2.1 INTRODUCTION

Economists, like carpenters, need a good set of tools. One of the strongest tools of microeconomics is demand and supply analysis. In this chapter we will discuss the basics of demand and supply. Some of the material covered should be a review from your introductory course.

For clarity, we will look first at each side of the market separately. We will begin by examining an individual's demand. We will next consider how we can aggregate individuals' demands into a market demand. Some of the factors which result in changes in demand will then be discussed. And we will emphasize the very important distinction between a change in demand and a change in quantity demanded.

Following our examination of demand, attention will turn to the other side of the market—the supply side. Here we will be focusing on the behavior of sellers. Again, we will consider an individual's supply as well as the derivation of a market supply schedule. We will then consider some factors that affect the position of the supply curve.

Having examined each side of the market independently, we will be able to combine the two and study the market equilibrium. What will be the equilibrium price, and what will be the equilibrium quantity bought and sold? The determination of price by the market is extremely important, because under capitalism, the price system ultimately answers the questions of "What will be produced?" "How will it be produced?" and "For whom will it be produced?" We will also look at how changes in demand and supply affect the market's equilibrium position.

Finally, we will be able to apply our basic tools to examine how and why various types of market intervention by the government affect price and quantity. We will look at the effects of different types of taxes and subsidies on output and price. We will consider the impact of meddling in foreign trade through import tariffs and export subsidies. The effects of various types of price and quantity controls, like rent controls and quotas, will be analyzed, and we will look at the markets for illegal goods and at black markets. Clearly the tools of demand and supply analysis can be applied to study many different issues.

2.2 INDIVIDUAL AND MARKET DEMAND

Before considering the interaction of buyers and sellers in the marketplace, it will be useful to examine the two sides of the market independently. We will begin arbitrarily by looking at the behavior of buyers, or the demand side.

When we talk of *demand* for a good (say oranges), to whose demand are we referring—an individual, a household, a group of individuals, or a country as a whole? At this stage it really does not matter, but we will start with the demand by a household. So by an individual, we mean an individual household. Similarly, on the supply side we will mean by individual, a single supplier.

By way of definition, *demand* simply indicates the quantities of a good (or

service) which the household would be willing and financially able to purchase at various prices, holding other things constant.

Demand can be illustrated through a demand schedule. For instance, for the Jones family, a hypothetical demand schedule is given in Table 2.1. The schedule is hypothetical because we can get these numbers only by asking the members of the Jones family a hypothetical question of how many oranges they would buy at different prices. One alternative is to watch how many oranges the Jones family actually does buy at different prices. But there is a problem with this. We have to assume that nothing besides the price of oranges has changed during the course of our observation (e.g., Mr. Jones has not lost his job, none of the children has gone away on a camping trip). Of course, in reality, "other things" do not stay the same, but we will first assume that other things stay the same and then examine what happens if other things change. It is always useful to start with some simple models and then introduce real world complications later.

You will notice a pattern in the numbers appearing in the schedule in Table 2.1. Price and quantity demanded vary inversely, or quantity demanded rises as price falls. This is because the demand schedule obeys the law of demand. Simply stated, the *law of demand* says: Other things staying the same, the quantity demanded of a commodity will be smaller at higher market prices and larger at lower market prices.

Let's consider why the law of demand is intuitively reasonable. Remember that as we change the price of oranges, we are holding other things constant. Those other things include consumer incomes and the prices of other goods. If the price of the commodity we are considering rose and consumers did not reduce their consumption of this commodity, then they would have to cut their consumption of other commodities. Usually, the consumer would cut the consumption of this and some other commodities. If there are substitutes, such as grapefruit, available, the consumer would switch, cut the consumption of this commodity, and increase the consumption of the now relatively cheaper substitute. The law of demand will be examined in much greater detail in a later chapter. For now it will suffice to see that it is generally plausible.

As with all laws in social science, there will of course be exceptions to the law of demand, but these exceptions are very few and isolated (see Section 2.8).

TABLE 2.1 A Hypothetical Demand Schedule for Oranges

Price per Orange (cents)	Quantity Demanded (dozens)
12	3
10	6
8	9
6	12
4	15
2	18

It is frequently useful to illustrate demand graphically through a demand curve. Figure 2.1 presents the demand curve which corresponds to the demand schedule from Table 2.1. In this figure we measure quantity on the horizontal axis and price on the vertical axis because this is the common practice. This may seem backward since from the previous discussion quantity is the dependent variable and as such should appear on the vertical axis. Actually, the practice of measuring quantity on the horizontal axis and price on the vertical axis goes back to the English economist Alfred Marshall (1842–1924) who viewed the demand curve from the sellers' point of view. The seller might ask "if I produce 10 units, what is the highest price at which I can sell each unit?" Thus, from the seller's viewpoint, quantity is the choice or independent variable, and price depends upon that quantity.

An important question concerns the slope of the demand curve. Why is it downward sloping (negatively sloped)? The answer is because of the law of demand. If quantity increases as price falls then the curve illustrating this relationship must slope downward from left to right. There is, incidentally, no reason to believe that a typical demand curve will have a constant slope or that the relationship between price and quantity will be a linear relationship. Demand curves are sometimes drawn this way merely for simplicity.

Although for some purposes it is useful to examine an individual consumer's demand, it frequently is necessary to analyze demand for an entire market made up of many consumers. We will now show how we derive the market demand curve from individuals' demand curves. In Figure 2.1 we have shown the demand curve for an individual consumer. We can take curves like this for each consumer, and by adding the quantities demanded by all consumers at each price we get the aggregate demand curve for the market as a whole. Let us, for the sake of exposition, assume that there are only two consumers in the market. Their demands and the market demand are shown in Table 2.2. The individual demand curves and the market demand curve are shown in Figure 2.2. D_1D_1 is the demand curve for consumer 1, D_2D_2 is the demand curve for consumer 2, and DD is the market demand curve. At the price OA (or \$10), the quantity demanded by consumer 1 is AB_1 (or 5 units), the quantity demanded by consumer 2 is AB_2 (or 8 units), and,

FIGURE 2.1 Demand curve of an individual consumer.

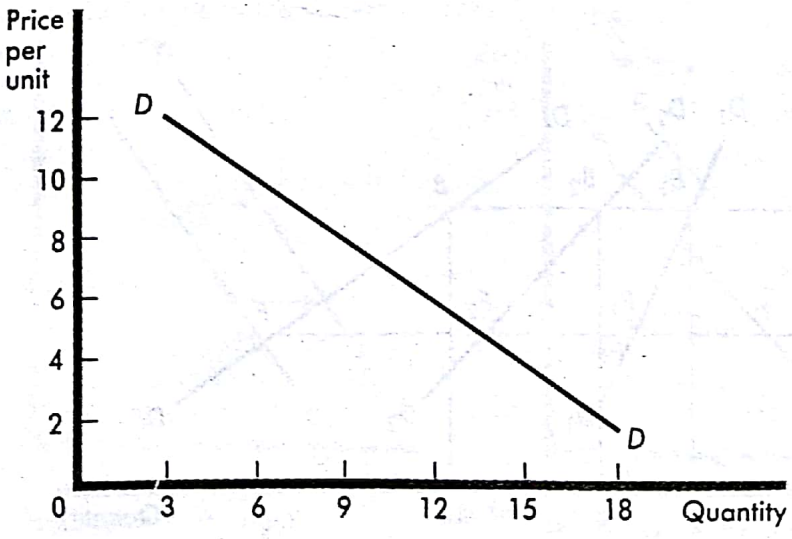


TABLE 2.2 Demand Curves for Two Consumers and the Market Demand Curve

Price	Quantity Demanded: Consumer 1	Quantity Demanded: Consumer 2	Market Demand
12	4	6	4 + 6 = 10
10	5	8	5 + 8 = 13
8	6	10	6 + 10 = 16
6	7	12	7 + 12 = 19
4	8	14	8 + 14 = 22

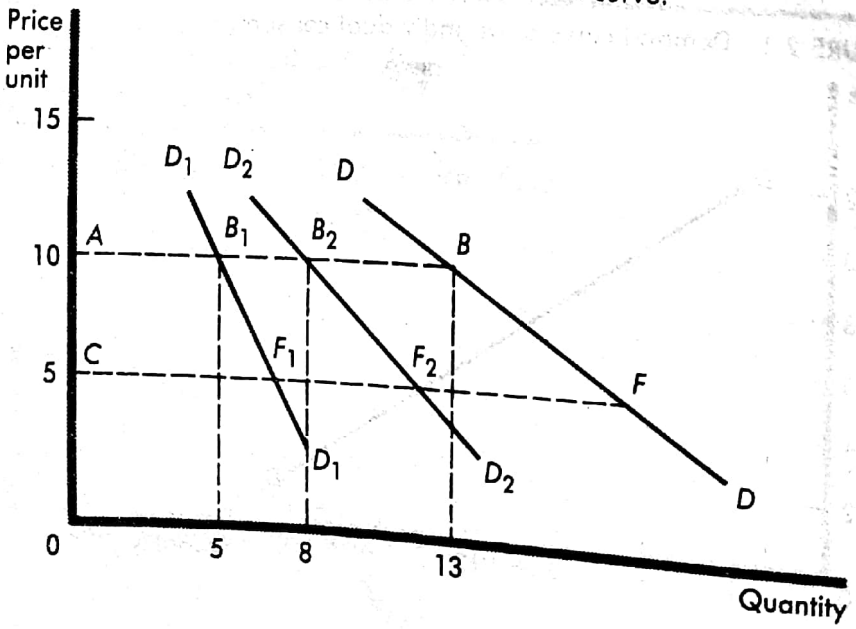
hence, total quantity demanded is $AB = AB_1 + AB_2$ (or 13 units). Note also that $B_1B = AB_2$. We obtain the other points on DD in a similar fashion. This operation is what is often called *horizontal summation.*

2.3 CHANGES IN DEMAND

Before discussing changes in demand, some very important and somewhat confusing terminology must be emphasized. To an economist, *demand* refers to the entire relationship between price and quantity, as long as other things remain the same. This is what is known as the "ceteris paribus" condition. The words "ceteris paribus" are Latin for "other things remaining the same." Demand is thus composed of many price and quantity pairs for a given set of circumstances. So an entire schedule or curve illustrates demand.

Now, for any single price there is a corresponding *quantity demanded.* So the term "quantity demanded" refers to a particular point on a demand curve. As long

FIGURE 2.2 Derivation of the market demand curve.



as the ceteris paribus conditions hold we can move along a stationary demand curve. We are merely changing quantity demanded.

If something other than price changes so that the ceteris paribus condition is violated, then an entirely new demand curve results. We say that there is a change in demand, and the demand curve shifts.

We are now ready to examine some changes which would result in a change in demand:

- Changes in tastes
- Changes in weather
- Changes in incomes
- Changes in prices of other commodities
- Changes in expectations

All these factors produce a *shift* in the entire demand curve. If more of the commodity is demanded at every price, then the demand curve shifts to the right as shown in Figure 2.3(*a*). This is called an *increase* in demand. If less of the commodity is demanded at every price, then the demand curve shifts to the left as shown in Figure 2.3(*b*). This is called a *decrease* in demand.

