Micro economics

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Chapter One

Individual Markets:

Demand and Supply

Chapter.1

Understanding Individual Markets: Demand and Supply

The simple tools of demand and supply can take one for in understanding not only specific economic issues, but also the operation of the entire economic system.

- **The overriding goal of this chapter is to understand the nature of market.**
- **How prices and outputs are determined.**
- **How the interaction of buying decision of households and the selling decision of producers will determine the price of product and the quantity which is actually bought and sold in the market.**

Chapter One

Markets Defined

A market is defined as an institution or mechanism which brings together buyers (“demanders”) and sellers (“suppliers”) of particular goods and services. Markets assume a wide variety of forms. The corner gas station, the fast-food outlet, the local record shop, a farmer's roadside stand-all are familiar.

All these situations which link potential buyers with potential sellers constitute markets. As our examples imply, some markets are local while others are national or international in scope. Some are highly personal, involving face- to- face contact between demander and supplier; others are impersonal in that buyer and seller never see or know one another.

Demand

The term “demand” has a very specific meaning to the economist. Demand is defined as a schedule which shows the various amounts of a product which consumers are willing and able to purchase at each specific price in a series of possible price during some specified period of time. Demand simply portrays a series of alternative possibilities which can be set down in tubular form. It shows the quantities of a product which will be demanded at various prices, all other things being equal. As our definition indicates, we usually view demand from the vantage point of price; that is, we read demand as showing the amounts consumers will buy at various possible prices. It is equally correct and sometimes more useful to view demand from the reference point of quantity. That is, instead of asking what quantities can be sold at various prices, we can ask what prices can be gotten from consumers for various quantities of a good Table 1, is a hypothetical demand schedule for a single consumer who is purchasing bushels of corn. Table 1, an individual buyer's demand for corn (hypothetical data).

Price per bushel	Quantity demanded per week
$5	10
4	20
3	35
2	55
1	80

Price of corn in the market happened to be $5 per bushel, our consumer would be willing and able to buy 10 bushels per week; if it were $4, the consumer would be willing and able to buy 20 bushels per week; and so forth.

The demand schedule in and of itself does not tell us which of the five possible prices will actually exist in the corn market. As we have already said, this depends on demand and supply. Demand, then, is simply a tabular statement of a buyer's plans, or intentions, with respect to the purchase of product.

Note that, to meaningful the quantities demanded at each price must relate to some specific time period- a day, a week, a month, and so forth. To say that a consumer will buy 10 bushels of corn at $5 per bushel is vague and meaningless. To say that a consumer will buy 10 bushels of corn per week at $5 per bushel is clear and very meaningful.

Law of Demand

A fundamental characteristic of demand is this: all else being constant, as price falls, the corresponding quality demanded rises. Or, alternatively, other things being equal, as price increases, the corresponding quality demanded falls. In short, there is a negative or inverse relationship between price and quantity demanded. Economists have labeled this inverse relationship the law of demand.

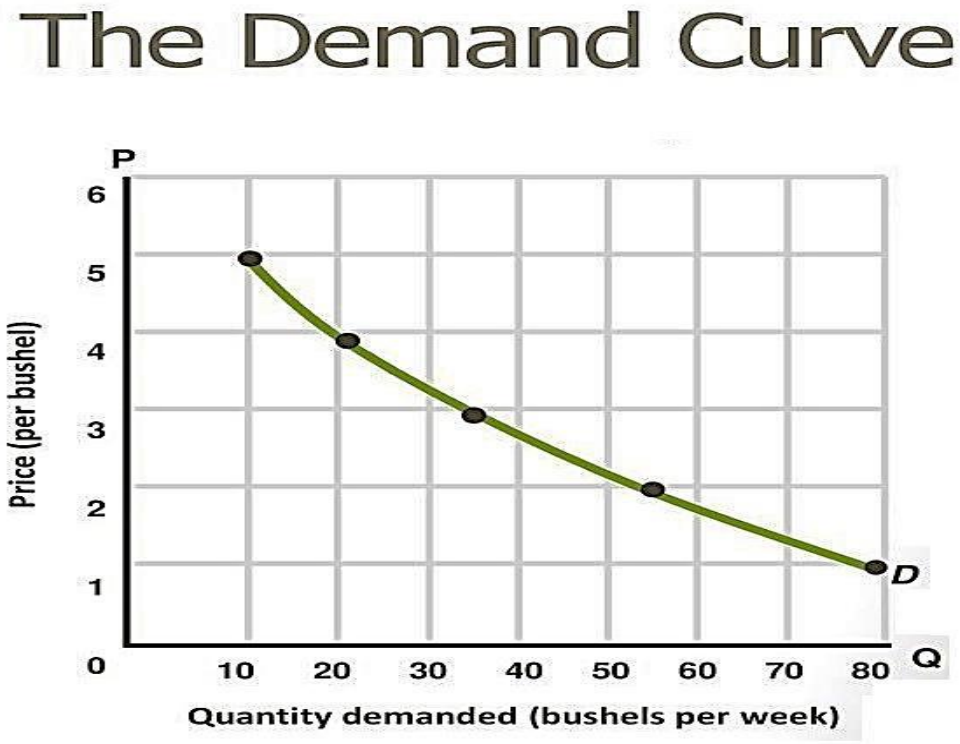
The Demand Curve

This inverse relationship between product price and quantity demanded can be presented on a simple two- dimensional graph measuring quantity demanded on the horizontal axis and price on the vertical axis 2. The process involved is that of placating on the graph those five Price-quantity possibilities shown in Table 1. We do this by drawing perpendiculars from the appropriate points on two axes.

Thus, for example, in plotting the $5-price-10 quantity demanded possibility, we must draw a perpendicular from the horizontal (quantity) axis at 10 to meet a perpendicular drawn from the vertical (price) axis at $5. If this is done for all five possibilities, the result is a series of points as shown in Figure 1. Each of these points represents a specific price and the corresponding quantity which the consumer will choose to purchase at that price. Now, assuming the same inverse relationship between price and quantity demanded at all points between the ones graphed, we can generalize on the inverse relationship between price and quantity demanded by drawing a curve to represent all price quantity demanded possibilities within the limits shown on the graph. The resulting curve is called a demand curve and is labeled DD in Figure 1. It slopes downward and to the right because the relationship it portrays between prices and demanded is negative or inverse. The law of demand people buys more at a low price than they do at a high price-is reflected in the downward slope of the demand curve.

What is the advantage of graphing our demand schedule? After all, Table1, and Figure 1 contain exactly the same data and reflect the same relationship between price and quantity demanded. The advantage of graphing is that it permits us to represent clearly a given relationship-in this case the law of demand in a much simpler way than we could if we were forced to rely upon verbal and tabular presentation. A single curve on a graph, if understood, is simpler to state and to manipulate than Tables and lengthy verbal presentations would be. Graphs are

invaluable tools in economic analysis. They permit clear expression and handling of sometimes complex relationships.



Determinants of Demand

When the economist constructs a demand curve such as D_1 in Figure 2, the assumption is made that price is the most important determinant of the amount of any product purchased. But economist is aware that factors other than price can and do affect purchases, thus, in locating a given demand curve such as D_1, it must also be assumed that other things are equal; that is, other non-price determinants of the amount demanded are conveniently assumed to be constant. When these non-price determinants of demand do in fact change, the location of the demand curve will shift to some new position to the right or left of D_1 for this reason these determinants are also referred to as demand shifters.

What are the major non price determinants of markets demand? The basic ones are (1) the tastes or preferences of consumers, (2) the number of consumers

in the market, (3) the money incomes of consumers, (4) the prices of related goods, and (5) consumer expectations with respect to future prices and incomes.

Changes in Demand

What happens if one or more of the determinants of demand should change? We know the answer: A change in one or more of the determinants will change the demand schedule data in Table 2 and therefore the location of the demand curve in Figure 2. Such a change in the demand schedule data or, graphically, a shift in the location of the demand curve is designated as a change in demand.

(1) price per bushel	(2) Quantity demanded per week single buyer	(3) number of buyers in the market	(4) total quantity demanded per week
$5	10	× 200	= 2,000
4	20	× 200	=4,000
3	35	× 200	=7,000
2	55	× 200	= 11,000
1	80	× 200	= 16,000

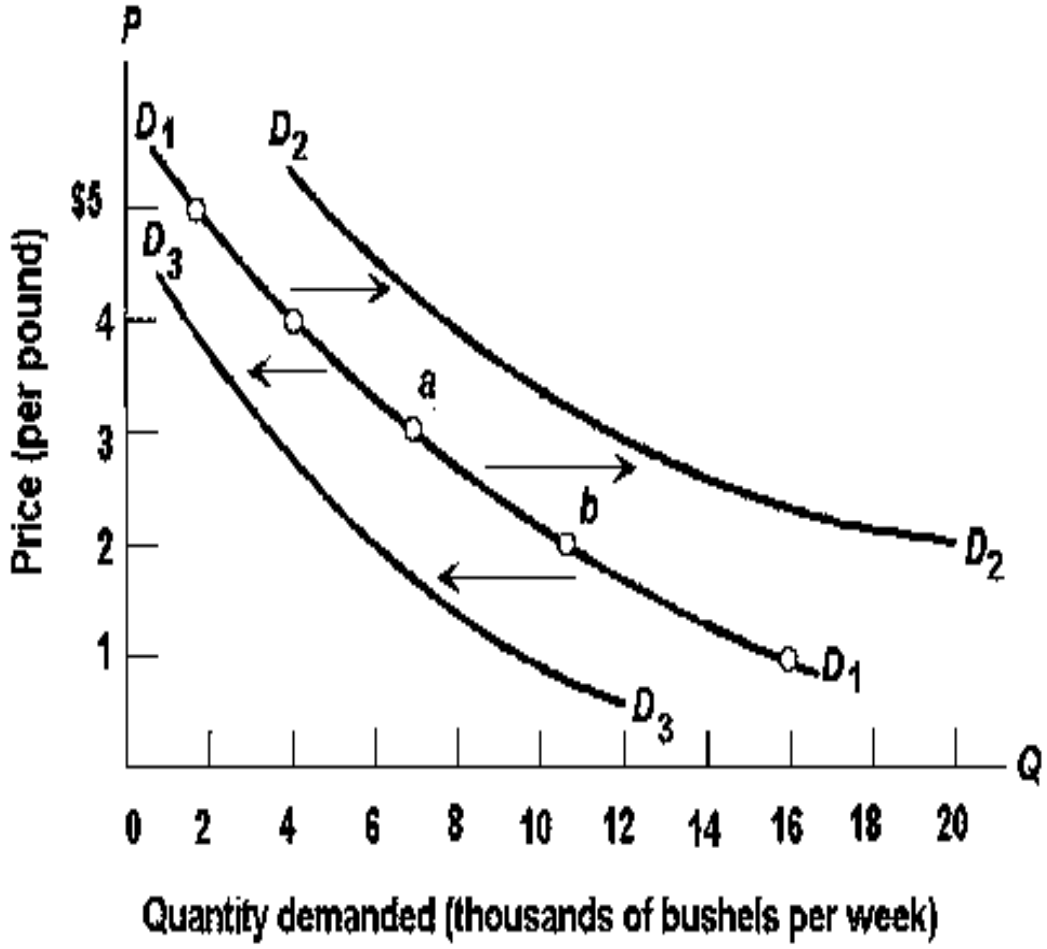


Figure2

Change in the demand for corn

A change in one or more of the determinants of demand–consumer tastes, the number of buyers in the market, money incomes, the prices of other goods, or consumer expectations–will cause a change in demand. An increase in demand shifts the demand curve to the right, as from D_1 to D_2. A decrease in demand shifts the demand curve to the left, as from D_1 to D_3. A change in the quantity demanded involves a movement, caused by a change in the price of the product under consideration, from one point to another–as from a to b–on a fixed demand curve.

More specifically, if consumers become willing and able to buy more of this particular good at each possible price than is reflected in column 4 of Table 2, an increase in demand has occurred. In Figure 2, this increase in demand is reflected in a shift of the demand curve to the right, for example, from D_1 to D_2. Conversely,

a decrease in demand occurs when, because of a change in one or more of the determinants, consumers buy less of the product at each possible price than is indicated in column 4 of Table 2. Graphically, a decrease in demand entails a shift of the demand curve to the left, for example, from D_1 to D_2 in Figure 2.

Let us now examine the effect upon demand of changes in each of the aforementioned non-price determinants.

1- Tastes A change in consumer tastes or preferences favorable to this product possibly prompted by advertising or fashion changes-will mean that more will be demanded at each price; that is, demand will increase. An unfavorable change in consumer preferences will cause demand to decrease, shifting the curve to the left. It is worth noting that technologies changes in the form of a new product may prompt a revision of consumer tastes. For example, the development and consumer acceptance of the hand calculator virtually eliminated the demand for slide rules. Similarly, the introduction of compact discs has tended to decrease the demand for long-playing records.

2- Number of buyers it is equally obvious that an increase in the number of consumers in a market will constitute an increase in demand. Fewer consumers will be reflected by a decrease in demand. Example: Dramatic improvements in communications have made financial markets international in scope, tending to increase the demand for stocks, bonds, and other financial instruments. The baby boom of the post-world war || period increased the demand for diapers, baby lotion, and services of obstetricians. Increasing life expectancy has increased the demands for medical care, retirement communities, and nursing homes. American trade negotiators are trying to reduce foreign trade barriers to American farm products in order to increase the demands for those products.

3- Income the impact of changes in money income demand is a bit more complex. For most commodities, a rise in income will cause an increase in demand.

Consumers typically buy more steaks, stereos, and Scotch as their incomes in incomes. Conversely, the demand for such products will decline in response to a fall in incomes. Commodities whose demand varies directly with money income are called superior or normal goods.

Although most products are normal goods, there are a few exceptions. Examples: as incomes increase beyond some point, the amounts of bread or potatoes or cabbages purchased at each price may diminish because the higher incomes now allow consumers to buy more high-protein foods, such as dairy products and meat. Rising incomes may also tend to decrease demands for used clothing and third-hand automobiles. Similarly, rising incomes may cause the demands for hamburger and margarine to decline as wealthier consumers switch to T-bones and butter. Goods whose demand varies inversely with a change in money income are called inferior goods.

4- prices of related goods whether a given change in the price of a related good will increase or decrease the demand for the product under consideration will depend upon whether the related good is a substitute for, or a complement to, it. For example, butter and margarine are substitute goods. When the price of butter rises, consumers will purchase a smaller amount of butter and this will cause the demand for margarine to increase. Conversely, price of butter falls, consumers will buy larger quantities of butter, causing the demand for margarine to decrease. To generalize: when two products are substitutes, the price of one good and the demand for the other are directly related. So it is with Millers and Budweiser, Sugar and Nutrasweet, Toyotas and Hondas, Tea and Coffee, and so forth.

But other pairs of products are complementary goods; they go together in that they are jointly demanded. If the price of gasoline falls and, as a result, you drive your car more, this extra driving will increase your demand for motor oil. Conversely, an increase in the price of gasoline will diminish the demand for motor

oil. Thus gas and oil are jointly demanded; they are complements. And so it is with ham and eggs, tuition and textbooks, VCRs and video cassettes, golf clubs and golf balls, cameras and rolls film, and so forth. When two commodities are complements, the price of one good and the demand for the other are inversely related.

Many pairs of goods, of course, are not related at all–they are independent goods. For such pairs of commodities as, for example, butter and golf balls, potatoes and automobiles, bananas and wristwatches, we should expect that a change in the price of one would have so impact upon the demand for the other.

5- Expectations consumer expectations about such things as future product prices, product availability, and future income can shift demand. Consumer expectations of higher future prices may prompt them to buy now in order to beat the anticipated price rises, and, similarly, the expectation of rising incomes may induce consumers to be less tightfisted in their current spending. Conversely, expectations of falling prices and income will tend to decrease the current demand for products. First example: if freezing weather destroys a substantial portion of Florida's citrus crop, consumers may reason that forthcoming shortages of frozen orange juice will escalate its price. Hence, they stock up on orange juice by purchasing extraordinarily large quantities now. Second example: Several years ago Jonny Carson Jokingly predicted a toilet paper shortage. Many of his **TV** fans took his comment seriously and within a few days' toilet paper was not be found on the shelves of many supermarkets. Third example: A first round **NFL** draft choice might splurge for a new: Mercedes in anticipation of a lucrative professional football contract.

We might summarize by saying that an increase in the demand for product X–the decision of consumers to buy more of X at each possible price–can be caused by (1) a favorable change in consumer tastes, (2) an increase in the

number of buyers in the market, (3) a rise in income if X is a normal good or a fall in income if X is an inferior good, (4) an increase in the price of related goods Y if Y is a substitute for X or a decrease in price of related good Y if Y is a complement to X, and (5) expectations of future increases in prices and incomes. Conversely, a decrease in the demand for X can be associated with (1) an unfavorable change in tastes, (2) a decrease in the number of buyers in the market, (3) a rise in income if X is inferior good or a fall in income if X is a normal good, (4) an increase in the price of related good Y if Y is complementary to X or a decrease in the price of related good Y if Y is a substitute for X and (5) expectations of future Price and income declines. Table 3 provides a convenient listing of the determinants of demand along with additional illustrations.

Changes in Quantity Demanded

A “change in demand” must not be confused with a change in the quantity demanded. We have noted that a change in demand refers to a shift the entire demand curve either to the right (an increase in demand) or to the left (a decrease in demand). The consumer's state of mind concerning purchases of this product has been altered. The cause: a change in one or more of the determinants of demand. As used by economists, the term "demand refers to a schedule or curve; therefore, a change in demand must mean that the entire schedule has changed and that graphically the curve has shifted its position.

In contrast, a change in the quantity demanded designated the movement from one point to another point–from one price quantity combination to another–on a fixed demand curve. The cause of a change in the quantity demanded is a change in the price of the product under consideration. In Table 2 a decline in the price asked by suppliers of corn from $5 to $4 will increase the quantity of corn demanded from 2000 to 4000 bushels.

Figure 2 is helpful in making the distinction between a change in demand and a change in the quantity demanded. The shift of the demand curve D_1 to either D_2 or D_3 entails a "change in demand". But the movement from point a to b on curve D_1 is a change in the quantity demanded.

The reader should decide whether a change in demand or a change in the quantity demanded is involved in each of the following illustrations:

1- Consumer incomes rise, with the result that more jewelry is purchased.

2- A barber raises the price of haircuts and experiences a decline in volume of business.

3- The price of Toyotas goes up and, as a consequence, the sales of Chevrolets increase.

Supply

Supply may be defined as a schedule which shows the various amounts of a product which a producer is willing and able to produce and make available for sale in the market at each specific price in a series of possible prices during some specified time period. This supply schedule portrays a series of alternative possibilities, such as those shown in Table 4 for a single producer. Supply tells us the quantities of a product which will be supplied at various prices, all other factors being held constant. Let us suppose, in this case, that our producer is a farmer producing corn, the demand for which we have just considered. Our definition of supply indicates that supply is usually viewed from the vantage point of price. That is, we read supply as showing the amount producers will offer at various possible prices. It is equally correct and more useful in some instances to view supply from the reference point of quantity. Instead of asking what quantities will be offered at various prices, we can ask what prices will be required to induce producers to offer various quantities of good.

Law of Supply

It will be immediately noted that Table 4 shows a positive or direct relationship between price and quantity supplied. As price rises, the corresponding quantity supplied rises; as price falls, the quantity supplied also falls. This particular relationship is called the law of supply. It simply tells us that producers are willing to produce and offer for sale more of their product at a high price than they are at a low price. Why? This again is basically a commonsense matter.

Price, we recall, is a deterrent from the consumer's standpoint. The obstacle of a high price means that the consumer, being on the paying end this price, will buy a relatively small amount of the product; the lower the price obstacle, the more the consumer will buy. The supplier, on the other hand, is on the receiving end of the product's price. To a supplier, price is revenue per unit and therefore is an inducement or incentive to produce and sell a product. The higher the price of the product, the greater the incentive to produce and offer it in the market.

Consider a farmer whose resources are shift Table within limits among alternative products. As price moves up in Table 4, the farmer will find it profitable to take land out of wheat, oats, and soybean production and put it into corn. Furthermore, higher corn prices will make it possible for the farmer to cover the costs associated with more intensive cultivation and the use of larger quantities of fertilizers and pesticides. All these efforts result in more output of corn. Consider a manufacturing concern. Beyond some point manufacturers usually encounter increasing production costs per unit of output. Therefore, a higher product price is necessary to cover these rising costs. But why do costs rise? They rise because certain productive resources–in particular, the firm's plant and machinery–cannot be expanded in a short period of time. Hence, as the firm increases the amounts of more readily variable resources such as labor, materials, and component parts, the fixed plant will at

Table 4-5 an individual producer's supply of corn (hypothetical data)

Price per bushel	Quantity demanded per week
$5	60
4	50
3	35
2	20
1	5

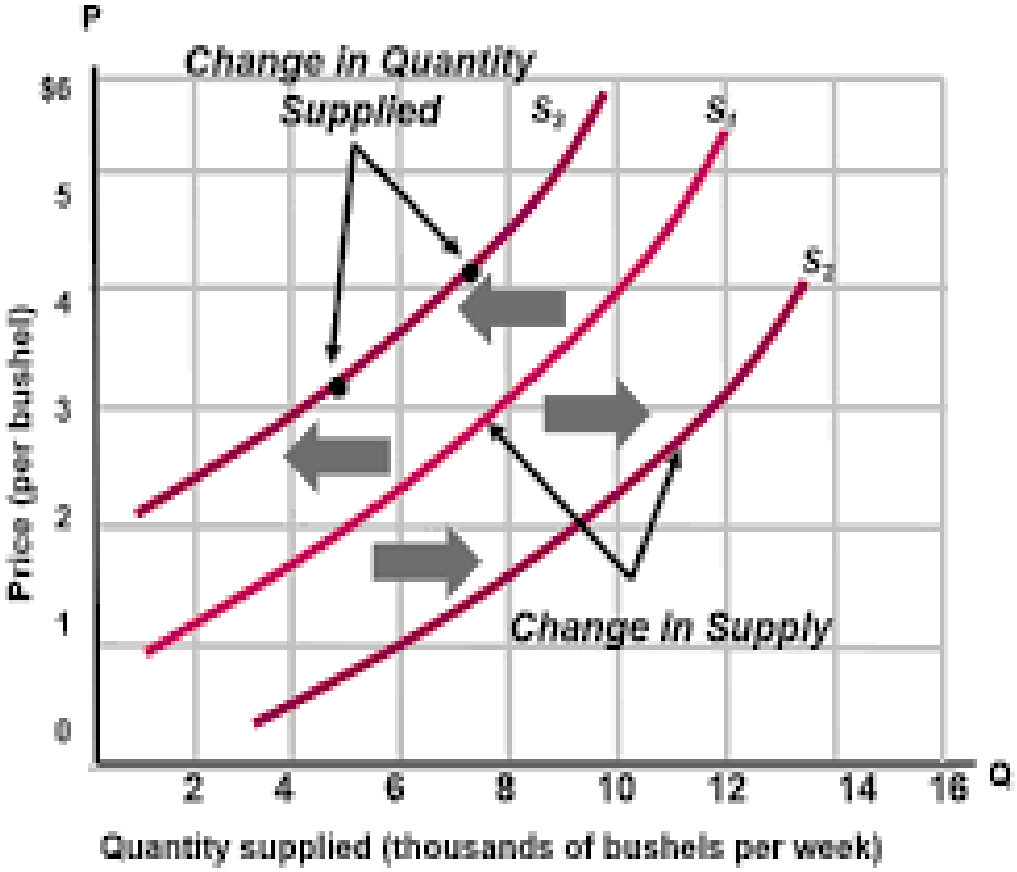


Figure 3

Changes in the Supply of Corn

A change in one or more of the determinants of supply-resource prices, productive techniques, the prices of other goods, taxes and subsidies, price expectations, or the number of sellers in the market-- will cause a change in

supply. An increase in supply shifts the supply curve to the right, as from 5 to Si. A decrease in supply is shown graphically as a movement of the curve to the left, as from 5t to 53. A change in the quantity supplied involves a movement caused by a change in the price of the product under consideration, from one point to another- as from a to b-on a fixed supply curve.

Some point become crowded or congested with the result that productive efficiency declines and the cost of successive units of output increases. Producers must receive a higher price to produce these more costly units. Price and quantity supplied are directly related.

The Supply Curve

As in the case of demand, it is convenient to present graphically the concept of supply. Our axes in Figure 4-4 are the same as those in Figure 4-3, except for the change of quantity demanded to quantity supplied. The graphing procedure is the same as that previously explained, but of course the quantity data and relationship involved are different. The market supply data graphed in Figure 3 as S\ are shown in Table 5, which assumes there are 200 suppliers in the market having the same supply schedules as the producer previously portrayed in Table 4.

Table 5 Market demand of corn, 200 Producers (hypothetical data)

(1)	(2)	(3)	(4)
Price per bushel	Quantity supplied per week, single producer	Number of sellers in the market	Total quantity supplied per week
$5	60	× 200	= 12.000
4	50	× 200	= 10.000
3	35	× 200	= 7.000

2	20	× 200	= 4.000
1	5	× 200	= 1,000

Determinants of Supply

In constructing a supply curve, the economist assumes that price is the most significant determinant of the quantity supplied of any product. But, as with the demand curve, the supply curve is anchored on the other things are equal assumptions. That is, the supply curve is drawn on the supposition that certain non-price determinants of the amount supplied are given and do not change. If any of these non-price determinants of supply do in fact change, the location of the supply curve will be altered.

The basic non price determinants of supply are (1) resource prices, (2) the technique of production, (3) taxes and subsidies, (4) prices of other goods, (5) price expectations, and (6) the number of sellers in the market. To repeat: A change in anyone or more of these determinants or supply shifters will cause the supply curve for a product to move either to the right or the left. A shift to the right, from S_1 to S_2 in Figure 4 designates an increase in supply: producers are now supplying larger quantities of the product at each possible price. A shift to the left, S_1 to S_3 in Figure 4, indicates a decrease in supply: Suppliers are offering less at each price.

Changes in Supply

Let us consider the effect of changes in each of these determinants upon supply.

1- **Resource Prices**. As indicated in our explanation of the law of supply, the relationship between production costs and supply is an intimate one. A firm's supply curve is based upon production costs; a firm must receive higher prices for additional units of output because those extra units are more costly to produce. It

follows that decreases in resource prices will lower production costs and increase supply that is, shift the supply curve to the right. Example: if the prices of seed and fertilizer decrease, we can expect the supply of corn to increase. Conversely, an increase in input prices will raise production costs and reduce supply, that is, shift the supply curve to the left, Example: increases in the prices of iron ore and coke will increase the cost of procuring steel and tend to reduce its supply.

2- **Technology** A technological improvement means that the discovery of new knowledge permits us to produce a unit of output more efficiently, that is, with fewer resources. Given the prices of these resources, this will lower production costs and increase supply. Example: recent dramatic breakthroughs in the area of superconductivity portend the possibility of transporting electric power with little or no loss. Currently, about 30 percent of electric power is lost when transmitted by copper cable. Consequence? Significant co reductions and supply increases in a wide range of products where energy is an important input.

