2

Demand and Supply: The Basics

Introduction

The most basic, and in many ways the most lasting, lesson to be learnt from "Economics 101" relates to the fundamental concepts of demand and supply and their interaction. These are usually presented in a simple graphical format involving demand and supply "curves". The word is in quotes because in this chapter, for simplicity, we will actually assume only straight-line relationships between price and quantities demanded and supplied. The main issue that is important in reality is the *direction* of the relationship between prices and quantities. Will a reduction in price lead to an increase in the quantity demanded of any particular product or service? Will an increase in price lead to an increase in supply? And so on. The principal technical tools for analyzing demand and supply conditions in particular markets, then, are the demand and supply schedules or curves.

The **demand curve** shows an estimate or conjecture about the relationship between the price of any particular product or service and the quantity of that product that will be demanded by consumers. It is usually assumed to slope downward, in the general case, for most products and services. In other words, the lower the price of the item, the greater the quantity of it that will be demanded. Technically, this is because of a presumption of **diminishing marginal utility** (MU) for most individuals and most products. The more an individual has or consumes of any one item, the less valuable or desirable will any additional or "marginal" quantity seem to that individual. Therefore, the price to be paid for marginal quantities of the item will decline the greater the quantity already consumed. This underlying individualistic concept is also assumed to translate into a downward-sloping demand curve at the market level.

An additional fundamental assumption is that a price expressed in dollars (or yen, or Euros, or pounds) is indeed a meaningful concept in terms of what the dollars or yen will buy. Essentially, this means that when the price changes in the market we are analyzing, the prices of other goods and services, whether these are **complements** to, or **substitutes** for, the product under consideration, must be assumed to remain the same. Similarly, it means that over the relevant time horizon, the overall purchasing power of money remains predictable. Therefore, what the demand curve is supposed to illustrate is the conjectural relationship, as seen by the analyst or businessperson, between the price and the total quantity demanded of the given product, holding constant all the other factors that might be expected to affect demand. It represents a statement to the effect that if the price happens to be, say, "x dollars", then the analyst expects the quantity demanded to be "y units", assuming that all other relevant factors remain unchanged. Changes in any of the other factors that might affect demand, such as changes in total income, changes in the prices of other goods, or simply a change of taste or fashion, must then show up as horizontal shifts in the entire demand curve. This would be a shift to the right

in the case of a change in a factor that tends to increase demand, or to the left, for a change that tends to reduce demand.

As mentioned, the consumption decision is derived from conjectures about the underlying needs, wants, and desires of the individual consumer. It is sometimes called "effective demand" because we assume that the individual has sufficient income to make the purchase: that is, it is not simply a wish. Individuals are faced with a wide variety of goods and services in the marketplace. Assuming that the individual's income is finite (limited) then choices must be made. Individuals attempt to maximize the benefits, or **utility**, of their purchases, subject to the limited budget at their disposal. Logic suggests that individuals will attempt to maximize the utility of all their purchases, subject to the budget constraint. This occurs when the prospective additional utility from each purchase is equivalent. At this point there would then be no basis to reallocate purchases among competing goods and services.

The **supply curve**, meanwhile, is supposed to illustrate the relationship between price and the quantity supplied to the market by firms or entrepreneurs. *If* it has an upward slope, this will be due to the **diminishing marginal productivity** (MP) of the variable inputs to the productive process. If, say, more labor is employed in the productive process, progressively fewer additional units of output are forthcoming, prices will have to rise to cover the increase in production costs. However, note that whether or not this assumption (that the supply curve slopes upward) is true in any particular marketplace must depend on the actual characteristics of the production process. In some large-scale industries, for example, it is often argued that the opposite is true: that is, costs fall, or at least remain constant, as output increases. As with the demand curve, other types of changes in supply conditions (other than those relating to the scale of output) must show up as shifts in the curve. Examples would be changes in the prices of productive factors, such as increases or decreases in wages, or a technological change in the production process.

Market Price

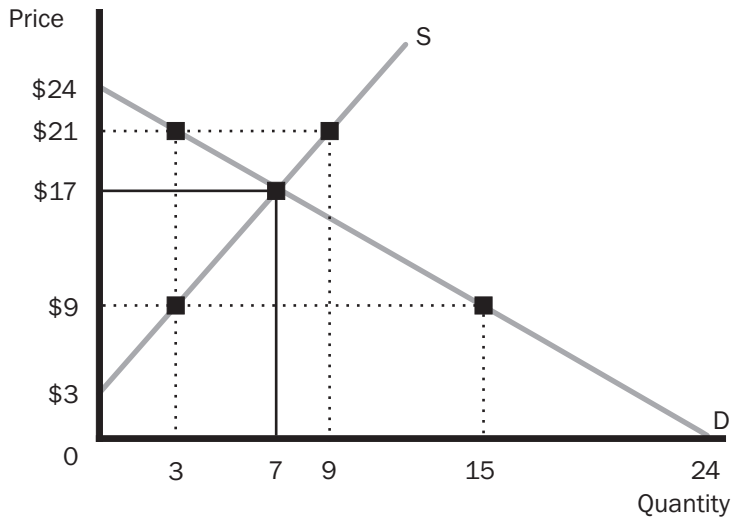
To illustrate the concept of **market price**, let us assume for concreteness that we have a demand curve and a supply curve, in a particular market, given by these numerical equations:

(2.1) $\mathbf{P = 24 - Q}$ (demand)

(2.2) $\mathbf{P = 3 + 2Q}$ (supply)

Here **P** stands for price (for example, in dollars), and **Q** for quantity (in whatever units are appropriate), over a given period of time. This "market" is then illustrated in Figure 2.1.