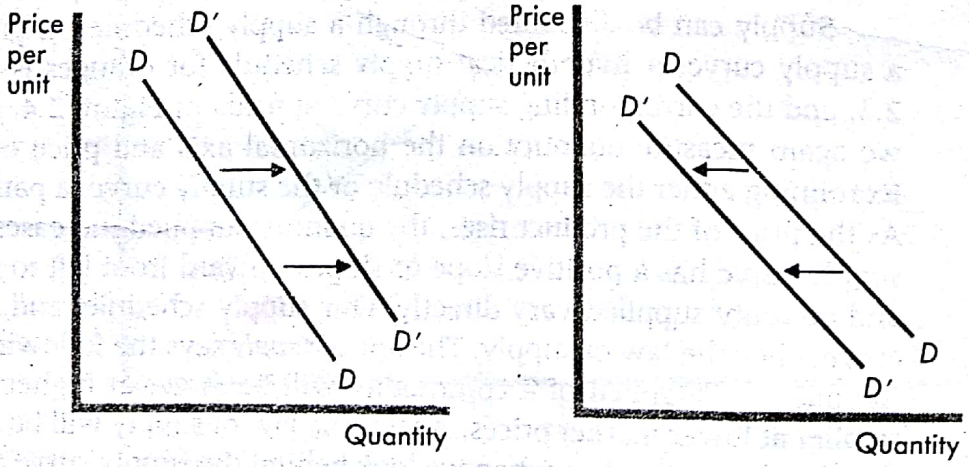
The following are some illustrations of changes in demand:

1. Change in tastes: Suppose Americans, imitating the British, start drinking tea more often. This will result in an increase in the demand for tea and a decrease in the demand for coffee.

2. Change in weather: An unusually dry summer results in a decrease in the demand for umbrellas. The demand curve shifts to the left.

3. Changes in prices of other goods: An increase in the price of heating oil results in an increase in the demand for natural gas. The demand curve for natural gas shifts to the right.

FIGURE 2.3 Shifts in the demand curve.



(a) A shift to the right (or increase in demand).

(b) A shift to the left (or decrease in demand).

4. *Changes in income:* An increase in family income increases the demand for video recorders. The demand curve shifts to the right.

5. *Changes in expectations:* Rumors that next year's new cars will be considerably more expensive increase the demand for this year's models. The demand for this year's cars shifts to the right.

Economists use special terminology to describe how demand responds to certain changes. For example, if an increase in consumer incomes leads to an increase in demand for a good, then that product is said to be a *normal* good. Most goods are normal. Tennis racquets, beer, pizza, and movie tickets are all examples of normal goods. However, if an increase in consumer incomes leads to a decrease in demand for a good, then that good is said to be an *inferior* good. Canned meat products and used clothing are examples of inferior goods.

Another set of terms deals with how the demand for one good reacts to a change in the price of another good. If an increase in the price of good X leads to an increase in the demand for good Y, then these two goods are said to be *substitutes*. Examples of substitutes are beef and chicken, pizza and hamburgers, or skateboards and roller skates. If instead, an increase in the price of good X leads to a decrease in the demand for good Y, then these two goods are said to be *complements*. Examples of complementary goods are gym shorts and tennis shoes, pizza and beer, cars and gasoline.

We will look at the demand side of the market in more detail later in this chapter as well as in subsequent chapters, but now we turn our attention to the other side of the market. The supply side of the market reflects the behavior of sellers or suppliers.

2.4 INDIVIDUAL AND MARKET SUPPLY

Again we will begin by examining supply for an individual seller or supplier. We will then aggregate to obtain a market supply. The supply side of the market is similar in some ways to the demand side and should thus now be easier to grasp.

By way of definition, *supply* indicates the quantities of a good (or service) which the seller is willing and able to provide at various prices, ceteris paribus.

Supply can be illustrated through a supply schedule or, graphically, through a supply curve. A hypothetical supply schedule for oranges is presented in Table 2.3, and the corresponding supply curve appears in Figure 2.4. In graphing supply we again measure quantity on the horizontal axis and price on the vertical axis. Examining either the supply schedule or the supply curve, a pattern again appears. As the price of the product rises, the quantity supplied increases as well. Thus, the supply curve has a positive slope or slopes upward from left to right. That is, price and quantity supplied vary directly. Our supply schedule, and, hence, our supply curve, obey the law of supply. The *law of supply* says the following: Ceteris paribus, the quantity supplied of a commodity will be larger at higher market prices and smaller at lower market prices. Again, the law of supply will be analyzed in greater detail in future chapters when we look behind the supply curve at the cost structure

TABLE 2.3 A Hypothetical Supply Schedule for Oranges

Price per Orange (cents)	Quantity Supplied (dozens)
4	3
6	6
8	9
10	12
12	15

of the firm. For now it will suffice to understand intuitively why this law makes sense.

We can explain the upward-sloping supply curve through the *law of diminishing returns*. A simple example will illustrate this concept. Suppose there is a factory which assembles bicycles. If 10 workers are employed, then daily output is typically 100 bicycles. If 20 workers are employed then output increases to 200. But if 30 workers are employed, output increases to only 270. The law of diminishing returns has set in. The successive units of input, or labor in this case, do not produce the same extra output. So assuming that the wage rate is constant, the cost of these extra bicycles is higher than the earlier ones. Hence, they will be produced only at a higher price. This is the basis for the upward-sloping supply curve.

Once again, it is sometimes useful to examine a single seller's supply curve. But many times a market supply curve is needed. We can sometimes derive the market supply curve from individual supply curves in the same manner that we derived a market demand curve, that is, by adding up the quantities supplied by all individuals at each price. But we can do this only if no specialized inputs are involved in the production process. Otherwise, some adjustments must be made.

FIGURE 2.4 Supply curve of an individual producer.

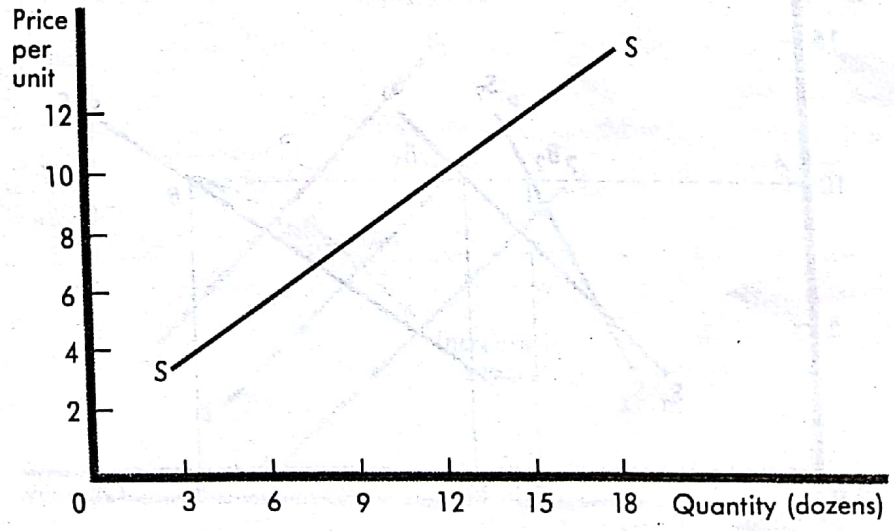


TABLE 2.4 Supply Curves for Two Suppliers and the Market Supply Curve

Price	Quantity Supplied: Supplier 1	Supplier 2	Market Supply
4	5	6	5 + 6 = 11
6	7	7	7 + 7 = 14
8	9	8	9 + 8 = 17
10	11	9	11 + 9 = 20
12	13	10	13 + 10 = 23

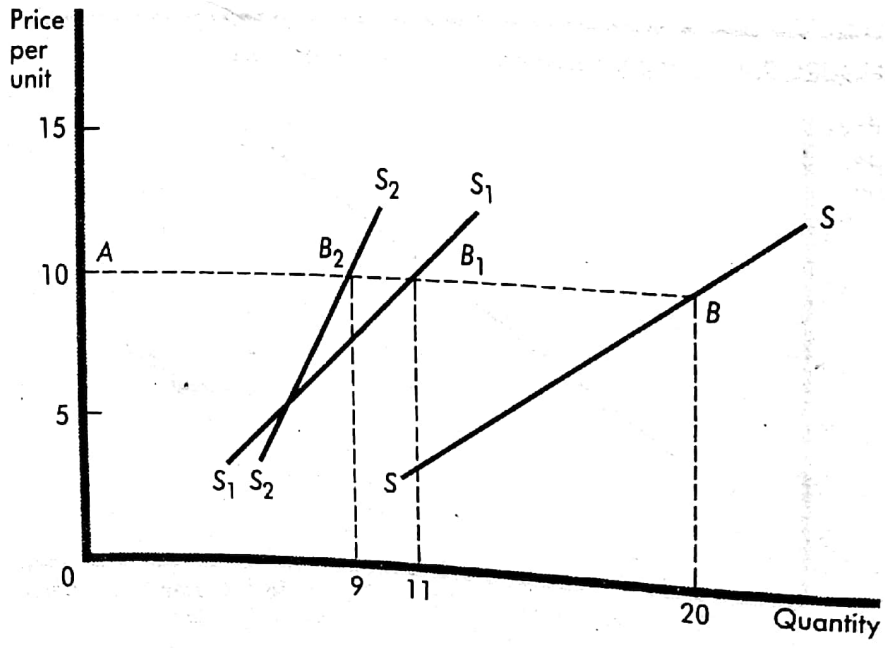
We will discuss this problem further in Chapter 10. For now we will simply assume that no specialized inputs are involved. This means that all firms can move along their individual supply curves without affecting input prices and, hence, production costs.

Again, for ease of exposition, we will make the simplifying assumption that there are only two suppliers in the market. Table 2.4 shows the quantities supplied by the two suppliers and the market supply. Figure 2.5 shows this diagrammatically.

2.5 CHANGES IN SUPPLY

With the supply side of the market, it is again important to clarify some otherwise confusing terminology. Supply refers to the entire relationship between price and

FIGURE 2.5 Derivation of the market supply curve from individual supply curves when input prices are constant.



quantity, ceteris paribus. So an entire supply schedule or supply curve illustrates supply. And corresponding to any single price, there is a single *quantity supplied.* So the term "quantity supplied" refers to a particular point on the supply curve. You will see that the distinction between supply and quantity supplied is analogous to the demand side of the market.

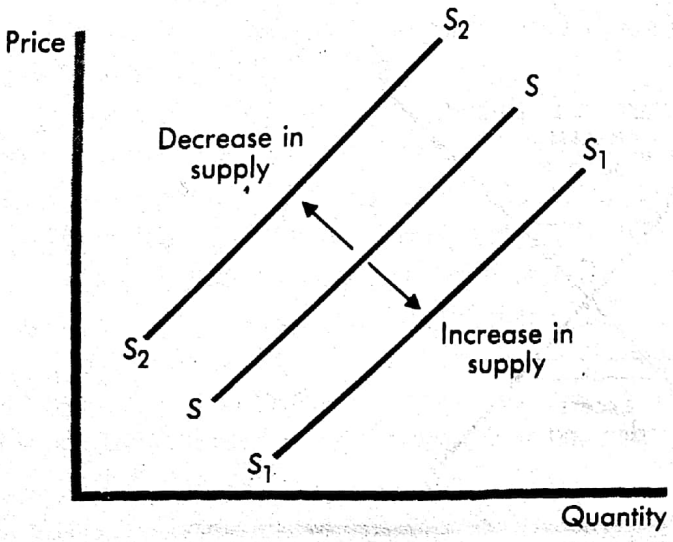
As long as the ceteris paribus conditions are satisfied, we can move along a single stationary supply curve, merely changing quantity supplied. But if something other than the price of the product changes, then an entirely new supply curve results. We say that there is a change in supply, and the supply curve shifts.

As with the demand curve, there are several factors that produce shifts in the supply curve. These are new discoveries, availability of a new technology, changes in the prices of alternate outputs, changes in the supply of inputs, changes in weather, and so on. If more of a commodity is supplied at every price, then we say that there is an increase in supply. The supply curve shifts to the right. If less of a commodity is supplied at every price, then we say that there is a decrease in supply. The supply curve shifts to the left. This is shown in Figure 2.6.

The following are some examples of changes in supply.

