

CHAPTER 2

Supply and Demand

Supply and demand are the most fundamental tools of economic analysis. Most applications of economic reasoning involve supply and demand in one form or another. When prices for home heating oil rise in the winter, usually it is because the weather is colder than normal and, thus, demand is higher than usual. Similarly, a break in an oil pipeline creates a short-lived gasoline shortage, as occurred in the Midwest in the year 2000. The price of DRAM, or dynamic random access memory, used in personal computers falls when new manufacturing facilities begin production, increasing the supply of memory.

This chapter sets out the basics of supply and demand, introduces equilibrium analysis, and considers some of the factors that influence supply and demand. Dynamics are not considered, however, until Chapter 4, which focuses on production; and Chapter 5 introduces a more fundamental analysis of demand, including a variety of topics such as risk. In essence, this is the economics “quickstart” guide to demand and supply, and we will look more deeply at these issues in the subsequent chapters.

1. DEMAND AND CONSUMER SURPLUS

LEARNING OBJECTIVES

1. What is demand?
2. What is the value to buyers of their purchases?
3. What assumptions are commonly made about demand?
4. What causes demand to rise or fall?
5. What is a good you buy only because you are poor?
6. What are goods called that are consumed together?
7. How does the price of one good influence demand for other goods?

Eating a French fry makes most people a little bit happier, and most people are willing to give up something of value—a small amount of money or a little bit of time—to eat one. The personal value of the French fry is measured by what one is willing to give up to eat it. That value, expressed in dollars, is the willingness to pay for French fries. So, if you are willing to give up three cents for a single French fry, your willingness to pay is three cents. If you pay a penny for the French fry, you’ve obtained a *net* of two cents in value. Those two cents—the difference between your willingness to pay and the amount you pay—is known as **consumer surplus**. Consumer surplus is the value of consuming a good, minus the price paid.

The value of items—like French fries, eyeglasses, or violins—is not necessarily close to what one must pay for them. For people with bad vision, eyeglasses might be worth ten thousand dollars or more in the sense that, people would be willing to pay this amount or more to wear them. Since one doesn’t have to pay nearly this much for eyeglasses means that the consumer surplus derived from eyeglasses is enormous. Similarly, an order of French fries might be worth \$3 to a consumer, but since they are available for \$1, the consumer obtains a surplus of \$2 from purchase.

How much is a second order of French fries worth? For most of us, the first order is worth more than the second one. If a second order is worth \$2, we would still gain from buying it. Eating a third order of fries is worth less still, and at some point we’re unable or unwilling to eat any more fries even when they are free, that implies that the value of additional French fries becomes zero eventually.

We will measure consumption generally as units per period of time; e.g., French fries consumed per month.

Consumer surplus

The value of consuming a good, minus the price paid.

Diminishing marginal value

Condition in which the value of the last unit declines as the number consumed rises.

Many, but not all, goods have this feature of **diminishing marginal value**—the value of the last unit declines as the number consumed rises. If we consume a quantity q , that implies the marginal value denoted by $v(q)$ falls as the number of units rises.^[1] An example is illustrated in Figure 1.1, where the value is a straight line, declining in the number of units.

Demand needn't be a straight line, and indeed could be any downward-sloping curve. Contrary to the usual convention, the quantity demanded for any price is represented by the vertical axis whereas the price is plotted along the horizontal.

It is often important to distinguish the *demand curve*—the relationship between price and quantity demanded—from the *quantity demanded*. Typically, “demand” refers to the curve, while “quantity demanded” is a point on the curve.

For a price p , a consumer will buy units q such that $v(q) > p$ since those units are worth more than they cost. Similarly, a consumer would not buy units for which $v(q) < p$. Thus, the quantity q_0 that solves the equation $v(q_0) = p$ indicates the quantity the consumer will buy. This value is illustrated in Figure 1.1.^[2] Another way of expressing this insight is that the marginal value curve is the inverse of the demand function, where the demand function gives the quantity purchased at a given price. Formally, if $x(p)$ is the quantity a consumer buys at price p , then $v(x(p)) = p$.

But what is the marginal value curve? Suppose the total value of consumption is $u(q)$. A consumer who pays $u(q)$ for the quantity q is indifferent to receiving nothing and paying nothing. For each quantity, there should exist one and only one price that makes the consumer indifferent between purchasing and receiving nothing. If the consumer is just willing to pay $u(q)$, any additional amount exceeds what the consumer should be willing to pay.