Figure 2.1: Market Price



We can tell from equations (2.1) and (2.2) that when the price is as high as $24, no one is prepared to buy any units of this particular item. As the price falls, they are prepared to buy successively more units. However, the demand is not infinite. Even when the price falls to zero, the maximum quantity demand is only 24 units. On the supply side, apparently it is not worth the while of firms to supply any units at all to the market until the price reaches at least $3. However, as the price rises beyond that level, they are prepared to supply more. For example, if the price *did* rise as high as $25, firms would be willing to supply a total of 11 units (but would not, in fact, be able to find any buyers at that price).

Turning now to the diagram in Figure 2.1, suppose that the price is momentarily as high as $21. The quantity demanded at this price is 3 units, and the quantity supplied is 9 units. In this situation of supply greater than demand, the usual presumption is that market prices will tend to fall, and that production will be cut back. The falling prices in turn will stimulate more demand. The adjustment process will continue until the market is in **"equilibrium"**. At this point demand and supply will be equal, an **equilibrium price** will be established, and neither the demanders nor suppliers will have any further incentive to change their behavior. There is no reason the situation should not then remain the same, with the same price ruling and the same quantities produced and consumed, period after period, until

there is some definite change in the prevailing market conditions. It can easily be seen that in our example the equilibrium price is \$17, and the equilibrium quantity is 7 units. Now, suppose that the price in the market momentarily goes as low as \$9. In this situation, there will be a larger quantity demanded (15 units) than is supplied (3 units). Now the argument is that prices will tend to be bid upward in the marketplace, and that consequently supply will increase. At the same time, the higher prices will tend to reduce demand. Again, the adjustment will be complete when the equilibrium market price and quantity are reached.

The basic conclusion suggested about the workings of demand and supply, therefore, is that if ever prices are "too high" or "too low", the tendency of market forces is to cause an adjustment in one direction or the other, and to re-establish a market equilibrium of price and quantities supplied and consumed. Of course, some markets "clear" faster than others. A sophisticated stock exchange will clear in seconds, while the market for a large recreational property could take months, or even years, to clear.

Once this tendency to market equilibrium is established, the other main purpose of demand and supply analysis is to provide some qualitative results about likely *changes* in market price and quantity when market conditions change. For example, what will happen if the incomes of buyers in the marketplace increase?

For these purposes it is sometimes useful to distinguish between changes in quantity demanded (or supplied) along the curve, due to changes in price, and "changes in demand" (or supply) shown by shifts of the curve, and due to other factors. See Figures 2.2 and 2.3.

Figure 2.2: Movements Along a Demand Curve Due to Price Changes Versus Shifts of the Curve

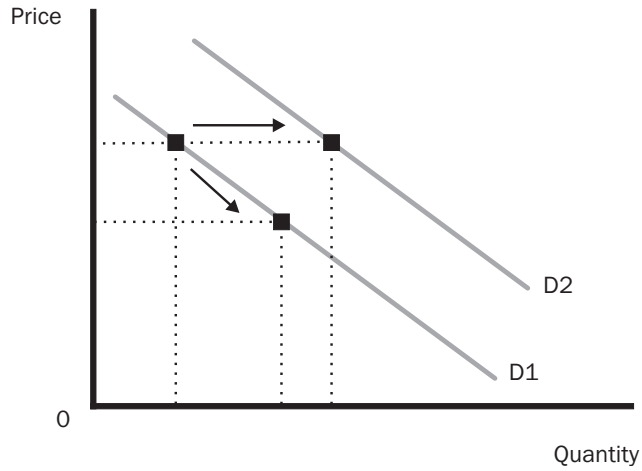
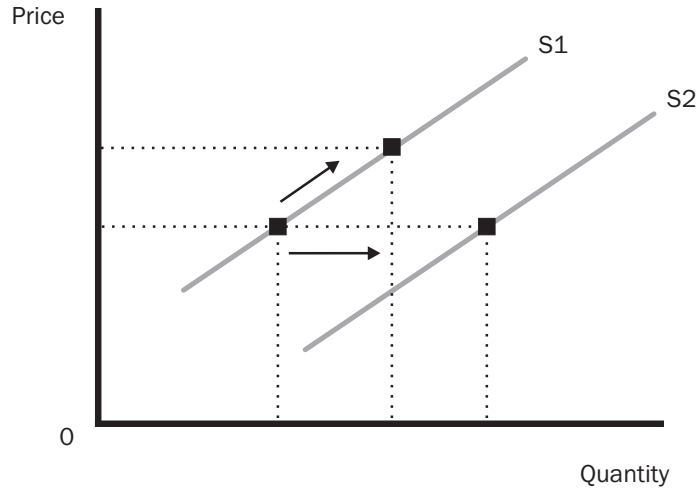


Figure 2.3: Movements Along a Supply Curve Due to Price Changes Versus Shifts of the Curve

