larger. Knowing the demand elasticity of a good helps us understand why some markets exhibit volatile quantities but stable prices, while other markets exhibit volatile prices but stable quantities.

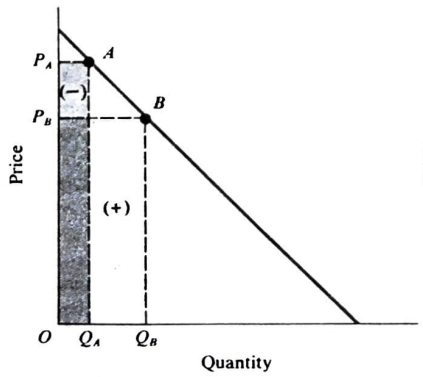
4-2 PRICE, QUANTITY DEMANDED, AND TOTAL EXPENDITURE

Other things equal, the demand curve shows how much consumers of a good wish to purchase at each price. At each price, total spending by consumers will be the price multiplied by the quantity demanded. We now discuss the relation between total spending and price and show the relevance of the price elasticity of demand.

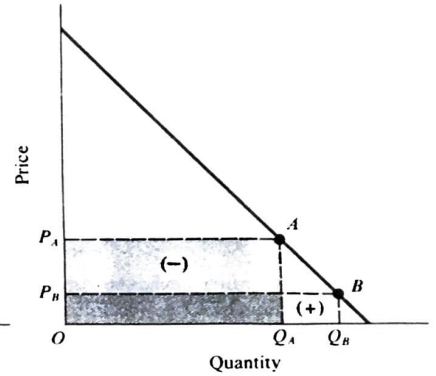
In Figure 4-4 we show how total spending changes as price changes. We consider three cases. In case A, we begin at the point A with price P_A and quantity demanded Q_A. Total spending is given by $P_A \times Q_A$ or the area of the rectangle OP_AAQ_A. We then examine a price cut to P_B at which consumers demand Q_B. Total spending is now $P_B \times Q_B$ or the area of the rectangle OP_BBQ_B. What is the change in total spending when prices are reduced from P_A to P_B? Spending falls by the grey shaded area marked (−) but rises by the blue shaded area marked (+). In case A the (+) area exceeds the (−) area and total spending increases. In the elastic range of the demand curve (towards the upper end) a cut in price raises the quantity demanded by more than sufficient to offset the lower price. Total spending increases.

Case B examines the lower end of the demand curve where demand is inelastic. Although the price cut raises the quantity demanded, the increase in quantity is insufficient to compensate for the lower price. The (+) area is smaller than the (−) area. Total spending falls. If price cuts increase total spending at high prices where the

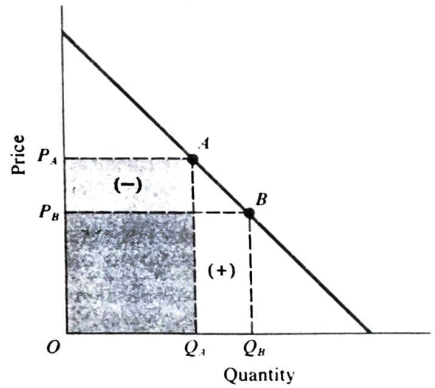
FIGURE 4-4 THE RELATIONSHIP BETWEEN ELASTICITY OF DEMAND AND THE EFFECT OF PRICE CHANGES ON EXPENDITURE. When the price is reduced from P_A to P_B, expenditure changes from OP_AAQ_A to OP_BBQ_B. Thus expenditure rises when demand is elastic (case A), falls when demand is inelastic (case B), and remains unchanged when demand is unit-elastic (case C).



Case A: Demand is elastic and expenditure increases when price falls



Case B: Demand is inelastic and expenditure falls when price falls



Case C: Demand is unit-elastic and expenditure is unchanged when price falls

TABLE 4-4
DEMAND ELASTICITIES AND CHANGES IN SPENDING

CHANGES IN TOTAL SPENDING INDUCED BY	PRICE ELASTICITY OF DEMAND		
	ELASTIC (e.g. −3)	UNIT-ELASTIC (−1)	INELASTIC (e.g. −0.3)
Price increase	Fall	Unchanged	Rise
Price reduction	Rise	Unchanged	Fall

demand elasticity is high and reduce total spending at low prices where the demand elasticity is low, you might guess that at some intermediate price a price cut will leave total spending unaltered. Case C shows this possibility. The higher quantity demanded exactly compensates for the lower price.