The consumer facing price p receives consumer surplus of $CS = u(q) - pq$. In order to obtain the maximal benefit, the consumer chooses q to maximize $u(q) - pq$. When the function CS is maximized, its derivative is zero. This implies that the quantity maximizing the consumer surplus must satisfy,

$$0 = \frac{d}{dq}(u(q) - pq) = u'(q) - p.$$

Thus, $v(q) = u'(q)$; implying that the marginal value is the derivative of the total value.

Consumer surplus is the value of the consumption minus the amount paid, and it represents the net value of the purchase to the consumer. Formally, it is $u(q) - pq$. A graph of consumer surplus is generated by the following identity.

$$CS = \max_q (u(q) - pq) = u(q_0) - pq_0 = \int_0^{q_0} (u'(x) - p) dx = \int_0^{q_0} (v(x) - p) dx$$

This expression shows that consumer surplus can be represented as the area below the demand curve and above the price, as illustrated in Figure 1.2. The consumer surplus represents the consumer's gains from trade, the value of consumption to the consumer net of the price paid.

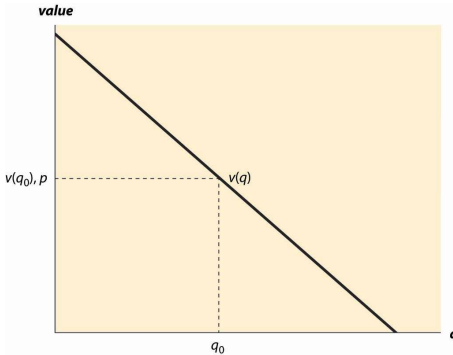
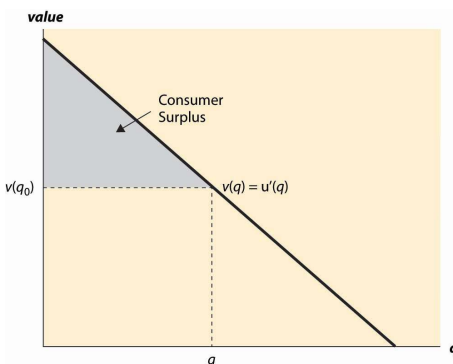
The consumer surplus can also be expressed using the demand curve, by integrating from the price up to where the demand curve intersects with the price axis. In this

$$CS = \int_p^\infty x(y) dy$$

case, if $x(p)$ is demand, we have

When you buy your first car, you experience an increase in demand for gasoline because gasoline is pretty useful for cars and not so much for other things. An imminent hurricane increases the demand for plywood (to protect windows), batteries, candles, and bottled water. An increase in demand is represented by a movement of the entire curve to the northeast (up and to the right), which represents an increase in the marginal value v (movement up) for any given unit, or an increase in the number of units demanded for any given price (movement to the right). Figure 1.3 illustrates a shift in demand.

Similarly, the reverse movement represents a decrease in demand. The beauty of the connection between demand and marginal value is that an increase in demand could, in principle, have meant either more units demanded at a given price or a higher willingness to pay for each unit, but those are in fact the same concept. Both changes create a movement up and to the right.

FIGURE 1.1 The demand curve**FIGURE 1.2 Consumer surplus**

For many goods, an increase in income increases the demand for the good. Porsche automobiles, yachts, and Beverly Hills homes are mostly purchased by people with high incomes. Few billionaires ride the bus. Economists aptly named goods whose demand doesn't increase with income **inferior goods**, with the idea that people substitute to better quality, more expensive goods as their incomes rise. When demand for a good increases with income, the good is called a **normal good**. It would have been better to call such goods superior, but it is too late to change such a widely accepted convention.

Another factor that influences demand is the price of related goods. The dramatic fall in the price of computers over the past 20 years has significantly increased the demand for printers, monitors, and Internet access. Such goods are examples of **complements**. Formally, for a given good x , a complement is a good whose consumption increases the value of x . Thus, the use of computers increases the value of peripheral devices like printers and monitors. The consumption of coffee increases the demand for cream for many people. Spaghetti and tomato sauce, national parks and hiking boots, air travel and hotel rooms, tables and chairs, movies and popcorn, bathing suits and sunscreen, candy and dentistry—all are examples of complements for most people. Consumption of one increases the value of the other. The complementarity relationship is typically symmetric—if consumption of x increases the value of y , then consumption of y must increase the value of x .^[3] From this we can predict that if the price of good Y decreases, then the amount good Y, a complementary good to X, will decline. Why you may ask? The reason is that consumers will purchase more of good X, when its price decreases. This will make good Y more valuable, and hence consumers will also purchase more of good Y as a result.