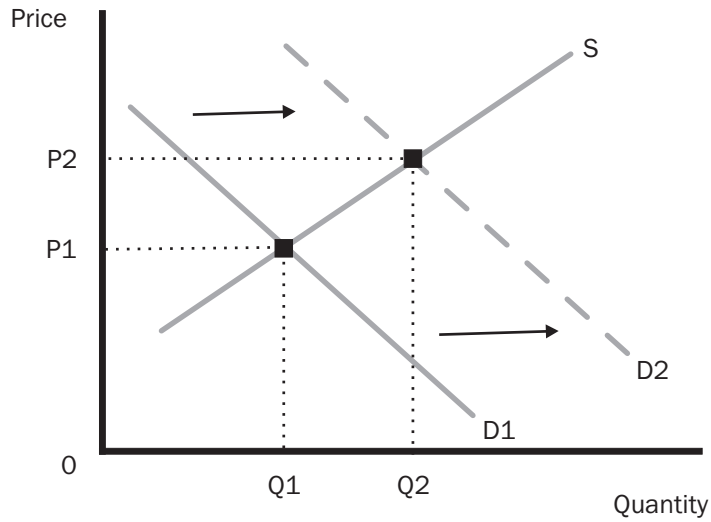


We illustrate these ideas below with three possible examples of demand or supply shifts, two of which are assumed to occur on the demand side and one on the supply side

Changes in Market Conditions

The first case to be looked at is the one originally mentioned above. Suppose that there is an increase in the incomes of the consumers in this market. If the product concerned is a so-called **normal good**, the presumption would be that the demand for this item at each price will increase. In other words, the demand curve will shift out and to the right. This is illustrated in Figure 2.4. As can be seen, the impact of the increase in demand is an increase in both the market price and in the quantity produced and sold. The price will increase from P1 to P2, and the quantity from Q1 to Q2. At the original price P1, the increase in demand initially sets up a situation of **excess demand** (demand greater than supply), and this will lead to an adjustment to the new equilibrium along the lines discussed above. Once the adjustment has been made, the presumption again is that the new higher equilibrium prices and quantities will prevail for some time, until there is another change in market conditions. One of the major purposes of marketing is actually to do just this, to shift the demand curve outward and to the right.

Figure 2.4: The Effect of an Increase in Income



Now consider a change in conditions on the supply side of the market. For example, think of a technological change that improves productivity *at each level of output*. This will tend to shift the supply curve out and to the right, as illustrated in Figure 2.5. As the costs are lower at each level of output, the prices that must be charged to cover those costs can also be lower. The result of the technological innovation in production is to lower the market price of the product, and to increase the quantity produced and sold. The equilibrium price falls from P1 to P2, and the quantity increases from Q1 to Q2. The so-called "Moore's Law" of computing power is a good example of this process. Ever since microcomputers were introduced in the 1980s, and up to the time of writing, there has been a continual increase in computing power, and a continual decline in the real price of computers.

As a third example of a change in market conditions, suppose that the product we are dealing with has been around a long time, and comes to be perceived as old fashioned or out-of-date. This need not even be for any genuine reason of obsolescence, but just due to a change of tastes or fashion. This is shown in Figure 2.6. We imagine the demand curve shifting back and to the left as the product becomes less and less popular. The market price falls from P1 to P2, and the quantity also falls from Q2 to Q1. In this case, business strategy asks the question, "Can we revitalize the brand, or must we exit the business?"

Figure 2.5: An Improvement in Technology

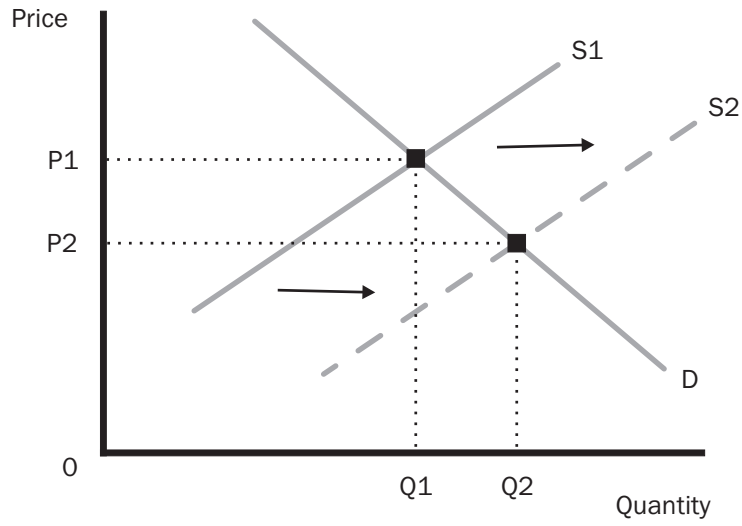
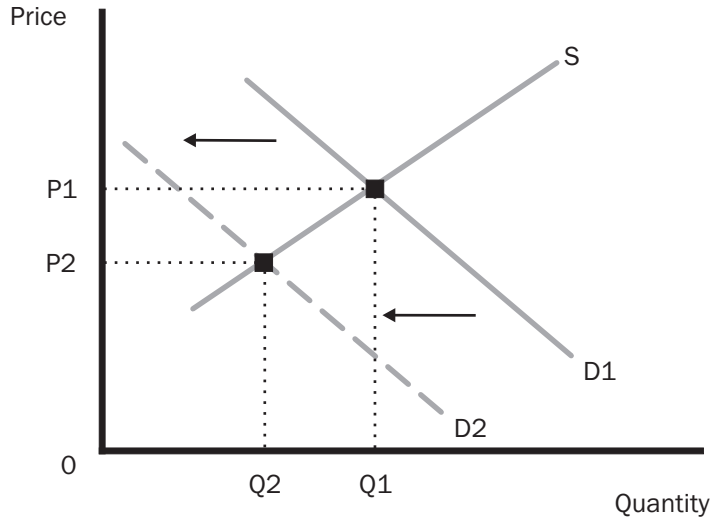


Figure 2.6: A Change in "Fashion"



From the three examples above it is clear that the demand/supply apparatus can be used to predict at least the general direction of the likely change in prices and quantities when market conditions change. The reader will be able to think of many more examples. What happens, for instance, when the price of some other product, that is a close substitute for the item we are interested in, either falls or rises?