Let us return to our definition of total spending, which we write formally as

Total spending = price × quantity demanded (1)

If quantity demanded rises 1 per cent when the price falls 1 per cent, total spending will remain unaltered. In fact, case C depicts the point on the demand curve at which the price elasticity of demand is −1 (a 1 per cent change in quantity divided by a −1 per cent change in price). If demand is elastic, a demand elasticity that is more negative than −1, as in case A, a 1 per cent price cut leads to an increase in quantity by *more* than 1 per cent. Hence total spending rises. Conversely, when demand is inelastic, a demand elasticity lying between 0 and −1, as in case B, a 1 per cent price cut leads to an increase in quantity by *less* than 1 per cent. Hence total spending falls. These results are summarized in Table 4-4.

The Price of Football Tickets

We are now required to advise the owner of the football club on the ticket price that will maximize spending on football tickets and thus the owner's revenue. Table 4-5 shows again the demand data of Tables 4-1 and 4-2. For reasons that will shortly become apparent, we also show the quantity of tickets demanded at a price of £6.25 per ticket. At this price the demand elasticity is −1. A 20 per cent price change (of £1.25) induces a 20 per cent change in the quantity demanded (of −10 000 tickets per game). Column (4) shows total spending on football tickets at each price.

Beginning from the highest price of £12.50, which completely deters football supporters, the table shows that successive price cuts first increase total spending on tickets then reduce total spending. Table 4-4 explains why. When the price is high, demand is elastic: price reductions increase

TABLE 4-5
THE PRICE ELASTICITY OF DEMAND AND TOTAL SPENDING ON FOOTBALL TICKETS

(1) PRICE (£/ticket)	(2) QUANTITY DEMANDED (thousands/game)	(3) PRICE ELASTICITY OF DEMAND	(4) TOTAL SPENDING (PRICE × QUANTITY DEMANDED) (£ thousand/game)
12.50	0	$-\infty$	0
10.00	20	−4	200
7.50	40	−1.5	300
6.25	50	−1	312.5
5.00	60	−0.67	300
2.50	80	−0.25	200
0	100	0	0

total spending. When demand is unit-elastic, at the price of £6.25, we reach a turning point. Above this price, price cuts have steadily increased total spending. Once we get below this price, further price cuts reduce total spending. We can thus draw two conclusions. First, as we imagine moving down the demand curve, total spending is instantaneously unchanging as we move through the price £6.25 at which demand is unit-elastic. Second, and of more importance, *spending and revenue reach a maximum at the point of unit-elastic demand*. This theoretical idea, and the empirical knowledge that this occurs at the price of £6.25 per ticket, are the pieces of information the football club owner needs to know.

4-3 FURTHER APPLICATIONS OF THE PRICE ELASTICITY OF DEMAND

Tube Fares

The relation between demand elasticities and total spending summarized in Table 4-4 can equally be applied to the problem of setting tube fares discussed in Chapter 2. If we know the demand elasticity, then we know in which direction to change fares in order to increase spending on tube tickets.

Suppose the underground is running at a deficit. After some empirical research it is concluded that the price elasticity of demand for tube journeys is −1.4. Demand is elastic. After all, potential tube users have many substitution possibilities. A rise in tube fares will reduce the quantity of journeys demanded but will also reduce total spending on tube fares. In this example it would be quite misguided to raise fares in an effort to increase tube revenues. A policy of cutting tube fares is needed. Conversely, if the demand elasticity is −0.7, raising tube fares will improve revenue.

The First Oil Price Shock

Perhaps the most dramatic illustration of the relation between demand elasticity and total spending is the oil price shock of 1973–74 discussed in Chapter 1. By collectively restricting oil supplies, OPEC induced a quadrupling of the equilibrium price of oil in 1973–74.

We now know that increases in price raise consumer spending and hence seller revenues when demand is inelastic. And demand for oil was *very* inelastic. Estimates of the demand elasticity for oil in the mid-1970s were around −0.1. Oil users had little immediate prospect of substituting other commodities for oil in its many uses: fuel for cars and aeroplanes, fuel for heating and for oil-fired power stations generating electricity, inputs for petrochemical processes. A small restriction in total supply produced a large rise in the equilibrium price and vast revenue gains for OPEC members.

The Coffee Frost

In 1977 a frost in Brazil, the world's largest supplier of coffee, led to a sharp reduction in the supply of coffee. Coffee prices rose significantly. The implication for total spending on coffee and the revenues of coffee producers depends on the elasticity of demand for coffee. If demand is inelastic, spending and revenue will increase when prices rise. Table 4-6 gives data for 1976–78 for the United States, the world's most important consumer of coffee. Even adjusting for general inflation, the US price of coffee rose from $2.01 per pound in 1976 to $3.20 per pound in 1977, falling back to $2.40 per pound in 1978. Although the quantity demanded fell in 1977, the table shows that total spending on coffee *rose* in that year. Far from hurting coffee producers, the frost actually made them better off.