3- **Taxes and subsidies** Businesses treat most taxes as costs. Therefore, an increase in, say, sales or property taxes will increase costs and reduce supply. Conversely, subsidies are “taxes in reverse”. If government subsidizes the production of some good, it in effect lowers costs and increases supply. We will see how government might tax or subsidize certain products to alter their supply for the purpose of improving the allocation of resources.

4- **Prices of other goods** Changes in the prices of other goods can also shift the supply curve for a product. A decline in the price of wheat may cause a farmer to produce and offer more corn at each possible price. Conversely, a rise in the price of wheat may make farmers less willing to produce and offer corn in the market. A firm manufacturing athletic equipment might reduce its supply of basketballs in response to a rise in the price of soccer balls.

5- **Expectations** Expectations concerning the future Price of a product can also affect a producer's current willingness to supply that product. It is difficult, however, to generalize concerning the way the expectation of, say, higher prices will affect the present supply curve of a product. Farmers might withhold some of their current corn harvest from the market, anticipating a higher corn Price in the future. This will cause a decrease in the current supply of corn. Similarly, if the price of IBM stock is expected to rise significantly in the near further, the supply offered today for sale might decrease. On the other hand, in many types of manufacturing, expected price increases may induce firms to expand their production facilities, causing supply to increase.

6- **Number of sellers** Given the scale of operations of each firm, the larger the number of suppliers, the greater will be market supply. As more firms enter an industry, the supply curve will shift to the right. The smaller the number of firms in an industry, the less the market supply will be. This means that as firms leave an industry, the supply curve will shift to the left Table 6 provides a checklist of the determinants of supply; the accompanying illustrations deserve careful study.

Changes in Quantity Supplied

The distinction between a change in supply and a change in the quantity supplied parallels that between a change in demand and a change in the quantity demanded. A change in supply is involved when the entire supply curve shifts. An increase in supply shifts the curve to the right; a decrease in supply shifts it to the left. The cause of a change in supply is a change in one or more of the determinants of supply. The term supply is used by economists to refer to a schedule or curve. A change in supply therefore must mean that the entire schedule has changed and that the curve has shifted.

A change in the quantity supplied, on the other hand, refers to the movement from one point to another point on a stable supply curve. The cause of such a movement is a change in the price of the specific product under consideration. in Table 5 a decline in the price of corn from \$5 to \$4 decreases the quantity of corn supplied from 12,000 to 10,000 bushels.

Shifting the supply curve from S_1 to S_2 or S_3 in Figure 3 entails changes in supply. The movement from point a to point b on S_1, however, is merely a change in the quantity supplied.

The reader should determine which of the following involves a change in supply and which entails a change in the quantity supplied:

1- Because production costs decline, producers sell more automobiles.

2- The price of wheat declines, causing the number of bushels of corn sold per month to increase.

3- Fewer oranges are offered for sale because their price has decreased in retail markets.

4- The Federal government doubles its excise tax on liquor.

Supply and Demand: Market Equilibrium

We may now bring the concepts of supply and demand together to see how the interaction of the buying decisions of households and the selling decisions of producers will determine the price of a product and the quantity which is actually bought and sold in the market. In Table 7, columns 1 and 2 reproduce the market supply schedule for corn (from Table 5), and columns 2 and 3, the market demand schedule for corn (from Table 2). Note that in column 2. We are using a common set of prices. We assume competition-the presence of larger number of buyers and sellers.

Table 7 market supply and demand for corn (hypothetical data)

(1)	(2)	(3)	(4)
Total quantity Supplied per week	Price per bushel	Total quantity Demanded per week	Surplus (+) or shortage (−) (arrows indicate effect on price)
12,000	$5	2,000	+ 10,000 ↓
10,000	4	4,000	+ 6,000 ↓
7,000	3	7,000	0
4,000	2	11,000	− 7,000 ↑
1,000	1	16,000	− 15,000 ↑

Now the question to be faced is this: Of the five possible prices at which corn might sell in this market, which will actually prevail as the market price for corn? Let us derive our answer through the simple process of trial and error. For no particular reason, we shall start with an examination of $5. Could this be the prevailing market price for corn? The answer is No, for the simple reason that producers are willing to produce and offer in the market some 12,000 bushels of corn at this price while buyers, on the other hand, are willing to take only 2000 bushels of the market at this price. In other words, the relatively high price of $5 encourages farmers to produce a great deal of corn, but that same high price discourages consumers from taking the product of the market. Other products appear as better buys when corn is high priced. The result in this case is a 10,000-bushel surplus or excess supply of corn in the market. This surplus, shown in column 4, is the excess of quantity supplied over quantity demanded at the price of $5. Practically put, corn farmers would find themselves with unwanted inventories of output.

Could a price of $5-even if it existed temporarily in the corn market-- persist over period of time? Certainty not, The very large surplus of corn would prompt competing sellers to bid down the price to encourage buyers to take this surplus of their hands. Suppose price gravitates down to $4. Now the situation has changed considerable. The lower price has encouraged buyers to take more of this product of the market and, at the same time, has induced farmers to use a smaller amount of resources in producing corn. The surplus, as a result, has diminished to 6000 bushels. However, a surplus or excess supply still exists and competition among sellers will once again bid down the price of corn. We can conclude, then, that prices of $5 and $4 will be unstable because they are too high. The market price for corn must be something less than $4.

To avoid letting the cat out of bag before we fully appreciate how supply and demand determine product price, let us now jump to the other end of our price column and examine $1 as the possible market price for corn. It is evident from column 4 that at this price, quantity demanded is in excess of quantity supplied by 15,000 units. This relatively low price discourages farmers from devoting their resources to corn production; the same low price encourages consumers to attempt to buy more corn than would otherwise be the case. Corn is a good buy when its price is relatively low in short, there is a 15,000- bushel shortage of, or excess demand for, corn. Can this price of $1 persist as the market price? No. Competition among buyers will bid up the price to something greater than $1. In other words, at a price of $1, many consumers who are willing and able to buy at this price will be left out in the cold. Many potential consumers, in order to ensure that they will not have to do without, will express a willingness to pay a price in excess of $1 to ensure getting some of the available corn. Suppose this competitive bidding up of price by buyers boosts the price of corn to $2. This higher price has reduced, but not eliminated, the shortage of corn. For $2, farmers are willing to devote more

resources to corn production, and some buyers who were willing to pay $1 for a bushel of corn will choose not to buy corn at a price of $2, deciding to use their incomes to buy other products or maybe to save more of their incomes. But a shortage of 7000 bushels still exists at a price of $2. We can conclude that competitive bidding among buyers will push market price to some Figure greater than $2.

By trial and error, we have eliminated every price but $3. So let us now examine it. At a price of $3, and only at this price, the quantity which farmers are willing to produce and supply in the market is identical with the amount consumers are willing and able to buy. As a result, there is neither a shortage nor a surplus of corn at this price. We have already seen that a surplus causes price to decline and a shortage causes price to rise, with neither a shortage nor a surplus at $3, there is no reason for the actual price of corn to move away from this price. The economist calls this price the market-clearing or equilibrium price, equilibrium meaning in balance or at rest. At $3, quantity-supplied and quantity demanded are in balance; that is, equilibrium quantity is 7000 bushels. Hence $3 is the only stable price of corn under the supply and demand conditions shown in Table 7. Or, stated differently, the price of corn will be established where the supply decisions of producers and the demand decisions of buyers are mutually consistent. Such decisions are consistent with one another only at a price of 3$. At any higher price, suppliers want to sell more than consumers want to buy and a surplus will result; at any lower price, consumers want to buy more than producers are willing to offer for sale, as is evidenced by the consequent shortage. Discrepancies between supply and demand intentions of sellers and buyers, respectively, will prompt price changes which subsequently will bring these two sets of plans into accord with one another.

A graphic analysis of supply and demand should yield the same conclusions. Figure 4. Puts the market supply and market demand curves for corn on the same

graph, the horizontal axis now measuring both quantity demanded and quantity supplied. A close examination of this diagram clearly indicates that at any price above the equilibrium price of 3$, quantity supplied will the equilibrium price of $3, quantity supplied will exceed quantity demanded. This surplus will cause a competitive bidding down of price by sellers eager to relieve themselves of their surplus. The falling price will cause less corn to be offered and will simultaneously encourage consumers to buy more. Any price below the equilibrium price will entail a shortage; that is, quantity demanded will exceed quantity supplied.

Competitive bidding by buyers will push the price up toward the equilibrium level. And this rising price will simultaneously cause producers to increase the quantity supplied and ration buyers out of the market, thereby causing the shortage to vanish. Graphically, the intersection of, the supply curve and the demand curve for the product will indicate the equilibrium point. In this case equilibrium price and quantity are $3 and 7000 bushels.

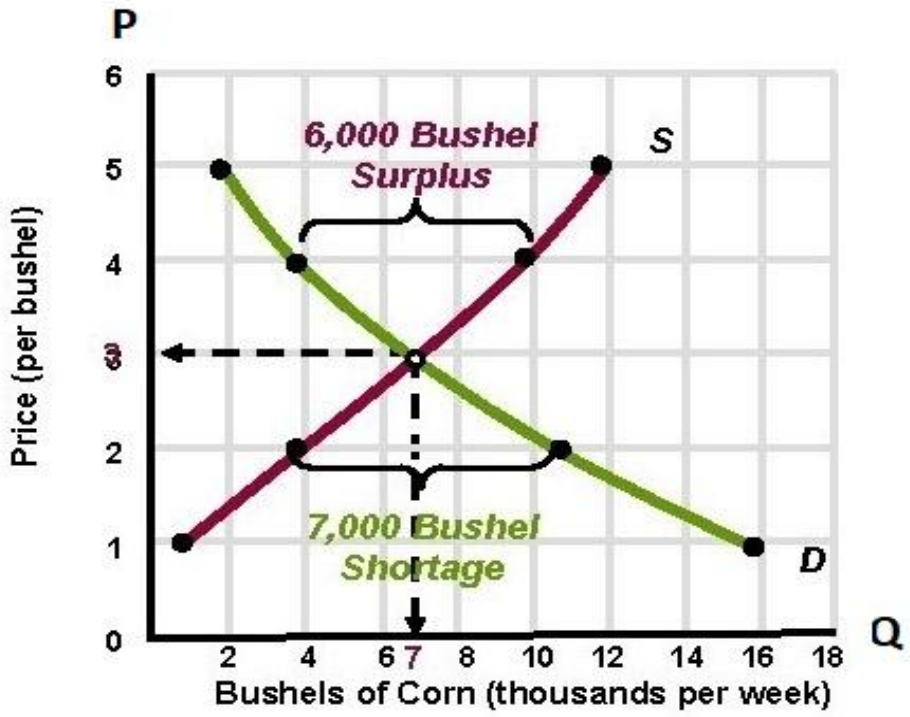


Figure 4

The equilibrium price and quantity for corn as determined by market demand and supply. The intersection of the down sloping demand curve D and the up sloping supply curve S indicates the equilibrium price and quantity, $3 and 7000 bushels in this instance. The shortages of corn which would exist at below-equilibrium prices, for example, 7000 bushels at $2, drive price up, and in so doing, increase the quantity supplied and reduce the quantity demanded until equilibrium is achieved. The surpluses which above-equilibrium prices would entail, for example, 6000 bushels at $4, push price down and thereby increase the quantity demanded and reduce the quantity supplied until equilibrium is achieved.

Rationing Function of Prices

The ability of the competitive forces of supply and demand to establish a price where selling and buying decisions are synchronized is called the rationing function of prices. In this case, the equilibrium price of $3 clears the market, leaving no burdensome surplus for sellers and no inconvenient shortage for potential buyers. The composite of freely made individual buying and selling decisions sets this price which clears the market. In effect, the market mechanism of supply and demand says this: Any buyer who is willing and able to pay $3 for a bushel of corn will be able to acquire one; those who are not, will not. Similarly, any seller who is willing and able to produce bushels of corn and offer them for sale at a price of $3 will be able to do so successfully; those who are not, will not. As we will see shortly, were it not that competitive prices automatically bring supply and demand decisions into consistency with one another, some type of administrative control by government would be necessary to avoid or control the short- ages or surpluses which might otherwise occur.

Changes in Supply and Demand

It was noted earlier that demand might change because of fluctuations in consumer tastes or incomes, Chances in consumer expectations, or variations in the prices of related goods. On the other hand, supply might vary in response to changes in technology, resource prices, or taxes. Our analysis would be incomplete if we did not stop to consider the effect of changes in supply and demand upon equilibrium price.

Changing demand let us first analyze the effects of a change in demand, assuming that supply is conveniently constant. Suppose that demand increases, as shown in Figure 4-6a. What is the effect upon price? Noting that the new intersection of the supply and demand curves is at a higher point on both the price and quantity axes can conclude that an increase in demand, other things (supply)

being equal, will have a price-increasing effect and a quantity-increasing effect. (The value of graphic analysis now begins to become apparent; we need not fumble with columns of Figures in determining the effect on price and quantity but only compare the new with the old point of intersection on the graph). A decrease in demand as illustrated in Figure 5 b, reveals both price-decreasing and quantity-decreasing effects. Price falls, and quantity also declines. In brief we find a direct relationship between a change in demand and the resulting changes in equilibrium price and quantity. Changing supply let us reverse the procedure and analyze the effect of a change in supply on price, assuming that demand is constant. If supply increases, as in Figure 5c, the new intersection of supply and demand is located at a lower equilibrium price. Equilibrium quantity, however, increases. If supply decreases, on the other hand, this will tend to increase product price. Figure 6d illustrates this situation. Here, price increases but quantity declines. In short, an increase in supply has a price decreasing and a quantity increasing effect. A decrease in supply has a price-increasing and a quantity-decreasing effect. There is an inverse relationship between a change in supply and the resulting change in equilibrium price, but the relationship between a change in supply and the resulting change in equilibrium quantity is direct.

Exercises

Chapter One

Individual Markets: Demand and Supply

Firstly

Suppose you have the following information

$$Qd = 200 - 5P$$

$$Qs = 5P$$

Required

1- determine price and quantity and presents graphically

2- Calculate the consumer surplus

3- If the government impose the tax where TS %20 from original price. Calculate price, quantity and consumer surplus after tax present graphically

4- calculate the government revenue and the kind of good

Answer

1- by equalize demand and supply

$$200 - 5P = 5\ P$$

$$10P = 200$$

$$P = 20$$

Substitute by $P = 20$ to obtain Q

$$Q = 200 - 5\ (20) \qquad = 100$$

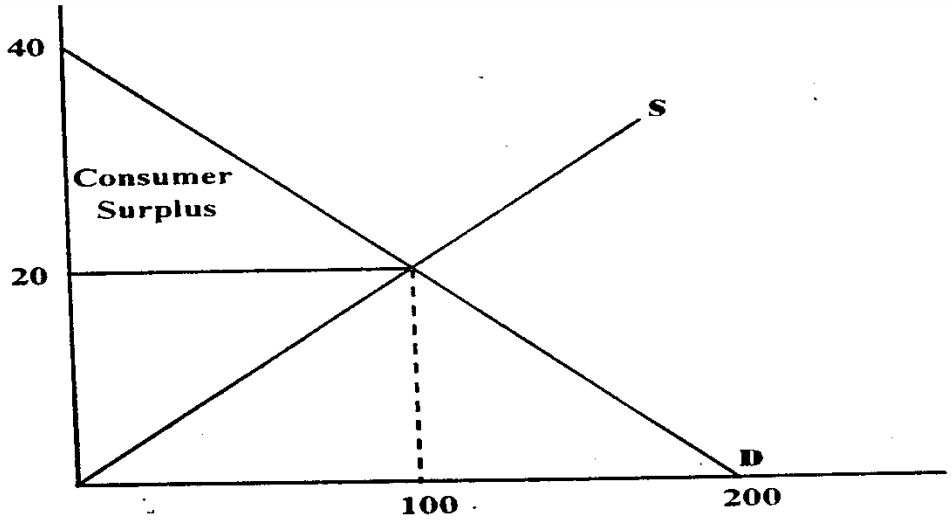
$$Q = 5\ (20) \qquad = 100$$

2- consumer surplus = $[(40 - 20)\ x\ 100]\ \frac{1}{2} = 1000$

3- new supply function after tax

$$Q = 5\ (P - 4)$$

$$Q = 5\ P - 20$$



$$D = S$$

$$200 - 5P = 5P - 20$$

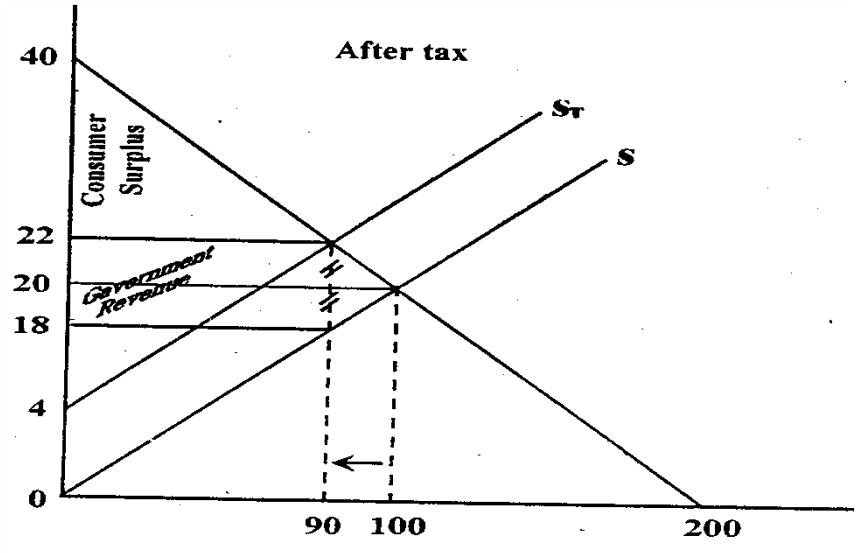
$$10P = 220$$

$$P = 22$$

Substitute by P = 22 to obtain Q

$$Q = 200 - 5\,(22) = 90$$

$$Q = 5\,(22) - 20 = 90$$



2- Consumer surplus = $[(40 - 22) \times 90] \times \frac{1}{2} = 810$

4- Government revenue = $(40 \times 90) = 360$

The good is normal because the tax divide between consumer and producer at equivalence.

Secondly

Suppose the government gave subsides to producer as %20 from original price

Required

1- price and quantity after subsides show that by graphic

2- calculate the total of subsides and kind of good

Answer

1- with subsides the supply function become to the following

$$Q = 5\ (P + 4)$$

$$Q = 5\ P + 20$$

Equalize between D = Q

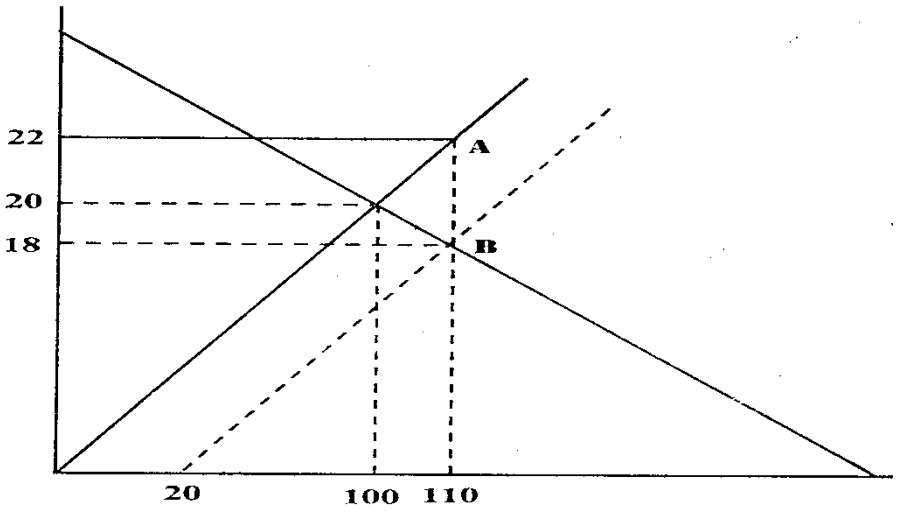
$$200 - 5\ P = 5\ P + 20$$

$$10\ P = 180$$

$$P = 18$$

$$Q = 200 - 5\ (18) = 110$$

$$Q = 5\ (18) + 20 = 110$$



Subsides = 110 x $4 = 440$

The good is normal

Price Floors

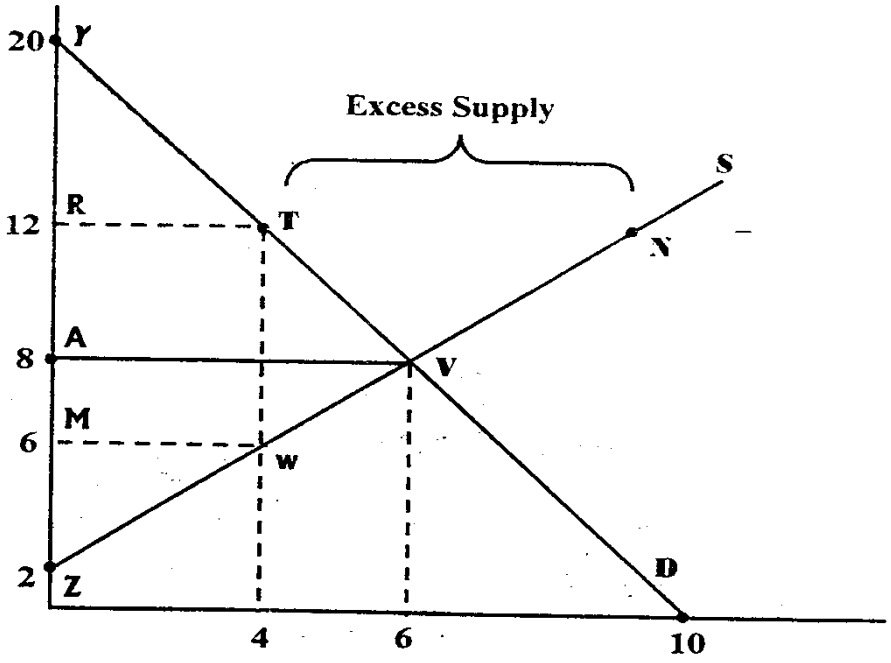
(Minimum price regulation)

As in the previous, the demand and supply curves are

$$Q^d = 10 - 0.5\ P$$

$$Q^s = -2 + P$$

Suppose the government sets a price floor of $12 in the marked, as illustrated in the following figure



What is the size of excess supply in the market with the price floor? What is the consumer surplus?

What is the producer surplus? Assuming producers with the lowest cost sell the good? What is the net economic benefit? What is the dead weight loss?

Now we are knowing the equilibrium price and quantity as follow

$$10 - 0.5\,P = -2 + P$$

$$1.5\,P = 12$$

$$P = 8$$

And $$Q = 10 - 0{,}5\ (8) = 6$$

With the price floor, consumers demand only 4 million unit (point T), but producers want to supply 10 million units (point N) thus, the excess supply is 6 million units, equal to the horizontal distance between points T and N.

	With no price floor	With price floor
Consumer surplus	Area YVA = $36 million	Area YTR = $16 million
Producer surplus	Area YVZ = $18 million	Area RTWZ = $32 million
Net benefits consumer surplus + producer surplus)	$36 + $18 =$54 million	$16 + $32 = $48 million
Deadweight loss	Zero	$6 million

- Consumer surplus is the area below the demand curve D and above the price floor of $12. This is area YTR = $ 16 million
- Producer supply 4 million units that consumers want, producer surplus will be the area above the portion of supply curve and below the price floor. This is area

$$RTWZ = RTWM + ZMW$$

$$= (4 \times 6) + (4 \times 4 \times \tfrac{1}{2})$$

$$= 24 + 8 = \$32$$

- The net economic benefit is the sum of consumer surplus ($16 million) and producer surplus ($32 million) = $48 million
- The dead weight loss is the difference between the net economic benefit with no price flooring ($54 million) and the net economic benefit with the price flooring ($48 million) = $6 million.

Impact of a price ceiling

Suppose the demand and supply curve are

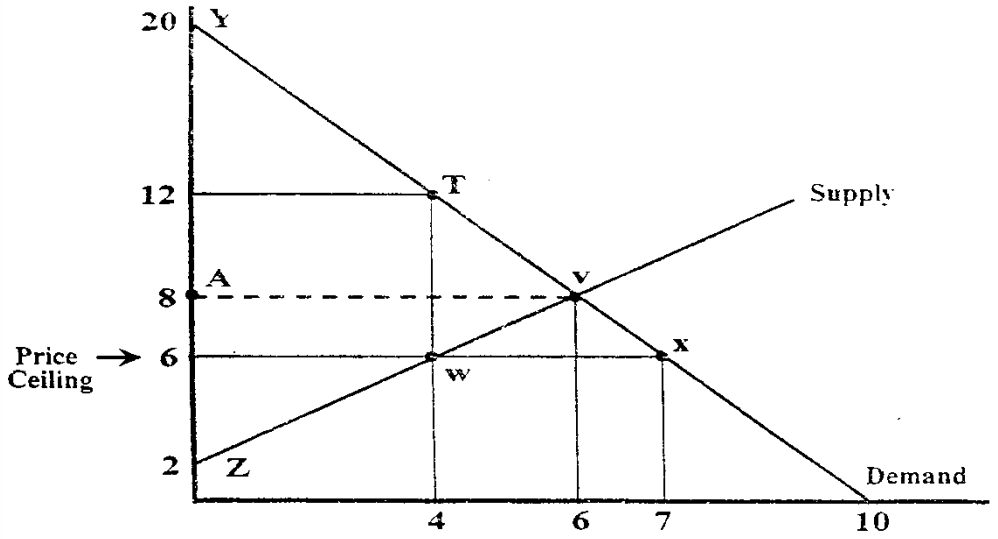
$$Q^d = 10 - 0.5\,P$$

$$Q^s = -2 + P$$

Suppose the government imposes a price ceiling of $6 in the market, as illustrated in the following Figure.

1- now what is the size of the shortage in the market with the price ceiling? What is the producer surplus?

2- what is the consumer surplus? What is the net economic benefit? What is the dead weight loss?



We can answer the above question as following. The equilibrium price before ceiling

$$Q^d = Q^s$$

$$10 - 0.5P = 2 + P$$

$$1.5P = 12$$

$$P = 8$$

Then

$$Q = 10 - 0.5\,(8) = 6$$

Now with price ceiling the consumer demand 7 unit at point X but producers supply only 4 units at point W. thus, the shortage (i.e, the excess demand) is 3 units equal to the horizontal distance between points W and X

	With no price ceiling	With price ceiling
Consumer surplus	Area YAV = $36 million	Area YTR = $40 million
Producer surplus	Area YVZ = $18 million	Area SWZ = $8 million
Net benefits consumer surplus + producer surplus)	$36 + $18 = $54 million	$40 + $8 = $48 million
Deadweight loss	Zero	$6 million

Producer surplus is the area above the supply curve s and below the price ceiling of $6. This area SWZ = $8 million

-If consumer purchases 4 units then consumer surplus will be the area below the portion of the demand curve and above the price ceiling. This is area YTWS = $40 million

The net economic benefit is the sum of consumer surplus ($40 million) and producer surplus ($8 million) = $48 million.

The deadweight loss is the difference between the net economic benefit with no price ceiling ($54 million) and the net economic benefit with the price ceiling ($48 million) = $6 million.