The Concept of Elasticity

Perhaps one of the most useful concepts in demand and supply analysis, certainly from the point of view of a person interested in business strategy, is that of **elasticity**. For example, the **price elasticity of demand** for a particular product predicts the percentage change in quantity demand for a given percentage change in price. This is a key empirical aspect of demand conditions from the strategic point of view. It makes an estimate of how much (and in what direction) revenue will change when prices are changed. Admittedly, this is not the be-all and end-all of business decision-making. In the first place, an increase in revenue does not necessarily mean an increase in profits (and vice versa), as costs may change as well. Second, the information is of more use to a firm that controls a large share of the market than one that has many competitors. (On both of these points, see the discussion in Chapter 4.) Nonetheless, it is an important starting point for such decision-making. There is also an analogous concept on the supply side, known as the **elasticity of supply**. This would predict the percentage change in quantity supplied for a given change in price. In fact, the concept of elasticity can be generalized still further. The **income elasticity of demand**, for example, would predict the percentage change in demand for a given percentage change in income, and the **cross elasticity of demand** indicates the percentage change in demand for a given item resulting from the percentage change in price of some other item, either a complement or substitute. And so on.

The mathematical formula for the price elasticity of demand is as follows:

$$\eta = -\frac{\Delta \mathbf{Q}/\mathbf{Q}}{\Delta \mathbf{P}/\mathbf{P}} \tag{2.3}$$

where η is the traditional symbol for elasticity, $\Delta\mathbf{Q}/\mathbf{Q}$ is the percentage change in quantity demanded (the symbol Δ means "change in"), and $\Delta\mathbf{P}/\mathbf{P}$ is the percentage change in price. There is a minus sign in the formula because the demand curve itself is downward sloping; therefore, multiplying through by a negative will yield a positive number for elasticity itself. Note that if we rearrange equation (2.3) slightly, it can also be written as:

$$\eta = -\left[\frac{\Delta Q}{\Delta P}\right]\left[\frac{P}{Q}\right] \tag{2.4}$$

Now, suppose that we have a demand equation of the form:

$$P = 10 - 0.5Q \tag{2.5}$$

And, turning this around to express **Q** as a function of **P**, rather than vice versa:

$$Q = 20 - 2P \tag{2.6}$$

From equation (2.6) it can be seen that $\Delta Q/\Delta P$ (which is the same thing as the slope of this line) will have a value of **–2**. We can then use this information to construct a numerical example of how elasticity will change along a straight-line demand curve, such as the one in equations (2.5) and (2.6).

The interesting point to notice about Table 2.1 is that even along a straight-line demand curve, elasticity will change depending on the existing combinations of prices and quantities. If prices are relatively high and the quantities demanded are therefore relatively low, we are likely to be in the "elastic" range of demand (with an elasticity of demand greater than one). In this range, a cut in prices will bring about an increase in revenue because quantity demanded increases proportionately more. On the other hand, if the existing situation is that prices are already relatively low and the quantities demand already relatively high, this would be an "inelastic" segment of the demand curve (with elasticity less than one). A further price cut will not be effective in increasing revenue. In fact, the opposite is

Table 2.1: Elasticity Example

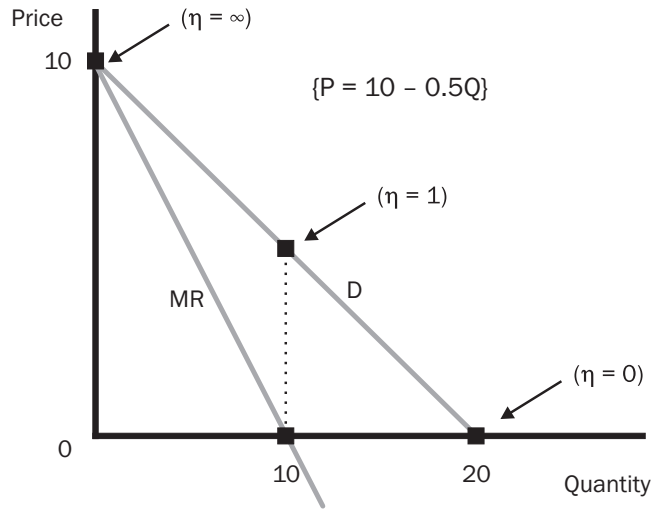
$$\eta = -\left[\frac{\Delta Q}{\Delta P}\right]\left[\frac{P}{Q}\right]$$

P	Q	$\Delta Q/\Delta P$	η
10	0	–2	∞
7	6	–2	2.33
5	10	–2	1
2	16	–2	0.25
0	20	–2	0

true. In this range, a price hike will actually bring in more revenue as the higher price more than offsets the fall in demand.