TABLE 4-6
THE MARKET FOR COFFEE IN THE UNITED STATES

	1976	1977	1978
Price ($/lb)*	2.01	3.20	2.40
Quantity (lbs)*	12.8	9.4	10.9
Total spending (price × quantity)	25.7	30.0	26.2

* Prices are in 1976 US dollars. Quantities are in pounds of coffee per head per year consumed in the United States.
Source: *Statistical Abstract of the United States*, 1980.

The demand for coffee turns out to be inelastic, although armchair reasoning might suggest an abundance of substitutes – tea, soft drinks, and beer. This example emphasizes the importance of consumer tastes. If buyers refuse to abandon coffee drinking it is useless to point out that a blend of tea and Coca Cola contains as much caffeine as the average cup of coffee.

Farmers and Bad Harvests

The example of coffee illustrates a general result. When demand is inelastic farmers may earn more revenue from a bad harvest than from a good one. As we pointed out earlier in Figure 4-3(a), when the supply curve shifts to the left it requires a large increase in price to eliminate excess demand if demand is inelastic. And price increases *raise* consumer spending and producer revenues when demand is inelastic. Nor is it surprising that the demand elasticity is low for many agricultural commodities such as coffee, milk, and wheat. These commodities are part of the staple diet of most households and eating habits are slow to change, even when prices of these commodities change.

If bad harvests raise farmers' revenues and good harvests lead to a collapse in agricultural prices and hence farmers' revenue, you may now be wondering why farmers do not get together like OPEC to restrict their supply in order to increase revenues in the face of inelastic demand. If so, you are beginning to think like an economist. If it were very easy to organize such collusion between farmers we would expect to see this done more often. Later in this book we discuss the difficulties that arise in trying to maintain a co-operative policy to restrict supply.

When demand is inelastic, suppliers *taken together* will be better off if supply can be reduced. However, if one farmer has a fire that destroys part of the crop but all other farmers' crops are unaffected, the unlucky farmer will definitely be worse off (unless fully insured). The reduction in a single farmer's output, unlike the reduction of all farmers' outputs simultaneously, will have only a negligible effect on supply. Market price will be unaffected and the unlucky farmer will simply be selling less output at the price that would have prevailed in any case. This illustrates a very important lesson in economics.

> What is true for the individual is not necessarily true for everyone together, and what is true for everyone together does not necessarily hold for the individual.

As in our example about cigarettes earlier in the chapter, the individual producer faces a demand that is very elastic – consumers can easily switch to the output of similar farmers – even though the demand for the crop as a whole is very inelastic.

4-4 THE LONG RUN AND THE SHORT RUN

The price elasticity of demand for a good is not independent of the length of time that consumers have to adjust their spending patterns when prices change. The dramatic oil price rise of 1973–74 caught many households owning a new but fuel-inefficient car. The households' immediate response to higher oil prices may have been to *plan* to buy a smaller car with greater fuel economy, but some households were unable to buy smaller cars immediately. In the *short-run*, they were stuck with their large-fuel-consumption cars. Unless they could rearrange their life-styles to make less use of a car, these households simply had to pay the higher petrol prices. That is precisely why the demand for petrol was so inelastic.

Over a longer period, however, consumers had time to sell their cars and buy cars with better fuel economy, or to move from the distant suburbs closer to their place of work in the city centre. Over this longer period, they were able to reduce the quantity of petrol demanded much more than they could initially. In Figure 4-5 we show this effect as a rotation of the demand curve. In the short run, the demand curve DD is steeper (and hence more inelastic) than the demand curve $D'D'$, which applies over a longer period. Beginning from the point A, a price rise from P_A to P_B reduces the quantity demanded to Q_S in the short run but to Q_L in the long run.

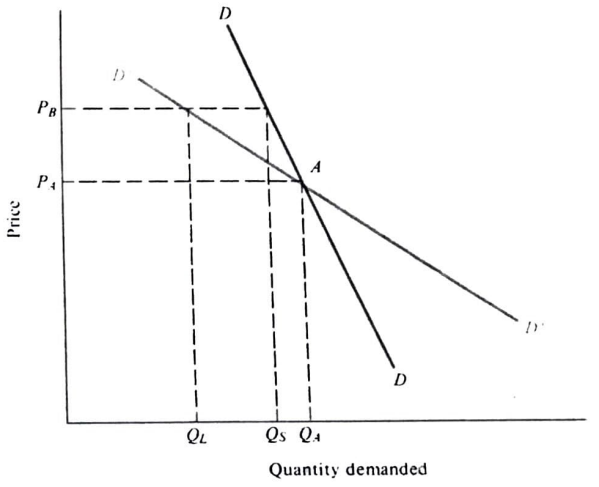


FIGURE 4-5 CHANGES IN DEMAND ELASTICITY OVER TIME. In the short run demand is very inelastic. Beginning from the point A, a price increase from P_A to P_B leads quantity demanded to fall only from Q_A to Q_S. In the long run consumers find ways to substitute away from the good whose price has risen. Demand becomes more elastic, the demand curve rotates from DD to $D'D'$, and the same price rise leads to the larger long-run quantity reduction to Q_L. Conversely, a price cut leads to a larger long-run increase in the quantity demanded.