Exercises

Chapter one

Demand and supply

Part A: True- false Questions

Circle whether the following statements are true (T) or false (F)

1- The law of demand states that a decrease in the price of a good shifts the demand curve leftward.

2- The law of demand implies that demand curve slope down

3- Each point on the demand curve reflects the highest price consumers are willing and able to pay for that particular unit of a good.

4- A substitute is a good that can be used in place of another good

5- If income increases or the price of a complement falls, the demand curve for a normal good shifts leftward.

6- Normal goods are those for which demand decreases as income decreases

7- A normal good is good for which demand decreases when income increases.

8- Because of increases marginal cost, most supply curves have a negative slope.

9- A supply curve shows the relation between the quantity of a good supplied and the price of the good. Usually a supply curve has positive slope.

10- If a producer can use resources to produce either good A or good B, then A and B are complements in production.

11- A price below the equilibrium price results in a shortage

12- A shortage causes the price to fall.

13- If the quantity demanded exceeds the quantity supplied, then there is shortage and the price is below the equilibrium price.

14- a surplus occurs when the price is greater than the equilibrium price.

15- if the quantity supplied exceeds the quantity demanded, then there is shortage and the price is below the equilibrium price.

16- Tom's income falls by 3% at the same time, his demand for (X) falls by 4%. All other things remaining the same, necessary good.

17- Given the usually shaped supply and demand curves, if demand is more elastic than supply, the greater burden of a unit tax falls on consumers.

18- a relative price is the ratio of one price to another.

19- if the price of a hot dog is $2 and the price of a hamburger is $4, the relative price of a hamburger is ½ of a hot dog.

20- The quantity demanded is the amount of a good that consumers plan to purchase at a particular price.

21- The law of demand states that, other things remaining the same, the higher the price of a good, the smaller is the quantity of the good demanded

22- The law of demand states that, the quantity of the good demanded varies inversely with its price.

23- The demand curve for normal good shifts leftward if income decreases or the expected future price rises.

24- By definition, an inferior good is good for which demand decreases when income increases.

25- A change in the price of a good does not shift the good's demand curve but does cause a movement along it.

26- The quantity supplied of good is the amount that producers are planning to sell at a particular price during a given time period.

Part B multiple choice questions

Circle the appropriate answer

1- If the price of a candy bar is $1 and the price of a fast food meal is $5.

a- The money price of a fast food meal is 1/5 of a candy bar

b- The money price of a candy bar is 1/5 of a fast food meal

c- The relative price of a fast food meal is five candy bars

d- The relative price of a candy bar is five fast food meals

2- The law of demand implies that, other things remaining the same

a- as the demand for cheeseburgers increases, the price of a cheeseburger will fall.

b- as the price of a cheeseburgers rises, the quantity of a cheeseburger demanded will decrease.

c- as income increases, the quantity of a cheeseburgers demanded will increase.

d- as the price of a cheeseburgers rises, the quantity of a cheeseburger demanded will increase.

3- Which of the following is consistent with the law of demand?

a- a decrease in the price of a gallon of milk causes a decrease in the quantity of milk demanded.

b- an increase in the price of a soda causes a decrease in the quantity of soda demanded.

c- an increase in the price of tape causes an increase in the quantity of tapes demanded.

d- a decrease in the price of juice causes no change in the quantity of juice demanded.

4- The law of demand implies that if nothing else changes, there is

a- a linear relationship between the price of a good and the quantity demanded

b- a positive relationship between the price of a good and the quantity demanded

c- a negative relationship between price of a good and the quantity demanded

d- an exponential relationship between price of a good and the quantity demanded

5- People buy more of good 1 when the price of good 2 rises. These goods are

a- normal good b- complements

c- substitutes d- inferior goods

6- Which of the following influences people's buying plans and varies moving along a demand curve?

a- preference b- the price of the good

c- income d- the prices of related goods

7- The demand for a good increase when the price of a substitute and also increase when the price of a complement

a- falls; fall b- rises; falls

c- rises; rises d- falls; rises

8- A complement is a good

a- used in conjunction with another good

b- used instead of another good

c – of lower quantity than another good

d- of higher quantity than another good

9- Suppose people buy more of good 1 when the price of good 2 falls. these goods are

a- substitutes b- inferior

c- normal d- complements

10- People come to expect that the price of a gallon of gasoline will rise next week as a result

a- next week's supply of gasoline decreases.

b- the price of a gallon of gasoline falls today

c- today's supply of gasoline increases

d- today's demand for gasoline increases

11- Inferior goods are those for which demand increases as

a- income decreases b- income increases

c- the price of a substitute rises d- the price of a substitute falls

12- If a good is an inferior good, then purchases of that good will decrease when

a- the demand for it increases b- population increases

c- income increases d- the price of a substitute rises

13- A reduction in the price of a good

a- does not shift the good's demand curve leftward but does decrease the quantity demanded.

b- shifts the good's demand curve leftward but does not decrease the quantity demanded

c- shifts the good's demand curve leftward and also decreases the quantity demanded.

d- neither shifts the good's demand curve leftward nor decrease the quantity demanded.

14- A decrease in quantity demanded caused by an increase in price is represented by a

a- movement up and to the left along the demand curve

b- movement down and to the right along the demand curve

c- leftward shift of the demand curve

d- rightward shift of the demand curve

15- When we say demand increases, we mean that there is a

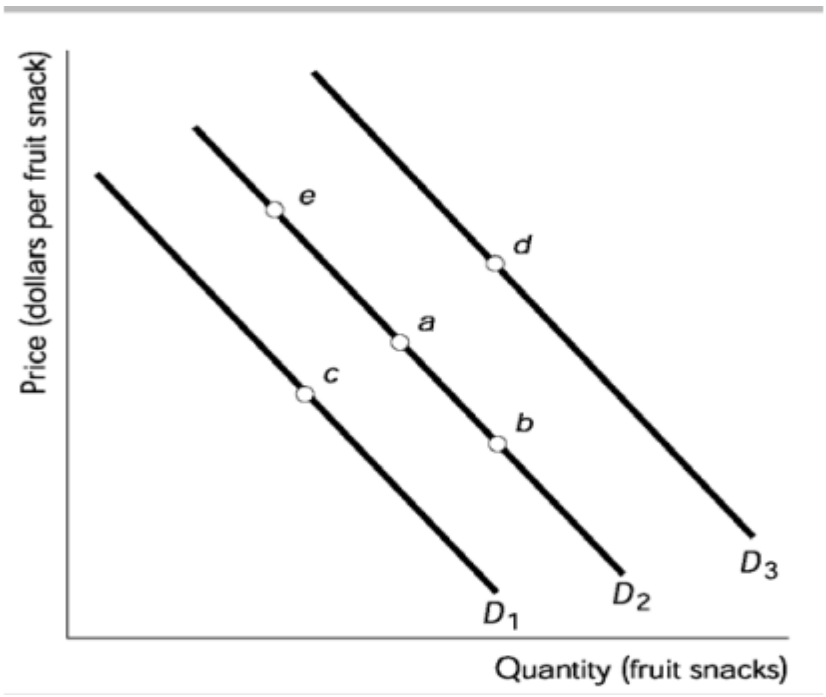
a- movement to the right along the demand curve

b- movement to the left along the demand curve

c- leftward shift of the demand curve

d- rightward shift of the demand curve

According to the following figure, answer the questions of (16) to (23)



16- In the figure above, which movement reflects an increase in demand?

a- from point a to point e b- from point a to point c

c- from point a to point b d- from point a to point d

17- In the figure above, which movement reflects a decrease in quantity demand?

a- from point a to point c b- from point a to point e

c- from point a to point d d- from point a to point b

18- In the figure above, which movement reflects how consumer would react to an increase in the price of a non-fruit snack?

a- from point a to point b b- from point a to point d

c- from point a to point c d- from point a to point e

19- In the figure above, which movement reflects an increase in the price of substitute for fruit snack?

a- from point a to point d b- from point a to point e

c- from point a to point b d- from point a to point c 51)

20- In the figure above, which movement reflects an increase in the price of a complement for fruit snack?

a- from point a to point b b- from point a to point d

c- from point a to point e d- from point a to point c

21- In the figure above, which movement reflects an increase in income if fruit snacks are an inferior good?

a- from point a to point d b- from point a to point c

c- from point a to point b d- from point a to point e

22- In the figure above, which movement reflects an increase in income if fruit snacks are a normal good?

a- from point a to point d b- from point a to point e

c- from point a to point b d- from point a to point c

23- In the figure above, which movement reflects a decrease in population?

a- from point a to point d

b- from point a to point c

c- from point a to point e

d- from point a to point b

24- The quantity supplied of a good or service is the quantity that a producer

a- actually sells at a particular price during a given time period.

b- should sell at a particular price during a given time period.

c- is willing to sell at a particular price during a given time period.

d- needs to sell at a particular price during a given time period.

25- A fall in the price of a good causes producers to reduce the quantity of the good they are willing to produce. This fact illustrates

a- a change in supply

b- the law of demand

c- the nature of an inferior good

d- the law of supply

26- Each point on a supply curve represents

a- the highest price sellers can get for each unit over time

b- the lowest price buyers will accept per unit over time

c- the lowest price for which a supplier can profitably sell another unit

d- the highest price buyers will pay the good

27- Which of the following is not held constant while moving along a supply curve?

a- prices of resources used in production

b- expected future prices

c- the number of sellers

d- the price of the good itself

28- An increase in the number of fast – food restaurants

a- increases the price of fast-food meals

b- raises the price of fast -food meals

c- increases the supply of fast-food meals

d- increase the demand for fast-food meals.

29- Which of the following will shift the supply curve for good X leftward?

a- a situation in which quantity demanded exceeds quantity supplied

b- an increase in the cost of the machinery used to produce X

c- A decrease in the wages of workers employed to produce X

d- a technological improvement in the production of X

30- Which of the following does not shift the supply curve?

a- an increase in the price of the good

b- a fall in the price of a substitute in production

c- a decrease in the wages of labor used in production of the good

d- a technological advance

31- If the price of a good changes but everything else influencing suppliers' planned sales remains constant, there is a

a- rotation of the initial supply curve around the initial price

b- new supply curve that is to the right of the initial supply curve

c- new supply curve that is to the left of the initial supply curve

d- movement along the supply curve

32- A decrease in the quantity supplied is represented by

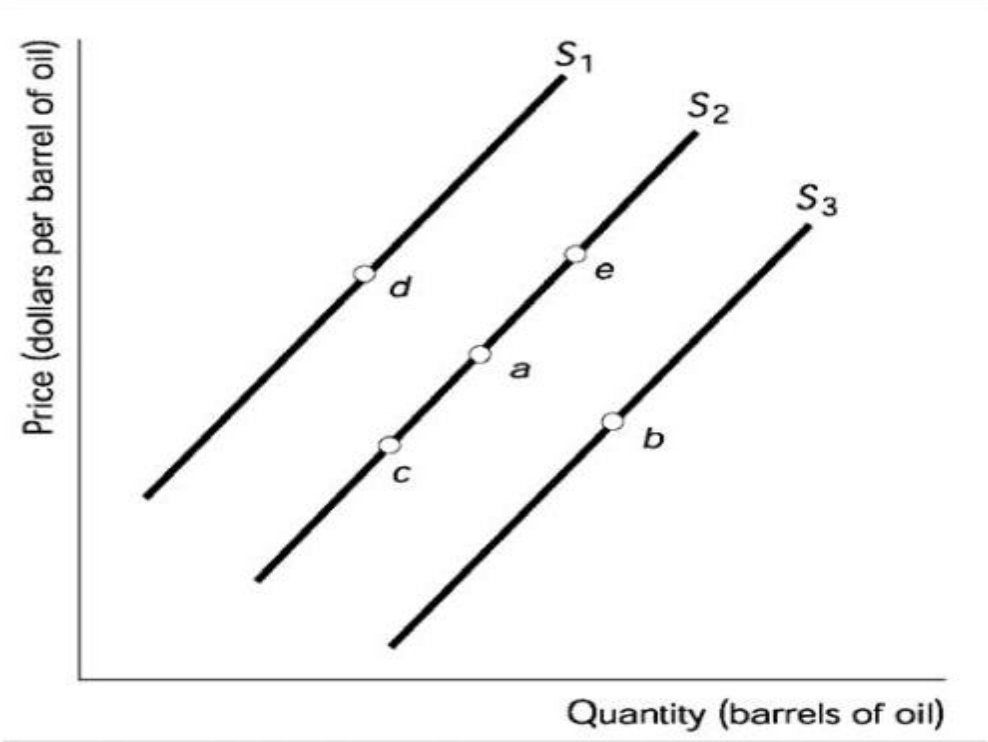
a- rightward shift in the supply curve

b- movement down the supply curve

c- leftward shift in the supply curve

d- movement up the supply curve

according to the following figure, answer the questions of (33 to (37)



33- In the figure above, an increase in the supply of oil would result in a movement from

a- point a to point d
b- point a to point e
c- point a to point b
d- point a to point c

34- In the figure above, an increase in the quantity of oil supplied but not in the supply of oil is shown by a movement from

a- point a to point c
b- point a to point b
c- point a to point e
d- point a to point d

35- In the figure above, a decrease in the quantity of oil supplied but not in the supply of oil is shown by a movement from

a- point a to point e
b- point a to point d
c- point a to point b
d- point a to point c

36- In the figure above, which could be caused by an increase in the wages of oil workers

a- point a to point d

b- point a to point b

c- point a to point c

d- point a to point e

37- In the figure above, which movement could be caused by the development of a new, more efficient refining technology?

a- point a to point e

b- point a to point c

c- point a to point b

d- point a to point d

38- The interaction of supply and demand explains

a- both the prices and the quantities of goods and services

b- the quantities of goods and services but not their prices

c- the prices of goods and services but not their quantities

d- neither the prices nor the quantities of goods and services

39- When the quantity demanded, equals quantity supplied

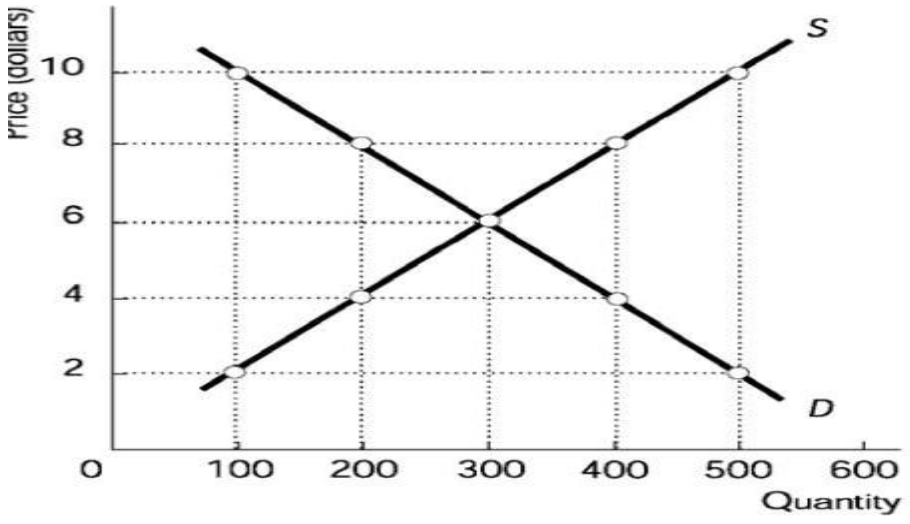
a- the government must be intervening in the market

b- there is a shortage

c- there is a surplus

d- none of the above

according to the following figure, answer the questions of (40 to (46)



40- The equilibrium price in the above figure is

a- $2 b-$8 c- $4 d- $6

41- The equilibrium quantity in the above figure is

a- 400 units b- 300 units c- 600 units d- 200 units

42- At a price of $10 in the above figure, there is

a- surplus of 400 units b- a shortage of 200 units

c- surplus of 200 units d- a shortage of 400 units. 99)

43- At a price of $4 in the above figure,

a- there is a surplus of 200 units

b- the equilibrium quantity is 400 units

c- the quantity supplied is 400 units

d- there is a shortage of 200 units.

44- If the good in the above figure is a normal good and income rises, then the new equilibrium quantity

a- is more than 300 units

b- is less than 300 units

c- could be less than, equal to, or more than 300 units

d- is 300 units.

45- The initial supply and demand curves for a good are illustrated in the above figure. If there are technological advances in the production of the good, then good, the good, then the new price for the good

a- is $6

b- is more than $6

c- could be less than equal to, or more than $6

d- is less than $6

46- The initial supply and demand curves for a good are illustrated in the above figure. If there is a rise in the price of the resources used to produce the good, then the new price

a- is less than $6 b- is more than $6

c- could be less than equal to, or more than $6 d- is $6

47- When the demand for a good decrease, its equilibrium price and equilibrium quantity

a- rises; decreases b- falls; decreases

c- falls; increases d- rises; increases

48- If good A is a normal good and income increases, the equilibrium price of A

a- and the equilibrium quantity will increase

b- and the equilibrium quantity will decrease

c- will rise and the equilibrium quantity will decrease

c- will fall and the equilibrium quantity will increase

49- When supply decreases and demand does not change, the equilibrium quantity

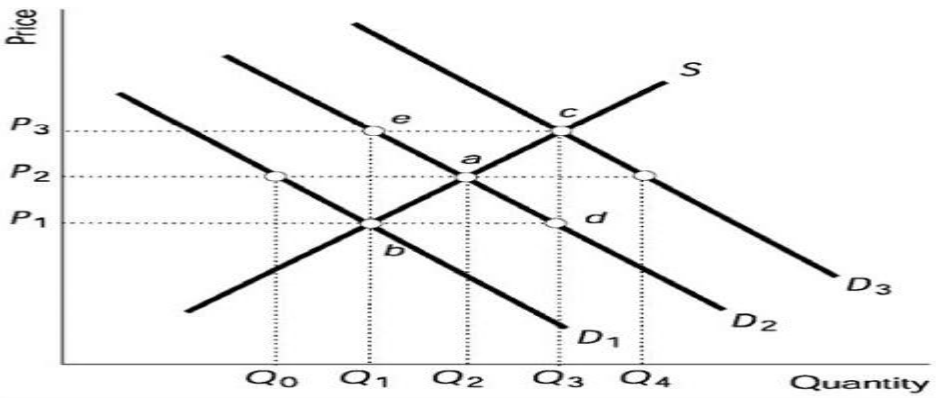
a- decreases and the prices rises

b- increases and the prices falls

c- decreases and the prices falls

d- increases and the prices rises

According to the following figure, answer the questions of (50 to (56)



50- In the above figure, a change in quantity demanded with unchanged demand is represented by movement from

a- point a to point c

b- point a to point e

c- point a to point b

d- none of the above represent a change in the quantity demanded with an unchanged demand

51- In the above figure, a change in quantity supplied with unchanged supply is represented by movement from

a- point b to point e

b- point b to point a

c- point e to point c

d- point a to point e

52- In the above figure, if D2 is the demand curve, then a price of P3 would result in

a- A surplus of Q3 – Q1

b- A shortage of Q4 – Q3

c- A surplus of Q4 – Q0

d- A shortage of Q3 – Q1 130)

53- In the above figure, if D2 is the original demand curve for a normal good and income decreases, which price and quantity may result?

a- point c, with price P3 and quantity Q3

b- point a, with price P2 and quantity Q2

c- point b, with price P1 and quantity Q1

d- point d, with price P1 and quantity Q3

54- In the above figure, if D2 is the original demand curve of substitute in consumption rises, which price and quantity may result?

a- point c, with price P3 and quantity Q3

b- point d, with price P1 and quantity Q3

c- point a, with price P2 and quantity Q2

d- point b, with price P1 and quantity Q

55- In the above figure, if D2 is the original demand curve and consumers come to expect that the price of the good will rise in the future, which price and quantity may result?

a- point a, with price P2 and quantity Q2

b- point c, with price P3 and quantity Q3

c- point d, with price P1 and quantity Q3

d- point b, with price P1 and quantity Q1

56- In the above figure, if D2 is the original demand curve and the population falls, which price and quantity may result?

a- point d, with price P1 and quantity Q3

b- point c, with price P3 and quantity Q3

c- point b, with price P1 and quantity Q1

d- point a, with price P2 and quantity Q2

problem

problem1

suppose that the market demand for potatoes is given by Q_d = 100 −4P and the market supply of potatoes is given by Q_s = 6P, where P is the price per bag of potatoes and Q is the number of bags per month.

Required

1- Compute the price and quantity that make that equilibrium and show that by graphically

2- Calculate the consumer and producer surplus

3- Suppose the government impose tax every unit produced where T = 10 then compute the new price and quantity after tax with graphically

4- Compute the consumer and producer surplus after tax

5- Calculate the total government revenue

6- What is the kind of good?

Problem 2

The demand and supply schedules for broccoli are given in the following tables. use this information to answer the question below.

Price (per pound)	Quantity demanded (1000 pounds)	Quantity supplied (1000 pounds)
1.00	100	0
1.50	90	40
2.00	80	80
2.50	70	120
3.00	60	160
3.50	50	200
4.00	40	240

1- What are the equilibrium price and quantity in the broccoli market? Illustrate your answer graphically.

2- Explain why the market will be in disequilibrium at a price of $3.50 per pound

3- Explain how the market will adjust from a price of $3.50 per pound to the equilibrium identified in part (1)

4- New studies indicate that broccoli has significant healing powers if it is consumed daily. How will these studies affect the broccoli market? Explain the adjustment process to the new equilibrium

5- Suppose instead that tighter immigration restrictions reduce the number of farm of farm laborers. How will these restrictions affect the broccoli market? Explain the adjustment process to the new equilibrium.

Problem3

Suppose that the market demand for potatoes is given by $Q_d = 200 - 5P$ and the market supply of potatoes is given by $Q_s = 5P$, where P is the price per bag of potatoes and Q is the number of bags per month.

Required

1- Compute the price and quantity that make that equilibrium and show that by graphically

2- Calculate the consumer and producer surplus

3- Suppose the government impose tax on every unit produced where T = 12 then compute the new price and quantity after tax with graphically

4- Compute the consumer and producer surplus after tax

5- Calculate the total government revenue

Problem 4

Suppose the demand function for necessary good as following

$$Q = 48 - 2P$$

$$Q = 4P$$

1- Calculate price and quantity which equilibrium position with graphically

2- Calculate consumer and producer surplus, also total benefit and deadweight

3- Suppose the government setting P = 12 as flooring price and then compute consumer, producer surplus and total benefit and also deadweight with graphically.

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Chapter Two

Elasticities of Demand and Supply

Chapter Two

Elasticities of Demand and Supply

When you have completed your study of this chapter, you will be able to

1- Define, explain the factors that influence, and calculate the price elasticity of demand.

2- Define, explain the factors that influence, calculate the price elasticity of supply.

3- Define and explain the factors that influence, the cross elasticity of demand and the income elasticity of demand.

What do you do when the price of gasoline rises? if you're like most people, you keep filling your tank, groan a bit, and cut back on something less essential so that you can afford to spend more on gas. But don't some people find that the higher price puts an automobile out of reach and forces them to ride the bus? Also, rising incomes, especially in China and other parts of Asia, are increasing the demand for oil fiche is bringing higher full prices Are you going to keep buying the same quantity of gasoline when the price hits $3 a gallon، $5, $10?

To answer questions such as these, we need to know how responsive buying plans and selling plans are to changes in prices. You're now going to discover a powerful tool for describing demand and supply and predicting the magnitudes of price and quantity changes when either demand or supply changes. That tool is elasticity–the elasticity of demand and the elasticity of supply.

A decrease in supply of gasoline brings a large rise in its price and a small decrease in the quantity that people buy. The reason is that buying plans for gasoline are not very responsive to a change in price. But an increase in the supply of airline services brings a small decrease in its price and a large increase in the quantity of air travel. In the case of air travel, buying plans are highly sensitive to a change in price. By knowing how sensitive or responsive buying plans are to price

changes we can predict how a given change in supply will change price and quantity.

But we often want to go further and predict by how much a price will change when an event occurs. To make more precise predictions

about the magnitudes of price and quantity changes, we need to know more about a demand curve than the fact that it slopes downward. We need to know how responsive the quantity demanded is to a price change.

Elasticity provides this information.

The price elasticity of demand is a measure of the responsiveness of the quantity demanded of a good* to a change in its price when all other influences on buyers' plans remain the same. To determine the price elasticity of demand, we compare the percentage change in the quantity demanded with the percentage change in price. But we calculate percentage changes in a special way.

Calculate the price elasticity of demand

Suppose the following data about wheat is available

Price	Quantity
180	20
360	16

We can calculate the price elasticity coefficient by the following equation

ΔQ=new quantity−initial quantity

Δ P = new price−initial price

Where

Initial quantity 20 and initial price 180

price elasticity coefficient (E) $= \frac{\Delta Q}{Q} \div \frac{\Delta P}{P}$

$= \frac{\Delta Q}{Q} . \frac{P}{\Delta P}$

$$= \frac{\Delta Q}{\Delta P} . \frac{P}{Q}$$

Then for our example

$$\mathbf{AQ = 16 - 20 = 4}$$

$$\mathbf{\Delta P = 360 - 180 = 180}$$

$$\mathbf{E = \frac{\Delta Q}{\Delta P} . \frac{P}{Q}}$$

$$\mathbf{E = \frac{-4}{180} . \frac{180}{20} = \frac{-4}{20} = -\frac{-1}{5} = -0.2}$$

$$\mathbf{Qr = 0.2}$$

Elastic and Inelastic Demand

To determine the responsiveness of the quantity of Starbucks latte demanded to its price. We need to compare the two percentages changes we've just calculated. The percentage change in quantity is 100 and the percentage change in price is 50, so the percentage change in quantity demanded is twice the percentage change in price. If we collected data on the prices and quantities of a number of goods and services (and we were careful to check that other things had remained the same), we could calculate lots of percentage changes. Our calculations would fall into three groups: The percentage change in the quantity demanded might exceed the percentage change in price, equal the percentage change in price, or be less than the percentage change in price. These three possibilities give three cases for the price elasticity of demand:

Demand is elastic if the percentage change in the quantity demanded exceeds the percentage change in price.

Demand is unit elastic if the percentage change in the quantity demanded equals the percentage change in price.

Demand is inelastic if the percentage change in the quantity demanded is less than the percentage change in price.

Figure 5.1 shows the different types of demand curves that illustrate the range of possible price elasticities of demand. Part (a) shows an extreme case of an elastic demand called a perfectly elastic demand–an almost zero percentage change in the price brings a very large percentage change in the quantity demanded. Consumers are willing to buy any quantity of the good at a given price but none at a higher price. Part (b) shows an elastic demand – the percentage change in the quantity demanded exceeds the percentage change in price. Part (e) shows a unit elastic demanded the percentage change in the quantity demanded equals the percentage change in price. Part (d) shows an inelastic demand–the percentage change in the quantity demanded is less than the percentage change in price. Finally, part (e) shows an extreme case of an inelastic demand called a perfectly inelastic demand–the percentage change in the quantity demanded is? Zero for any percentage change in price.