1. *Discoveries:* The supply curve of natural gas shifts to the right because of the discovery of a number of new gas fields.
2. *New technology:* The supply curve for personal computers shifts to the right because of rapid developments in computer technology.
3. *Changes in weather:* Because of bad weather, the supply curve of wine shifts to the left.
4. *Changes in prices of alternative outputs:* If the price of soybeans rises, some farmers will plant more soybeans and less wheat. The supply curve of wheat shifts to the left.
5. *Changes in input supply:* A reduction in the supply of steel will cause the supply curve for cars to shift to the left.

FIGURE 2.6 Shifts in the supply curve.



2.6 MARKET EQUILIBRIUM AND THE IMPACT OF CHANGES IN DEMAND AND SUPPLY

We have now examined each side of the market separately. It is now time to put the two together. Alfred Marshall compared demand and supply to the two blades of a pair of scissors. There is no point in arguing which of the two blades is doing the cutting. Similarly, prices are determined by the interaction of demand and supply, and one cannot ignore either element. So now we will examine how market price is determined and how the transaction takes place.

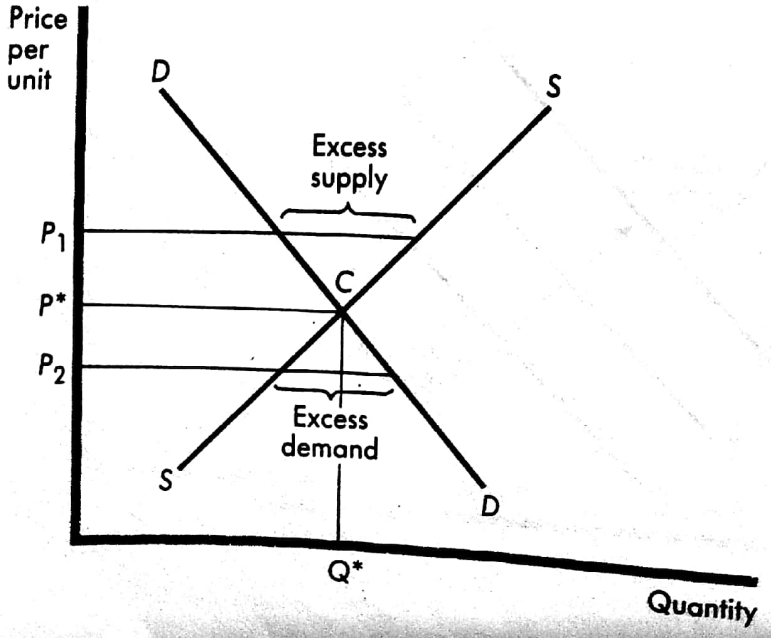
The determination of price depends on what market organization we are considering and whether there is price discrimination (that is, the seller charges different prices to different customers). These are topics we discuss in detail in future chapters (Chapters 10 through 14). For the present we shall assume that the market is *competitive*. This means that there is a large number of buyers and sellers and, hence, no one buyer or seller has control over the market price. In this case the point of intersection of the aggregate or market demand and supply curves gives the price that will prevail in the market. This is shown as the price P^* in Figure 2.7. This is the price that every buyer will pay. The corresponding quantity Q^* is the total quantity transacted by the buyers and sellers.

The price P^* is determined by the intersection of the market demand and supply curves and is called the *equilibrium price*. The quantity transacted Q^* is called the *equilibrium quantity*.

The word "equilibrium" denotes a state of rest from which there is no tendency to change. In Figure 2.7 the point C describes a position of equilibrium because this is the point where all buyers and all sellers are satisfied.

If the price is higher than P^*, say P_1, then the buyers can buy what they want to buy at that price, but the sellers cannot sell all they want to sell. This is a situation of *excess supply* or *surplus* in the market. The suppliers are dissatisfied. This situation cannot be sustained and the market price has to come down.

FIGURE 2.7 Determination of equilibrium price and quantity (competitive markets).



If the price is lower than P^*, say P_2, then the sellers can sell what they want to sell at that price, but buyers cannot buy all they want to buy. This is a situation of *excess demand* or *shortage* in the market. The buyers are dissatisfied. This situation cannot be sustained and the market price has to go up.

When prices are above or below P^* we say the market is in *disequilibrium.* There is, of course, the question of how one gets to the equilibrium point C in actual practice. One story goes like this: There is an auctioneer who calls off prices and asks for bids from buyers and sellers.[1] She then adds up the bids on the demand side and on the supply side. If there is excess supply she lowers the price and calls for bids again. If there is excess demand, she raises the price and calls for bids again. This procedure continues until the equilibrium price is found. *Then and only then does trade take place.* This process of getting to the equilibrium price is called a *tatonnement* process.

There are, of course, several problems with this story. All this auctioning takes time. Furthermore, we have to assume that buyers and sellers tell the truth, that both buyers and sellers keep their commitments, and that the auctioneer is doing a free service in finding the equilibrium price (quite a curious assumption for economists to make).

Very few markets have such auctioneers. However, the argument goes that many markets function *as if* there were an invisible auctioneer.

The simple model of market equilibrium does indeed provide a useful framework for the analysis of many practical problems as we will presently illustrate. We do not have to delve deeply into the question of how the equilibrium point is reached. An equilibrium position need not be realized for equilibrium analysis to be a useful tool. When the external circumstances change, the equilibrium will be disturbed, and in actual practice this happens all the time. However, an analysis of the equilibrium position shows in what direction economic variables are headed.

We can now discuss the effects of changes in demand and supply on the equilibrium price and quantity. What we will be doing falls in the area of *comparative statics.* That is, we study the effect on equilibrium positions if the demand and supply curves shift.

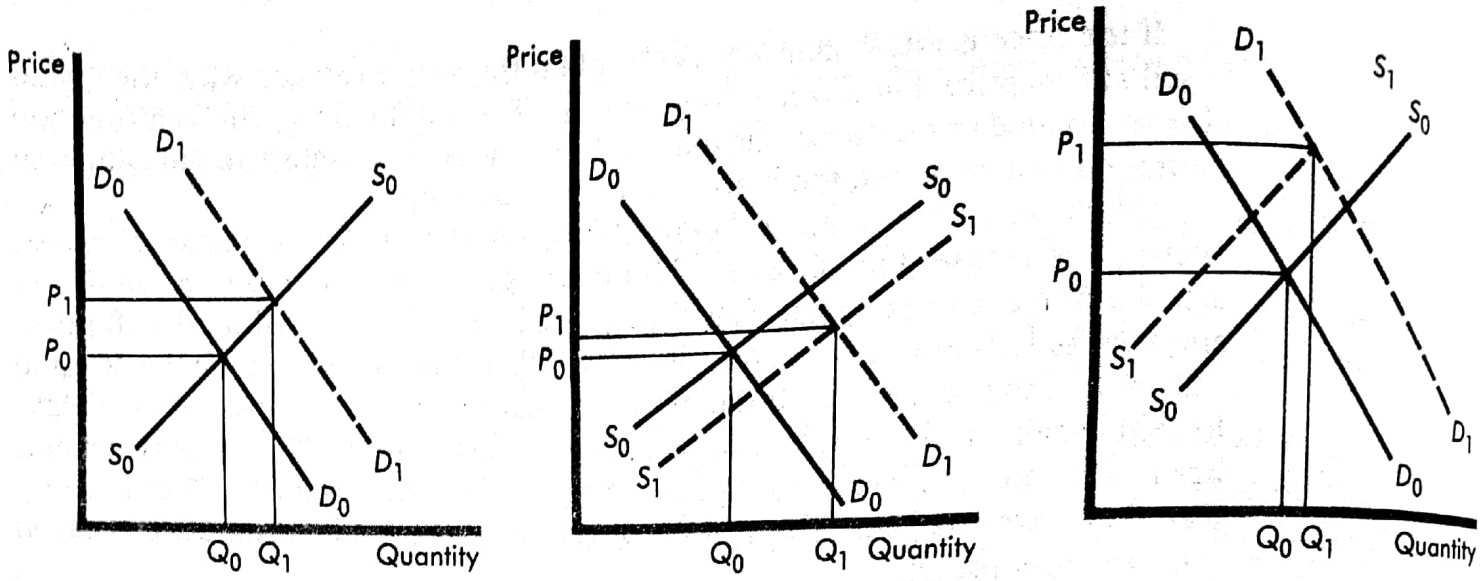
Let us consider an increase in demand. What happens to the equilibrium price and quantity depends on whether (1) the supply curve is unchanged, (2) there is an increase in supply, or (3) there is a decrease in supply. These situations are described in Figure 2.8.

In all three cases D_0D_0 is the initial demand curve and S_0S_0 the initial supply curve. D_1D_1 is the new demand and S_1S_1 is the new supply curve. The initial equilibrium price and quantity are P_0 and Q_0 respectively and the new equilibrium price and quantity are P_1 and Q_1 respectively.

In Figure 2.8(a), when supply remains unchanged, the effect of an increase in demand is that both the equilibrium price and quantity increase.

In Figure 2.8(b), when there is an increase in supply, equilibrium quantity increases, but we cannot say anything about equilibrium price. This is because the increase in demand puts upward pressure on price while the increase in supply

[1]This auctioneer is usually called a "Walrasian" auctioneer after the name of a famous French economist Leon Walras (1834–1910).



(a) Supply unchanged. (b) An increase in supply. (c) A decrease in supply.

FIGURE 2.8 Effects on equilibrium price and quantity of an increase in demand.

puts downward pressure on price. Price can go up, stay the same, or go down. It all depends on the relative magnitudes of the shifts in the demand and supply curves. In Figure 2.8 we see that the equilibrium price goes up, but we can get the other conclusions by changing the magnitudes of the shifts in the demand and supply curves.

In Figure 2.8(*c*), when there is a decrease in supply, the equilibrium price goes up, but we cannot say anything about the equilibrium quantity. This time, the decrease in supply puts downward pressure on output while the increase in demand puts upward pressure. The net effect can be either an increase or decrease. Again, it all depends on the relative magnitudes of the shifts in the demand and supply curves. Only one of the three possibilities is illustrated in Figure 2.8 but it is easy to show the other cases by just changing the magnitudes of the shifts in the demand and supply curves.

We can analyze the case of a decrease in demand in a similar fashion. All these cases are shown in Table 2.5. For compactness we use the following notation:

$P(+)$ means the equilibrium price goes up

$P(-)$ means the equilibrium price goes down

$P(?)$ means we cannot say whether the equilibrium price goes up, stays the same, or goes down

$Q(+)$, $Q(-)$, and $Q(?)$ are defined similarly and refer to equilibrium quantities

The results can be verified by drawing the demand and supply curves.

EXAMPLE 2.1 Winter Freezes in Florida and the Price of Orange Juice

The orange juice market demonstrates fluctuations in price resulting from shifts in the supply curve (and during recent years shifts in the demand curve as well). During the early 1980s, with demand fairly stable, shifts in supply produced price

TABLE 2.5 Effects of Shifts in the Demand and Supply Curves on Equilibrium Price and Equilibrium Quantity

	Demand		
Supply	Increase	No Change	Decrease
Increase	P(?) Q(+)	P(−) Q(+)	P(−) Q(?)
No Change	P(+) Q(+)	No change	P(−) Q(−)
Decrease	P(+) Q(?)	P(+) Q(−)	P(?) Q(−)

changes. Prices shot up whenever the Florida orange crop was threatened by winter freezes. In January 1982, the nearby futures price of orange juice went up from \$1.15 to \$1.65 per pound.[2] In January 1984, it again went up from \$1.25 to \$1.65 (and rose to \$1.90 by April). In January 1985, it rose again from \$1.55 to \$1.85. Then several changes took place on the supply side: The Florida citrus industry moved further south from Orlando so that winter freezes stopped having as much impact on the supply side, and Brazil emerged as a major producer of oranges and a major exporter of orange juice. With these developments, orange juice prices fell steadily from \$1.85 in June 1985 to \$0.80 in March 1986. Since then prices crept up so that they stood around \$1.70 toward the end of 1987. This latter movement in prices has nothing to do with winter freezes. This has been mainly a consequence of the rise in demand for orange juice. With the growth in health consciousness here and in Europe, people started drinking more orange juice.