The price elasticity of demand is lower in the short run than in the long run when there is more scope for substitution of other goods. This result is very general. For example, even if addicted smokers cannot reduce their consumption of cigarettes in response to a rise in the price of cigarettes, fewer young people will start smoking if the price is high and gradually the number of smokers in the population will fall.

How Long is the Long Run?

The *long run* is the period necessary for complete adjustments to a price change. Its length depends on the type of adjustments consumers wish to make. Demand responses to a change in the price of chocolate should be completed within a few months, but full adjustment to changes in the price of oil or cigarettes may take several years. The short run refers to the period immediately after prices change and before long-term adjustment can occur.

Table 4-7 shows actual data on energy demand for a group of seven major industrial countries – the UK, United States, France, West Germany, Holland, Canada, and Japan. Behaviour in Japan is so striking that it is shown separately. The first column compares quantity and price data (adjusted for inflation) in 1976 with the corresponding data for 1973. It gives us some idea of the short-run response to the OPEC oil price shock of 1973–74 which quickly led to general increases in energy prices. The second column shows equivalent data for 1981, giving an idea of longer-run responses.

Table 4-7 makes two points clearly. First, there is a tendency for the demand elasticity for energy to rise over time. Second, even in the longer run, the demand for energy remains very inelastic. Even by 1981, eight years after the original price shock, the elasticity in the seven counties as a whole is only -0.17. In Japan the elasticity is lower still. Even eight years may be insufficient to design and produce smaller cars to reduce household demand for petrol, to design and build factories with better insulation so that firms may reduce their demand

TABLE 4-7
ADJUSTMENT IN ENERGY DEMAND TO THE OIL PRICE SHOCK OF 1973–74

	(1) BY 1976			(2) BY 1981		
	% CHANGE IN			% CHANGE IN		
	QUANTITY	REAL PRICE	DEMAND ELASTICITY*	QUANTITY	REAL PRICE	DEMAND ELASTICITY*
Seven major industrial countries	−3.7	32.7	−0.11	−14.0	82.4	−0.17
Japan	−0.3	79.6	0	−19.1	176.1	−0.11

Source: *OECD Economic Outlook 1981*, December 1981.
* Although demand elasticities refer to movements along a demand curve holding income constant, income levels have changed in all these countries since 1973. The quantity data, and the demand elasticities calculated thereby, refer to quantity of energy divided by total income in the corresponding countries to crudely correct for the effect of changing incomes on energy demand.

for heating fuel, or to design and bring on stream chemical process plant capable of using synthetic inputs to replace hydrocarbons derived from oil.

4-5 THE CROSS-ELASTICITY OF DEMAND

The price elasticity of demand tells us about movements along a given demand curve holding constant all determinants of demand except the price of the good itself. To complete the analysis of demand behaviour, we now hold constant the own price of the good and examine the effect of variations in the prices of related goods. In the next section we examine the effect of changes in consumer income.

We begin by considering the appropriate measure of the sensitivity of the quantity demanded to changes in the price of a related good, holding constant all other determinants of demand. Extending our earlier idea of the (own) price elasticity of demand, we now introduce the cross price elasticity of demand, sometimes abbreviated to cross-elasticity of demand. The cross-elasticity tells us the effect on the quantity demanded of the good i when the price of *another* good, good j, is changed. As before, we use percentage changes.

> The *cross price elasticity of demand* for good i with respect to changes in the price of good j is the percentage change in the quantity of good i demanded, divided by the corresponding percentage change in the price of good j.

The cross-elasticity may be positive or negative. The cross-elasticity is positive if a rise in the price of good j increases the quantity demanded of good i. Suppose good i is tea and good j is coffee. We expect an increase in the price of coffee to raise the demand for tea. The cross-elasticity of tea with respect to coffee is positive. Cross price elasticities tend to be positive when two goods are substitutes and negatives when two goods are complements. We expect a rise in the price of petrol to reduce the demand for cars because petrol and cars are complements.

Table 4-8 shows estimates for the UK. Own price elasticities for food, clothing and footwear, and travel and communication are given down the diagonal of the table, from top left (the own price elasticity of demand for food) to bottom right (the price elasticity of demand for travel and communication). Off-diagonal entries in the table show cross price elasticities of demand. Thus, for example, −0.12 is the cross price elasticity of demand for food with respect to travel and communications. A 1 per cent increase in the price of travel and communication reduces the quantity of food demanded by 0.12 per cent.