These ideas are further illustrated in Figure 2.7, which shows the simple straight-line demand curve from equation (2.5) and the associated **marginal revenue** (MR) curve. As can be seen, when prices are at their maximum (and nothing is sold at all), the elasticity of demand is actually infinite. In this case, it is obviously a good idea to cut prices. Then, there is a range with elastic demand ($\eta > 1$) and similarly an inelastic range ($0 < \eta < 1$), at the lower price levels. Between these two ranges, there is one point on the demand curve where elasticity is exactly equal to one. (This would be called **unit elasticity**.) Finally, when the price falls to zero the elasticity of demand also falls to zero. Note that at the exact point where the demand curve is unit elastic, marginal revenue (MR) is zero. This immediately tells us the significance of the MR curve. Roughly speaking, marginal revenue is the *additional* sales revenue that is to be expected when an additional unit of the item is sold. Therefore, it is positive when demand is elastic, and negative when demand is inelastic (as can be seen). When elasticity is equal to unity, marginal revenue must be exactly zero (MR = 0). Marginal revenue is explained in more detail in Chapter 5.

Figure 2.7: Elasticity along a Straight-Line Demand Curve



Working with Demand Elasticity

The following examples will give some more insight into the usefulness of the concept of demand elasticity from the point of view of business decision-making. In Figure 2.8 we suggest a case in which the demand curve is simply a vertical line at some given quantity. The demand curve here is **perfectly inelastic**, which means that the consumers always want to buy exactly the same amount regardless of price. It is obviously tempting to think of this product as some sort of (at least mildly) addictive substance. Clearly, there is no point in ever cutting prices in this market. If the price is cut from P1 to P2, the quantity demanded does not increase. All that happens is that an amount of revenue is lost equal to the shaded area in the diagram. To the contrary, if the demand for this product really is perfectly inelastic, prices could be raised by any amount, and the consumers will still pay, thereby increasing revenue.

Figure 2.9, meanwhile, shows the usual type of straight-line demand curve in its elastic range. In this case, as suggested, a price cut will indeed bring in more revenue. If the price falls from P1 to P2, the quantity demanded will increase from Q1 to Q2. It is true that some revenue is lost, as a result of the lower price on the first Q1 units sold (the solid shaded area in the diagram), but this is more than offset by the gain in revenue from all of the new sales (the striped shaded area in the diagram).