The opposite case of a complement is a **substitute**. For a given good x , a substitute is a good whose consumption decreases the value of x . Colas and root beer are substitutes, and a fall in the price of root beer (resulting in an increase in the consumption of root beer) will tend to decrease the demand for colas. Pasta and ramen, computers and typewriters, movies (in theaters) and sporting events, restaurants and dining at home, spring break in Florida versus spring break in Mexico, marijuana and beer, economics courses and psychology courses, driving and bicycling—these are all examples of substitutes for most people. An increase in the price of a substitute increases the demand for a good; and, conversely, a decrease in the price of a substitute decreases demand for a good. Thus, increased enforcement of the drug laws, which tends to increase the price of marijuana, leads to an increase in the demand for beer.

Much of demand is merely idiosyncratic to the individual—some people like plaids, some like solid colors. People like what they like. People often are influenced by others—tattoos are increasingly common, not because the price has fallen but because of an increased acceptance of body art. Popular clothing styles change, not because of income and prices but for other reasons. While there has been a modest attempt to link clothing style popularity to economic factors,^[4] by and large there is no coherent theory determining fads and fashions beyond the observation that change is inevitable. As a result, this course, and economics generally, will accept preferences for what they are without questioning why people like what they like. While it may be interesting to understand the increasing social acceptance of tattoos, it is beyond the scope of this text; and indeed beyond most, but not all, economic analyses. We will, however, account for some of the effects of the increasing acceptance of tattoos through changes in the number of parlors offering tattooing, changes in the variety of products offered, and so on.

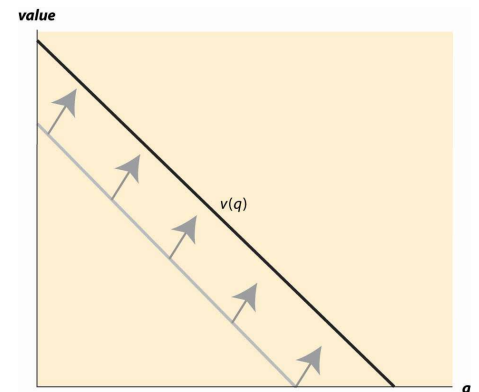
Inferior good

Goods whose demand doesn't increase with income.

Normal good

Goods whose demand increases with income.

FIGURE 1.3 An increase in demand



Complement

For a given good x , a good whose consumption increases the value of x .

Substitute

For a given good x , a good whose consumption decreases the value of x .

KEY TAKEAWAYS

- **Demand** is the function that gives the number of units purchased as a function of the price.
- The difference between your willingness to pay and the amount you pay is known as **consumer surplus**. Consumer surplus is the value in dollars of a good minus the price paid.
- Many, but not all, goods have the feature of **diminishing marginal value**—the value of the last unit consumed declines as the number consumed rises.
- Demand is usually graphed with price on the vertical axis and quantity on the horizontal axis.
- Demand refers to the entire curve, while quantity demanded is a point on the curve.
- The marginal value curve is the inverse of demand function.
- Consumer surplus is represented in a demand graph by the area between demand and price.
- An increase in demand is represented by a movement of the entire curve to the northeast (up and to the right), which represents an increase in the marginal value v (movement up) for any given unit, or an increase in the number of units demanded for any given price (movement to the right). Similarly, the reverse movement represents a decrease in demand.
- Goods whose demand doesn't increase with income are inferior goods, with the idea that people substitute to better quality, more expensive goods as their incomes rise. When demand for a good increases with income, the good is called normal.
- Demand is affected by the price of related goods.
- For a given good x , a complement is a good whose consumption increases the value of x . The complementarity relationship is symmetric—if consumption of x increases the value of y , then consumption of y must increase the value of x .
- The opposite case of a complement is a substitute. An increase in the consumption of a substitute decreases the value for a good.