The own price elasticities for the three goods lie between −0.30 (clothing and footwear) and −0.61 (travel and communication), much as we might have expected from our previous discussion of price elasticities of demand for broad categories of basic commodities. Nor should we be surprised that for all three goods the quantity demanded is more sensitive to changes in the own price of the good than to changes in the price of any other good.

TABLE 4-8
CROSS PRICE AND OWN PRICE ELASTICITIES OF DEMAND IN THE UK

PERCENTAGE CHANGE IN QUANTITY DEMANDED OF:	WITH RESPECT TO A 1% PRICE CHANGE IN: FOOD	CLOTHING AND FOOTWEAR	TRAVEL AND COMMUNICATION
Food	−0.37	−0.03	−0.12
Clothing and footwear	0.19	−0.30	−0.23
Travel and communication	0.42	−0.01	−0.61

Source: Angus Deaton, 'The Analysis of Consumer Demand in the UK 1900–70', *Econometrica*, March 1974, Table 1.

The largest cross price elasticity is for the demand for travel and communication with respect to food. Higher food prices *increase* the quantity of travel and communication demanded. Perhaps households make more extensive shopping expeditions in search of supermarkets offering special discounts on meat. However, an increase in the price of travel and communications *reduces* the demand for food since the cross price elasticity is −0.12. Perhaps the decline in passengers on trains and aeroplanes reduces the number of people who eat between meals.

4-6 THE EFFECT OF INCOME ON DEMAND

Finally, holding constant the own price of a good and the prices of related goods, we examine the response of the quantity demanded to changes in consumer incomes. For the moment we neglect the possibility of saving. Thus a rise in the income of consumers will typically be matched by an equivalent increase in total consumer spending.

In Chapter 3 we pointed out that higher consumer incomes will tend to increase the quantity demanded for most goods. However, demand quantities will typically increase by different amounts as incomes rise. Thus the pattern of consumer spending on different goods depends on the level of consumer incomes. We define the budget share of a good as the fraction of total consumer spending for which it accounts.

> The *budget share* of a good is its price multiplied by the quantity demanded, divided by total consumer spending or income.

Table 4-9 reports the share of consumer spending in the UK devoted to food and to wines and spirits between 1975 and 1984. The first column shows that real consumer spending (and incomes) have risen over the decade. Column (2) shows that the budget share of food has fallen over the decade, whereas column (3) shows that the budget share of wines and spirits has risen. Since the real price of both food and wines and spirits has remained fairly constant over the decade, it seems plausible to attribute these changes in budget share primarily to changes in real consumer incomes. To investigate this question further, we must now develop a measure of the response of quantity demanded to changes in income. By analogy with our previous measures of demand responsiveness, we now define the income elasticity of demand.

> The *income elasticity of demand* for a good is the percentage change in quantity demanded divided by the corresponding percentage change in income.

Since our strategy for analysing demand has been to consider varying one determinant at a time, the income elasticity of demand measures the effect on quantity demanded when incomes are changed but the own price of the good and the prices of related goods are held constant.

TABLE 4-9
BUDGET SHARES OF FOOD AND WINES AND SPIRITS IN THE UK, 1975–84

	(1) REAL CONSUMER SPENDING (£ billion, 1980 prices)	(2) BUDGET SHARE (%) OF: FOOD	(3) WINES AND SPIRITS
1975	124.9	17.6	3.1
1978	131.6	17.1	3.3
1981	136.6	16.6	3.4
1984	145.5	15.6	3.5

Source: CSO, *UK National Accounts*.

Normal, Inferior, and Luxury Goods

The income elasticity of demand measures how far the demand curve shifts horizontally when incomes change. Figure 4-6 shows two possible shifts caused by a given percentage increase in income. The income elasticity is larger if the given rise in income shifts the demand curve from DD to $D''D''$ than if the same income rise shifts the demand curve only from DD to $D'D'$. When an income rise shifts the demand curve to the left, the income elasticity of demand is a negative number, indicating that higher incomes are associated with smaller quantities demanded at any given prices.

In Chapter 3 we distinguished *normal* goods, for which demand increases as income rises, and *inferior* goods, for which demand falls as income rises. We can now define normal and inferior goods in terms of their income elasticities of demand.

> A *normal* good has a positive income elasticity of demand. An *inferior good* has a negative elasticity of demand.

It is also useful to distinguish luxury goods and necessities.

> A *luxury good* has an income elasticity that is larger than one. A *necessity good* has an income elasticity that is less than one.