A detailed analysis of the orange juice market would involve a discussion of the several factors that contributed to shifts in the demand and supply curves, import restrictions in the United States, growth in the Brazilian orange industry, fluctuations in worldwide demand, and relocation of the Florida citrus industry. This is left as an exercise for interested students.

EXAMPLE 2.2 The Copper Market

The copper market showed wide price swings in the 1980s. These price swings were produced by changes in both the demand and supply conditions. Copper prices were over \$1.00 per pound in 1980. They fell to about \$0.60 per pound in 1986. The price decline was a result of a decrease in demand (use of fiber optics rather than copper wire in phone cables and other communications, use of plastic pipes in home construction, and so on) and an increase in supply from low-cost producers such as Zaire, Chile, and Zambia. Many U.S. producers whose costs of production were higher than \$0.65 per pound had to shut down production. Between 1982 and 1986, nearly half of U.S. copper producers left the market, and others trimmed in size. Copper producers like Phelps Dodge and Magma Copper modernized their plants. The costs of production in the industry were \$0.65 per

[2]We are talking of nearby futures price because it is readily available. It is the price on a contract for delivery in the near future. The wholesale price would exhibit a similar behavior. For the purpose of our illustration, which price does not matter. Interested students can collect data on wholesale prices and retail prices.

pound in 1987 as compared to $0.90 per pound in 1982 and were expected to go down further. The industry produced 1.3 million tons in 1987 compared with 1.1 million tons in 1981—with a work force one-third of the total 28,000 workers employed in 1980.

In the latter part of 1987, however, copper prices shot up. From about $0.62 per pound in June 1987, prices rose to $1.20 per pound in November 1987. This was the result of a decrease in supply caused by troubles in the African countries, labor unrest and strikes in Chile, and a decline in the domestic productive capacity in the United States. Simultaneously, there was an increase in the industrial demand from South Korea, Japan, and Taiwan. Once the problems in the African countries and Chile were settled, it was expected that the copper price would come down.

There was even some talk of some individual buying up the available stocks and creating a temporary squeeze. However, one needs to be reminded of the attempt by the Hunt brothers from Texas to "corner" the silver market in 1980. They kept on buying silver and pushed the prices from $6 an ounce to $50 an ounce within a few months. But then the roof caved in. At that price, every one wanted to sell the silver in their house. Many antiques were melted. A lot of silver was recovered from scrap. The price of silver came down faster than it had gone up. The Hunt brothers were left holding the bag. From billionaires, they turned into millionaires.

2.7 GENERAL PRINCIPLES OF DEMAND AND SUPPLY ANALYSIS

We turn our attention now to some applications and extensions of basic demand and supply analysis. These applications focus on the impact of various types of government intervention on market equilibrium. The first form of intervention to be examined is the imposition of taxes and subsidies.

2.7.1 Taxes and subsidies

Two important things to remember in demand and supply analysis are:

1. The distinction between shifts in the demand and supply curves and movements along the curves.

2. In the presence of taxes, subsidies, and other distortions, the price buyers pay and the price suppliers keep are different, and the quantity demanded depends on the former price whereas the quantity supplied depends on the latter price.

We will illustrate these principles with a simple example of a per unit or excise tax. Other examples will be given in later sections.

An excise or per unit tax

An excise tax is a tax of a fixed amount T on each unit of commodity. Per unit or excise taxes are currently imposed on goods such as gasoline, liquor, and cigarettes. This is different from a sales tax which is a percentage tax. (The analysis of a sales tax is similar, and we will point out the minor modifications later.)

The effect of a per unit tax of T is illustrated in Figure 2.9. The per-unit tax

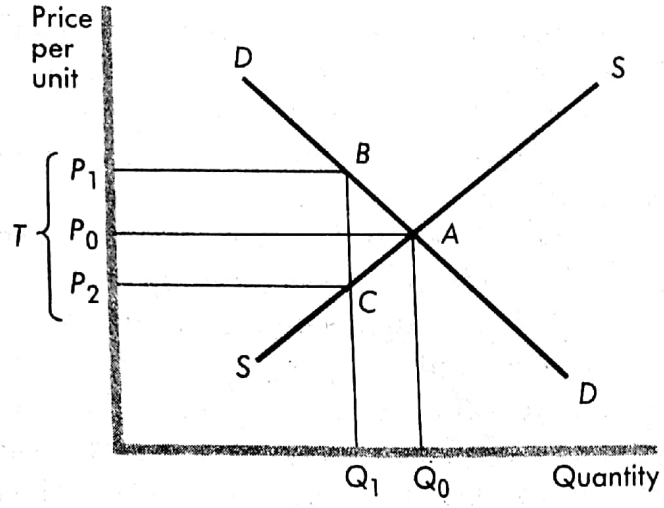


FIGURE 2.9 Effect of a per unit tax.

implies that: the price buyers pay = the price sellers keep + the tax T. In Figure 2.9 DD is the demand curve and SS the supply curve. Without the tax the equilibrium price is P_0. This is the price buyers pay and the price sellers keep. With the excise tax, there is a wedge of height T between the price buyers pay and the price sellers keep. Buyers move up the demand curve, and sellers move down the supply curve until the vertical distance between the two is equal to T. This is shown by the points B and C in Figure 2.9. P_1 is the price buyers pay, and P_2 is the price sellers keep. The difference $P_1 - P_2 = T$ is the tax the government collects. At the price P_1 the quantity demanded is Q_1, and at the price P_2 the quantity supplied is again Q_1, and, thus, there is equilibrium. Since there is equilibrium, there are no forces producing any change.

From the buyers' point of view the price has *risen* from P_0 to P_1, but from the sellers' point of view the price has *fallen* from P_0 to P_2.

Politicians, however, are accustomed to looking at only one side of the story. The following is a common argument: "The effect of a tax on a commodity might seem at first sight to be an advance in price to the consumer. But an advance in price will diminish the demand. And a reduced demand will send the price down again. It is not certain, therefore, after all, that the tax will really raise the price."[3] A similar argument was made by President Carter regarding his tax on gasoline. When asked by reporters whether the tax would raise the price of gasoline, he said that initially the tax would push the price up, but the higher price would discourage demand and bring the price down. All this merely shows the confusion among the press reporters and even high-ranking politicians about a very simple matter.

The rise in the price paid by buyers to P_1, reduces the *quantity demanded* to Q_1, but, since suppliers also get a lower price, the fall in the price to P_2 reduces the *quantity supplied* to Q_1. Thus, quantity demanded is equal to quantity supplied, and there is no more incentive for the buyers or sellers to change anything. Note that there are no shifts in the demand and supply curves that the politicians are talking about when they talk of "decrease" in demand. Further, a rise in the price of a commodity does not produce shifts in demand for that same commodity. All you have is a movement along the demand curve for that commodity.

[3]The quotation is in H. D. Henderson, *Supply and Demand*, Cambridge, London, 1922, p. 27.

We have shown the effects of the per unit tax as a movement of buyers along the demand curve from A to B and of suppliers along the supply curve from A to C. There are alternative ways of showing the new equilibrium. In Figure 2.9 we labelled the vertical axis as "price" and said P_1 is the price paid by buyers and P_2 the price kept by sellers. Instead, we can label the vertical axis as "consumers' price." This is shown in Figure 2.10. In this case, since the vertical axis measures the price buyers pay, the demand curve stays the same but the supply curve shifts up by a vertical distance equal to T, the per-unit tax. The equilibrium market price (price paid by consumers) is P_1, and the quantity demanded and supplied is Q_1.

Alternatively, we can label the vertical axis as "sellers' price." In this case, since this is the price suppliers keep, the supply curve stays the same but the demand curve shifts down by a vertical distance equal to T. This is shown in Figure 2.11. The equilibrium market price (sellers' price) is P_2, and the quantity demanded and supplied is Q_1.

Thus, there are several ways of looking at the same problem. The important things to note are the following:

1. The per unit tax raises price for buyers only. This results in a reduction in the quantity demanded. But the per unit tax lowers the price for the sellers, and this reduces the quantity supplied as well. The result is an equilibrium position with a lower quantity and a *higher price for buyers* and *lower price for sellers.* No further changes will take place. We can show this effect as a movement of buyers along the demand curve and of sellers along the supply curve.

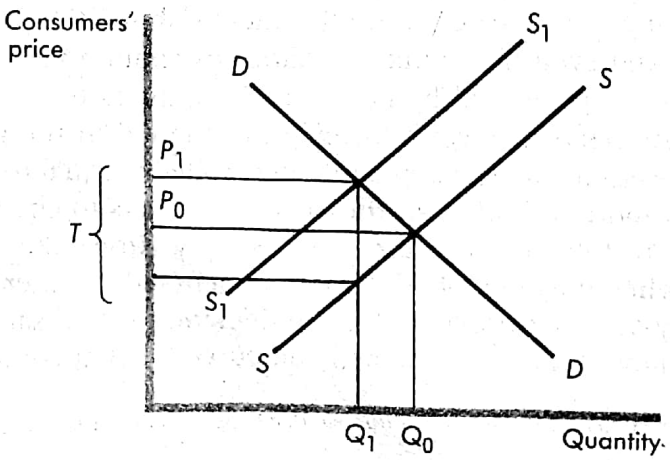
2. By labeling the vertical axis as consumers' price (looking from the demand side) we can show the effect as no change in the demand curve and a decrease in supply. See Table 2.5, which shows the result as $P(+)$, $Q(-)$.

3. By labeling the vertical axis as sellers' price (looking from the supply side) we can show this effect as no change in the supply curve and a decrease in demand. See Table 2.5, which shows the result as $P(-)$, $Q(-)$.

A sales tax (percentage tax)

We can now analyze a sales tax which is a percentage tax. Suppose the tax rate is 8 percent. If we are analyzing it in Figure 2.9 we have to measure the wedge

FIGURE 2.10 Effect of a per unit tax shown as a shift in the supply curve.