Influences on the Price Elasticity of Demand

What makes the demand for some things elastic and the demand for others inelastic? The influences on the price elasticity of demand fall into two groups:

- **Availability of substitutes**
- **Proportion of income spent**

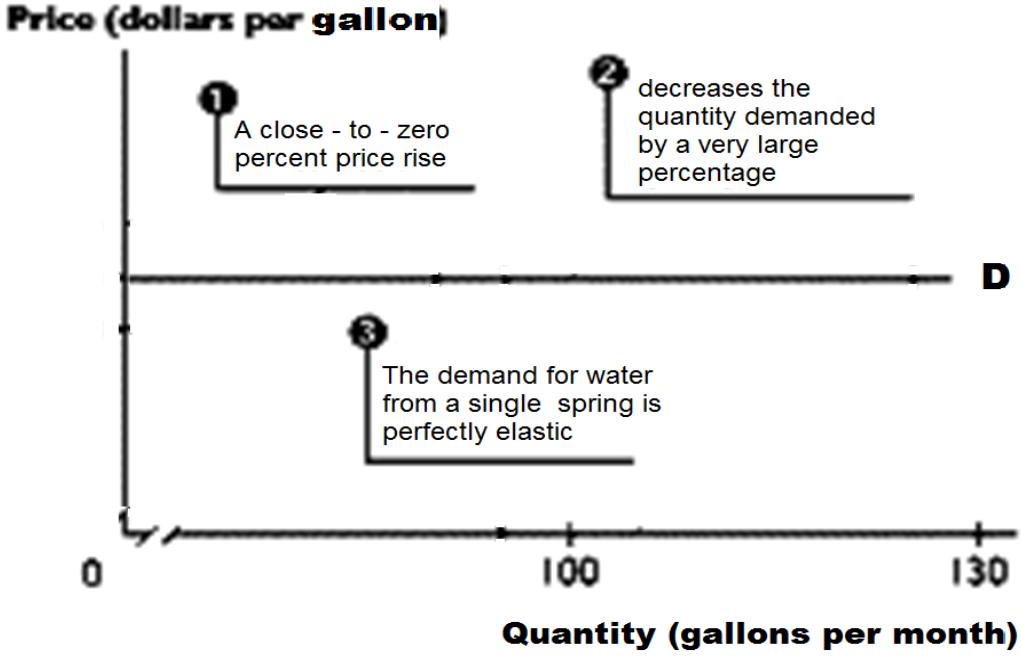
Availability of Substitutes

The demand for a good is elastic if a substitute for it is easy to find. Soft drink containers can be made of either aluminum or plastic and it doesn't matter which, so the demand for aluminum is elastic.

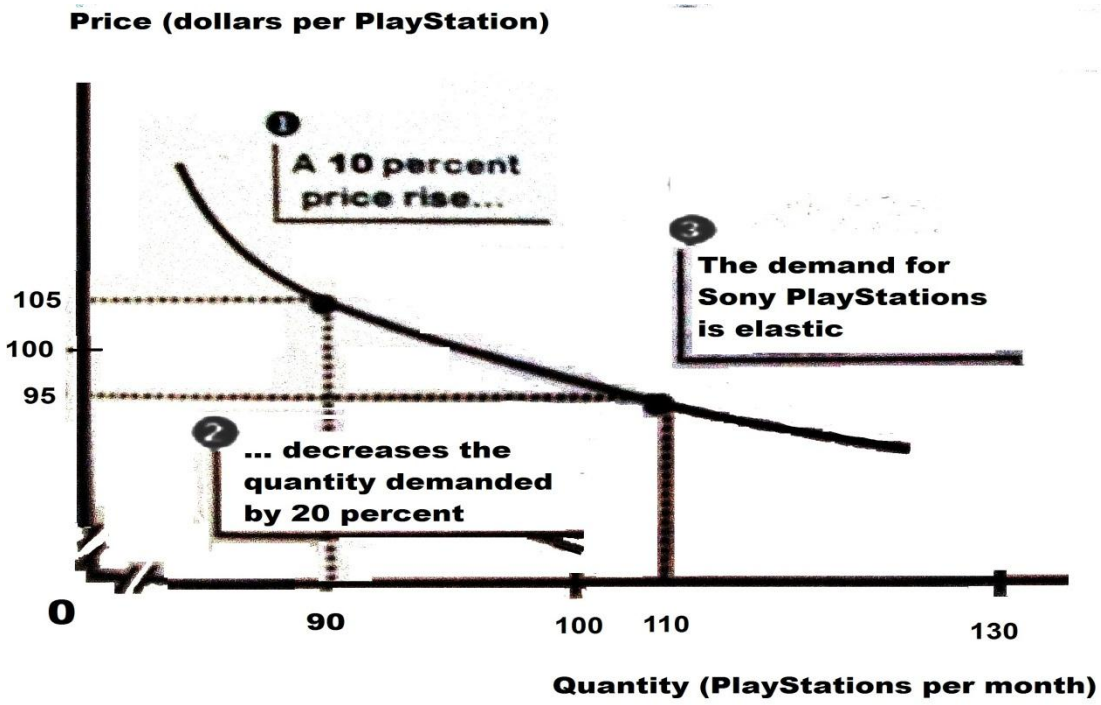
The demand for a good is inelastic if a substitute for it is hard to find. Oil has, poor substitutes imagine a coal–fueled car), so the demand for oil is inelastic.

Three main factors influence the ability to find a substitute for a good: whether the good is a luxury or a necessity, he w narrowly it is defined, and the amount of time available to find a substitute for it.

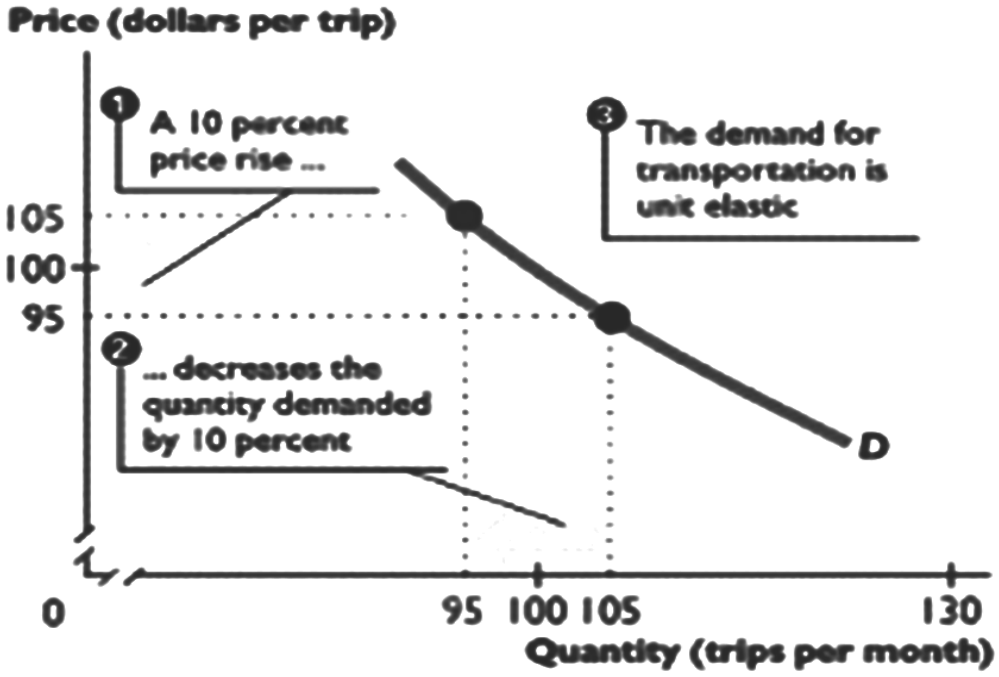
Figure 5.1
The Range of price Elasticities of Demand



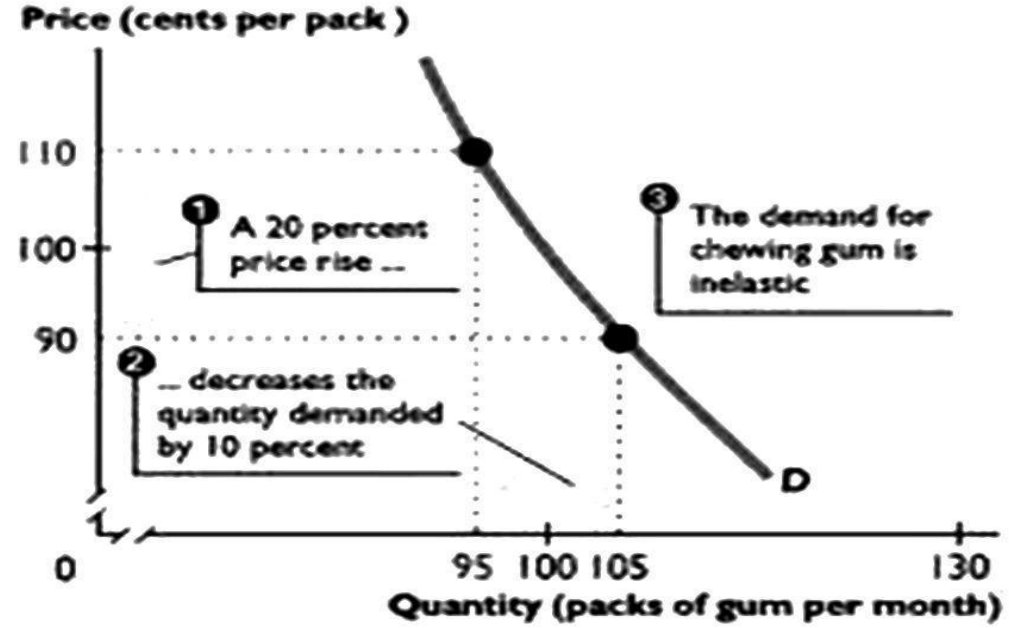
(a) Perfectly elastic demand



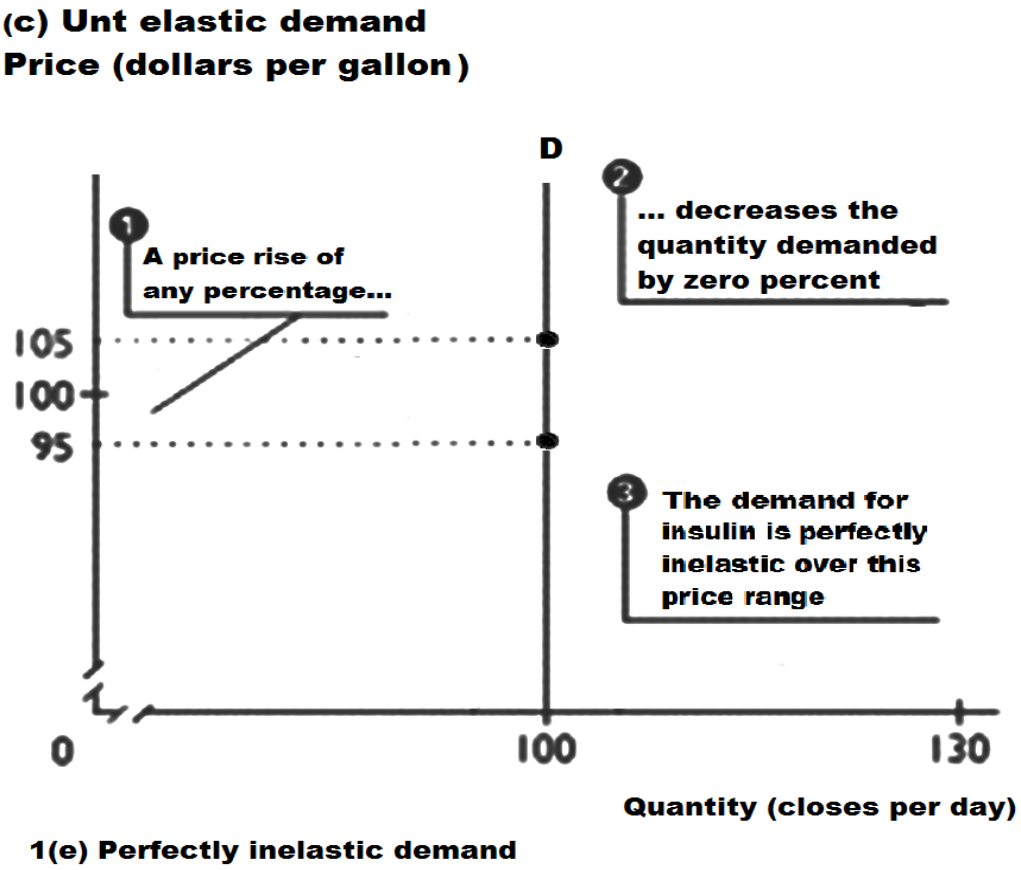
(b) Elastic demand price



(c) Unit elastic demand



(d) Inelastic demand



1(e) Perfectly inelastic demand

(1) A price rise brings (2) a decrease in the quantity demanded. The relationship between the percentage change in the quantity demanded and the percentage change in price determines (3) the price elasticity of demand which ranges from perfectly elastic (part a) to perfectly inelastic (part e).

Luxury Versus Necessity We call goods such as food and housing necessities and goods such as exotic vacations luxuries. A necessity has poor substitutes–you must eat–so the demand for a necessity is inelastic. A luxury has many substitutes–you don't absolutely have to go to Galapagos this summer–so the demand for a luxury is elastic.

Narrowness of Definition The demand for a narrowly defined good is elastic. For example, the demand for a Starbucks latte is elastic because a New World latte is a

good substitute for it. The demand for a broadly defined good is inelastic. For example, the demand for coffee is inelastic because tea is a poor substitute for it

Time Elapsed Since Price The longer the time that has elapsed since the price of a good changed, the more elastic is the demand for the good. For example, when the price of gasoline increased steeply during the 1970 s and 1980s, the quantity of gasoline demanded didn't change much because many people owned gas-guzzling automobiles-the demand for gasoline was inelastic. But eventually, fuel-efficient cars replaced gas guzzlers and the quantity of gasoline demanded decreased the demand for gasoline became more elastic.

Proportion of Income Spent A price rise, like a decrease in income, means that people cannot afford to buy the same quantities of goods and services as before. The greater the proportion of income spent on a good, the greater is the impact of a rise in its price on the quantity of that good that people can afford to buy and the more elastic is the demand for the good. For example, toothpaste takes a tiny proportion of your budget an housing takes a large proportion. If the price of toothpaste doubles, you buy almost as much toothpaste as before. Your demand for toothpaste is inelastic, If your apartment rent doubles, you shriek and look for more roommates Your demand for housing is more elastic than is your demand for toothpaste.

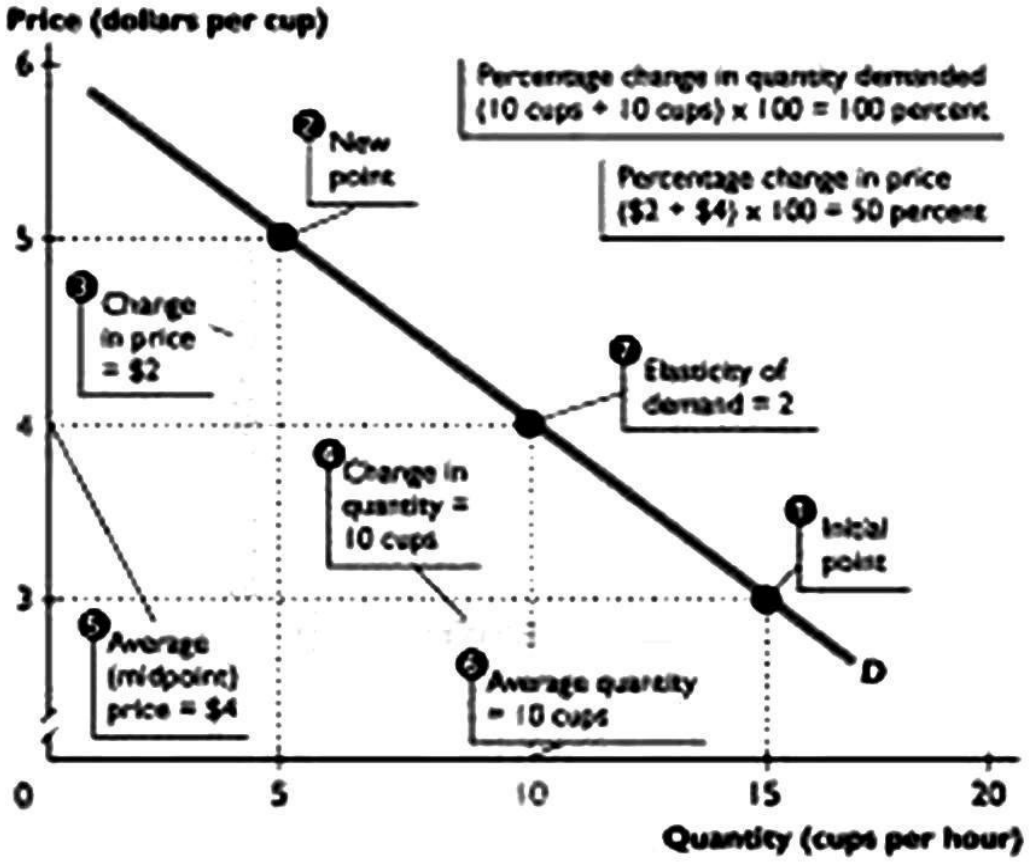
Computing the Price Elasticity of Demand

To determine whether the demand for a good is elastic, unit elastic, or inelastic, we compute a numerical value for the price elasticity of demand by using the following formula:

$$\text{Price elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

- If the price elasticity of demand is greater than 1, demand is elastic.
- If the price elasticity of demand equals 1 demand is unit elastic.
- If the price elasticity of demand is less than 1, demand is inelastic.

Figure 5.2 illustrates and summarizes the calculation for the Starbucks latte example. Initially, the price is $3 a cup and 15 cups an hour are demanded–the initial point in the figure. Then the price rises to $5 a cup and the quantity demanded decreases to 5 cups an hour the ne point in the figure. The price rises by $2 a cup and the average (midpoint) price is $4 a cup, so the percentage change in price is 50. The quantity demanded decreases by 10 cups an hour and/ the average (midpoint) quantity is 10 cups an hour, so the percentage change it quantity demanded is 100.



(1) At the initial point, the price is $3 a cup and the quantity demanded is 15 cups an hour.

(2) At the new point, the price is $5 a cup and the quantity demanded is 5 cups an hour.

(3) The change in price is $2 a cup, and (4) the change in the quantity) demanded is 10 cups an hour.

(5) The average price is $4 a cup, and (6) the average quantity demanded is 10 cups an hour. The percentage change in quantity demanded is 100, the percentage change in price is 50, and (7) the price elasticity of demand is 2.

Using the above formula, you can see that the price elasticity of demand for a Starbucks latte is

Price elasticity of demand $= \frac{100 \text{ percent}}{50 \text{ percent}} = 2.$

The price elasticity of demand is 2 at the midpoint between the initial price and the new price on the demand curve. Over this price range, the demand for a Starbucks latte is elastic.

Interpreting the Price Elasticity of Demand Number

The number we've just calculated for a Starbucks latte is only an example. We don't have real data on the price and quantity. But suppose we did have real data and we discovered that the price elasticity of demand for a Starbucks latte is 2. What does this number tell us?

It tells us three main things:

1. The demand for Starbucks latte is elastic. Being elastic, the good has plenty of convenient substitutes (such as other brands of latte) and takes only a small proportion of buyers' incomes.

2. Starbucks must be careful not to charge too high a price for its latte. Pushing the price up brings in more revenue per cup but wipes out a lot of potential business.

3- The flip side of the second point: Even a slightly lower price could create a lot of potential business and end up bringing in more revenue

Elasticity Along a Linear Demand Curve

Slope measures responsiveness. But elasticity is not the same as slope. You can see the distinction most clearly by looking at the price elasticity of demand along a, linear (straight-line) demand curve. The slope is constant, but the elasticity varies. Figure (5.3) shows the same demand curve for a Starbucks latte as that in Figure (5.2) but with the axes extended to show lower prices and larger quantities demanded.

Let's calculate the elasticity of demand at point A If the price rises from $3 to ($5) a cup, the quantity demanded decreases from 15 to 5 cups an hour. The average price is $4 a cup, and the average quantity is 10 cups-point A. The elasticity of demand at point A is 2, and demand is elastic.

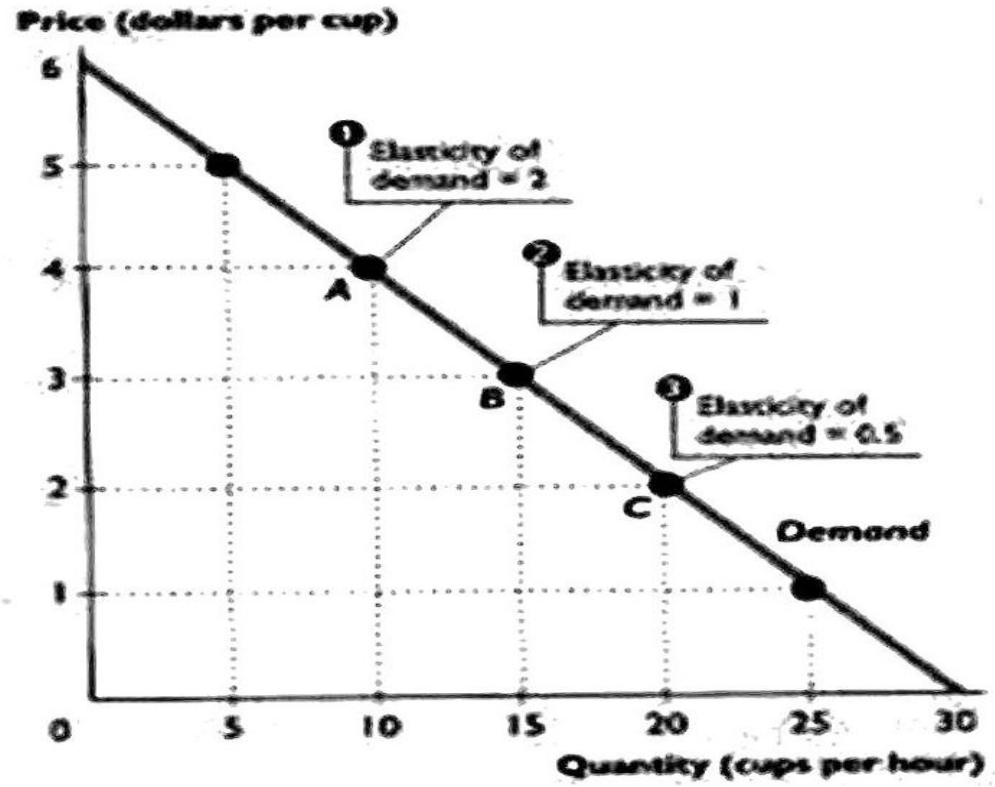
Let's calculate the elasticity of demand at point C. If the price falls from $3 to $1a cup, the quantity demanded increases from 15 to 25 cups an hour. The average price is $2 a cup, and the average quantity is 20 cup - point C. the elasticity of demand at point C is 0.5 and demand is inelastic,

Finally, let's calculate the elasticity of demand at point B, which is the midpoint of the demand curve. If the price rises from $2 to $4a cup, the quantity demanded decreases from 20 to 10 cups an hour. The average price is $3 a cup, and the average quantity is 15 Cup -point B. The elasticity of demand at point 8 is 1, and demand is unit elastic. Along a linear demand Curve,

- Demand is unit elastic at the midpoint of the curve.
- Demand is elastic at all points above the midpoint of the curve.
- Demand is inelastic at all points below the midpoint of the curve.

Figure (5.3)

Elasticity Along a Linear Demand Curve



On a linear demand curve, the slope is constant but the elasticity decreases as the price falls and the quantity demanded increases.

(1) At point A, demand is elastic.

(2) At point B, which is the midpoint of the demand curve, demand is unit elastic.

(3) At point C, demand is inelastic. Demand is elastic at all points above the midpoint of the demand curve and inelastic at all points below the midpoint of demand curve.

The Price Elasticity of Supply

You know that when demand increases, the equilibrium price rises and the equilibrium quantity increases, but does the price rise by a large amount and the quantity increase by a little? Or does the price barely rise and the quantity increase by a large amount?

To answer this question, we need to know the price elasticity of supply.

The price elasticity of supply is a measure of the responsiveness of the quantity supplied of a good to a change in its price when all other influences on sellers' plans remain the same. We determine the price elasticity of supply by comparing the percentage change in the quantity supplied with the percentage change in price.

Elastic and Inelastic Supply

The supply of a good might be

- Elastic.
- Unit elastic.
- inelastic.

Figure (5.5) illustrates the range of supply elasticities. Figure 5.5 (a) shows the extreme case of a perfectly elastic supply–an almost zero percentage change in price brings a very large percentage change in the quantity supplied. Figure (5.5) (b) shows an elastic supply–the percentage change in the quantity supplied exceeds the percentage change in price. Figure (5.5) (c) shows a unit elastic supply–the percentage change in the quantity supplied equals the percentage change in price. Figure (5.5) (d) shows an inelastic supply–the percentage change in the quantity supplied is less than the percentage change in price. And Figure (5.5) (e) shows the extreme Case of a perfectly inelastic supply–the percentage change in the quantity supplied is Zero when the price changes.

Influences on the Price Elasticity of Supply

What makes the supply of some things elastic and the supply of others inelastic? The two main influences on the price elasticity of supply are

- **Production possibilities**
- **Storage possibilities**

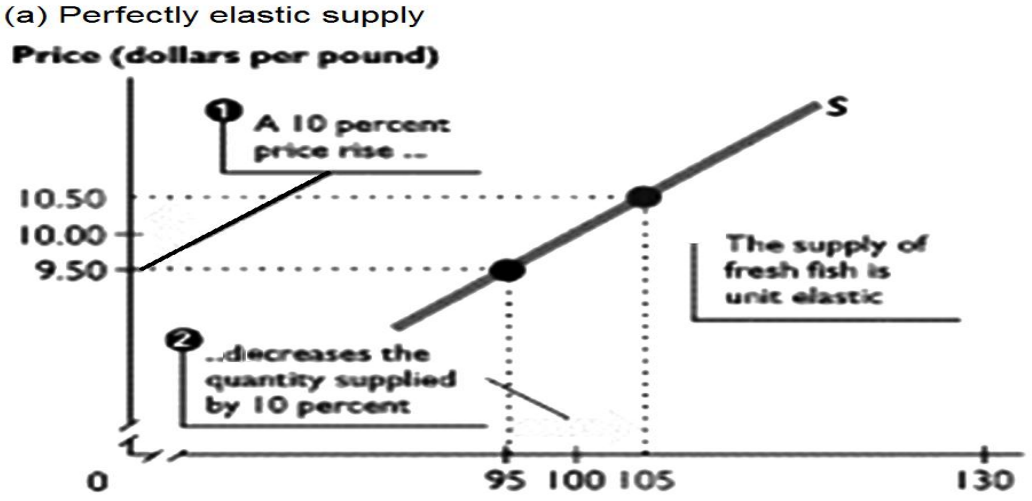
Production Possibilities

Some goods can be produced at a constant (or very gently rising) opportunity cost. These goods have an elastic supply. The silicon in your computer chips is an

example of such a good. Silicon is extracted from sand at a tiny and almost constant opportunity cost, so the supply of silicon is perfectly elastic.