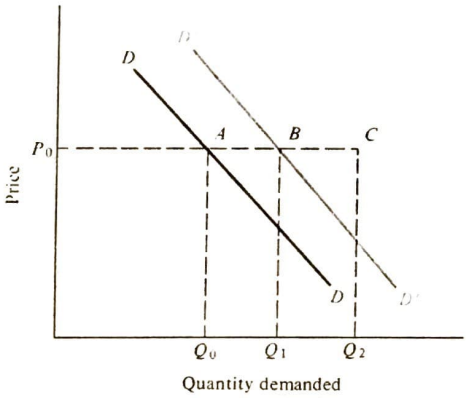


FIGURE 4-6 INCOME ELASTICITY AND SHIFTS IN THE DEMAND CURVE. Beginning at the Point A on the demand curve DD, the income elasticity measures the horizontal shift in the demand curve when income rises 1 per cent. At the given price P_0, a shift to the point B on the demand curve $D'D'$ reflects a lower income elasticity than a shift to the point C on the demand curve $D''D''$. Leftward shifts in the demand curve when income rises would indicate a negative income elasticity.

All inferior goods are necessities, since their income elasticities of demand are negative. However, necessities also include normal goods whose income elasticity of demand lies between zero and one.

These definitions also tell us what will happen to budget shares when incomes are changed but prices remain unaltered. The budget share of inferior goods must fall as incomes rise. Higher incomes (budgets) are associated with lower quantities demanded at constant prices. Conversely, the budget share of luxuries must rise when income rises. Because the income elasticity of demand for luxuries exceeds one, a 1 per cent rise in income increases quantity demanded (and hence total spending on luxury goods) by more than 1 per cent. Rises in income will *reduce* the budget share of normal goods that are necessities. Although income rises increase the quantity demanded, a 1 per cent income rise leads to a rise in quantity demanded by less than 1 per cent, so the budget share must fall.

Inferior goods tend to be low-quality goods for which there exist higher-quality, but more expensive, substitutes. Poor people satisfy their needs for meat and clothing by buying low-quality cuts of meat and nylon shirts. As their incomes rise, they switch to nicer cuts of meat (steak) and more comfortable shirts (cotton). Rising incomes lead to an absolute decline in the demand for cheap cuts of meat and nylon shirts.

Luxury goods tend to be high-quality goods for which there exist lower-quality, but quite adequate, substitutes: Mercedes cars rather than small Fords, foreign rather than domestic holidays. Necessities that are normal goods lie between these two extremes. As incomes rise, the quantity of food demanded will rise but only a little. Most people still enjoy fairly simple home cooking even when their incomes rise. Looking back at Table 4-9, we see that wines and spirits are luxuries whose budget share increased as UK incomes rose after 1975. Food cannot be a luxury, since its budget share fell as incomes rose, but it is not an inferior good either. At constant (1980) prices which adjust for the effects of inflation, real food spending *increased* from £22 billion in 1975 (17.6 per cent of £124.9 billion) to £22.7 billion in 1984 (15.6 per cent of £145.5 billion).

Table 4-10 summarizes the demand responses to changes in incomes holding constant the prices of all goods. The table shows the effect of income increases. Reductions in income have the opposite effect on quantity demanded and budget share.

Table 4-11 reports estimates of income elasticities of demand in the UK. As in the estimates of own price elasticity presented in Table 4-3, we show broad categories of goods in the left-hand column and narrower definitions of commodities in the right-hand column. Again we notice that the variation in elasticities is larger for narrower definitions of goods. Higher incomes have much more effect on the way in which households eat (more steak, less bread) than on the amount they eat in total. As we suggested earlier, food is a normal good but not a luxury. The income elasticity of 0.45 confirms this. The right-hand column indicates that, within the food budget, increases in income lead to a switch towards vegetables (whose income elasticity is higher than the income elasticity for food as a whole) and away from bread, for which the quantity de-

TABLE 4-10
SUMMARY OF DEMAND RESPONSES TO A 1 PER CENT INCREASE IN INCOME

TYPE OF GOOD	INCOME ELASTICITY	CHANGE IN QUANTITY DEMANDED	CHANGE IN BUDGET SHARE	EXAMPLE
Normal	Positive	Increases		
Luxury	Larger than 1	Increases by more than 1%	Increases	Yachts
Necessity	Between 0 and 1	Increases by less than 1%	Falls	Food
Inferior	Negative	Falls	Falls	Bread

TABLE 4-11
ESTIMATES OF INCOME ELASTICITIES OF DEMAND IN THE UK

BROAD CATEGORIES OF GOODS	INCOME ELASTICITY OF DEMAND	NARROWER CATEGORIES OF GOODS	INCOME ELASTICITY OF DEMAND
Tobacco	−0.50	Coal	−2.02
Fuel and light	0.30	Bread and cereals	−0.50
Food	0.45	Dairy produce	0.53
Alcohol	1.14	Vegetables	0.87
Clothing	1.23	Travel abroad	1.14
Durables	1.47	Recreational goods	1.99
Services	1.75	Wines and spirits	2.60

Source: as in Table 4-3.

manded declines. Richer households can afford to eat lots of salads in order to avoid getting fat. Poorer people need large quantities of bread to ward off the pangs of hunger. Notice that tobacco (chiefly cigarettes) is not only a necessity but even an inferior good. Although strictly inessential for physical survival, tobacco has the largest budget share among the poorer people. Richer people get their kicks in other (more expensive) ways.