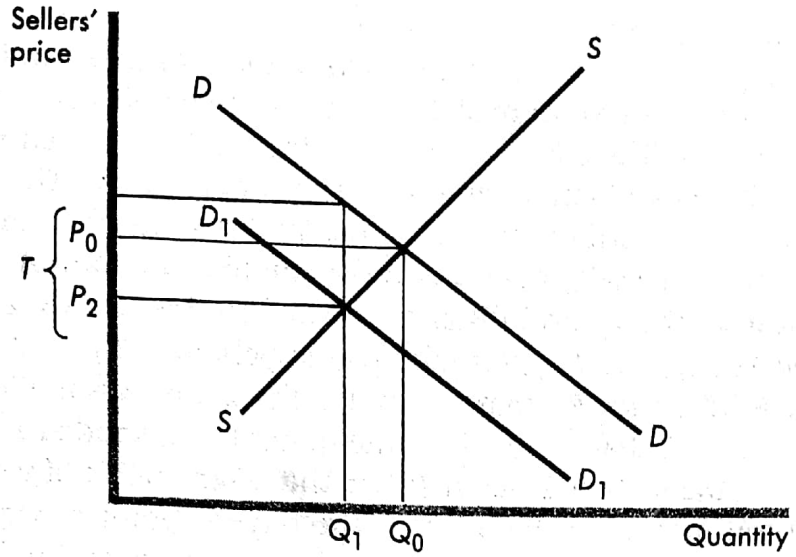


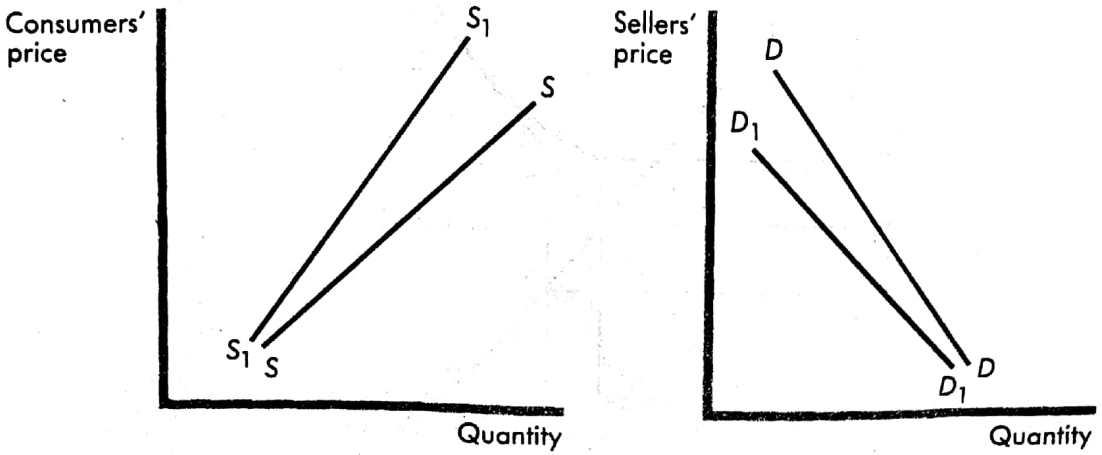
FIGURE 2.11 Effect of a per unit tax shown as a shift in the demand curve.

$(P_2 - P_1)$ as 8 percent of P_2. Thus, we keep on moving a vertical wedge from A to the left till EC = 8 percent of the vertical distance CQ_1. Then that will give P_1 as the price paid by the buyer, P_2 as the price the seller gets, and Q_1 as the equilibrium quantity.

If we are analyzing it as in Figure 2.10, the shift in the supply curve will not be a parallel shift as in the case of the per unit tax. At lower prices, the distance between SS and S_1S_1, which measures the per unit amount of the tax, is smaller than at higher prices. In fact, with linear supply curves as we have been drawing, and an 8 percent tax, the slope of S_1S_1 will be 1.08 times the slope of SS. This is shown in Figure 2.12. (The shifts are thus rotations.)

If we are analyzing it as in Figure 2.11, the shift in the demand curve will not be a parallel shift as in the case of the per unit tax. Again at lower prices, the distance between DD and D_1D_1, which measures the per-unit amount of the tax, is smaller than at higher prices. With linear demand curves and an 8 percent tax, the slope of D_1D_1 will be 0.92 times the slope of DD. This is also shown in Figure 2.12.

FIGURE 2.12 Rotation of the supply and demand curves with a sales tax (a percentage tax).



A production subsidy

The case of a production subsidy is similar to that of the per unit tax and sales tax. Suppose it is a per-unit subsidy of an amount Z. Examples of goods thus subsidized are milk and corn. The effect is shown in Figure 2.13, which is similar to Figure 2.9. DD is the demand curve, and SS is the supply curve. The initial equilibrium price is P_0 and equilibrium quantity is Q_0. With the subsidy, the price buyers pay differs from the price sellers get. From the equilibrium point A, we move a wedge to the right until the vertical distance is equal to the subsidy Z. P_2 now gives the price suppliers get, and P_1 gives the price buyers pay. $P_2 - P_1 = Z$, the amount of subsidy. At the price P_2, that sellers get, the quantity supplied is Q_1 and at the price $P_1 = P_2 - Z$ that buyers pay, the quantity demanded is Q_1. Thus, there is equilibrium in the market. Note that from the sellers' point of view the equilibrium price has risen from P_0 to P_2 but from the buyers' point of view the equilibrium price has fallen from P_0 to P_1. (Whether press reporters and politicians would call this an increase in price or decrease in price is a good question.) Note that the equilibrium quantity has increased from Q_0 to Q_1.

Again, we can analyze this in terms of shifts in demand and supply curves as done earlier. If the vertical axis is labeled "price including subsidy" (or price that producers get), then we can depict it as unchanged supply and increase in demand. From Table 2.5 we see the result as $P(+)$, $Q(+)$. If the vertical axis is labeled "price excluding subsidy" (or price paid by consumers), then we can depict it as unchanged demand and an increase in supply. From Table 2.5 we see the result as $P(-)$, $Q(+)$.

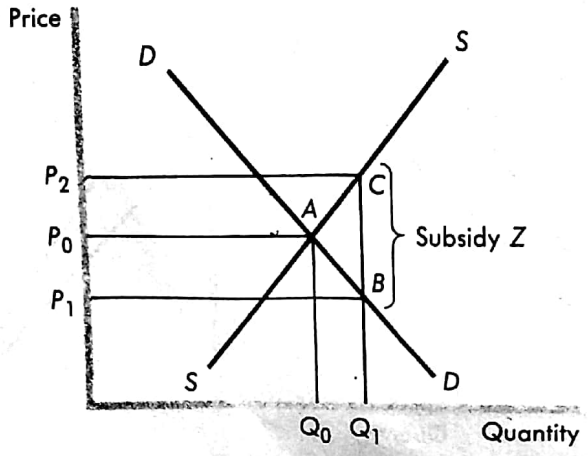
A percentage subsidy can be analyzed in a manner similar to the analysis of a sales tax. We will, therefore, not pursue this further.

2.7.2 Import tariffs and export subsidies

We have until now discussed the effects of a per unit tax and a production subsidy. The same techniques of analysis can be used to analyze import tariffs and export subsidies.

Import tariffs are commonplace in virtually all countries. The United States currently imposes an import tax or tariff on items such as clothespins, chickens

FIGURE 2.13 Effect of a production subsidy.



(dead), tomatoes, cork, and champagne. At the same time, many underdeveloped countries subsidize the export of industrialized goods, and our government effectively subsidizes the export of grain to Russia. So what are the results of such import tariffs and export subsidies?

Let's look first at an import tariff. Consider a commodity that is both domestically produced and consumed and also traded in the world market. Let P_f be the foreign price or world price of the commodity and let us assume that domestic buyers can buy any amount they want at this price and domestic sellers can sell any amount they want at this price in the world market. (We are abstracting from all transportation costs and so on.) Then without the tariff, the domestic price is also P_f.

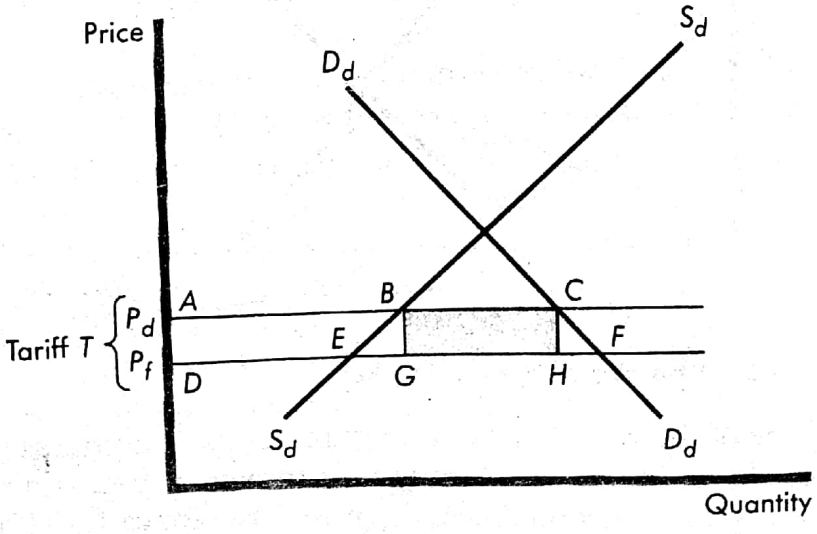
The situation is shown in Figure 2.14. D_dD_d is the domestic demand curve, S_dS_d the domestic supply curve. Without any tariffs the domestic price is the foreign price P_f. At this price DE is the quantity supplied domestically, and DF is the domestic quantity demanded. The difference is made up by imports which are given by EF.

With the imposition of a tariff T, the domestic price P_d is equal to $P_f + T$, domestic quantity supplied rises to AB, and domestic quantity demanded falls to AC. The difference is made up by imports which now fall to BC. The government collects a revenue of T per unit of imports. Thus, the government's revenues are given by the shaded area $BCHG$.

The argument for the import tariff is to protect domestic production and employment. However, instead of a tariff on imports, suppose the government gives a subsidy equal to T to domestic producers. The effect is that producers get a price P_d and, hence, the quantity supplied rises to AB. But consumers still pay P_f, and, thus, domestic quantity demanded does not change. It is still DF. The difference GF is made up by imports.

However, along with a production subsidy of T, if the government imposes a consumption tax of T per unit, the consumers also pay the price P_d, and thus demand is curtailed to AC as before. The government now collects revenues of T per unit on the total consumption, which is AC. This revenue is given by the area $ACHD$. But it pays out $ABGD$ to producers as a subsidy. Thus, its net revenue is as before $BCHG$ (which is the revenue from the import tariff).

FIGURE 2.14 Effect of an import tariff.



What this shows is that *a tariff of T per unit has exactly the same effects as a production subsidy of T per unit plus a consumption tax of T per unit. It should now be clear who is paying the costs of import tariffs.*

The case of export subsidies is exactly analogous. This is shown in Figure 2.15. D_dD_d is the domestic demand curve, and S_dS_d is the domestic supply curve. Without any tariffs and subsidies, the domestic price is the foreign price P_f. At this price DG is the domestic quantity demanded, and DH is the domestic quantity supplied. The difference GH is exported.

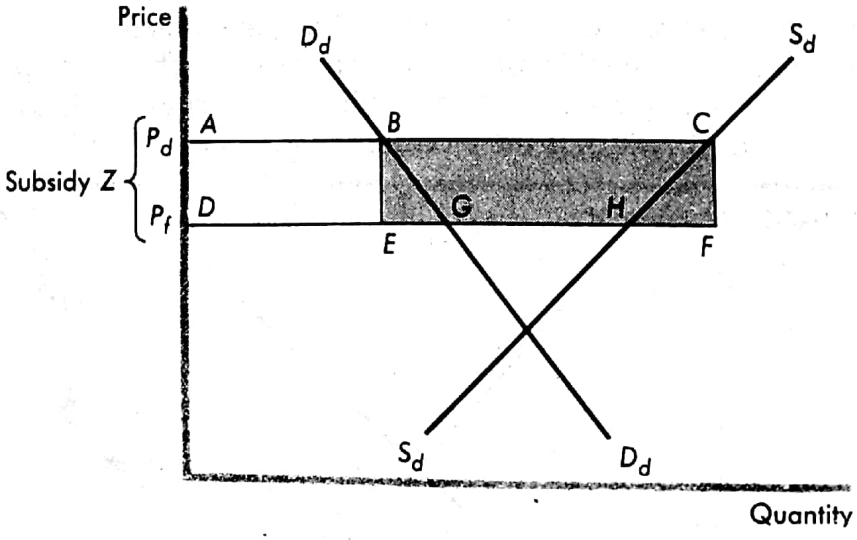
Now, the government wants to stimulate exports and introduces an export subsidy of Z per unit. The domestic price rises to $P_d = P_f + Z$. Domestic quantity demanded falls to AB, and domestic quantity supplied increases to AC. The difference is the exports BC, which are higher than GH. The cost to the government is the subsidy of Z per unit for the exports BC. It is thus the area of the shaded rectangle $BCFE$.

Now exactly the same result is achieved by a production subsidy of Z per unit and a consumption tax of Z per unit. The cost to the government for the production subsidy is $ACFD$. The revenues from the consumption tax are $ABED$. The difference is the net cost to the government, which is $BCFE$.