Figure 2.8: A Price Cut Causes a Loss in Revenue

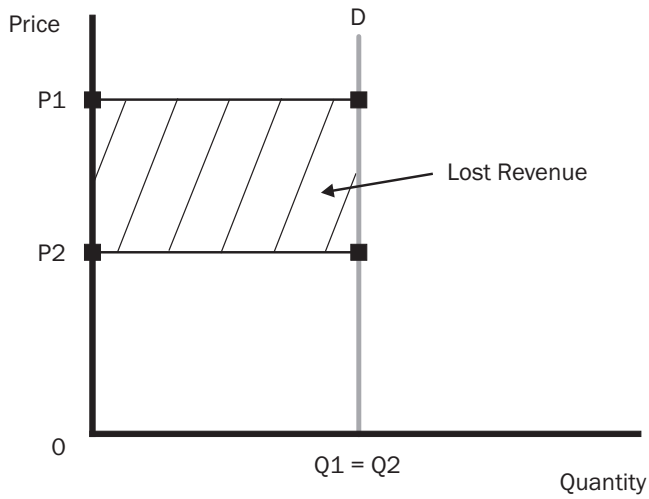


Figure 2.9: A Price Cut Brings in More Revenue

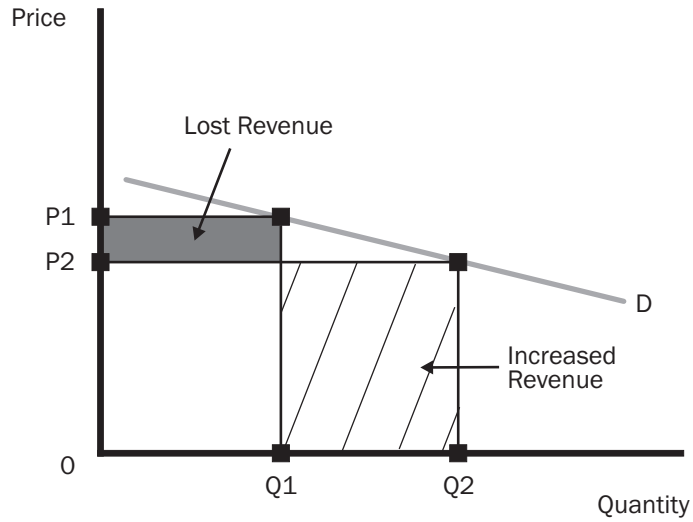


Fig 2.10: A Demand Curve with Unit Elasticity throughout its Length

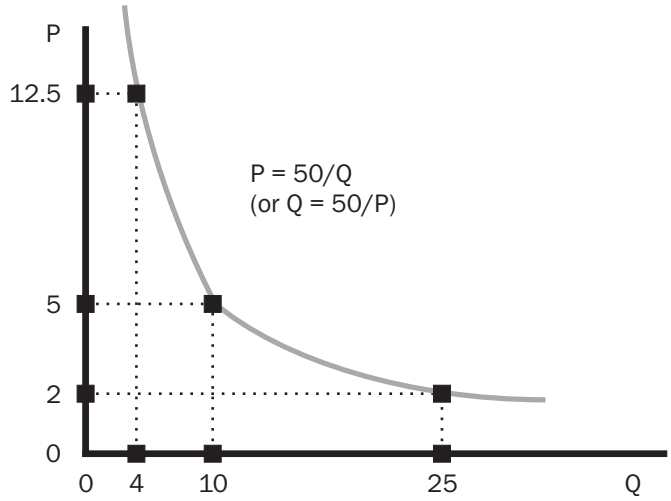


Figure 2.10 departs, for once, from the simplifying assumption that demand curves are roughly linear, and shows a curvilinear example of a demand curve given by the equation **P = 50/Q**. This is, in fact, a geometric form known as a **rectangular hyperbola**, and it has the special property that the price elasticity of demand is equal to one (unit elastic) throughout it's length. In this special case, revenue never changes — it is always equal to $50 regardless of the price charged because the quantity demand changes in the same proportion. Marginal revenue is zero.

Working with Supply Elasticity

As mentioned, the elasticity of supply is an analogous concept to that of the elasticity of demand, and we demonstrate the significance of supply elasticity with a few examples. In Figure 2.11, for example, we reprise a standard textbook discussion of supply conditions. This deals with the market for rental housing units in a particular location or city, in the "short run". The point of this diagram is that in the short run, the supply of rental units in a given location must be very nearly perfectly inelastic (that is, the supply curve will be a vertical line). It takes time to build new apartment buildings, or even to convert existing buildings for residential use. Therefore, if there is noticeable increase in demand, shown in the diagram by a shift of the demand curve out and to the right, in a free market the immediate impact is entirely on prices. Rents will be increased from P1 to P2.

However, over a somewhat longer period of time, in the so-called "long run", supply will be considerably more elastic, as there will then be enough time to convert existing properties, put up new apartment buildings, and so on. This is illustrated by the flatter supply curve in Figure 2.12. Therefore, if the increase in demand is sustained over a period of time, the final result will be a more modest increase in rents, and a greater supply of rental apartments to the market, assuming government land use policies are supportive of new property development.

Economists point to the sequence of events described in Figures 2.11 and 2.12 as a prime example of the role of the price mechanism in optimally allocating resources. There is a greater need for apartments (as shown by the increase in demand), and initially there is a large rise in price reflecting this change. However, precisely as a result of the incentives provided by the higher prices, more rental units are built and more of society's resources are devoted to rental housing. The final result is that more apartments are provided to satisfy the greater need, and the prices themselves return to more reasonable levels. So everything works out according to plan, at least in this example (with supportive institutional structures,

Figure 2.11: An Increase in the Demand for Rental Housing in the Short Run

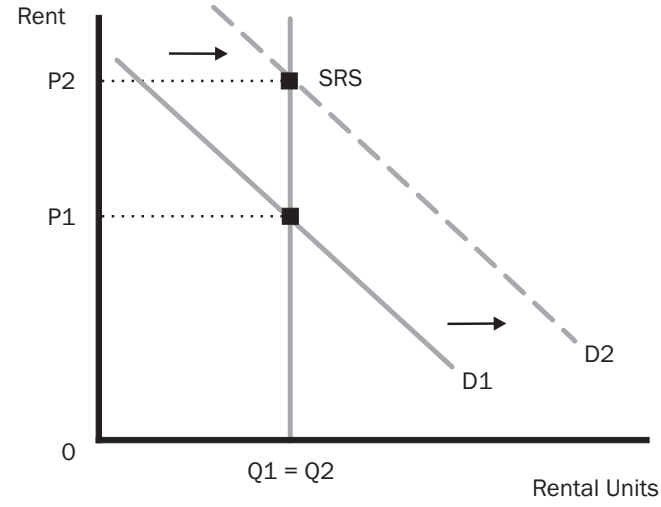
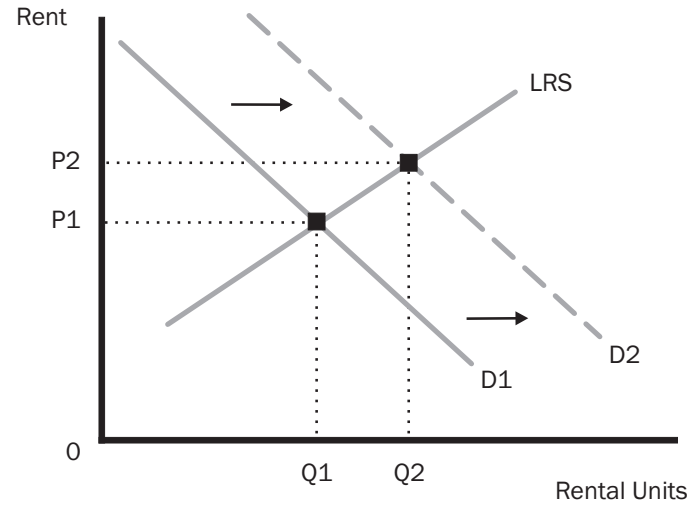