Using Income Elasticities of Demand

Income elasticities are key pieces of information in forecasting the pattern of consumer demand as the economy grows and people become richer. Suppose we think that on average incomes will grow at 3 per cent per annum for the next five years. Given the estimates of Table 4-11, a 15 per cent change in incomes will reduce the demand for tobacco by 7.5 per cent (even if tobacco taxes are not raised) but will increase the demand for wines and spirits by 39 per cent. The growth prospects for these two industries are very different. These forecasts will affect decisions by firms about whether or not to build new factories, projections by governments of tax revenue from cigarettes and alcohol (the former will fall if tax rates per packet remain unchanged but the latter will rise sharply if taxes per bottle remain unchanged), and calculations by British Rail about the balance of smoking and non-smoking carriages that should be provided.

Later in this book we shall see that these considerations apply not only within national economies but in trade between nations. As Third World countries become richer, their demand for luxuries such as the familiar household durables, televisions, washing machines, and cars will rise rapidly. If the British government wants to improve the export performance of the UK, it may make more sense to subsidize new firms in these industries rather than to subsidize the dairy industry, where demand prospects are much worse.

4-7 THE EFFECT OF INFLATION ON DEMAND

We have now introduced elasticities to measure the response of quantity demanded to separate variations in three factors – the own price, the price of related goods, and income. In Chapter 2 we distinguished *nominal* variables, measured in the prices of the day, and *real* variables, which make adjustments for inflation when comparing measurements at different dates. You may have noticed that the examples in this chapter that discuss actual numbers for the UK and other economies refer to real prices (Table 4.7) and real incomes (Table 4.9). We conclude this chapter by examining the effect of inflation on demand behaviour.

Suppose all nominal variables double. Every good costs twice as much, wage rates are twice as high, rents charged by landlords and dividends paid by firms double in money terms. Whatever

bundle of goods could previously be purchased out of income can still be purchased. Goods cost twice as much but incomes are twice as high. If meat used to cost twice as much as bread it still costs twice as much. In fact, nothing at all has really changed. Demand behaviour will be unaltered by a doubling of the nominal value of *all* prices and *all* forms of income.

How do we reconcile this assertion with the idea that demand elasticities measure changes in quantity demanded as prices change? Remember that each of the elasticities (own price, cross price, and income) measured the effect of changing that variable holding constant all other determinants of demand. When all prices and all incomes are simultaneously changing, the definitions of elasticities warn us that it is incorrect simply to examine the effect of one variable, such as the own price, on quantity demanded. We can decompose the change in quantity demanded into three components: the effect of changes in the own price alone, plus the effect of changes in price of other goods alone, plus the effect of changing incomes. When all nominal variables change by the same proportion, the sum of these three effects turns out to be exactly zero.

In examining economic data we can pursue one of two strategies. The first is to undertake a complete econometric analysis which is capable of simultaneously capturing the three distinct effects. However, a simpler strategy will sometimes suffice. Let us think again about the definition of elasticities. If we hold income and the price of all other goods constant, the own price elasticity tells us the effect of changes in the price of a good that affect its real or relative price compared with other goods. Similarly, holding constant the prices of all goods, the income elasticity tells us the effect of changes in money income that affect its real purchasing power, the quantity of goods that it will purchase. The definitions of elasticities make sense not because they refer to nominal variables but because their 'other things equal' assumptions make nominal and real changes coincide. Own price and cross price elasticities tell us about the effects of changes in real or relative prices. Income elasticities tell us about the effects of changes in real income.

With this insight, we can see how to amend our analysis to handle economies that are experiencing inflation, where the nominal values of most prices and incomes are rising over time. We can see now why doubling all prices has no effect on demand: it affects neither real income nor relative prices. We can also see how it may be possible to examine data in a simple way without resorting to a full econometric analysis. If an economy is experiencing inflation, prices are certainly changing. We may be able to get round the 'other things equal' problem simply by measuring all nominal variables in real terms (for example, in 1975 prices). In Table 4-7 we examined the dramatic change in oil prices. In real terms, changes in incomes or other prices are small relative to the change in real oil prices, though nomical incomes and prices of other goods changed a lot in the 1970s. By working in real terms, we may increase the relevance of the 'other things equal' assumption to the point at which we can essentially explain changes in oil quantity demanded by looking only at real oil prices.

Similarly, in Table 4-9 we looked at the effect of real income on budget shares. We picked two commodities (food, and wines and spirits) whose real price had remained fairly constant over the 1970s. Again, by working in real terms we may make the 'other things equal' assumption sufficiently relevant that a simple examination of the relationship between two variables tells most of the story.