Some goods can be produced in only a forced quantity. These goods have a perfectly inelastic supply. A beachfront home in Malibu can be built only on a unique beachfront lot so the supply of these homes is perfectly inelastic.

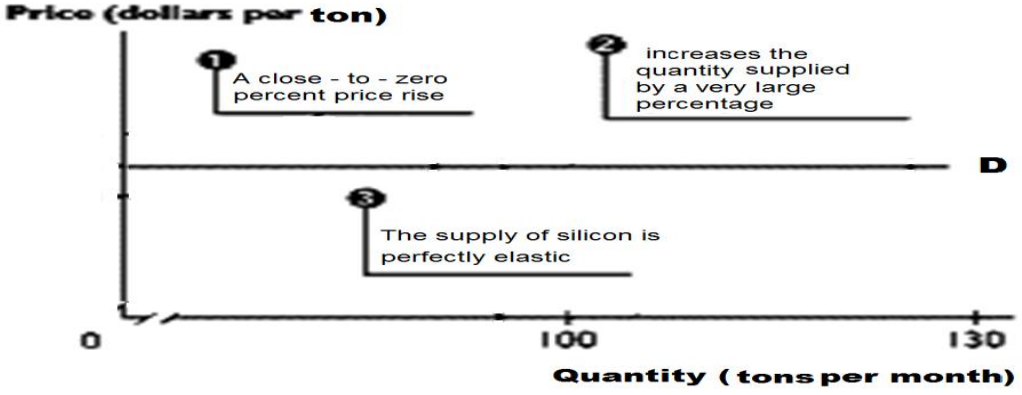
Hotel



(a) Perfectly elastic supply Price

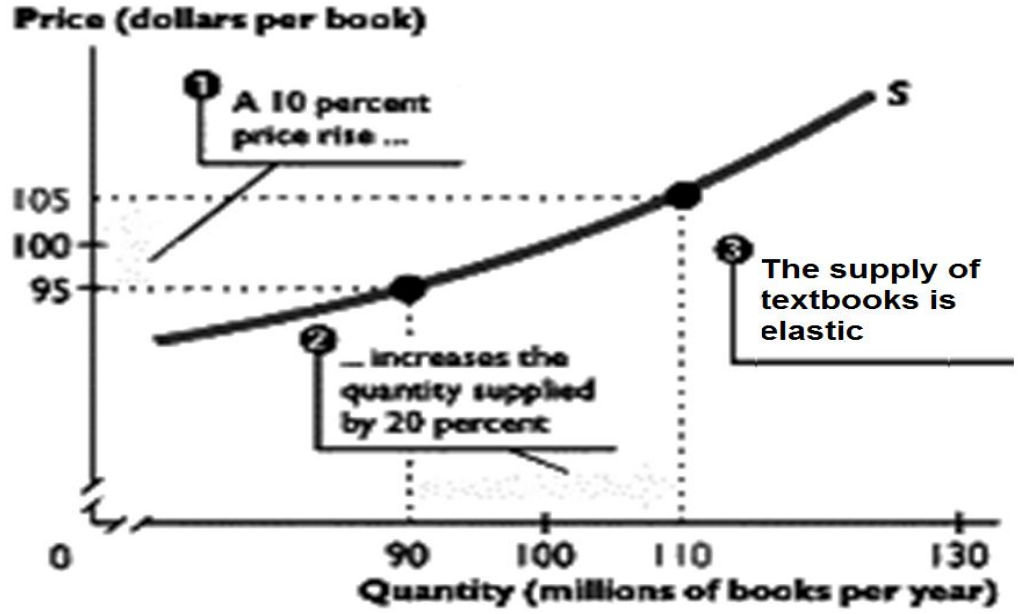
rooms in New York City can't easily be used as office accommodation and office space cannot easily be converted into hotel rooms, so the supply of hotel rooms in New York City is inelastic. Paper and printing presses can be used to produce textbooks or magazines, and the supplies of these goods are elastic.

Figure 5.5
The Range of price Elasticities of Supply

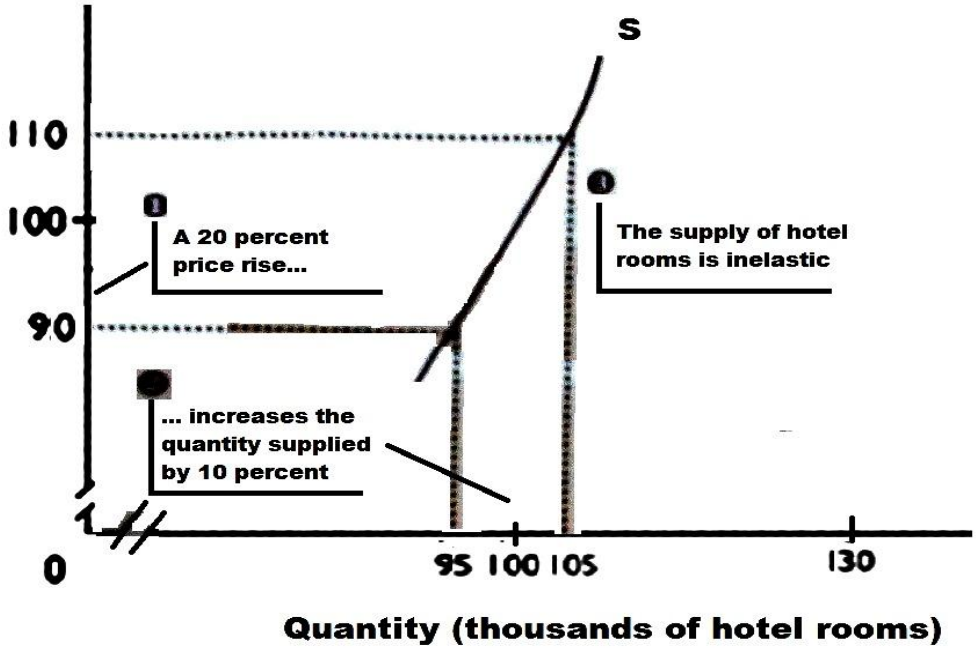


(a) Perfectly elastic demand

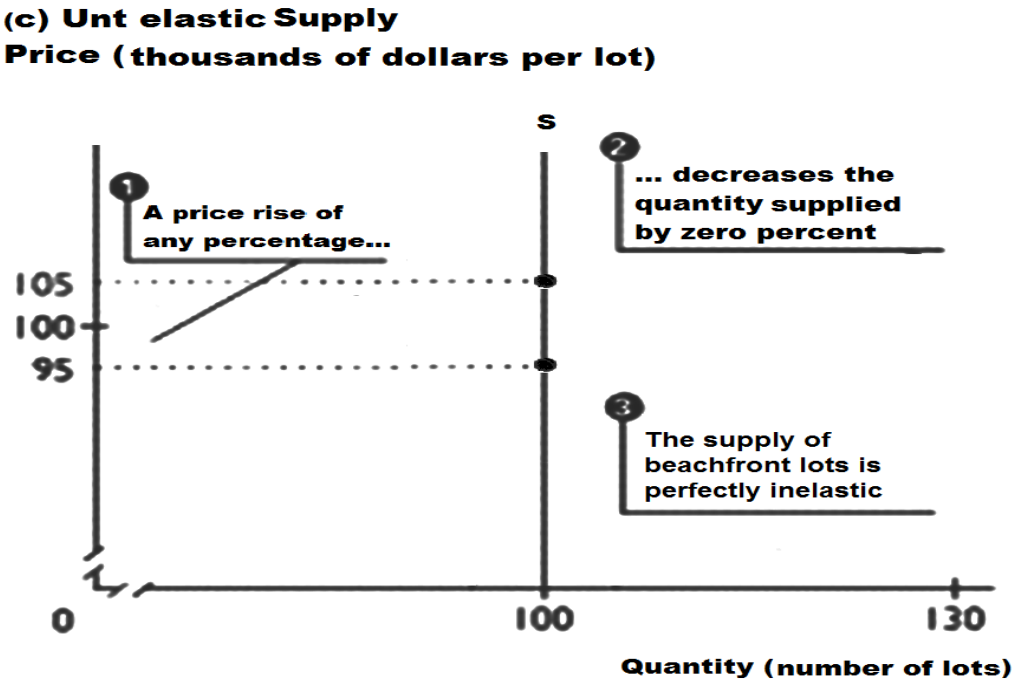
(X) perfectly inelastic supply



(b) Elastic supply



(d) Inelastic supply



(1) A price rise brings

(2) an increase in the quantity supplied. The relationship between the percentage change in the quantity, Supplied and the percentage change in price determines.

(3) The price elasticity of supply, which ranges from perfectly elastic (part a) to perfectly inelastic (part e).

Time a Elapsed Since Price Change As time passes after a price change, it becomes easier to change production plans and supply becomes more elastic. For some items-fruits and vegetables are examples-it is difficult or perhaps impossible to change the quantity supplied immediately after a price change. These goods have a perfectly inelastic supply on the day of a price change. The quantities supplied depend on crop-planting decisions that were made earlier. In the case of oranges, for example, planting decisions have to be made many years in advance of the crop being available.

Many manufactured goods also have an inelastic supply if production plans have had only a short period in which to change. For example, before it launched the Wii in November 2006, Nintendo made a forecast of demand, set a price, and

made a production plan to supply the United States with the quantity that it believed people would be willing to buy. It turned out that demand outstripped Nintendo's earlier forecast. The price of the Wii increased eBay, an Internet auction market, to bring market equilibrium. At the high price that emerged, Nintendo would have liked to ship more units of Wii, but it could do nothing to increase the quantity supplied in the near term. The supply of the Wii was inelastic.

As time passes, the elasticity of supply increases. After all the technologically-possible ways of adjusting production have been exploited supply is extremely elastic-perhaps perfectly elastic for most manufactured items. In 2007 Nintendo was able to step up the production rate of the Wii and the price on eBay began to fall. The supply of Wii had become more elastic as production continued to expand.

Storage Possibilities

The elasticity of supply of a good that cannot be stored (for example, a perishable item such as fresh strawberries) or a service depends only on production possibilities. But the elasticity of supply of a good that can be stored depends on the decision to keep the good in storage or offer it for sale. A small price change can make a big difference to this decision, so the supply of a storable good is highly elastic. The cost of storage is the main influence on the elasticity of supply of a storable good. For example, rose growers in Colombia, anticipating a surge in demand on Valentine's Day in February, hold back supplies in late January and early February and increase their inventories of roses. They then release roses, from inventory for Valentine's Day.

Computing the Price Elasticity of Supply

To determine whether the supply of a good is elastic, unit elastic, or inelastic, we compute a numerical value for the price elasticity of supply in a way similar to that used to calculate the Price elasticity of demand. We use the formula:

$$\text{Price elasticity of supply} = \frac{\text{percentage change in quantity supplied}}{\text{Percentage change in price}}$$

• If the price elasticity of supply is greater than 1, supply is elastic.

• If the price elasticity of supply equals 1, supply is unit elastic.

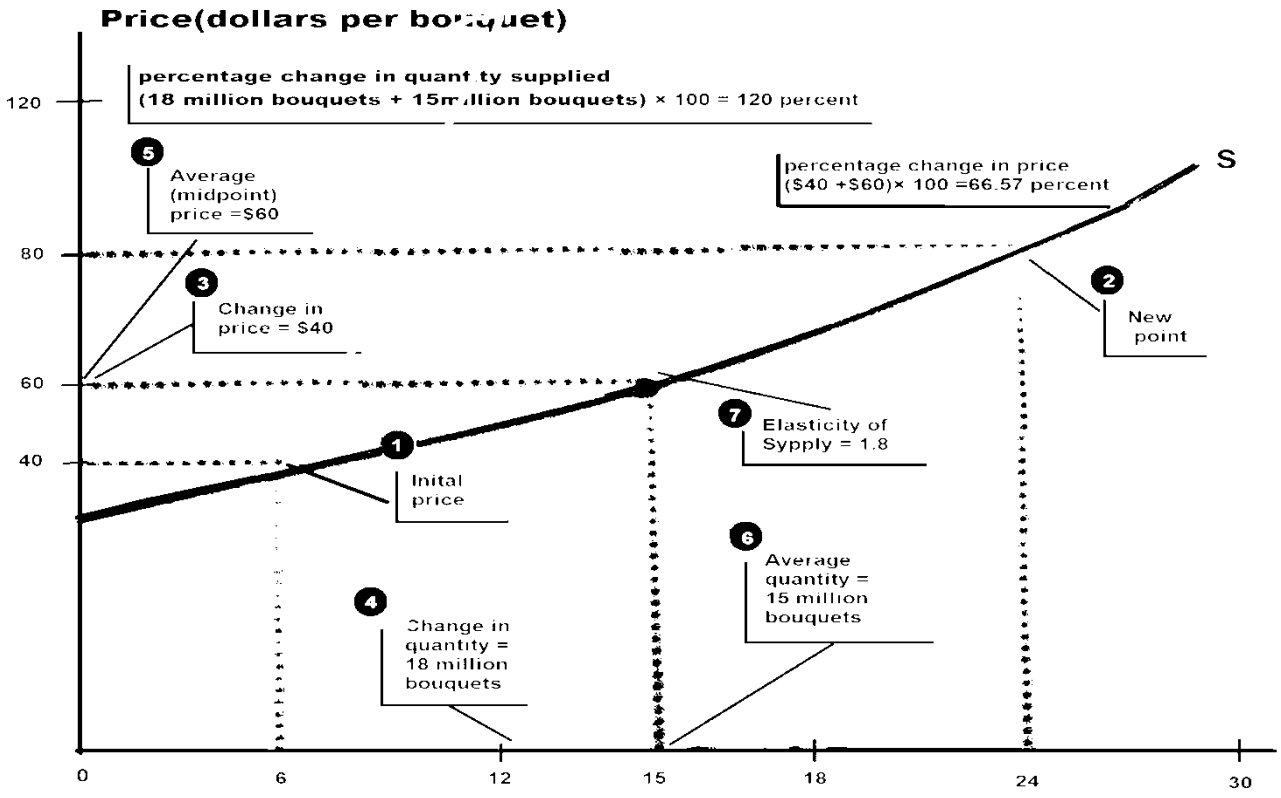
• If the price elasticity of supply is less than 1, supply is inelastic.

Figure illustrate and summarizes the calculation. Ina normal month, the price of roses is $\$40$ a bouquet and 6 million bouquets are supplied--the initial point in the figure In February, the price rises to $\$80$ a bouquet and the quantity supplied increases to 24 million bouquets-the new point in the figure. The price increases by $\$40$ a bouquet and the average, or midpoint, price is $\$60$ a bouquet. so the percentage change in the price is 66.67 percent The quantity supplied increases by 18 million bouquets and the average, or midpoint, quantity is 15 million bouquets, so the percentage change in the quantity supplied is 120 percent. Using the above formula, you can see that the price elasticity of supply of roses is

$$\text{Price elasticity of demand} = \frac{\mathbf{120\ percent}}{\mathbf{66.67\ percent}} = 1.8$$

The price elasticity of supply is 1.8 at the midpoint between the initial point and. the new point on the supply curve. In this example, over this price range, the supply of roses is elastic.

Figure 5.5
Price Elasticity of Supply Calculation



(1) At the initial point, the price is $40 a bouquet and the quantity supplied is 6 million bouquets month.

(2) At the new point, the price is $80 a bouquet and the quantity supplied is 24 million bouquets a month.

(3) The change in price is $40 a bouquet, and

(4) the change in the quantity supplied is 18 million bouquets a month.

(5) The average price is $60 a bouquet, and

(6) the average quantity supplied is 15 million bouquet month.

The percentage change in quantity supplied is 120, the percentage change in price is 66.67, and the price elasticity of supply is 1.8.

Cross elasticity AND income elasticity

Domino's Pizza in Chula Vista has a problem. Burger King has just cut its prices Domino's manager, Pat, knows that pizzas and burgers are substitutes. He

also knows that when the price of a substitute for pizza falls, the demand for pizza decreases, But by how much will the quantity of pizza bought decrease if Pat maintains his current price?

Pat also knows that pizza and soda are complements, He knows that if the price of a complement of pizza falls, the demand for pizza increases. So he wonders whether he might keep his customers by cutting the price he charges for soda. But he wants to know by how much he must cut the price of soda to keep selling the same quantity of pizza with cheaper burgers all around him.

To answer these questions, Pat needs to calculate the cross elasticity of demand. Let's examine this elasticity measure.

Cross Elasticity of Demand

The cross elasticity of demand is a measure of the responsiveness of the demand for a good to a change in the price of a substitute or Complement when other things remain the same. It is calculated by using the formula:

$$\text{Cross elasticity of demand} = \frac{\textbf{Percentage change}}{\textbf{in quantity d demanded of a good one of its substitutes or complements}}$$

Suppose that when the price of a burger falls by 10 percent, the quantity of pizza demanded decreases by 5 percent. The cross elasticity of demand for pizza with respect to the price of a burger is

$$\text{Gross elasticity of demand} = \frac{\textbf{−5 percent}}{\textbf{−10 percent}} = 0.5$$

The cross elasticity of demand for a substitute is positive. A fall in the price of a substitute brings a decrease in the quantity demanded of the good. The quantity demanded of a good and the price of one of its substitutes change in the same direction.

Supposes that when the price of soda falls by 10 percent, the quantity of pizza demanded increases by 2 percent. The cross elasticity of demand for pizza with respect to the price of soda is

$$\text{Cross elasticity of demand} = \frac{+2 \text{ percent}}{-10 \text{ percent}} = -0.2$$

The cross elasticity of demand for a complement is negative. A fall in the price of a complement brings an increase in the quantity demanded of the good. The quantity demanded of a good and the price of one of its complements change in opposite directions.

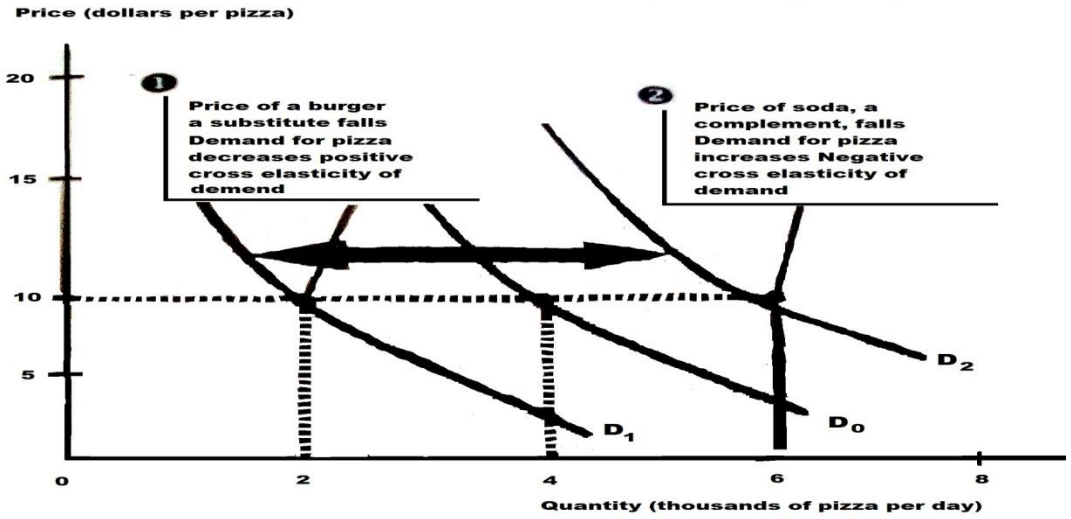


Figure (5.7) illustrates these two cross elasticities of demand for pizza. With the Price of a pizza constant at $\$10$, when the price of a burger falls, the demand for pizza decreases and the demand curve for pizza shifts leftward from D_0 to D_1. When the price of soda falls, the demand for pizza increases and the demand curve for pizza shifts rightward from D_0 to D_2 The magnitude of the cross elasticity determines how far the demand curve shifts.

Income Elasticity of Demand

The U.S. and global economies are expanding and people are enjoying rising incomes. This increasing prosperity brings an increasing demand for most types of goods. But by how much will the demand for different items increase? Will the

demand for some item increase so rapidly that we spend an increasing percentage of our incomes on them? And will the demand for some items decrease?

The answer depends on the income elasticity of d demand. The income elasticity of demand is a measure of the responsiveness of the demand for a good to a change in income when other things remain the same. It is calculated by using the following formula:

$$\text{Income elasticity of demand} = \frac{\textbf{Percentage change in quantity demanded}}{\textbf{Percentage change in income}}$$

The income elasticity of demand falls into three ranges:

- Greater than 1 (normal good, income elastic).
- Between zero and 1 (normal good, income inelastic).
- Less than zero (inferior good).

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The income elasticity of demand falls into three ranges:

• Greater than 1 (normal good, income elastic).

• Between zero and 1 (normal good, income inelastic).

• Less than zero (inferior good).

As our incomes increase: items that have

• An income elastic demand takes an increasing share of income.

• An income inelastic demand takes decreasing share of income.

• A negative income elasticity of demand takes an absolutely smaller amount of income

Questions

Multiple-Choice Questions

1- To aggregate individual demand curves into a market demand curve, we

a. horizontally sum individual indifference curves.

b. vertically sum individual indifference curves

c. horizontally sum individual demand curves.

d. vertically sum individual demand curves.

e. first (b) then (d).

2- If kisses at a carnival's "Kissing Booth" were free, people could conceivably consume all they wanted. At this zero price, the elasticity of demand for kisses becomes

a. zero

b. relatively (but not completely) inelastic

c. unit elastic.

d. relatively (but not perfectly) elastic.

e. infinite

3- At a sufficiently high price the sale of yellow ribbon would be completely cut off and not even Tony Orlando would buy. At his price, the elasticity of demand for yellow ribbon becomes

a. zero

b. relatively (but not completely) inelastic.

c. unit elastic.

d. relatively (but not perfectly) elastic.

e. infinite

4- Suppose that your local baseball team decides to allow fans who collect 20 bottle cap liners from Coke to attend games for $1.00 instead of the usual $3.50. If

both the gate receipts were rise and Coca Cola's revenues were to rise with the adoption of the proposed plan, which of the following statements must be true?

a. The demand for Coca Cola is price elastic, but the price elasticity of demand for baseball tickets cannot be determined.

b. The demand for Coca Cola is price inelastic, but the price elasticity of demand for baseball tickets cannot be determined.

c. The demand for your local team's tickets is price elastic, but the price elasticity of demand for Coca Cola cannot be determined.

d. The demand for your local team's tickets is price elastic, but the price elasticity of demand for Coca Cola cannot be determined.

e. Insufficient information is given to determine the price elasticity of demand for either your local baseball team's tickets or Coca Cola.

5- If the demand for gasoline is relatively but not completely price inelastic, then it follows that

a. people would be willing to pay any price to drive.

b. a decrease in the price of gasoline would increase the supply of gasoline

c. a decrease in the price of gasoline would reduce the total amount spent on gasoline.

d. gasoline consumption could not be cut without rationing

e. an increase in the price of gasoline would not cause the quantity demanded of gasoline to fall.

6-. For tourists who visit Mt. St. Helens and lava good pun, there are "Kiss My Ash" T-shirts, Three possible prices are shown in the demand schedule below.

Price	T-Shirts Demanded
6	X
7	120
8	Y

If the demand for these T-shirts is relatively (but not completely) price inelastic, which of the following values or range of values for X and Y must be correct?

a. X is greater than 140 and Y is less than 105.

b. X lies between l20 and 140; Y lies between 105 and 120.

c. X lies between 120 and 140; Y is less than 105.

d. X is greater than 140 and Y lies between 105 and 120.

e. X is equal to y which in turn is equal to 120.

7- If consumers spend $15 million a month on records, regardless of whether the price they pay goes up or down, that implies that their price elasticity of demand for records is

a. zero

b. one.

c. infinite.

d. 33 1/3,45, or 78.

e. cannot be determined.

8- The demand for a commodity is likely to be more price elastic

a. the smaller the number of substitutes for the commodity.

b. the narrower and more specific the definition of the commodity.

c. the smaller the importance of the commodity in the consumer's budget.

d. at low prices rather than high pieces.

e. in summer than in winter

9- If the demand for Kellogg's Frosted Flakes is relatively elastic

a. Frosted Flakes will have a high price.

b. Frosted Flakes is probably an inferior good.

c. an increase in the price of Frosted Flakes will not appreciably affect sales.

d. a decrease in the price will reduce the expenditure on Frosted Flakes.

e. Frosted Flakes has many close substitutes.

10- Which of the following will not be a determinant of the price elasticity of demand for commodity?

a. The absence of substitutes for the good.

b The presence of substitutes for the good.

c. The importance of the commodity in consumer's budgets.

d. The length of the time period to which the demand curve pertains.

e. The cost of producing the commodity.

11- Consider a demand curve which is perpendicular to the quantity axis. This curve most likely presents

a. the demand curve for Sugar Smacks.

b. the demand curve tor sugar.

c. the demand curve for insulin

d. the long-run supply curve of sugar.

e. a side view of a postcard.

12. Which of the following goods probably has the highest price elasticity of demand?

a. Kellogg's Frosted Flakes.

b. Food.

c. Breakfast cereals.

d. Sugar-coated breakfast cereals.

e. Kellogg's breakfast cereals.

13- The price elasticity of demand will increase with the length of the period to which the demand curve pertains because

a. consumers' incomes will increase.

b. the demand curve will shift outward.

c. all prices will increase over time.

d. consumers will be better able to find substitutes.

e. firms will be better able to produce the good for less.

\14- The income elasticity of demand for a Giffen good is

a. positive and greater than one.

b. positive and less than one.

c. zero.

d. negative.

e. undefined.

15- Which of the following is a reasonable value for the income elasticity of demand for powdered milk?

a. -30

b. -0.3

c. 0

d. 0.3

e. 3.0

16- Luxuries are distinguished from necessities by

a. the number of substitutes available for each.

b. the fact that luxuries have high prices and necessities have low ones.

c. the high price elasticity of demand for luxuries and the low price elasticity of demand for necessities.

d. the high income elasticity of demand for luxuries and the low income elasticity of demand for necessities.

e. the slope of the Engel curve.

17-Which of the following is likely to have a negative cross elasticity of demand?

a. Aluminum foil and cellophane.

b. Jellybeans and licorice sticks

c. Bethlehem steel and imported Japanese steel.

d. Big Macs and French fries.

e. Buggy whips and bug spray.

18- Suppose that Adam and Eve spend all of their income on apples. Which of the following statements must be true?

1. The price elasticity of demand for apples is infinite.

2. The income elasticity of demand for apples is one.

3. The cross elasticity of demand between apples and any other good is zero.

a. 1 only.

b. 1and 2 only.

c. 2 and 3 only.

d. 1 and 3 only.

e. 1,2. and 3

19- For a firm operating in circumstances of perfect competition, which of the following statements is not correct?

a. The total revenue curve is a straight line.

b. Demand is infinitely elastic.

c. The demand curve is a horizontal line.

d. Price and marginal revenue are always equal.

e. Marginal revenue always equals marginal cost.

20- If he demand curve for a good is a rectangular hyperbola, which of the following statements must be true?

a. The marginal revenue curve is also a rectangular hyperbola.

b. The total revenue curve is a rectangular hyperbola.

c. The marginal revenue curve coincides with the quantity axis

d. The total revenue curve is a straight line.

e. The total revenue curve increases, reaches a maximum, then decreases.