Figure 2.12: An Increase in the Demand for Rental Housing in the Long Run



Case Study 3

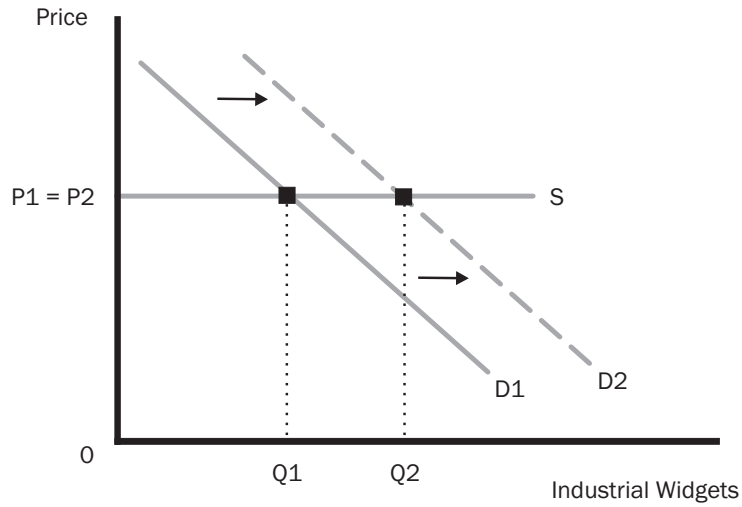
"An Aging Population and the Death of Brands"
New York; September 23, 2040

It was a marketer's dream: an aging population with an unprecedented level of wealth. The strategy was simple. Create a wide array of branded products for the "graying" population in the developed countries. Advertising campaigns routinely employed "nostalgia" celebrities to appeal to wealthy retirees. However, the myth of brands was confronted by the reality of longevity. More and more people are living well over 100 years of age. The appeal of brands, with their higher prices, was more than outweighed by concerns about whether retirees would have sufficient income to last beyond 100 years of age. Susan Wright, the president of the luxury goods manufacturer, Gukki corporation, believes that demand has become much more price elastic as the population ages, "People are just more price sensitive than we ever expected."

regulations and capital markets). The *absence* of these mechanisms may explain the high rental prices we see in many big cities, such as London.

Finally, we consider the case of a market with a **perfectly elastic** supply curve, as shown in Figure 2.13. As suggested earlier this might arise, for example, in some large-scale industry with mass production, in which costs per unit are essentially constant over a wide range of output. Hence, there is no need for prices to rise to cover costs when output rises. The result of

Figure 2.13: An Increase in the Demand for Industrial Products



an increase in demand in this case would be simply more resources devoted to the desired product, with no actual increase in price.

Other Applications of the Concept of Elasticity

As mentioned, in addition to the price elasticities of demand and supply, there are some other applications of the concept of elasticity that might be useful to the businessperson. If the symbol **Y** stands for the income of the relevant consumer group, for example, then the formula for the income elasticity of demand is given by:

$$\eta_Y = (\Delta Q/Q)/(\Delta Y/Y) \tag{2.7}$$

The income elasticity of demand is the percentage change in demand resulting from a given percentage change in income. If $0 < \eta_Y < 1$ (the elasticity is greater than zero but less than one), the item concerned is a **normal good**. An increase in income will cause an increase in the demand

Case Study 4

"Transit in Trouble"
Boston; October 15, 2020

The entire Boston transit system is bankrupt. The government is uncertain as to whether or not the system can be saved, or if it must be shut down in its entirety. Professor Lau, of Harvard University, indicated that the demise of transit is a result of every possible elasticity working against the system. Price elasticity, income elasticity, and the cross elasticity of substitution have all conspired to impact negatively on the Boston transit system. Incomes have risen dramatically in the past 10 years. As a result, commuters prefer to use their own vehicles. The cost of personal transport has fallen dramatically, and vehicles have become more environmentally friendly. As the system lost ridership, it was forced to raise fares to pay for systems operations. One problem with the fare increases was that relatively less well-off consumers, who relied more heavily on the transit system, were increasingly unable to afford riding the system on a regular basis.

for the good, but not by so much as the increase in income ("normal" because this is what is expected to happen in most cases). If $\eta_Y < 0$, the good concerned would be an **inferior good**. When income increases people buy less of it or don't buy it all. A person with a low income, for example, might have a demand for rental accommodation in a basement apartment,

but one with a higher income will buy a condo or a detached house. If η_Y **> 1**, this is a **superior good**. The demand for this type of product actually increases with income. Wealthy people might serve caviar rather than potato chips at a party, for instance.

For two goods **1** and **2**, the formula for the cross price elasticity of demand, meanwhile, is:

$$\eta_X = [\Delta Q1/Q1]/[\Delta P2/P2] \tag{2.8}$$

If η_x **< 0**, the goods are complements. If the price of butter goes up, the demand for bread goes down. If η_x **< 0**, the goods are substitutes. A rise in the price of coffee causes an increase in the demand for tea.

Chapter Summary

- The market price is determined by the interaction of supply and demand.
- An equilibrium price and quantity is determined in the marketplace through the interaction of buyers and sellers.
- Elasticity describes the relationship between a dependent variable (such as quantity demanded) and an independent variable (such as the price of the product, the price of substitutes, or income).
- Businesspeople need to know the relevant elasticity for their goods or services. What if, say, income increases by 10%? Will the demand for my product increase by more, the same, or a smaller percentage than 10%?

Problems

1. Suppose you are in charge of a toll bridge that costs essentially nothing to operate. The demand for bridge crossings, Q, is given by $P = 15 - 0.5Q$.
   (a) Draw the demand curve for bridge crossings.
   (b) How many people would cross the bridge if there were no tolls?
   (c) What is the revenue associated with a bridge toll of $5?
   (d) Consider an increase in the toll to $7. At this new higher price, how many people would cross the bridge? Would the toll bridge revenue increase or decrease? What does your answer tell you about the elasticity of demand?