We can thus restate the central theme of our analysis of demand behaviour. *Price elasticities measure the response of quantity demanded to changes in the relative price of goods. Income elasticities measure the response of quantity demanded to changes in the real value or purchasing power of income.*

SUMMARY

1 Unless otherwise specified, the elasticity of demand refers to the own price elasticity of demand. It measures the sensitivity of quantity demanded to changes in the own price of a good, holding constant the prices of other goods and income. Demand elasticities are negative since demand curves slope down. In general, the demand elasticity changes as we move along a given demand curve. Along a straight line demand curve, elasticity falls as price falls.

2 Demand is elastic if the price elasticity is more negative than -1 (for example -2). Price cuts then increase total spending on the good. Demand is inelastic if the demand elasticity lies between -1 and 0. Price cuts then reduce total spending on the good. When demand is unit-elastic the demand elasticity is -1 and price changes have no effect on total spending on the good.

3 The demand elasticity depends on how long customers have to make adjustments to a price change. In the short run the substitution possibilities may be limited. Demand elasticities will typically rise (become more negative) with the length of time allowed for adjustment. The time required for complete adjustment will vary from good to good.

4 The cross price elasticity of demand measures the sensitivity of quantity demanded of one good to changes in the price of a related good. Positive cross-elasticities tend to imply that goods are substitutes. Negative cross-elasticities tend to imply that goods are complements.

5 The income elasticity of demand measures the sensitivity of quantity demanded to changes in income, holding constant the prices of all goods.

6 Inferior goods have negative income elasticities of demand. Higher incomes reduce the quantity demanded and the budget share of such goods. Luxury goods have income elasticities larger than 1. Higher incomes raise the quantity demanded and the budget share of such goods.

7 Goods that are not inferior are called normal goods and have positive income elasticities of demand. Goods that are not luxuries are called necessities and have income elasticities less than 1. All inferior goods are necessities, but normal goods are necessities only if they are not luxuries.

8 Doubling all nominal variables should have no effect on demand since it alters neither the real value (purchasing power) of incomes nor the relative prices of goods. In examining data from economies experiencing inflation it is often best to look at real prices and real incomes which measure prices and incomes adjusted for the rate of inflation.

KEY TERMS

Price elasticity of demand
Cross price elasticity of demand
Income elasticity of demand
Short-run and long-run adjustments
Budget shares
Luxuries and necessities
Normal and inferior goods
Elastic, inelastic, and unit-elastic demand
Substitutes and complements
Real prices and real incomes

PROBLEMS

1 You own a fruit stall, and have 100 baskets of strawberries that must be sold immediately, regardless of the price. Your supply curve of strawberries is vertical. From past experience in the fruit business you know that the demand curve for strawberries slopes down and that you can sell exactly 100 baskets if you charge £1 per basket. (*a*) Draw a supply and demand diagram showing market equilibrium. (*b*) You believe that the elasticity of demand for strawberries at £1 per basket is -0.5. You suddenly discover that 10 of your baskets are rotten and cannot be sold. Draw the new supply curve and show what happens to the equilibrium price of strawberries. What is the new equilibrium price?

2 Consider the following goods: (*a*) milk, dental services, beer; (*b*) chocolate, chickens, train journeys; (*c*) theatre trips, tennis clubs, films. For each of the three categories, state whether you expect demand to be elastic or inelastic. Then rank the elasticities within each category. Explain your answer.

3 Where along a straight line demand curve does consumer spending reach a maximum? Explain why. What use is this information to the owner of a football club?

4 The following table shows price and income elasticities for vegetables and catering services. For each good, explain whether it is a luxury or a necessity, and whether demand is elastic or inelastic.

	PRICE ELASTICITY	INCOME ELASTICITY
Vegetables	-0.17	0.87
Catering services	-2.61	1.64

5 In 1974 UK households spent £1.3 m on bread and cereals and in 1984 they spent £3.9 m on bread and cereals, yet bread is supposed to be an inferior good. How do you account for this?

6 (*Harder question.*) Suppose the price of oil falls. Think about the market for coal. How will the oil price fall affect the demand curve for coal (*a*) in the short run? (*b*) in the long run? What will happen to the price of each substitute for oil as a result of the fall in oil prices?

7 Common Fallacies Show why the following statements are incorrect: (*a*) Because cigarettes are a necessity the government can raise the tax on cigarettes (and hence cigarette prices) as much as it likes. Tax revenues from cigarettes will always increase when the tax rate is raised. (*b*) Farming is a risky business. Farmers should take out insurance against bad weather which could lead to a huge reduction in all their crops. (*c*) Higher levels of consumer income must be good news for producers.