Thus, *an export subsidy of Z per unit is exactly equivalent to a production subsidy of Z per unit plus a consumption tax of Z per unit. And so it also follows that both import tariffs and export subsidies are equivalent to a production subsidy plus a consumption tax.*

In the above discussion we have, of course, abstracted from the costs of tax collection and disbursal of subsidies which can be substantial. But the analysis shows how we can demonstrate the equivalence of different policies by using a simple demand and supply analysis.

FIGURE 2.15 Effect of an export subsidy.



EXAMPLE 2.3 The World Sugar Market

Sugar is one of the world's most important foods. It accounts for 10 percent of the available calories in the world (only next to wheat, rice, and maize). Sugar is also unique: It was the first food crop to be grown, not for eating at home, but for export.

It was brought to Europe from the Middle East by the Arab invaders in the eighth century along with cotton, rice, and oranges. However, it was not until the conquest of Barbados in 1627 and the subsequent development of sugar plantations that it achieved any importance as a food. By 1800 it became a necessity, and by 1900 it was supplying nearly one-fifth of the calories in the British diet. If one looks at per-capita sugar consumption, one finds that it increases steadily with per-capita income until a per-capita income of say $6,000 to $8,000 and then declines because of the increase in health consciousness and calorie counting. (Japan, the United States, Canada, some European countries, and Australia are examples.) Such populous countries like Bangladesh, China, India, and Indonesia are at the low end of per-capita income, and with economic development their demand for sugar is expected to grow.

Sugar is both an agricultural and an industrial business. Refining sugar is more complicated than processing wheat, coffee, and other crops. Since it is advantageous to have refineries where sugar cane is grown, sugar gives many countries their first taste of industrialization. The sugar plantations were perhaps the first examples of industrial capitalism. By the late seventeenth century a typical plantation would have 80 acres and a work force of 100. When farms of over 30 acres were uncommon in Britain, the sugar plantations in the Caribbean were the biggest enterprises in the world, predating by a century the development of industrial capitalism in other areas.

Sugar was also the center of a three-way trade. Britain sent cloth, tools, beads, and weapons to Africa, shipped African slaves to the Caribbean to work on the sugar plantations, and brought Caribbean sugar to Britain.

From 1670 to 1820, when it was overtaken by raw cotton, sugar was Britain's biggest single import. In the nineteenth century, however, Britain levied taxes on the imports of sugar, and sugar became the focus of arguments about free trade. The free traders won, and taxes were removed in 1843. However, after more than almost a century and a half, the free trade issue remains.[4]

The sugar market is an interesting example of a market that is enslaved by government subsidies and import restrictions. The U.S. government has been regulating sugar imports in one way or another almost continuously since 1789, which is some sort of proof that governments do not learn from past mistakes. In 1934 a quota system was set up and has continued ever since with an interruption in the 1970s.

The U.S. government subsidizes the price of domestic sugar (the subsidized price is 20 to 22 cents per pound, whereas the world market price was as low as 3.5 cents per pound in 1985 and was about 6.5 cents per pound in 1987). But the U.S. government is not alone. The European common market (EEC) pays its farmers about 20 cents and Columbia pays its farmers about 21 cents. The resulting surpluses are dumped in the world market. Because of the subsidies, the European farmers increased their annual production between 1977 and 1985 from 10.8 million to 13.3 million tons. During those 8 years, the EEC "sold" 38 million tons of sugar on world markets at world prices. The European taxpayers lost more than $12 billion.

[4] "Return to Where We Left Off in 1843," *The Economist*, August 10, 1985, p. 51; and Sidney W. Mintz, *Sweetness and Power: The Place of Sugar in Modern History*, Viking Press, New York, 1985.

Not all sugar traded on world markets is sold at world market prices. Around one-third of sugar traded internationally is sold under fixed contracts. Russia guarantees a market for Cuban sugar, the United States a market for its third-world friends, and the EEC for former British colonies and others. Since the importers pay the same high price as they pay for the domestic producers, this sounds like a good deal for the exporting countries. However, none of the exporting countries except a few (Cuba and Mauritius, for instance) sell more than half their output at these subsidized prices, and they have to sell the rest at world market prices. Some other countries (Thailand, Australia, and the Philippines, for instance) do not have a "sugar daddy."

As far as the United States is concerned, there is no restriction on domestic production, and the imported sugar is also bought at the high domestic subsidized price, not at the much lower world price. The domestic supply has been rising when demand has been falling because U.S. consumers have become more diet conscious. Between 1983 and 1987 sugar production in the United States increased by 1 million tons whereas quantity consumed decreased by 1 million tons. The high price of sugar has also encouraged the production of cheaper substitutes like high-fructose corn syrup. The price support for sugar has created a lovely market for the corn people, and now the grain growers from the corn belt join the plantation owners in the south in lobbying for price supports for sugar. Pretty soon a time will come when the United States would have to reduce import quotas to zero or drop the price support program, or else dump on the world market the supplies it buys from the domestic sugar producers. In 1986 the Commodity Credit Corporation decided that it was not going to hold sugar any more and sold 150,000 tons of sugar to China. It had paid 18 cents a pound for it and China got it for 4.75 cents a pound. The world price at that time was 6.33 cents, and the U.S. bargain sale brought it down to 4.96 cents in 2 days. The foreign sugar exporters like Fiji, Australia, and Thailand were infuriated.[5]

If cars that cost $8,000 to make had to be sold at $2,000, all the world's automobile manufacturers would go bust, starting with the least efficient ones. However, with the blessings of the different governments around the world, the only growers in the sugar market that will be going out of business are the most efficient ones (in Australia, Brazil, Cuba, Fiji, the Philippines, and so on).

2.7.3 Controls on prices and quantities

There are several governmental policies that are designed to: (1) prevent prices from rising to their market equilibrating level, or (2) prevent prices from falling to their market equilibrating level, or (3) prevent quantities from reaching their market equilibrating level.

Examples of case (1) are interest rate controls, rent controls, controls on natural gas prices, and controls on several consumer prices. Examples of case (2) are the price support programs for different agricultural commodities and minimum wage laws. An example of case (3) is an import quota.

In the case of controls on maximum prices, what the government has in mind

[5]Lindley H. Clark, Jr., "How Protectionism Soured the Sugar Market," *The Wall Street Journal*, November 5, 1987, p 36.

is the idea that low-income consumers are likely to suffer a great hardship if prices are "too high." In the case of agriculture, the argument for the price support programs is that farm incomes suffer if prices are "too low." In the case of minimum wage laws, again the stated purpose is to protect workers from employers' exploitation. In all these cases, one can argue that one should attack the income problem by changing incomes directly (income subsidies) rather than by tinkering with prices.

As can be seen from a simple demand and supply diagram like the one in Figure 2.7, fixing the price below the market equilibrating level creates an excess demand or shortage, and supporting the price above the market equilibrating level creates an excess supply or a glut. What happens to this excess supply or excess demand depends on the specific case we are considering. For instance, in the case of agricultural price support programs the government purchases part of the excess supply and subsidizes the farmers in storing the remainder. In the case of minimum wage laws, the excess supply of labor goes into the pool of unemployed. Among this pool, those who qualify get unemployment insurance, some of the workers get discouraged and drop out of the labor force, and some others find jobs at lower wages among occupations not covered by the minimum wage laws or in an illegal way even among those occupations covered by minimum wage laws.

In the case of consumer goods subject to price controls, a black market will develop as a consequence of excess demand. We will discuss this issue in the next section.

In the case of price controls on natural gas, the excess demand (those customers that cannot get natural gas) spills over into the demand for alternative fuels (for example, heating oil, electricity, and, in the case of industrial customers, into coal).

In the case of rent controls, the excess demand will go into alternative housing arrangements. Furthermore, the actual market price can really be higher than the controlled price, because landlords can make tenants buy furniture from them at exorbitant prices and in some cases demand "key money" (down payment for the privilege of renting the apartments).

Since one of the major objectives of the price controls (controls on natural gas prices, rent controls, and so on) is to prevent large income transfers to the owners of these resources, it might be interesting to see under what conditions this is possible. Consider the case where the quantity supplied is fixed and equal to Q_0. The effects of price controls in this situation are illustrated in Figure 2.16.

The supply curve SS is vertical at the quantity Q_0. DD is the demand curve. The equilibrium price is P_0 and, of course, the quantity supplied and demanded is Q_0.

Suppose the price is controlled at P_c, which is less than P_0. Then the quantity supplied is still Q_0 as before. There is, of course, an excess demand equal to BC, but this will remain unsatisfied. One thing that has happened is that there is an income transfer equal to the shaded area shown in Figure 2.16 from the producers or resource owners to consumers. Earlier consumers spent $P_0 \cdot Q_0$ for the amount Q_0. Now they spend only $P_c \cdot Q_0$ for the same amount Q_0.

In the case of rent controls, assuming the quantity of housing to be fixed, there is an income transfer from landlords to the tenants that are currently occupying the apartments or houses. Of course, the rent control draws new consumers into

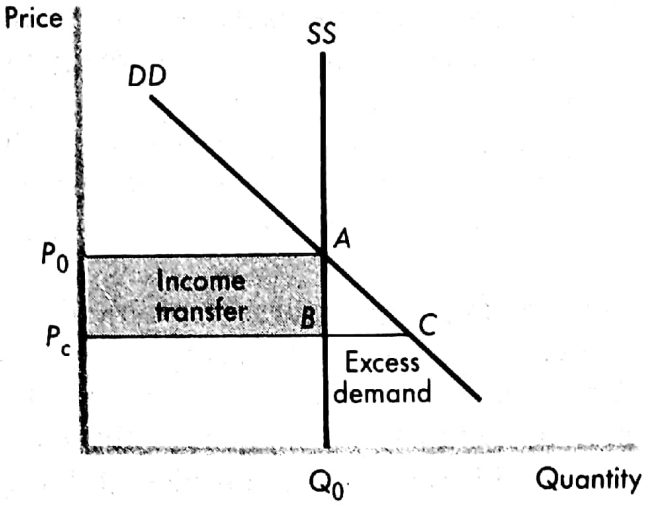


FIGURE 2.16 Effect of price controls under conditions of fixed supply.

the market, and this is what causes the excess demand. But since quantity supplied is fixed, they cannot get any rental housing in this market.

A similar story can be told for price controls on natural gas. The price controls result in an income transfer from natural gas producers or pipeline companies to the consumers. Of course, the low controlled price draws new customers into the market, and this is what produces the excess demand. But since the quantity supplied is fixed, these new customers cannot get natural gas and must find alternative energy sources.

Of course, quantity supplied is not fixed except in the very short run and, thus, the above arguments may not hold good in the long run. But the argument about income transfers is based on an implicit assumption of fixed supply.

EXAMPLE 2.4 Cattle Raisers' Lament

Governments can create shortages by legislating prices below the market equilibrium price and gluts by legislating price supports above the market equilibrium price. The surpluses created by price supports are disposed of in a number of ways, sometimes by selling them even to communist countries at prices below world market prices (by dumping them) and sometimes by novel methods. One particular example is that of the slaughter of milk cows in 1986.

The price support program for milk created an oversupply of milk. In the spring of 1986 the Agriculture Department (USDA) came up with a plan to reduce national milk production through a buy out of surplus milk cows. About 1.6 million milk cows were to be slaughtered or exported over a period of 6 months.