21- Which of the following is not true of marginal revenue?

a. it is always equal to the price if the price is constant.

b. it is zero if total revenue is at a maximum.

c. it is negative when total revenue is decreasing.

d. it is zero if demand is infinitely elastic.

22- In describing the relationship between the elasticity of demand at a certain output level and marginal revenue at that same output level, which of the following statements must be true?

a. If the price elasticity of demand is equal to zero, marginal revenue is equal to price.

b. If the price elasticity of demand is less than one (but greater than zero), marginal revenue is positive.

c. If the price elasticity of demand is equal to one, marginal revenue is zero.

d. If the price elasticity of demand is greater than one, marginal revenue is equal to half the price.

e. If demand is infinitely elastic, marginal revenue is zero.

23- The idea behind the direct market experiment is

a. to use statistical methods to estimate demand curves.

b. to interview consumers concerning their buying habits, motives, and intentions.

c. to gauge the effect of price changes on a product while attempting to keep other market conditions stable.

d. to sell the same product at different prices in a number of stores.

e. to use the actual observations of price-quantity combinations across various sectors of the market.

24- In the last decade, many colleges and universities have doubled their fees and tuition, but there has been no appreciable decrease in the number of students enrolled. In fact, at many institutions enrollments have increased. This would imply that

a. the demand curve for higher education is infinitely elastic.

b. the demand curve for higher education is completely inelastic.

c. the demand curve for higher education is upward sloping

d. the demand curve for higher education is shifting out.

e. higher education is an inferior good.

25- As a market analyst for the US. Department of Transportation, in trying to determine the impact of free public transit on the use of automobiles, you would be most interested in the concept of

a. price elasticity of demand.

b. price elasticity of supply.

c. are elasticity of demand.

d. income elasticity of demand.

e. cross elasticity of demand.

26- Which services were shown to be inferior goods for adult females?

a. Cleanings and crowns.

b. Extractions and dentures.

c. Extractions and crowns.

d. Cleanings, fillings examinations, and crowns.

e. Cleanings, fillings, examinations, and dentures.

27. If only children were provided with dental insurance, for which of the following services would expenditure change the least?

a. Cleanings

b. Crowns.

c. Examinations

d. Fillings

e. Orthodontia.

28- If only children were provided with dental insurance, for which of the following services would quantity demanded change the least?

a. Cleanings.

b. Crowns

c. Examinations.

d. Fillings.

e. Orthodontia.

29- Price elasticity of demand is defined as

a. the maximum amount consumers will pay for an additional unit of output.

b. the increase in quantity demanded induced by a one cent decrease in price.

c. the percentage change in quantity resulting from a one percent change in price.

d. the absolute change in quantity demanded induced by a one unit change in price.

e. the percentage change in quantity resulting from a one unit change in price.

30- In 1976, a frost in Brazil killed over 500 million coffee trees and damaged many more. A civil war in Angola, a major supplier of coffee, cut back its crop. And, an earthquake in Guatemala disrupted the flow of coffee. In spite of these calamities, these three producers reported an increase in export earnings. On the basis of this information, which of the following must be true?

a. The demand for coffee is price elastic.

b. The supply of coffee is price elastic.

c. The demand for coffee is price inelastic,

d. The supply of coffee is price inelastic.

e. The demand for coffee is unit elastic.

31- If the demand for emeralds is elastic, then

a. emeralds will have a high price.

b. a reduction in price will lead to an increase in the expenditure on emeralds.

c. the slope of the demand curve for emeralds must be greater than one.

d. a price reduction will not appreciably affect sales.

e. the slope of the price consumption curve for emeralds must be greater than one.

32- George Herman budgets a fixed amount of his weekly allowance to the purchase of baseball cards. This would imply that his demand for baseball cards is

a. linear and downward sloping.

b. completely inelastic.

c. infinitely elastic.

d. unit elastic.

e. upward sloping.

33- The market demand for a product is found by:

a. horizontally summing the individual demand curves.

b. vertically summing the individual demand curves.

c. both horizontally and vertically summing the individual demand curves.

d. none of the above.

34- If a demand curve is linear, then:

a. it is unitarily elastic throughout.

b. it is elastic if its slope is greater than 1.

c. it is elastic if its slope is equal to 1.

d. its elasticity varies throughout.

e. it is inelastic throughout.

35- If income elasticity is less than one:

a. the good is an inferior good.

b. the good is income inelastic.

c. the good is a Giffen good.

d. the good is a luxury good.

e. none of the above.

36- Suppose good A and good B have a cross price elasticity of +.01, We then know that the goods are most likely:

a. complementary goods.

b. substitute goods.

c. unrelated or independent goods.

d. both inferior.

e. both Giffen.

37- When the demand curve is linear and downward sloping, marginal revenue is:

a. equal to piece

b. greater than price.

c. less than price

d. non-linear.

e. none of the above.

38- Suppose that the demand function is given as P = 16-2Q. We then would estimate the marginal revenue function as

a. MR = 16-4Q

b. MR = 8-2Q

c. MR = 16-8Q

d. MR = 16-2Q

e. none of the above

39- If the relationship between marginal revenue and elasticity is: MR = P(1−1/e)

a. at an elasticity of 1, marginal revenue is zero.

b. at an elasticity of 0, marginal revenue is 1.

c. at an elasticity of 1, marginal revenue is 1.

d. at an elasticity of 3, marginal revenue is zero.

e. at an elasticity of 0, marginal revenue is 1.

40- Suppose you collected data on the price and sales of motor oil at a discount store for a period of three months. When you plotted this information on a graph you could estimate:

a. demand curve,

b. a supply curve.

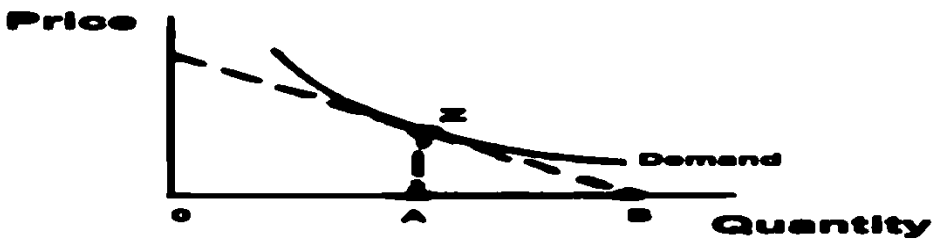
c. an Engel curve.

d. none of the above.

Multiple Choice Questions with Diagrams

A dashed line is drawn tangent to a non-linear demand curve at point z,

as shown in the figure. If line segment OB is more than twice the length of line segment AB, then the elasticity at point z must be



a. completely inelastic.

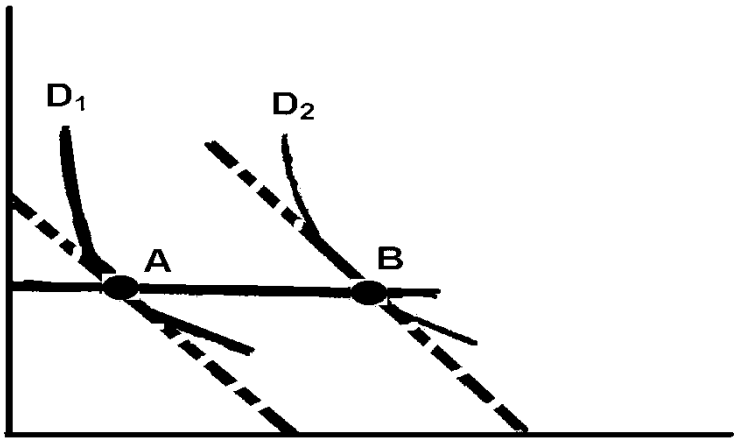
b. relatively (but not completely) inelastic.

c. unit elastic

d. relatively (but not perfectly) elastic.

e perfectly elastic.

2- This problem is to compare the price elasticity of demand at point A on the non-linear demand curve D_1 with the price elasticity of demand at point B on the non-linear demand curve D_2, as shown in the figure. If both tangent lines are parallel, which of the following statements must be true?



a. The price elasticity at A is greater than that at B.

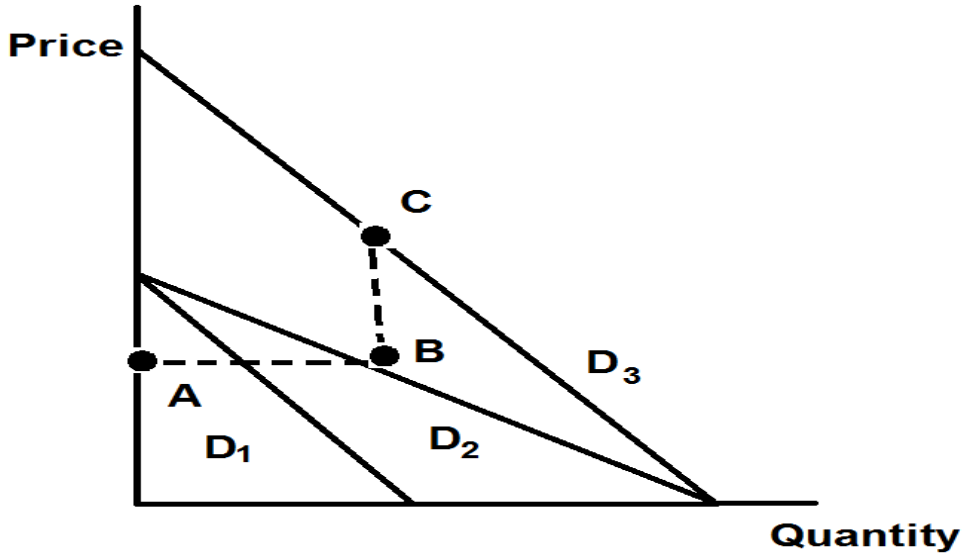
b. The price elasticity at A is less than that at B.

c. The price elasticity at A is equal to that at B.

d. There is not enough information to determine which elasticity is greater or whether they are the same.

3- Three straight-line demand curves, D_1, D_2, and D_3 are as shown in the figure. Assume that demand curves D_1 and D_2, have the same price-axis intercept. Assume that demand curves $D_2$and D_3, have the

Same quantity-axis intercept. If point C lies directly above point B and point B lies directly to the right of point A, which of the following statements must be true?



a. The price elasticity at A is greater than that at B.

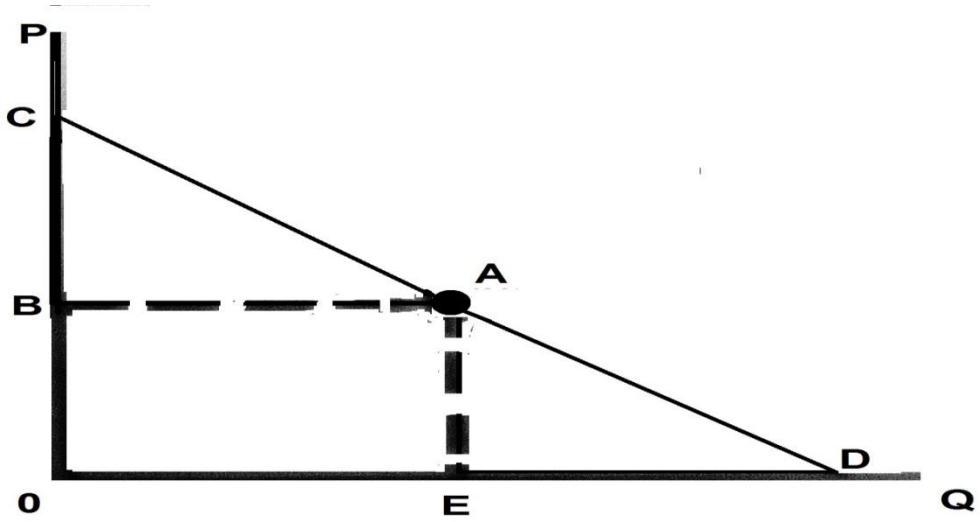
b. The price elasticity a tB is less than that at C.

c. The price elasticity at A is greater than that at C.

d. The price elasticity at A is less than that at C.

e. The price elasticity at B is equal to that at C.

4- Referring to the diagram to the right, price elasticity can be estimated by determining the ratio of:



a. AB/CD

b. AB/BC

c. AD/AC

d. DE/DC

e. none of the above.

Elasticity and its Applications

Part A: True False Questions:

Circle whether the following statements are true (T) or false (F)

1-The price elasticity of demand can range between zero and infinity. 2- Demand is perfect inelastic when shifts in the supply curve results in no change in price.

3- Demand is inelastic a large change in quantity demanded results in a small change in price.

4-The demand for movies is unit elastic if 5 percent increase in the price leads to a 5 percent decrease in the quantity demanded.

5- Unit elastic demand means that the ratio of e change in the quantity demanded to a change in the price equals 1.

6- A good with a horizontal demand curve has a demand with a price elasticity of demand of infinity.

7- Vertical supply curve indicates an elasticity of supply that equals zero.

8- A horizontal supply curve indicates an elasticity of supply that equals zero.

9- If a 5 percent increase in the price results in a 9 percent increase in quantity supplied, the elasticity of supply is 0.30.

10- If at a given moment, no matter what the price, producers cannot change the quantity supplied, the momentary supply has zero elasticity.

11- If a 1 percent decrease in the price of a pound of squash results in a larger percentage decrease in the quantity supplied, supply is elastic.

12- If a 1 percent decrease in the price of a pound of oranges results in a smaller percentage decrease in the quantity supplied, supply is elastic.

13- The elasticity of supply measures the responsiveness of quantity supplied to change sin price.

14- A 10 percent increase in income has caused a 5 percent decrease in the quantity demanded. The income elasticity is 0.5.

15- If goods A and B are complements, the cross elasticity of demand between A and B is negative.

Part B: multiple-choice questions

Circle the appropriate answer

1- The price elasticity of demand measures

A) The slope of a budget curve.

B) How often the price of a good changes.

C) The responsiveness of the quantity demanded to changes in price.

D) How sensitive the quantity demanded is to changes in demand.

2- The price elasticity of demand equals

A) The percentage change in the quantity demanded divided by the percentage change in the price.

B) The change in the quantity demanded divided by the change in price.

C) The percentage change in the price divided by the percentage change in the quantity demanded.

D) The change in the price divided by the change in quantity demanded.

3- The table above gives the demand schedule for snow peas. If the price of snow peas falls from $4.00 to $3.00 a bushel, total revenue will

A) Increase because demand is elastic in this range.

B) Increase because demand is inelastic in this range.

C) Decrease because demand is inelastic in this range.

D) Decrease because demand is elastic in this range.

4- If demand is price elastic,

A) A 1 percent decrease in the price leads to an increase in the quantity demanded that exceeds 1 percent.

B) A 1 percent increase in the price leads to an increase in the quantity demanded that exceeds 1 percent.

C) The price is very sensitive to any shift of the supply curve.

D) A 1 percent decrease in the price leads to a decrease in the quantity demanded that is less than 1 percent.

5- If the price elasticity is between 0 and 1, demand is

A) inelastic B) Elastic. C) Perfectly elastic D) Unit elastic

6- If a rightward shift of the supply curve leads to a 6 percent decrease in the price and a 5 percent increase in the quantity demanded, the price elasticity of demand is

A) 0.83 B) 0.30 C) 0.60 D) 1.20

7- A 10 percent increase in the quantity of spinach demanded results from a 20 percent decline in its price. The price elasticity of demand for spinach is

A) 0.5 B) 20.0 C) 2.0 D) 10.0

8- A 20 percent increase in the quantity of pizza demanded results from a 10 percent decline in its price. The price elasticity of demand for pizza is

A) 2.0 B) 10.0 C) 0.5 D) 20.0

9- Suppose a rise in the price of peaches from $5.50 to $6.50 per bushel decreases. The quantity demanded from 12,500 to 11,500 bushels The price elasticity of demand is

A) 0.5 B) 1000.0 C) 2.0 D) 1.0

10- A fall in the price of lemons from $10.50 to $9.50 per bushel increases the quantity demanded from 19.200 to 20.800 bushels. The price elasticity of demand is

A) 1.25 B) 1.20 C) 8.00 D) 0.80

11- A fall in the price of cabbage from $10,50 1o $9.50 per bushel increases the quantity demanded from 18.800 to 21,200 bushels. The price elasticity of demand is

A) 1.20 B) 0.80 C) 8.00 D) 1.25

12- The price elasticity of demand is 5.0 if a 10 percent increase in the price results in_____ decrease in the quantity demanded.

A) 10 percent B) 50 percent C) 2 percent D) 5 percent

13- The figure above illustrates a linear demand curve. By comparing the price elasticity in the $2 to $4 price range with the elasticity in the $8 to $10 range, you can conclude that the elasticity is

A) The sane in both price ranges.

B) Greater in the $8 to $10 range when the price rises but greater in the $2 to $4 range when the price falls.

C) Greater in the $8 to $10 range.

D) Greater in the $2 to $4 range 38)

14- The figure above illustrates a linear demand curve. If the price falls from $8 to $6.

A) The quantity demanded will increase by less than 20 present.

B) Total revenue will remain unchanged.

C) Total revenue will increase.

D) Total revenue will decrease.

15- The figure above illustrates linear demand curve. In the range from $8 to 56

A) The demand is unit elastic.

B) The demand is price inelastic.

C) The demand is price elastic.

D) More information is needed to determine if the demand is price elastic, unit elastic or inelastic.

16) The figure above illustrates a linear demand curves. if the price falls from $6 to $4.

A) Total revenue will decrease.

B) Total revenue will increase.

C) Quantity demanded will increase by more than 100 percent.

D) Total revenue will remain unchanged.

17) The figures above illustrates a linear demand curve. In the price range from $8 to $6, demand is _____ and in the price range $4 to $2. demand is _____

A) Elastic: inelastic B) inelastic, inelastic

C) Elastic: elastic D) inelastic: elastic

18) The figure above illustrates a linear demand curve, if the price rises from $6 to $8 demand is _____ and if the price falls from $8 to $6 demand is _____

A) ineiasie; inelastic B) elastic; inelastic

C) Elastic; elastic D) inelastic; elastic

19) 10 percent decrease in the price of a Pepsi decreases the demand for a Coca-Cola by 50 percent. The cross elasticity of demand between a Pepsi and Coca-Cola is

A) 5 B) 10 C) 0.20 D) 50

20- a fall in the price of X from $12 to $8 causes an increase in the quantity of Y demanded from 900 fe 1,100 units. What is the cross elasticity of demand between X and Y?

A) 2 B) -0.5 C) -2 D) 0.5

21- A fall in the price of X from $12 to $8 causes an increase in the quantity of Y demanded from 900 to 1,100 units. X and Y are

A) Complements B) Normal goods C) Substitutes D) inferior goods

22- 10 percent decrease in income decreases the quantity demanded of compact discs by 3 percent. The income elasticity of demand for compact discs is

A) 10.0 B) 3.3 C) -0.3 D) 0.3

23- A rise in the price of cabbage from $14 o $18 per bushel, caused by a shift of the demand curve, increases the quantity supplied from 4,000 to 6.000 bushels. The elasticity of supply is

A) 1.5 B) 1.0 C) 0.6 D) 0.8

24) If a shift in the demand curve that raises the price of oranges from $7 to $9 a bushel increases the quantity of oranges supplied from 4,000 bushels to 6,000 Bushels, the

A) Supply of oranges is elastic.

B) Supply of oranges is inelastic

C) Demand for oranges is inelastic

D) Demand for oranges is elastic

25- Supply is elastic if

A) 1 percent change in price causes a larger percentage change in quantity supplied.

B) The good in question is a normal good.

C) The slope of the supply cure is positive.

D) 1 percent change in price causes smaller percentage change in quantity supplied

26) A 10 percent increase in income causes the quantity of orange juice demanded to increase from 19.200 to 20,800 gallons. The income elasticity of demand for orange juice is

A) 0.8 B) 1.2 C)1.0 D) 0.5

27) 10 percent increase in income causes e quantity of apple juice demanded to increase from 18,800 to 21,200 gallons. The income elasticity of demand for apple juice is

A) 0.5 B) 1.0 C) 1.2 D) 0

Chapter Three

The Theory of Consumer Behavior

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The Theory of Consumer Behavior

The overriding goal of this chapter is to understand

- Low of diminishing marginal utility.

- Consumer choice and budget restraint.

- Utility maximizing rule.

- Indifference curve analysis.

- The effects of change in price or income: an algebraic approach.

- Finding income and substitution effects algebraically.

- Exercises

Chapter Three

The Theory of Consumer Behavior

Two Explanations of the Law of Demand

The law of demand may be treated as a commonsense notion. A high price usually does discourage consumers from buying; a low price typically does encourage them to buy. Now let us explore two complementary explanations of the downsloping nature of the demand curve which will back up our everyday observation.[1]

Income and Substitution Effects

You may recall that the law of demand- the downsloping demand curve- can be explained in terms of the income and substitution effects. Whenever the price of a product decreases, two

1- Income Effect

If the price of a product - say, steak- declines, the real income or purchasing power of anyone buying that product will increase. This increase in real income will be reflected in increased purchases of a variety of products, including steak. For example, with a constant money income of, say, $20 per week you can purchase 10 pounds of steak at a price of $2 per pound. But if the price of steak falls to $1 per pound and you buy 10 pounds of steak, $10 per week is freed for buying more of this and other commodities. A decline in the price of steak increases the real

[1] - A third explanation, based upon indifference curves is in some respects more precise and more sophisticated than the two we now discuss –an introduction to indifference curve analysis is provided in this appendix to this chapter.

income of the consumer, enabling him or her to purchase a larger quantity of steak.[2] This is called the income effect.

2- Substitution Effect

The lower price of a product means that it is now cheaper relative to all other products and consumers will tend to substitute the cheaper product for other products which are now relatively more expensive. In our example, as the price of steak fall- the prices of other products being unchanged steak will become more attractive to the buyer. At $1 per pound it is a better buy than at $2 per pound. Consequently, the lower price will induce the consumer to substitute steak for some of the now relatively less attractive items in the budget. Steak may well be substituted for pork, chicken, veal, fish, and a variety of other foods. A lower price increases the relative attractiveness of a product and makes the consumer willing to buy more of it. This is known as the substitution effect.

The income and substitution effects combine to make a consumer able and willing to buy more of a specific good at a low price than at a high price.

Law of Diminishing Marginal Utility

A second explanation centers upon the notion that, although consumer wants in general may be insatiable, wants for specific commodities can be fulfilled. In a given span of time, wherein the tastes of buyers are unchanged, consumers can get as much of specific goods and services as they want. The more of specific product consumers obtain, the less anxious they are to get more units of the same product. This can be most readily seen for durable goods. A consumer's want for an automobile, when he or she has none, may be very strong; the desire for a second

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[2] - We assume here that steak is a normal or superior good.

car is much less intense; for a third or fourth, very weak. Even the wealthiest of families rarely have more than a half-dozen cars, despite the fact that their incomes would allow them to purchase and maintain a whole fleet of them.

Economists put forth the idea that specific consumer wants can be fulfilled with succeeding units of a commodity in the law of diminishing marginal utility. Let us dissect this law to see exactly what it means. That a product has utility if it has the power to satisfy a want. Utility is want satisfying power. Two characteristics of this concept must be emphasized: First, utility and usefulness are by no means synonymous. Paintings by Picasso may be useless in the functional sense of the term yet be of tremendous utility to art connoisseurs. Second, and implied in the first point, utility is a subjective notion. The utility of a specific product will vary widely from person to person. A bottle of muscatel wine may yield substantial utility to the Skid Row alcoholic, but zero or negative utility to the local temperance union President. A pair of eyeglasses has great utility to someone who is extremely far - or nearsighted, but no utility to a person having $20-20$ vision.

By marginal utility we simply mean the extra utility, or satisfaction, which a consumer gets from one additional unit of a specific product. In any relatively short time wherein the consumer's tastes can be assumed not to change, the marginal utility derived from successive units of a given product will decline.[3] Why? Because a consumer will eventually become relatively saturated, or filled up, with that particular product. The fact that marginal utility will decline as the consumer

[3] - For a time the marginal utility of successive units of a product may increase. A third can of beer may yield a larger amount of extra satisfaction than the first or second. But beyond some point, we can expect the marginal utility of added units to decline in the case of beer this decline may be abrupt.

acquires additional units of a specific product is known as the law of diminishing marginal utility.

We have noted that utility is a subjective concept. As a result, it is not susceptible to precise quantitative measurement. But for purposes of illustration, let us assume that we can measure satisfaction with units we shall call “utils”. This mythical unit of satisfaction is merely a convenient pedagogical device which will allow us to quantity our thinking about consumer behavior. Thus, in Table 1, we can illustrate the relationship between the quantity obtained of a product–say, fast–food hamburgers– and the accompanying extra utility derived from each successive unit. Here we assume that the law of diminishing marginal utility Sets in with the first hamburger consumed.

Table 1, the law of diminishing marginal utility as applied hamburgers (hypothetical data)

Unit of hamburgers	Marginal utility utils	Total utility utils
First	10	10
Second	6	16
Third	2	18
Fourth	0	18
Fifth	−5	13

Each successive hamburger yields less and less extra utility than the previous one as the consumer's want for hamburgers comes closer and closer to fulfillment. Total utility can be found for any number of hamburgers by cumulating the marginal– utility Figures as indicated in Table 1. The third hamburger has a marginal utility of 2 utile; 3 hamburgers yield a total utility of 18 utile (=10 + 6 + 2).

Notice that marginal utility becomes zero for the fourth hamburger and negative for the fifth.

Now, how does the law of diminishing marginal utility explain why the demand curve for a specific product is downsloping? If successive units of goods yield smaller amounts of marginal, or extra, utility, then the consumer will buy additional units of a product only if its prices falls. The consumer for whom these utility data are relevant may buy, say, 2 hamburgers at a price of $1. But, owing to diminishing marginal utility from additional hamburgers, a consumer will choose not to buy more at this price, because giving up money really means giving up other goods, that is, alternative ways of getting utility. Therefore, additional hamburgers are not worth it unless the price (sacrifice of other goods) declines. (when marginal utility becomes negative, McDonalds or Burger King would I've to pay you to consumer another hamburger!) From the seller's viewpoint, diminishing marginal utility forces the producer to lower the price in order to induce buyers to take a larger quantity of the product. This rationale supports the notion of a downsloping demand curve.

Theory of Consumer Behavior

In addition to providing a basis for explaining the law of demand, the idea of diminishing marginal utility also plays a key role in explaining how consumers should allocate their money income among the many goods and services which are available for them to buy.

Consumer Choice and Budget Restraint

We can picture the situation of the typical consumer being something like this:

1- Rational Behavior

The average consumer is a fairly rational person, and attempts to dispose of his or her money income in such a way as to derive the greatest amount of

satisfaction, or utility, from it. Typical consumers want to get the most for their money or, more technically, to maximize total utility.

2- Preferences

We many suppose, too, that the average consumer has rather clear-cut preferences for various goods and services available in the market. We assume that buyers have a good idea of how much marginal utility they will get from successive units of the various products which they might choose to purchase.

3- Budget Restraint

The consumer's money income is limited in amount. Because a consumer supplies limited amounts of human and property resources to businesses, the money income received will be limited. With a few possible exceptions-the Rockefellers, Bob Hope, Michael Jackson, and Saudi Arabia's King Fahd - all consumers are subject to a budget restraint.