2. If both the supply and demand curves shift right, we know the direction of the change in quantity, but not the direction of the price change. If supply shifts right but demand shifts left, we cannot know the direction of either the price or quantity change. Explain why you agree or disagree with these statements.

3. It is generally accepted that the demand for food is relatively price inelastic. If a severe drought reduces production by half, can you determine the effect on farm revenue? If not, what other factors would determine farm revenue?

4. Which of the following events would cause a movement along the demand curve for European-produced clothing, and which would cause a shift in the demand curve?
   (a) Higher costs for producing clothing outside Europe, passed on to consumers in the form of higher prices
   (b) An increase in the income of European consumers
   (c) A reduction in costs in the European clothing industry

5. You have been asked to analyze the world market for wheat. You have estimated the following supply and demand curves:

   $$Qs = 440 + 165P$$
   $$Qd = 1600 - 12P$$

   (a) Calculate the equilibrium price and quantity.
   (b) Calculate the price elasticity of supply and demand at equilibrium.

6. What factors might make demand more elastic?

7. Assume the price of gasoline in 2004 was on the average $1.35 a gallon and 15 million gallons a day were sold. In 2005, the price on the average was $2.15 a gallon and 14 million gallons were sold. Assuming further that the demand for gasoline did not shift between the two years, use the midpoints of these figures to calculate the price elasticity of demand and indicate whether demand was elastic or inelastic.

Case Study Questions

The Comeback of Caterpillar

Demand

1. Global demand grew by 4.5% in the 1990s. How does this impact forecasts for future demand?
2. Growth in demand was fastest in developing nations. Discuss the implications.
3. Why is the distinction between original equipment and replacement parts important?
4. Why are marketing, distribution, and service so important for this industry?
5. Why was product diversification an important component of Caterpillar's strategy?

Hint: Caterpillar's market has evolved over time. From a focus on the American market, Caterpillar expanded to Canada and Europe. As well, Caterpillar's dominant market position was eroded. Caterpillar has responded by penetrating new markets expanding its marketing efforts, and diversifying the product line.

Supply

1. Discuss the contribution of each of the following elements in the heavy construction equipment industry supply curve:
   - Labor
   - Financial capital
   - Physical capital
   - Technology
2. What is the role of outsourcing in the supply function?

Hint: The case indicates that "Traditionally, Caterpillar functioned as a vertically integrated company that relied heavily on in-

Case Study Questions Continued

house production." Outsourcing, the use of suppliers, can allow a firm to become more productive by focusing on its core competencies.

Elasticity

1. Is the demand for the heavy construction equipment industry elastic or inelastic?
2. Did the entry of Komatsu make the industry demand curve more or less elastic?
3. Did the entry of Komatsu make the industry supply curve more or less elastic?

Hint: The purchase of heavy construction equipment represents a major expenditure. Purchases can be postponed for a time, but equipment must be purchased eventually. The addition of Komatsu alters the industry dynamic. Customers have more choice and the potential for greater negotiating power over price.

Appendix 2.1

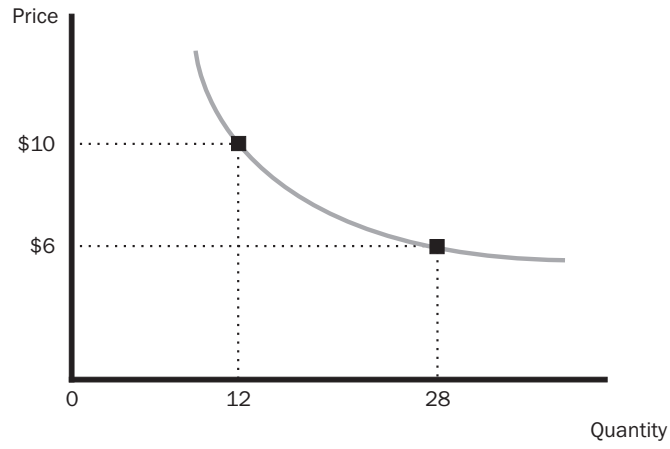
Another Method for Calculating Elasticity

Here is another method for calculating price elasticity of demand, in the case where the demand "curve" actually is a curve, and not a convenient straight line.

In Figure 2A.1 we see that if the prices for this particular product drops from \$10 to \$6, the quantity demanded will increase from 12 to 28. Now remember the elasticity formula:

$$\eta = (-)(\Delta Q/Q)/(\Delta P/P) \quad (2A.1)$$

Figure 2A.1: Elasticity Calculation using Midpoints



We know that $\Delta\mathbf{P}$ (the change in price) is –4, and that $\Delta\mathbf{Q}$ (the change in quantity) is 16. However, what values should be used for the terms **P** and **Q** in equation 2A.1? There are two values each of prices and quantity: the starting point and the end point in both cases. The simplest answer is to use the midpoints of the price and quantity ranges. That is:

(2A.2) **P = 8** (midpoint between 10 and 6)

and also:

(2A.3) **Q = 20** (midpoint between 12 and 28)

Now use these values in the elasticity formula. The result is:

(2A.4) η **= (–)(16/20)/(–4/8) = 1.6**

So, the price elasticity of demand is 1.6 over these prices and quantities, which is in the "elastic" range.