The cattle raisers, however, were not too happy with this plan and protested that this undermines the market for fed cattle. However, this is not true. The cow meat is entirely different from grain-fed steer beef. It cannot be branded as "USDA Choice." It is only useful for the production of hamburgers, hot dogs, bologna, and so on. Thus, the USDA plan would affect only the ranchers who cater to this market. Since the meat industry anyway imported more than 1 billion pounds of boneless beef annually, the cow meat would affect mostly the countries that supply the United States with boneless beef. Australia, New Zealand, and Canada were

the major suppliers to this market. Ireland was the only country in Europe from which these supplies came. Thus, the meat from the dairy herd buy out would have exerted pressure on the foreign suppliers and would have even helped the trade balances for the U.S. The cattle raisers would not have been seriously affected.[6]

Finally, we come to the case of quantity controls. As mentioned earlier, an example of quantity control is an import quota. The effect of an import quota is the same as that of an import tariff as shown in Figure 2.14. Going back to that figure, if the government restricts imports to the level BC, the domestic price will rise to P_d. The government can restrict imports by issuing import licenses equal to the amount BC. If these are issued at random (by say a lottery), then the lucky importers who obtain the licenses will reap the benefit which is $BC \cdot T$ or the shaded area $BCHG$ in Figure 2.14. However, if the government auctions the import licenses, then it will get revenues equal to the shaded area $BCHG$, which is what the government gets from an import tariff. *This shows the relationship between a quantity control and a price control.*

Actually, the case of a per unit tax considered earlier in Section 2.7.1 can also be viewed as one of quantity control. Instead of letting the amount produced be Q_0, the government restricts output to Q_1 by issuing production licenses for that amount. This amount will fetch the price P_1 in the market, but the suppliers are willing to supply this quantity at a price P_2. Thus, $(P_2 - P_1)Q_1$ represent the profits that the lucky producers who get the licenses make, if the government gives away licenses in a lottery. However, if the production licenses are auctioned off, the government will get revenues of $(P_2 - P_1)Q_1$, which is exactly the revenue it gets from a per unit tax. The situation is similar to an import quota.

There are several other examples of quantity controls. The government policy of "pollution standards" is a policy of pollution quotas where each firm is given a quota on the amount of pollution it can generate. We will be discussing this problem in Chapter 19. In the field of agriculture, acreage controls control not output but an input in production. We will discuss this as well in Chapter 15.

2.7.4 Illegal activities and black markets

In the previous section, when we discussed price controls, we argued that some of the excess demand generates a "black market." In other words, some transactions will take place at the controlled price and some other transactions will take place above the controlled price in an illegal market often called the "black market." In the case of minimum wage laws, these transactions are below the price supports (employment at wages below the minimum wage). To study the black market let us first consider demand and supply in a completely illegal market.

Suppose buying and selling a good X is illegal. This could be babies, some drugs, human organs, or U.S. jeans in Russia. The demand and supply curves are shown in Figure 2.17. DD and SS show the demand and supply curves if the buying and selling were legal. The equilibrium would be at A.

Now suppose there is a penalty for those caught buying or selling the product. The consequence of this is a decrease in demand and a decrease in supply. The

[6]See Emerson Moran, "Cattlemen's Beef Is Just Baloney," *Wall Street Journal*, May 14, 1986, p. 30.

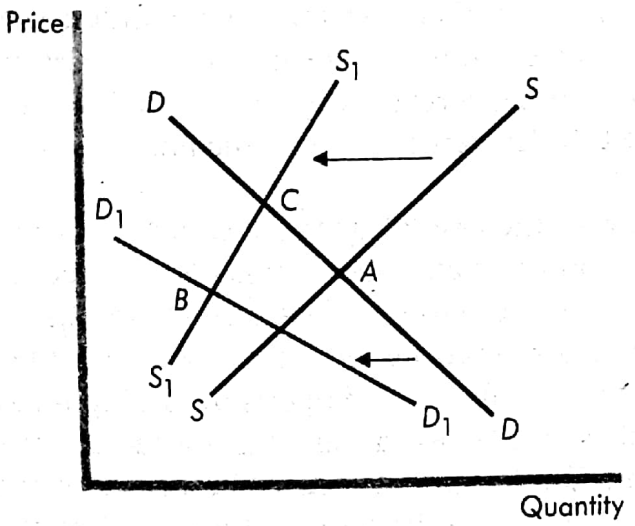


FIGURE 2.17 Demand and supply for illegal goods when penalties are imposed on both buyers and sellers.

equilibrium quantity falls but we can't say anything about the equilibrium price (see Table 2.5, the case of a decrease in both demand and supply).

In actual practice, frequently only the sellers are penalized. In this case, only the supply curve shifts, and equilibrium price clearly rises. However, the reduction in equilibrium quantity will not be as dramatic. This demonstrates that if the objective of outlawing certain goods is to curtail their use, then penalties should be imposed on both buyers and sellers.

Black markets develop when the government attempts to control the price of a product and that price is below the equilibrium price. All trade in this product is not illegal, rather only trade at a price in excess of the controlled price. For example, "scalping" Superbowl tickets is against the law in many places. Selling most items at above an official price is illegal in most communist countries—and, as a result, black markets are prevalent.

The black market situation is shown in Figure 2.18: *DD* is the demand curve and *SS* the supply curve.[7] The market equilibrium occurs at *A*. Suppose the price is controlled at level P_c. This generates an excess demand equal to *BC*. These unsatisfied buyers enter the black market. If there are no penalties on the buyers, then their demand curve is *EC*. Suppose there is a penalty on the seller. Then the supply curve shifts leftward to S_1S_1. The equilibrium is now at the point *F*. The black market price is higher than the market-equilibrating price. Actually, the average market price (the weighted average of the legal price and black market price) could also be higher than the market-equilibrating price (although it is not the way the diagram is drawn).

Now suppose the buyers also pay a penalty. In this case the black market demand curve shifts leftward to D_1D_1. The black market equilibrium is at the point *G*. In this case the black market price is below the market equilibrium price but one can get other results by changing the magnitudes of the shifts. If no penalties are imposed on sellers and penalties are imposed on buyers only, the black market

[7]The analysis here is based on Kenneth E. Boulding, "A Note on the Theory of the Black Market," *Canadian Journal of Economics and Political Science*, February 1947, pp. 115–118. The exposition and diagrams are, however, different and relate to the preceding discussion of illegal activities.

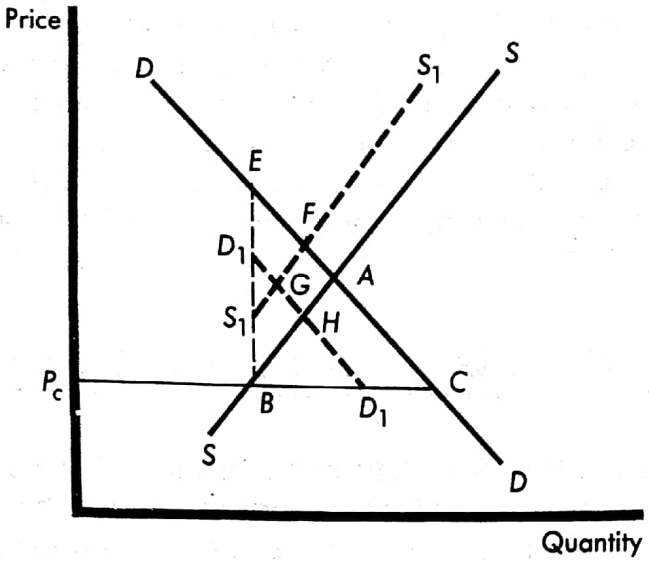


FIGURE 2.18 Price determination in black market.

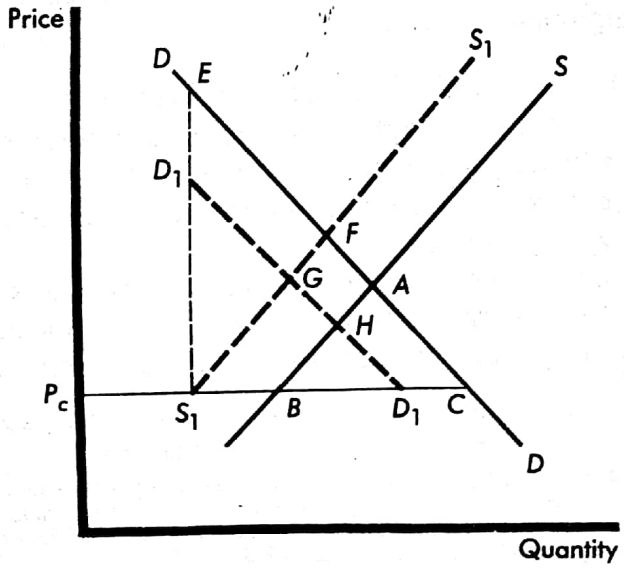
equilibrium is at H (since the supply curve does not shift). Thus, *if our concern is with the price in the black market, it is better to penalize the buyers rather than the sellers.*

Also, note that if the penalties are sufficiently high, then the black market demand curve D_1D_1 and the black market supply curve may not intersect and, thus, no transactions can take place.[8]

Finally, some supplies currently available in the "free" market might disappear into the black market. Of course, in the extreme case where all supplies disappear we can apply the analysis of the illegal markets we discussed earlier. The case where some of the supplies from the free market disappear into the black market is illustrated in Figure 2.19. All the curves and equilibrium points are defined as

[8]This is not shown in the diagram, but we can just move S_1S_1 upward and D_1D_1 downward. Note that any meaningful intersection has to be to the right of the point B.

FIGURE 2.19 Price determination in black market when part of the legal supply disappears into the black market.



in Figure 2.18. The only change is that the black market supply S_1S_1 starts at a point to the left of B. S_1B is the supply disappearing into the black market. The excess demand is now S_1C instead of BC. One can draw conclusions similar to those drawn with Figure 2.18. We will omit the details here.

Note that the IRS estimated that it lost $90 billion in unpaid taxes due to black market activity and tax cheating in 1981 and that the figure would likely grow to $135 billion by 1985.[9]

2.8 EXCEPTIONS TO THE LAWS OF DEMAND AND SUPPLY

As stated earlier in Section 2.2, the law of demand says that ceteris paribus quantity demanded falls as price rises and rises as price falls. Are there any exceptions to this law? Does quantity demanded ever rise as the price rises and fall as the price falls? The answer is yes, and the following are some examples:

1. Goods with snob appeal: Many items such as jewelry are valued for their "snob appeal." The economist Thornstein Veblen coined the phrase, "conspicuous consumption" to describe the consumption of items that are valued just because of their high price.[10] If prices are reduced, the buyers' satisfaction from possessing them goes down, and the quantity demanded goes down. The same thing happens for fur coats and fancy cars as well. If they are "cheap," then there is nothing great about possessing them.

2. Goods with uncertain product quality: There are many goods for which we do not know the quality, and we sometimes judge the quality by the price. We often say "if it costs so much, it must be really good." In markets where prices act as "signals" of quality, people tend to assume that quality has gone up when prices are raised and hence may demand more of the commodity at a higher price.

3. Giffen goods: For completeness our list should include Giffen goods, named for the nineteenth-century English economist Robert Giffen. He argued that the demand curve for some inferior goods would slope upward for theoretical reasons. There is no empirical evidence to establish the existence of a Giffen good, but we will examine his argument in Chapter 4.

As with the violations of the law of demand, there are cases of violations of the law of supply. That is, there are cases where less will be supplied at a higher price and more at a lower price. One example is based on imperfect information. This is similar to the uncertainty about product quality discussed in the case of the violations of the law of demand.[11]

In summary, the violations of the laws of demand and supply we discussed are to be found in (1) markets for goods with snob appeal, (2) markets with imperfect information and uncertainty, and (3) the case of Giffen goods.

[9]See O. Friedrich, "Tax Cheating—Bad and Getting Worse," *Time*, March 28, 1983, pp. 26–32.

[10]Thornstein Veblen, *The Theory of the Leisure Class*, Macmillan, New York, 1899.