4- Prices

The goods and services available to consumers have price tags on them. Why? Because they are scarce in relation to the demand for them, or stated differently, their production entails the use of scarce and therefore valuable resource. In the ensuing examples we shall suppose that product prices are not affected by the amounts of specific goods which the individual consumer buys; pure competition exists on the buying or demand side of the market.

Obviously, if a consumer has a limited number of dollars and the products he or she wants have price tags on them. The consumer will be able to purchase only a limited amount of goods the consumer cannot buy everything wanted when each purchase exhausts a portion of a limited money income. It is precisely this point which brings the economic fact of scarcity home to the individual consumer.

In marking his choices, our typical consumer is in the same position as the Western prospector... Who is restocking for his next trip into the back country and who is forced by the nature of the terrain to restrict his luggage to whatever he can carry on the back of one burro. If he takes a great deal of one item, say baked beans, he must necessarily take much less of something else, say bacon. His job is to find that collection of products which, in view of the limitations imposed on the total, will best suit his needs and tastes.[4]

The consumer must make compromises; choices must be made among alternative goods to obtain with limited money resources the most satisfying mix of goods and services.

Utility Maximizing Rule

The question then boils down to this: of all the collections of goods and services which a consumer can obtain within the limit of his or her budget, which specific collection will yield the greatest utility or satisfaction? Bluntly put, the rule to be followed in maximizing satisfactions is that the consumer's money income should be allocated so that the last dollar spent on each product purchased yields the same amount of extra (marginal) utility. We shall call this the utility maximizing rule. When the consumer is balancing his Margin's in accordance with this rule, there will be no incentive to alter his or her expenditure pattern. The consumer will be in equilibrium and, barring a change in tastes, income, or the prices of the various goods, he or she will be worse off- total utility will decline - by any alteration in the collection of goods purchased.

5- E. T Weller the economic system (New York the Macmillan company, 1952), P89.

A numerical illustration will help explain the validity of the rule. For simplicity's sake we limit our discussion to just two products. Keep in mind that analysis can readily be extended to any number of goods. Suppose that consumer brooks are trying to decide which combination of two products – A and B – she should purchase with her limited daily income of $10. Obviously, Brook's preferences for these two products and their prices will be basic data determining the combination of A and B which will maximize her satisfactions. Table 2 summarizes Brook's preferences for products A and B. Column 2a shows the amount of extra or marginal utility Brooks will derive from each successive unit of A. Column 3a reflects Brook's preferences for product B. In each case the relationship between the number of units of the product obtained and the corresponding marginal utility reflects the law of diminishing marginal utility. Diminishing marginal utility is assumed to occur with the first unit of each product purchased.

Table 2 the utility maximizing combination of products A and B obtainable with an income of $ 10*[5] (hypothetical data)

(1)	(2) product A: price = $1		(3) product B: price = $2	
Unit of product	(a) marginal utility, utils	(b) marginal utility per dollar (MU/ price)	(a) marginal utility utils	(b) superior utility per dollar (MU/price)
First	10	10	24	12
Second	8	8	20	10

[5] - It is assumed in this table that the amount of marginal utility received from additional units of each of the two products is independent of the quantity of the other product. For example, the marginal utility schedule for product A is independent of the amount of B obtained by the consumer.

Third	7	7	18	9
Fourth	6	6	16	8
Fifth	5	5	12	6
Sixth	4	4	6	3
Seventh	3	3	4	2

But before we can apply the utility maximizing rule to these data, we must put the marginal- utility information of two columns 2a and 3a. Peru dollars spent basis Why? Because a consumer's choices will be influenced not only by the extra utility which successive units of, say, product A will yield, but also by how many dollars (and therefore how many units of alternative good B) she must give up to obtain those added units of A. Example: Suppose you prefer a compact disc whose marginal utility is, say, 36 utile to a m whose marginal utility is just 24 utile. But if CD's price is $12 and the movie only $6, the choice would be for the movie rather than the CD! Why? Because the marginal utility per dollar spent would be 4 unils for the movie (4 = 24 ÷$6) as compared to only 3 utile for the CD (3 = 36 ÷ $12). You co buy two movies for $12 and, assuming the marginal utility of the second movie is, utile, your total utility would be 40 utile. Forty of satisfaction from two movies is clearly superior to 36 utile derived from the same $12 expenditure on one CD. The point is this: to make the amounts of extra utility derived from differently priced goods comparable, marginal utility must be put on a per dollar spent basis. This is done in columns 2b and 3b. These Figures are obtained by dividing the marginal utility data of columns 2a and 3a by the assumed prices of A and B - $1 and $2, respectively.

Now we have brooks' preferences- on unit and per dollar bases and the price tags of and B before us. Brooks stands patiently with $10 to spend on A and B. In what order should she allocate her dollars on units of A and B to achieve the

highest degree of utility the limits imposed by her money income? And what specific combination of A and B will she have obtained at the time that she exhausts her $10?

Concentrating on columns 2b and 3b of Table 2, we find that Brooks should first spend $2 on the first unit of B. Why? Because its marginal utility per dollar of 12 utile is higher than A's but now Brooks finds herself indifferent about whether she should buy a second unit of B or the first unit of A, because the marginal utility per dollar of both is 10. So she buys both of them. Brooks now has 1 unit of A and 2 of B. Note that with this combination of goods the last dollar spent on each yield the same amount of extra utility. Does this combination of A and B therefore represent the maximum amount of utility which Brooks can obtain? The answer is "No." this collection of goods only costs $5 [= (1×$1) + (2 × $2)]; Brooks has $5 of income remaining, which she can spend to achieve a still higher level of total utility.

Examining columns 2b and 3b again, we find that Brooks should spend the next $2 on a third unit of B because the marginal utility per dollar for the third unit of B is 9 as compared to 8 for the second unit of A. But now, with 1 unit of A and 3 of B, we find she is again indifferent to a second unit of A and a fourth unit of B. Let us again assume Brooks purchases one more unit of each. Marginal utility per dollar is now the same at utile for the last dollar spent on each product, and Brook's money income of $10 is exhausted [(2 × $1) ÷ (4 × $2)]. The utility is combination of goods attainable by Brooks units of A and $ of B.[6] By summing the marginal

[6] -To simplify we assume in this example that brooks spend her entire income: she neither borrows nor saves. Saving can be regarded as a utility yielding commodity and incorporated in our analysis. it is treated thus in question 5 at end of the chapter

utility information of columns 2a and 3a we find that Brooks is realizing 18 (= 10 + 8) utils of satisfaction from the 2 units of A and 78 (=24 + 20 + 18 + 16) utils of satisfaction from the 4 units of B. Her $10 of income, optimally spent, yields 96 (= 18 + 78) utils of satisfaction. Table 3 summarizes this step by step process for maximizing consumer utility and merits careful study by the reader. It is to be emphasized that there are other combinations of A and B which are obtainable with $10. but none of these will yield a level of total utility as high as do 2 units of A and 4 of B. For example, 4 units of A and 3 of B can be obtained for $10. However, this combination violates the utility maximizing rule; total utility here is only 93 utils, clearly inferior to the 96 units yielded by 2 of A and B. furthermore, there are other combinations of A and B (such as 4 of A and 5 of B or 1 of A and 2 of B) wherein the marginal utility of the last dollar spent is the same for both A and B. but all such combinations are either unobtainable with Brooks 's limited money income (as 4 of A and 5 of B) or fail to exhaust her money income (as 1 of A and 2 of B) and therefore do not yield her the maximum utility attainable.

Table 3 sequence of purchases in achieving consumer equilibrium

Potential choice	Marginal utility per dollar	Purchase decision	Income remaining
First unit of A First unit of B	10 12	First unit of B for $2	$8 =$10-$2
First unit of A second unit of B	10 10	First unit A for $1 and second unit of B for $2	$5 =$8-$3
Second unit A Third unit of B	8 9	Third unit of B for $2	$3 =$5-$2
Second unit of A Fourth unit of B	8 8	Second unit of A for $1 And fourth unit of B for $2	$0 =$3-$3

Algebraic Restatement

We are now in position to restate the utility maximizing rule in simple algebraic terms. Our rule merely says that a consumer will maximize her

satisfactions when she allocates her money income in such a way that the last dollar spent on product A, the last on product B, and so forth, yield equal amounts of additional, or marginal, utility. Now the marginal utility per dollar spent on A is indicated by MU of product A L price of A (column 2b of Table 2) and the marginal utility per dollar spent on B by MU of product B/price of B (column 3b of Table 2). our utility– maximizing rule merely requires that these rations be equal. That is,

$$\frac{MU\ \ of\ product\ A}{Price\ of\ A} = \frac{MU\ \ of\ product\ B}{Price\ of\ B}$$

And, of course, the consumer must exhaust her available income. Our tabular illustration has shown us that the combination of 2 units of A and 4 of B fulfills these conditions in that

$$\frac{8}{1} = \frac{16}{2}$$

And the consumer's $ 10 income is spent.

If the equation is not fulfilled, there will be some reallocation of the consumer's expenditures between A and B, from the low to the high marginal utility per dollar product, which will increase the consumer's total utility. For example, if the consumer were to spend $10 on 4 of A and 3 of B, we would find that

$$\frac{MU\ of\ A{:}\ 6\ utils}{Price\ of\ A{:}\ \$1} < \frac{MU\ of\ B{:}\ 18\ utils}{Price\ of\ B{:}\ \$2}$$

The last dollar spent on A provides only 6 until satisfaction, and the last dollar spent on B provides 9(=18 ÷ $2). On a per dollar basis, units of B provides more extra satisfaction than units of A. Hence, the consumer will increase her total satisfaction by purchasing more of B and less of A. As dollars are reallocated from A to B, the marginal utility from additional units of B will decline as the result of moving down the diminishing marginal utility schedule for B, and the marginal utility of A will rise as the consumer moves up the diminishing marginal utility schedule for A. At some new combination of A and B specifically, 2 of A and 4 of B the equality

of the two ratios and therefore consumer equilibrium will be achieved. As we already know, the net gain in utility is 3 utility utils (= 90 − 93).

Indifference Curve Analysis

The Budget Line: What Is Obtainable

A budget line simple shows the various combinations of two products which can be purchased with a given money income. For example, if the price of product A is $1.50 and the price of B is $1.00, then the consumer could purchase all the combinations of A and B shown in Table 1 with $12 of money income. We note that at one extreme the consumer might spend all of his or her income on 8 units of A and have nothing left to spend on B. Or, by giving up 2 units of A and thereby freeing $3, the consumer could have 6 units of A and 3 of B. and so on to the other extreme, at which the consumer could buy 12 units of B at $1.00 each, thereby expending his or her entire money income on B and having nothing left to spend on A.

Figure 1 shows the budget line graphically. Note that the slope of the budget line measures the ratio of the price of B to the price of A; more precisely, the absolute value of mathematical P_B/P_A = $1.00/$1.50 =2/3. This is merely the mathematical way of saying that the consumer must forgo 2 units of A (measured on the vertical axis) at $1. Each in order to make available $3 to spend on 3 units of B (measured on the horizontal axis). In other words, in moving down the budget or price line, 2 of A (at $1.50 each) must be given up to obtain 3 of B (at $1.00 each). This yields a slope of $\frac{2}{3}$

Table 1 the budget line: combinations of A and B obtainable with an income of $12 (hypothetical data)

Units of A (price =$1.50)	Units of B (price = $1.00)	Total expenditures
8	0	$12 (=$12+$0)
6	3	$12(=$9+$3)
4	6	$12(=$6 +$6)
2	9	$12(=$3 + $9)
0	12	$12 (=$0+$12)

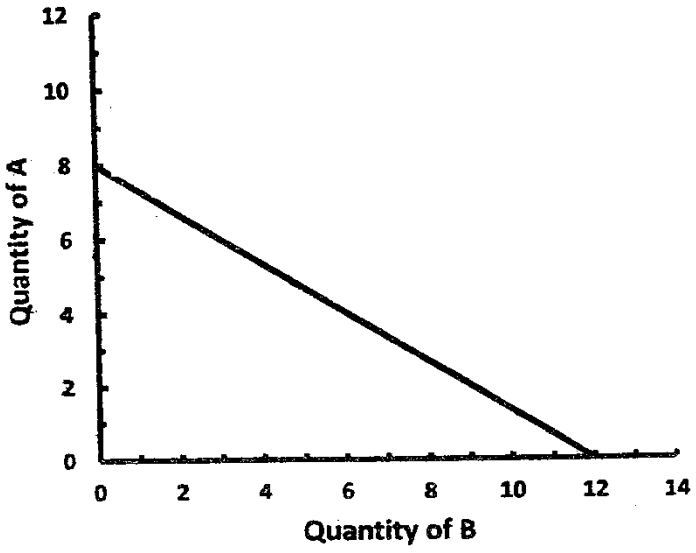


Figure 1 a Consumer's budget line

The budget line shows all the various combinations of any two products which can be purchased, given the prices of the products and the consumer's money income

Two other characteristics of the budget line merit comment.

1- Income Change

The location of the budget line varies with money income. Specifically, an increase in money income will shift the budget line to the right; a decrease in money income will move it to the left to verify these statements, simply recalculate Table 1 on the assumption that money income in (a) $24 and (b) $6 and plot the new budget lines in Figure 1.

Price Changes

A change in product prices will also shift the budget line. A decline in the prices of both products which is the equivalent of a real income increase-will shift the curve to the right. You can verify this assertion by recalculating Table1 replotting Figures 1 on the assumption that P_A = $75 and P_B = $50. Conversely, an increase in the prices of A and B will shift the curve to the left. Again, assume P_A = $3 and P_B = $2 and rework Table 1 Figure 1 to substantiate this statement. Note in particular what happens if we change P_B while holding P_A (and money income) constant. The reader should verify that, if we lower P_B from $1.00 to $50, the budget line will fan outward to the right. Conversely, by increasing P_B from, say, $1.00 to $1.50, the line will fan to the left. In instances the line remains anchored at 8 units on the vertical axis because P_A has not changed.

Indifference Curves: What Is Preferred

We know budget lines reflect market data having to do with income and prices. The budget line reveals the combinations of A and B which are obtainable, given money income and prices. Indifference curves, on the other hand, embody

subjective information about consumer preferences for A and B by definition, an indifference curve shows all products A and B which will yield the same level of satisfaction or utility to the consumer. Table 2 and Figure 2 present a hypothetical indifference curve involving products A and B. The consumer's subjective preferences are such that he or she will realize the same total utility from each combination of A and B shown in the Table or curve; hence the consumer will be indifference as to which combination is actually obtained.

It is essential to understand several characteristics of indifference curves.

1-Downsloping

Indifference curves are downsloping for the simple reason that both product A and B yield utility to the consumer. Hence, in moving from combination j to combination K, the consumer is obtainable more of B and thereby increasing his or her total utility; therefore, some of A must be taken away to decrease total utility by a precisely offsetting amount. In brief, more of B necessitates less of A so that the quantities of A and B are inversely related. And any curve which reflects inversely related variables is downsloping

Table 2 an indifference schedule (hypothetical data)

Combination	Units of A	Units of B
j	12	2
K	6	4
l	4	6
m	3	8

2- Convex Origin

But, as viewed from the origin, a downsloping curve can be concave (bowed outward) or convex (bowed inward). A concave curve has an increasing (steeper) slope as one moves down the curve, while a convex curve has a diminishing (flatter) slope as one moves down it. (Recall that the production possibilities curve of Figure 2 is concave, reflecting the law of increasing opportunity costs)

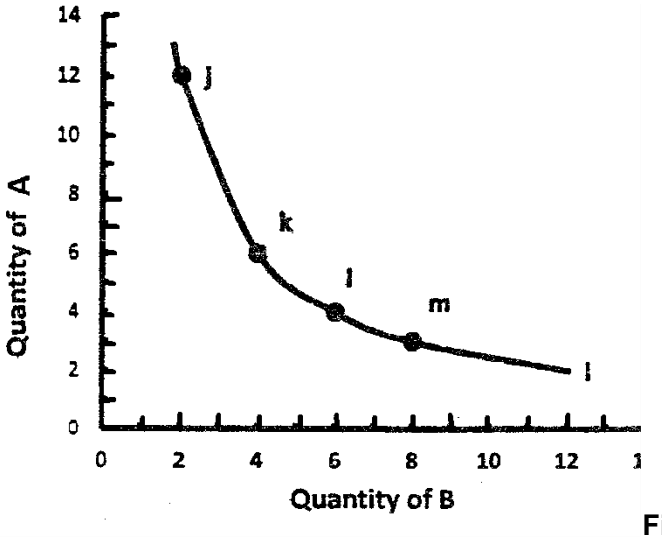


Figure 2

Consumer's indifference curve represents some combination of products A and B which is equality satisfactory to the consumer, that is, each combination of A and B embodies the same level of total utility.

We note in Figure 2 that the indifference curve is convex as viewed from the origin. That is, the slope diminishes or becomes flatter as we move from j to k, to l, to m, and so on down the curve. Technically, the slop of the indifference curve measures the marginal rate of substitution (MRS) because it shows the rate, at the margin, at which the consumer is prepared to substitute one good for the other (B for A) so as to remain equally satisfied. The diminishing slope of the indifference curve means the willingness to substitute B for A diminishes as one moves down the curve.

What is the rationale for this convexity; that is, for a diminishing MRS? The answer is that a consumer's subjective willingness to substitute B for A (or vice

versa) will depend upon the amounts of B and A which he or she has to begin with. Consider Table 2 and Figure 2 once again, beginning at point j. Here, in relative terms the consumer has a substantial amount of A and very little of B. this means that at the margin B is very valuable (that is, its marginal utility is high), while A is less valuable at the margin (its margin utility is low). It follows that the consumer will be willing to give up a substantial amount of A to get 2 More unit of B. In this particular case, the consumer is willing to forgo 6 units of A to get 2 more units of B; the MRS. $\frac{6}{2}$ or 3. But at point K the consumer now has less A and more B. This means that A will now be somewhat more valuable, and B somewhat less valuable, at the margin. Hence, considering the move from point K to point l, the consumer is only willing to give up 2 units of A to get 2 more units of B so the MRS is now only $\frac{2}{2}$, or 1. having still less of A and more of B at point l, the consumer is only willing to give up 1 unit of A in return for 2 more of B and, hence, the MRS falls to $\frac{1}{2}$. In general, as the amount of B increases the marginal utility of additional units of B decreases. Similarly, as the quantity of A decreases, its marginal utility increases. This means in Figure 3 that in moving down the curve the consumer will be willing to give up smaller and smaller amounts of A as an offset to acquiring each additional unit of B. the result is a curve with a diminishing slope, that is, one which is convex when viewed from the origin. Alternatively stated, the **MRS** declines as one moves southeast along the indifference curve.

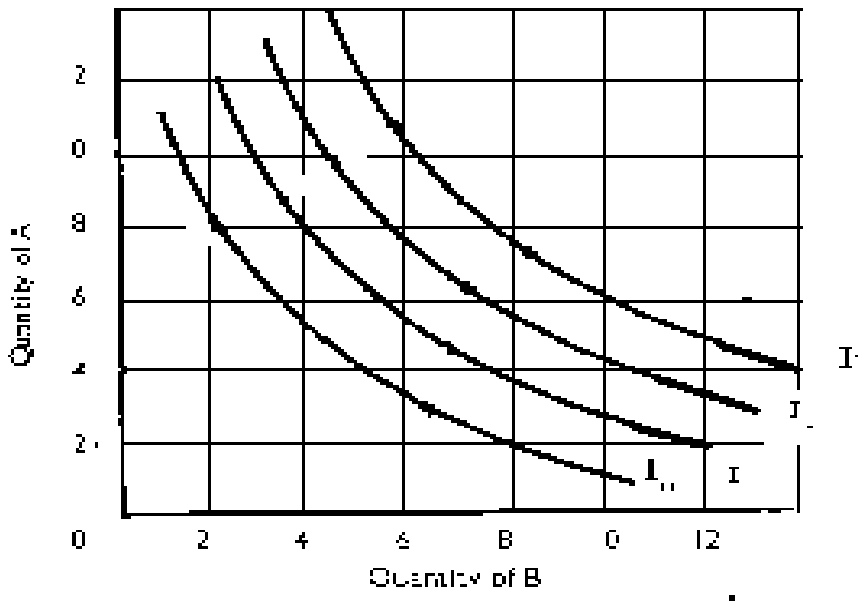


Figure 3

An indifference map

An indifference map is comprised of a set indifference curves. Each successive curve further from the origin indicates a higher level of total utility. That is, any combination of products A and B shows by a point on 14 is superior to any combination of Aa shown by a point 13, 12, 11

Indifference Map

The single indifference curve of Figure 2 reflects some constant (but unspecified) level of total utility or satisfaction. It is possible and useful for our analysis to sketch a whole series of indifference curves or, in other words, an indifference map as shown in Figure 3. Each curve reflects a difference level of total utility. Specifically, each curve to the right of our original curve (labeled I_3 in Figure 3) reflects combinations of A and B which yield more utility than I_3. Each curve to the left of I_3 reflects less total utility than I_3. In other words, as we move out form the origin each successive indifference curve entails a higher level of utility. This can be simply demonstrated by drawing a line in a northeasterly direction from the origin and noting that its points of intersection with each successive curve entail larger amounts of both A and B and therefore a higher level of total utility. Noting that axes of Figures 1 and 3 are identical, we can now determine the consumer's

equilibrium position by combining the budget line and the indifference map as shown in Figure 4. Recall that, by definition, the budget line indicates all combinations of A and B which the consumer can attain, given his or her money income and the prices of A and B. The question is: of these attainable combinations, which will the consumer most prefer? The answer is: that combination which yields the greatest satisfaction or utility. Specifically, the utility-maximizing combination level be the one lying on the highest attainable indifference curve. In terms of Figure 4 the consumer's utility maximizing or equilibrium combination of A and B is at point X where the budget line is tangent to I_3. Why not, for example point Y? Because Y is on a lower indifference curve, I_2. By trading down the budget line- by shifting dollars from purchases of A to purchases of B - the consumer can get on an indifference curve further from the origin and thereby increase total utility from the same income. Why not Z? Same reason: point Z is on a lower indifference curve I_1. By trading Up the budget line - by reallocating dollars from B to A - it is possible for the consumer to get on higher indifference curve I_3 and increase total utility. How about point W on indifference curve L_4? While it is true that W entails a higher level of total utility than does X, point W is beyond (outside) the budget line and hence not attainable to the consumer. Point X is the best or optimal attainable combination of products A and B. At this point we note that by definition of tangency, the slope of the highest obtainable indifference curve equals the slope of the budget line. Because the slope of the indifference curve reflects the MRS and the slope of the budget line P_B /P_A the optimal or equilibrium position is where

MRS = P_B/P_A

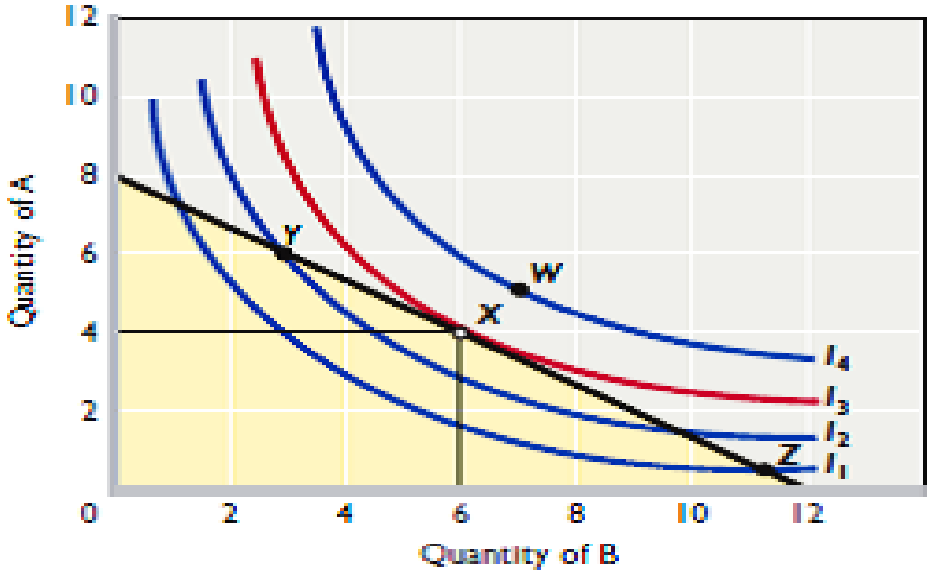


Figure 4

The consumer's equilibrium position is at point X, where the budget line is tangent to the highest attainable indifference curve 13. In this case the consumer will buy 4 units of A at $1.50 per unit and 6 of B at $1 per unit with a $12 money income points Z and Y also represent attainable combinations of A and B, but yield less total utility as is evidenced by the fact they are on lower indifference curves. While W would entail more utility than X it is outside the budget line and therefore unattainable.

Digression: The Measurement of Utility

The alert reader may have sensed an important difference between the marginal utility theory and the indifference curve theory of consumer demand. The marginal-utility theory assumes that utility is numerically measurable. That is, the consumer is assumed to be able to say how much extra utility he or she derives from an extra unit of A or B. Given the prices of A and B, the consumer must be able to measure the marginal utility derived from successive units of A and B in order to realize the utility maximizing (equilibrium) position as previously indicated by

$$\frac{Marginal\ utility\ of\ A}{price\ of\ A} = \frac{Marginal\ utility\ of\ B}{price\ of\ B}$$

The Effects of a Change in Income

What happens to the consumer's choices of food and clothing as income changes? Let's look at the optimal choice diagram Figure.2 (a), which measures the quantity of food consumed (x) on the horizontal axis and the quantity of clothing (y) on the vertical axis. Suppose the price of food is P_x = \$2 and the price of clothing is P_y = \$4 per unit, with both prices held constant. The slope of her budget lines is $P_x/P_y = -1/2$.

We saw also that an increase in income results in an outward, parallel shift of the budget line. Figure 2 (a) illustrates the consumer's budget lines and optimal choices of food and clothing for three different levels of income, as well as three of her indifference curves (U_1, U_2 , and U_3) initially, when the consumer's weekly income is I_1 = \$40, her budget line is BL_1. She chooses basket A, consuming 10 units of food and 5 units of clothing per week. As her income rises to I_1 = \$68, the budget line shifts out BL_2. she then chooses basket B, with a Weekly consumption of 18 units of food and 8 units of clothing. If her income increases to I_3 = \$92, she faces budget line BL_3. Her optimal basket is C, with 24 units of food and 11 units of clothing.