[11]This problem is discussed in Joseph E. Stiglitz and Andrew Weiss, "Credit Rationing in Markets with Imperfect Information," *The American Economic Review*, June 1981, pp. 393–411. Some other examples pertaining to used cars, medical insurance, and so on can be found in G. Akerlof, "The Market for Lemons: Qualitative Uncertainty and the Market Mechanism," *Quarterly Journal of Economics*, August 1970, pp. 488–500.

EXAMPLE 2.5 Supplier-Induced Demand—The Case of Physicians

The conventional demand and supply model we have discussed is based on the assumption that price and output can be explained by the interaction of *independent* supply and demand. This assumption has been called into question in the market for medical services. It has been argued that medical practitioners have the ability to generate demand for their services directly, that they have the ability to shift the position of the consumers' demand curve. This is a case of supplier-induced demand, and the inducement hypothesis in this case states that doctors generate demand for their own services.[12]

The first evidence on the inducement hypothesis was provided by Fuchs and Kramer, who found, using data for different states, that visits per capita are positively associated with the number of physicians per capita when income, price, insurance benefits, and hospital beds per capita are held constant.[13] Thus, more doctors means more doctoring. The findings by Fuchs and Kramer were criticized on empirical and logical grounds by Sloan and Feldman, Yett, and others.[14] A question that was asked by Yett was: "After all, if physicians really do have the power to raise fees and sell more of the same service to a small number of patients in areas where physician density is high, why don't they do this sort of thing in all circumstances? If the answer is that they aim for a target income, what determines the height of the target?" Fuchs and Kramer were also criticized on grounds that they used aggregate data for states.

To respond to these criticisms, Fuchs reexamined the supplier-induced demand hypothesis using in-hospital surgery rates and the supply of surgeons.[15] He again found that more surgeons per capita mean more operations per capita! He found that "other things equal, a 10 percent increase in surgeon/population ratio results in a 3 percent increase in *per capita* utilization. Moreover, differences in supply seem to have a perverse effect on fees, raising them when the surgeon/population ratio increases." As for surgeon supply, Fuchs found that it was determined in part by factors unrelated to demand, especially by the attractiveness of the area as a place to live.

The supplier-induced demand hypothesis has profound implications for public policy. We cannot expect to reduce the price of medical care by increasing the supply of physicians and surgeons. More doctors mean more doctoring and higher fees. More surgeons mean more operations and higher fees. Maybe this is why the medical profession is not too opposed to the expansion of medical schools.

Price controls applied to physicians' fees to restrain total health care spending may be unproductive. They may merely lead to more visits, substitution of costly procedures for simple ones, increased use of hospital care, and so on. There is substantial empirical evidence to show this. The greatest 2-year change in physi-

[12] J. Richardson, "The Inducement Hypothesis: That Doctors Generate Demand for Their Own Services," in J. Van der Gaag and M. Perlman, eds., *Health, Economics and Health Economics*, North Holland, Amsterdam, 1981, pp. 189–214, presents evidence from Australian data.

[13] V. R. Fuchs and M. J. Kramer, "Determinants of Expenditures for Physicians' Services in the U.S. 1948–68," National Bureau of Economic Research, Occasional Paper No. 117, New York, 1972.

[14] See A. C. Enthoven, "The Behavior of Health-Care Agents: Provider Behavior," in Van der Gaag and Perlman, *Health, Economics*, pp. 173–188 for a survey of this literature.

[15] V. R. Fuchs, "The Supply of Surgeons and the Demand for Operations," *Journal of Human Resources*, Supplement, Fall 1978, pp. 35–36.

cians' services occurred during the 2-year period when price controls were in effect (fiscal year 1973 and fiscal year 1974).[16] Physician utilization rates increased 6.3 percent and 5.5 percent, respectively. The increases were 3.9 and 4.3 percent the previous 2 years, and 2.5 and 2.8 percent in the 2 subsequent years. Thus, physicians may have increased billings to compensate for their inability to raise fees.

The theoretical underpinnings of the supply-induced demand hypothesis are weak. But there is considerable empirical evidence to suggest that it might be valid. And the policy implications if it is valid are very important.

2.9 SUMMARY AND CONCLUSIONS

The demand curve relates price to the desired quantities of purchase. Other conditions remaining the same, quantity demanded falls as price increases. The market demand curve is obtained by summing the individual quantities demanded at each price; similarly, the supply curve relates price to the desired quantities of sale. Other things remaining the same, quantity supplied rises as price increases. The market supply curve can be obtained by summing the individual quantities supplied at each price, if no specialized inputs are involved.

It is important to distinguish between the terms "demand" and "quantity demanded." In common conversation they may be used interchangeably, but in economics they mean two different things. Demand refers to the entire relationship between price and quantity. Quantity demanded refers to the quantity which buyers are willing to purchase at a particular price. Thus, when we say there is an increase in demand, we mean that the demand curve shifts to the right so that quantity demanded increases at *every* price. Similarly, a decrease in demand means a shift of the demand curve to the left. The terms "increase in supply" and "decrease in supply" are similarly interpreted as shifts in the supply curve.

Market equilibrium occurs at the point of intersection of the market demand and supply curves. Market equilibrium changes when there is a change in one or more conditions that influence the behavior of either buyers or sellers so that there is a shift in the demand and/or supply curves.

Shifts in the demand curve occur when there is a change in tastes or income or the prices of related goods. Shifts in the supply curve occur with changes in input supply, the state of technology, changes in the prices of alternate outputs, new discoveries, and changes in weather.

Taxes (subsidies) will also cause the demand or supply curves to shift. An excise tax (per-unit tax) can be described as an upward shift in the supply curve by an amount equal to the tax, when the price paid by consumers is plotted on the vertical axis (Figure 2.10). Alternatively, it can be shown as a downward shift in the demand curve when the price kept by sellers is plotted on the vertical axis (Figure 2.11).

The effect of import tariffs and export subsidies can be shown as movements along the given demand and supply curves.

A tariff of T per unit is exactly the same as a production subsidy of T per unit

[16] Z. Y. Dickman, *A Study of Physicians' Fees*, Council on Wage and Price Stability, Washington, D.C., 1978.

plus a consumption tax of T per unit. A similar conclusion applies to export subsidies. Both import tariffs and export subsidies are equivalent to a production subsidy plus a consumption tax.

Controls on prices or quantities produce a situation of excess demand or excess supply. These require measures of "rationing" if there is excess demand or "surplus disposal" if there is excess supply.

In markets for illegal goods, suppliers are usually highly penalized. However, this causes the equilibrium price to rise, but the quantity transacted may not fall much. If the government would like to control both the price and the quantity of a good transacted illegally, then it should penalize not only the sellers but the buyers as well.

Price controls may produce black markets. The analysis of black markets is similar to that of illegal markets.

KEY TERMS

Black Market
Ceteris Paribus
Change in Demand
Change in Quantity Demanded
Change in Quantity Supplied
Change in Supply
Complements
Conspicuous Consumption
Demand
Disequilibrium
Equilibrium Price and Quantity
Excess Demand or Shortage
Excess Supply or Surplus
Export Subsidy
Import Tariff
Inferior Good
Law of Demand
Law of Supply
Market Demand
Market Supply
Normal Good
Substitutes
Supply
Tatonnement Process

QUESTIONS

1. Listed below are six statements. Indicate which is an increase or decrease in demand, an increase or decrease in quantity demanded, an increase or decrease in supply, or an increase or decrease in quantity supplied.
   a. TWA reduces its average plane fare by 30 percent in order to attract more passengers.
   b. The government grants an export subsidy to the producers of oranges in order to increase the sale of oranges abroad.
   c. Wheat farmers in Nebraska decide to withhold some of their product from the market because prices are too low.
   d. The higher price of imported whiskey causes more people to drink Kentucky bourbon.
   e. The government imposes an excise tax on automobile tires, and sellers cannot pass much of this tax on to consumers. As a result, the number of tires offered on the market for sale drops.
   f. Saudi Arabia opens its "oil spigot" in order to teach those OPEC members who discounted price in the international market a lesson.
2. What does the term "ceteris paribus" mean? How does it relate to the distinction between a change in quantity demanded and a change in demand?

3. Consider the market for video cassette recorders (VCRs). How will each of the following changes affect demand, supply, and equilibrium price and quantity? Discuss why.
   a. Consumer incomes increase dramatically.
   b. Penalties on the recording of copyrighted materials are imposed and enforced.
   c. Movie theaters reduce their prices.
   d. An improvement in technology dramatically reduces production costs.
   e. The price of recording tape increases.
   f. It is rumored that prices of VCRs will rise sharply next year.

4. The table below is a demand and supply schedule for oranges. The quantity is measured in boxes of 48 oranges each.

Price per Box (48 per box)	Quantity Demanded (millions of boxes per year)	Quantity Supplied (millions of boxes per year)
$6	25	125
5	50	100
4	75	75
3	100	50
2	125	25
1	150	0

   a. What are the equilibrium price and quantity in the orange market?
   b. At a price of $6 per box, does a surplus or shortage exist in the market? What is the magnitude of this disequilibrium condition?
   c. If the government controlled the price of oranges at $3 per box, what would happen in the orange market?
   d. Suppose that the world price of oranges is $2 per box. Will there be imports into or exports from the domestic market? Why? By how much?

5. If the equation for a market demand curve is $Q_d = 10 - 4P$, and the equation for the market supply curve is $Q_s = 4P$, find the market equilibrium price and quantity. Verify your answer graphically.

6. The following statement was recently made by one of this nation's top political leaders: "With the price of crude petroleum falling so rapidly, it will be difficult for the oil refineries to keep up with the increase in demand for gasoline."
   a. Criticize the statement. Can you find a flaw in the leader's reasoning? Explain.
   b. What effect will the falling price of petroleum have on the supply of gasoline? Explain.

7. From January of 1979 through January of 1980, the price of gold nearly tripled. Yet as the price of gold rose, sales of gold increased as well. Does this imply that the demand for gold is upward sloping? Why or why not?

8. For each of the following statements, answer "true" or "false," and then provide a reason for your answer.

a. An increase in demand and a decrease in supply will always result in a higher equilibrium price and a lower equilibrium quantity.

b. Ceteris paribus, if the government supports a product's price below its equilibrium price, neither a surplus nor shortage will exist.

c. An increase in the price of mink coats will cause quantity demanded to fall.

d. An increase in demand and an increase in supply have an indeterminate effect on product price, but equilibrium quantity increases.

e. If the government imposes an import tariff on Japanese televisions, the supply of imported televisions decreases.

9. During the summer of 1985, some watermelons were accidentally contaminated with an herbicide. Several consumers became seriously ill. This accident had two immediate results. First, consumers were frightened. Second, the agricultural authorities destroyed a large number of suspect melons. Using demand and supply analysis, explain the impact of this incident on the market for watermelons. Could you have predicted the impact on equilibrium price? On equilibrium quantity consumed? Why or why not?

10. From time to time, the federal government gives away surplus agricultural commodities (cheese, butter, and so on), and retail grocers often complain that the "giveaways" reduce their sales. Is this complaint valid? Is there a change in demand or quantity demanded? Explain your answer.

11. In April of 1981, Japan imposed a "voluntary quota" on the export of cars to the United States. Many people believed that they agreed to voluntarily restrict exports because they feared that the alternative would be the imposition by the United States of an import tariff on Japanese cars. Why would the Japanese prefer the quota to the tariff?

12. Every year there is a shortage of Superbowl tickets at the "official" price. (What does this imply about the official price relative to the equilibrium price?) Generally, a black market (scalping) then develops in which tickets are sold for several hundred dollars or more. If tickets were instead auctioned to ensure that they sold for the equilibrium price, how would the average price paid be affected? If stiff penalties were imposed on scalpers, how would the current black market price be affected? Demonstrate your conclusions using demand and supply analysis.