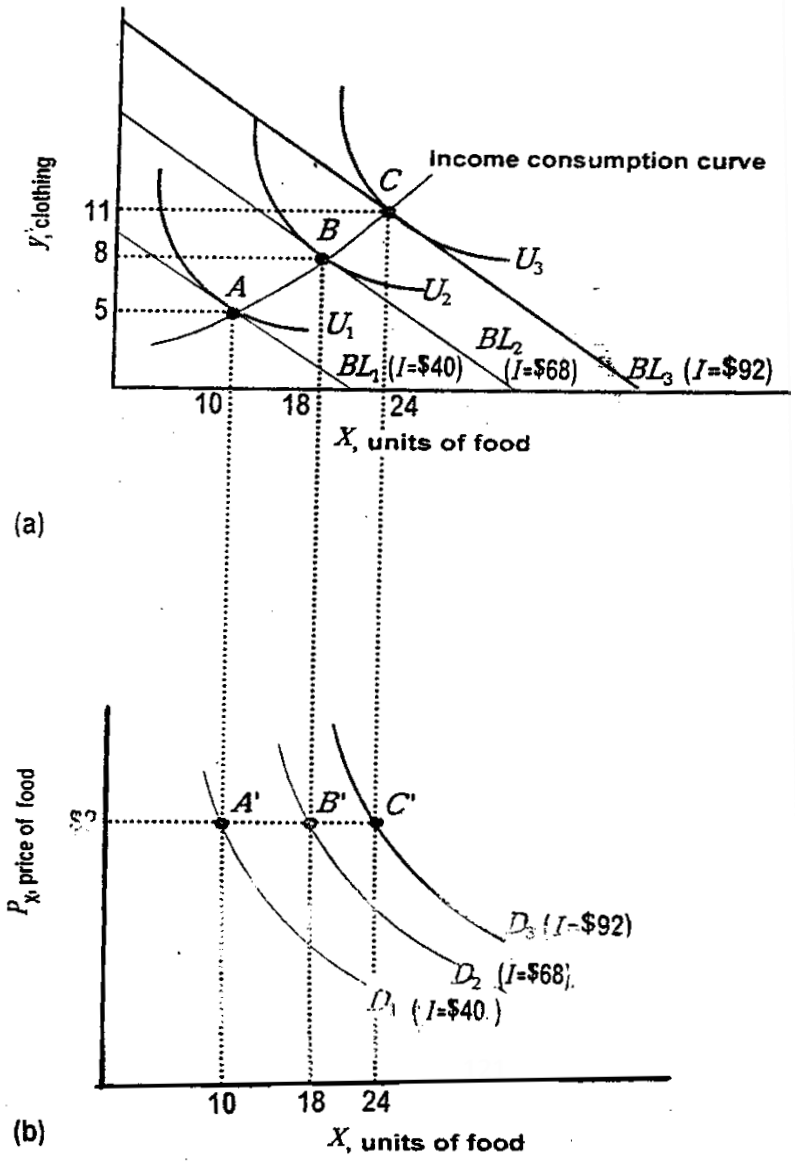
One way we can describe how changes in income affect the consumer's purchases is by drawing a curve that connects all the baskets that are optimal as income changes (keeping prices constant). this curve is called the income consumption curve. In Figure. 2 (a), the optimal baskets A, B, and C lie on the income consumption curve.

Changing Income: Shifting a Demand Curve

In Figure 2. (a) the consumer purchases more of both goods as her income rises. In other words, an increase in income results in a rightward shift in her demand curve for each good.

In Figure. 2 (b) we illustrate this by seeing how a change in income affects her demand curve for food. The price of food (held constant at $2) appears on the vertical axis, and the quantity of food on the horizontal axis. When the consumer's weekly income is $40, she buys 10 units of food each week, corresponding to point A on demand curve D_1 in Figure. 2 (b). If her income rises to $68, she buys 18 units of food, corresponding to point B on demand curve D_2. Finally, if her income rises to $92, she buys 24 units of food, corresponding to point C on demand curve D_3.

Using a similar approach, you can also show the demand curve for clothing shift as income changes (see Problem 1, at the end of this chapter).



(a) Figure 2 the effects of changes in income on consumption

The consumer buys food at P_x = \$2 per unit clothing at P_y = \$4 per unit. Both prices are held constant as income varies.

(b) Optimal choice diagram. The budget lines reflect three different levels of income. The slope of budget lines is $P_x / P_y = -1/2$. BL_1 is the budget line when the weekly income is \$40 BL_1 and BL_2 are the budget lines when income is \$68 and \$92, respectively. We can draw a curve connecting the baskets that are optimal (A, B, and C) as income changes. This curve is called the income consumption curve.

The Effects of Changes in Price or Income an Algebraic Approach

So far, in this chapter, we have used a graphical approach to show how the amount of a good consumed depends on the levels of prices and income. We have shown how to find the shape of the demand curve when the consumer has a given level of income (as in Figure 1), and how the demand curve shifts as the level of income changes (as in Figure 2).

We can also describe the demand curve algebraically. In other words, given a utility function and a budget constraint, we can find the equation of the - consumer's demand curve. The next two exercises illustrate this algebraic approach.

Finding a Demand Curve (No Corner Points)

A consumer purchases two goods, food and clothing. The utility function is U (x,y) = xy, where x denotes the amount of food consumed and y the amount of clothing. The marginal utilities are MU_x = y and MU_y = x the price of food is P_x, the price of clothing is P_y, and income is I.

Problem

(a) show that the equation for the demand curve for food is x = I1 $(2P_x)$.

(b) is food a normal good? Draw D_1, the consumer's demand curve for food when the level of income is I = $\$120$. Draw D_2 the demand curve when I = $\$200$.

Solution

(a) in learning by Doing Exercise 3, we learned that the indifference curves for the utility function U(x,y) = xy are bowed in toward the origin and do not intersect the axes. So any optimal basket must be interior that is, the consumer buys positive amounts of both food and clothing.

How do we determine the optimal choice of food? We know that an interior optimum must satisfy two conditions:

An optimal basket will be on the budget line. This means that equation (4.1) must hold: $\mathrm{P_x x} + \mathrm{P_y} y$ = I .

Since the optimum is interior, the tangency condition equation (4.3) must also hold: $\mathrm{MU_x/MU_y} = \mathrm{P_x/P_y}$, or with the marginal utilities given y/x = $\mathrm{P_x/P_y}$, or y = $(\mathrm{P_x/P_y})$X.

We can now solve for X by substituting y = $(\mathrm{P_x/P_y})$X into the equation for the budget line $\mathrm{P_x x} + \mathrm{P_y} y$ = I this gives us:

$$\mathrm{P_x x} + \mathrm{P_y} y \left(\frac{P_x}{P_y}\right) = I$$

Or x =I/$(2\mathrm{P_x})$

This is the equation of the demand curve for food. Given the consumer's income and the price of food, we can easily find the quantity of food the consumer will purchase.

(a) if income is $\$120$, the equation of the demand curve for food D_1 will be X = $120/=(2P_x)$ = $60/P_x$ we can plot points on the demand curve, as we have done in Figure.5.

An increase in income to $\$200$ shifts the demand curve rightward to D_2, with the equation x − $200/(2P_x)$ = $100/P_x$. Thus, food is a normal good.

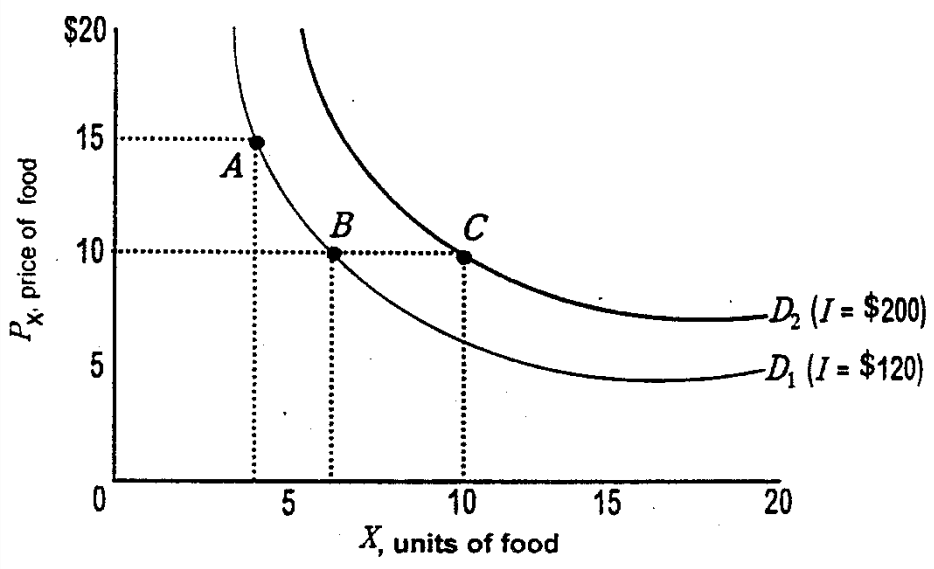


Figure 5 demand curve for food at different income levels

The quantity of food demanded x, depends on the price of food, P_x and on the level of income. I. the equation representing the demand for food is x = I $(2P_x)$. When income is $\$120$, the demand curve is D_1 in the graph. Thus if the price of food is %15. The consumer buyer 4 units of food (point A). if the price of food drops to $\$10$. She buyer 6 units of food (point B). if income rises to $\$200$. The demand curve shifts to the right, to D_2. In this case, if the price of food is $\$10$, the consumer buys 10 units of food (point C).

Similar Problems 5 and 7.

The solution to part (a) of this exercise starts out looking very much like the solution to learning-By-Doing Exercise 4.2, where we were interested in finding the optimal consumption of food and clothing given a specific set of prices and level of income. Learning By-Doing Exercise 2, however, goes farther. By using the exogenous variables (P_x, P_y and I) instead of actual numbers, we find the equation of the demand curve, which lets us determine the quantity of food demanded for any price and income.

Finding a Demand Curve (With a Corner Point Solution)

A consumer purchases two goods, food and clothing. He has the utility function U(x,y) =x y + 10x, where x denotes the amount of food consumed and y the amount of clothing. The marginal utilities are MU_x = y + 10 and MU_y = x. The consumer's income is \$100, and the price of food is \$1. The price of clothing is P_y

Problem: Show that the equation for the consumer's demand curve for clothing is

$$y = \frac{100-10P}{2P} \text{ when } P_y < 10$$

$$y = 0, \text{ when } P_y \geq 10$$

Use this equation to fill in the following Table to show how much clothing he will purchase at each price of clothing (these are points on his demand curve):

P_y	2	4	5	10	12
y					

Solution: In learning by doing exercise. 3, we learned that the indifference curves for the utility function U (x , y) = xy + 10x are bowed in toward the origin. They also intersect the x axis, since the consumer could have a positive level of utility with purchases of food (x > 0) but no purchases of clothing (y = 0). So he might not buy any clothing (I.e., choose a corner point) if the price of clothing is too high.

How do we determine the consumer's optimal choice of clothing? If he is at an interior optimum, we know that this optimal basket will be the budget line. This means that equation (4.1) must hold with the price of x and income given: x + $P_y y$ = 100. At an interior optimum, the tangency condition as expressed in equation $(4,4)$ must also hold : $MU_x/\ MU_y = P_x/P_y$ or with the marginal utilities given, $(y + 10)/x = 1/P_y$, or more simply, X = $P_y y + 10\ P_y$.

We can now solve for y by substituting x = $P_y y + 10P_y$ into the equation for the budget line x + Pyy = 100. This gives us $2P_y y + 10P_y = 100$, or y = $(100 - 10P_y)\ /(2P_y)$. Note that the value of this equation for the consumer's demand curve for clothing is positive when $P_y < 10$. But if $P_y \geq 10$, then $100 - 10P_y$ is zero or negative, and the consumer will demand no clothing (in effect, y = 0 when $P_y \geq 10$, since the consumer can't demand negative amounts of clothing). In other words, when $P_y \geq 10$ the consumer will be at a corner point at which he buys only food.
Using the equation for the demand curve, we can complete the Table as follows:

Py	Py	2	4	5	10	12
y	y	20	7.5	5	0	0

Similar problem 1.4

In the previous section, we analyzed the overall effect of a change in the price of a good. Here, we refine our analysis by breaking this effect down into two components – a substitution effect and an income effect:

- When the price of a good falls, good becomes cheaper relative to other goods. Conversely, a rise in price makes the good more expensive relative to other goods. In either case,

The consumer experiences the substitution effect–– the change in the quantity of the good the consumer would purchase after the price change to achieve the same level of utility. For example, if the price of food falls, the consumer can

achieve the same level of utility by substituting food for other goods (I.e., by buying more food and less of other goods); similarly, if the price of food rises, the consumer may substitute other goods for food to achieve the same level of utility.

- When the price of a good falls, the consumer's purchasing power increases, since the consumer can now buy the same basket of goods as before the price decrease and still have money left over to buy more goods. Conversely, a rise in price decreases the consumer's purchasing power (I.e., the consumer can no longer afford to buy the same basket of goods). This change in purchasing power is termed the income effect because it affects the consumer in much the same way as a change in income would; that is, the consumer realizes a higher or lower level of utility because of the increase or decrease in purchasing power and therefore purchases a higher or lower amount of the good whose price has changed the income effect accounts for the part of the total difference in the quantity of the good purchased that isn't accounted for by the substitution effect.

2- Change in the price of a good: substitution effect and income effect.

The substitution effect and the income effect occur at the same time when the price of a good changes, resulting in an overall movement of the consumer from an initial basket (before the price change) to a filial basket (after the price change). To better understand this overall effect of a price change, we will show how to break it down (de-compose it) into its two components-the substitution effect and the income effect.

In the following sections, we perform this analysis in relation to price decreases. (Learning-By-Doing Exercise, shows a corresponding analysis in relation to a price increase).

The Substitution Effect

Suppose that a consumer buys two goods, food and clothing, that both goods have a positive marginal utility, and that the price of food decreases. The substitution effect is the amount of additional food the consumer would buy to achieve the same level of utility. Figure 6 shows three optimal choice diagrams that illustrate the steps involved in finding the substitution effect associated with this price change.

Step1 Find the initial basket (the basket the consumer chooses at the initial priceP_{x_1}) as shown in Figure. 6 (a), when the price of food is P_{x_1} the consumer faces budget line BL_1 and maximizes utility by choosing basket A on indifference curve U_1. The quantity of food she purchases is x A.

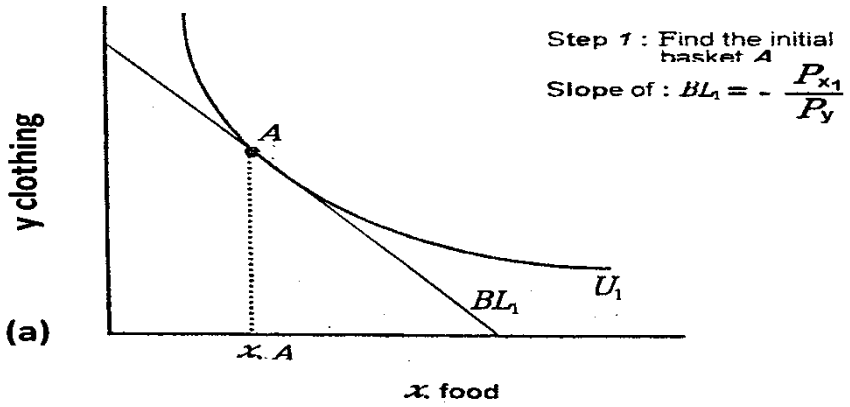
Step 2. Find the final basket (the basket the consumer chooses after the price falls to P_{x_2}). As shown in Figure 6 (b), when the price of food falls to P_{x_2} the budget line rotates outward to BL_2, and the consumer maximizes utility by choosing basket C on indifference curve U_2. The quantity of food she purchases is XC. Thus, the overall effect of the price change on the quantity of food purchased is X C − X A . predictably, the consumer realizes a higher level of utility as a result of the price decrease, as shown by the fact that the initial basket A lies inside the new budget line BL_2

Step 3 Find an intermediate decomposition basket that will enable us to identify the portion of the change in quantity due to the substitution effect. We can find this basket by keeping two things in mind. First, the decomposition basket reflects the price decrease, so it must lie on a budget line that is parallel to BL_2. Second, the decomposition basket reflects the assumption that the consumer achieves the initial level of utility after the price decrease, so the basket must be at the point where the budget line is tangent to indifference curve U_1. As shown in Figure 6 (C). These two conditions are fulfilled by

basket BL_d (the decomposition budget line). At basket B, the consumer purchases the quantity of food X B. Thus , the substitution effect accounts for the consumer's movement from basket A to basket B that is , the portion of the overall effect on the quantity of food purchased that can be attributed to the substitution effect is XB − XA

The Income Effect

Still looking at Figure 6, suppose the consumer has income I. When the price of food is P_{x_1}, she can buy any basket on BL_1, and when the price of food is P_{x_2}, she can buy any basket on BL_2. Note that the decomposition budget line BL_d. Lies inside BL_2., which means that the income I_d that would be needed to buy a basket on BL_d. is less



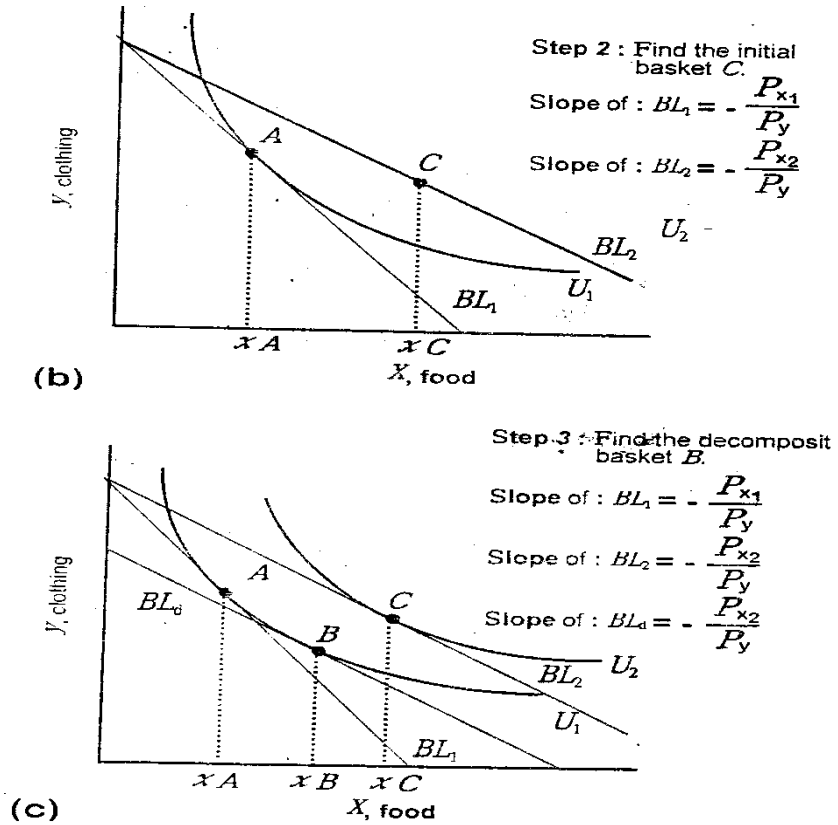


Figure 6 income and substitution effects. Case 1 (X is a Normal Good)

As the price of food drops from P_{x_1}, to P_{x_2}, the substitution effect leads to an increase in the amount of food consumed from X_A to X_B (so the substitution effect is $X_B - X_A$). The income effect also leads to an increase in food consumption, from X_B to X_c (so the income effect is $X_c - X_B$). The overall increase in food consumption is $X_c - X_A$. When a good is normal, the income and substitution effects reinforced each other.

Change in the Price of a Good Substitution Effect and Income Effect

Than the income I needed to buy a basket on BL_2. Also note that basket A (on BL_1) and basket B (on BL_d) are on the same indifference curve U_1 (I.e., the consumer would be equally satisfied by baskets A and B), which means that the consumer would be indifferent between the following two situations: (1) having a higher income I when the price of food is higher at P_{X_1} (I.e., buying basket A) and (2) having a lower income I_d when the price of food is lower at P_{X_2} (I.e., buying

basket B). Another way of saying this is that the consumer would be willing to have her income reduced to Id if she can buy food at the lower price P_{X_2}.

With this in mind, let's find the income effect, the change in the amount of a good consumed as the consumer's utility changes. In the example illustrated by Figure 6, the movement from basket A to basket B (I.e., the movement due to the substitution effect) doesn't involve any change in utility, and as we have just seen, we can view this movement as the result of a reduction in income from I to I_d as the price falls from P_{X_1} to P_{X_2}. In reality, however, the consumer's income doesn't fall when the price of food decreases, so her level of utility increases, and we account for this by "restoring" the "lost" income. When we do this, the budget line shifts from BL_d to BL_2, and the consumer's optimal basket shifts from basket B (on BL_2) to basket C (on BL_2) . thus, the income effect accounts for the consumer's movement from the decomposition basket B to the final basket C –that is , the portion of the overall effect on the quantity of food purchased that can be attributed to the income effect is $X_C - X_B$.

In sum, when the price of food falls from P_{X_1} to P_{X_2} the total change on food consumption is $(X_C - X_A)$. This can be decomposed into the substitution effect $(X_B - X_A)$ and the income effect $(X_C - X_B)$. When we add the substitution effect and the income effect, we get the total change in consumption.

Income and Substitution Effects When Goods Are Not Normal

As we noted earlier, the graphs in Figure. 6 are drawn for the case (we call it Case 1) in which food is a normal good. As the price of food falls, the income effect leads to an increase in food consumption. Also, because the marginal rate of substitution is diminishing, the substitution effect leads to increased food consumption as well. Thus, the income and substitution effects work in the same direction. The demand curve for food will be downward sloping because the quantity

of food purchased will increase when the price of food falls. (Similarly, if the price of food were to rise, both effects would be negative. At a higher price of food, the consumer would buy less food.)

However, the income and substitution effects do not always work in the same direction. Consider Case 2, in Figure.7 (instead of drawing three graphs like those in Figure. 6, we have only drawn the final graph like Figure 6 (c)] with the initial, final, and decomposition baskets). Note that basket C, the final basket, lies directly above basket B, the decomposition basket. As the budget line shifts out from BL_d to BL_2, the quantity of food consumed does not change. The income effect is therefore zero $(X_C - X_B = 0)$. Here a decrease in the price of food leads to a positive substitution effect on food consumption $(X_B - X_A > 0)$ and a zero income effect. The demand curve for food will still be downward sloping because more food is purchased at the lower price $(X_C - X_A > 0)$.

The income and substitution effects might even work in opposite directions, as in Case 3, in Figure 8, where food is an inferior good. When a good is inferior, the indifference curves will show that the income effect is negative (I.e., the final basket C will be to the left of the decomposition basket B); as the budget line shifts out from BL_d to BL_2, the quantity of food consumed decreases $(X_C - X_B < 0)$.

In contrast, the substitution effect is still positive $(X_B - X_A > 0)$ in this case, because the substitution effect is larger than the income effect, the total change in the quantity of food consumed is also still positive $(X_C - X_A > 0)$, and therefore, the demand curve for food will still be downward sloping.

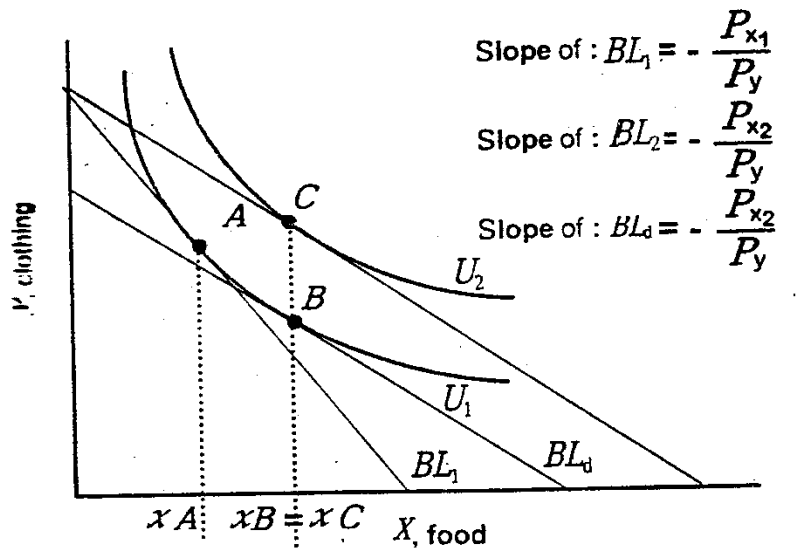


Figure 7 income and substitution effects. Case 2 (X is neither a Normal Good nor an inferior Good))

As the price of food drops from P_{x_1}, to P_{x_2}, the substitution effect leads to an increase in the amount of food consumed from X_A to X_B (so the substitution effect is $X_B - X_A$). The income effect on food consumption is zero because , X_B is the same as X_c (so the income effect is $X_c - X_B = 0$). The overall effect on food consumption is $X_c - X_A$.

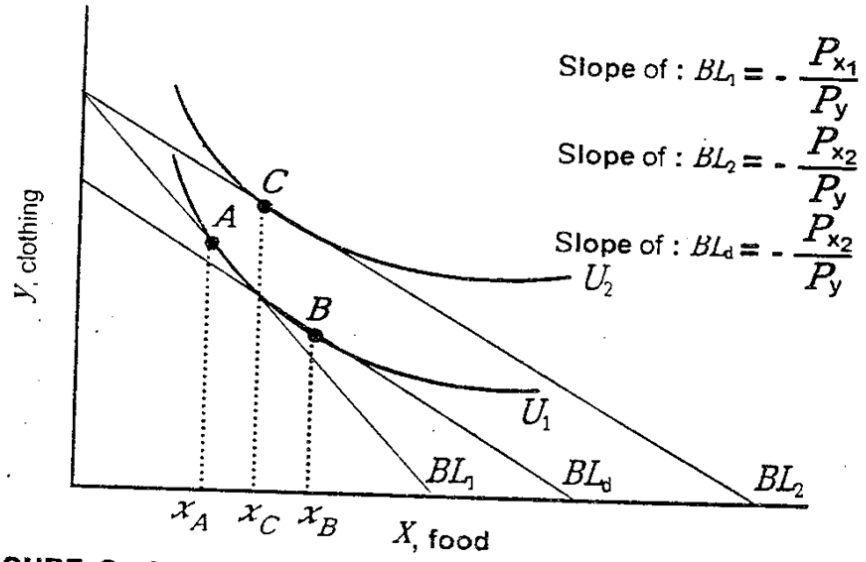
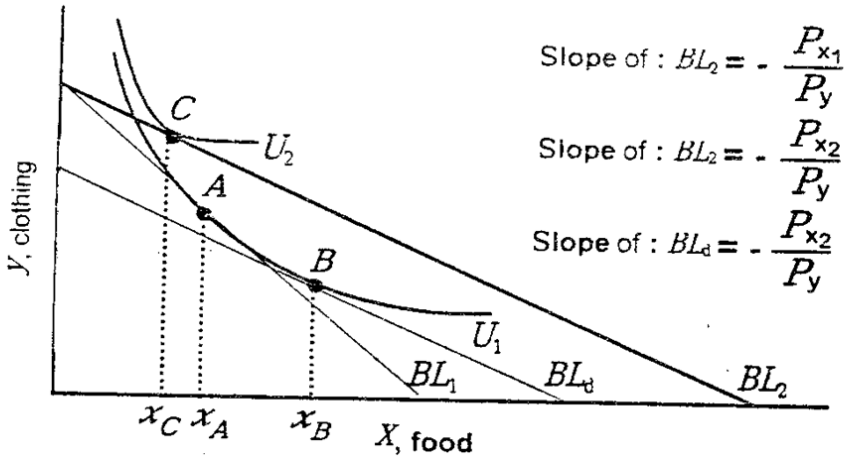


FIGURE. 8 Income and Substitution Effects: Case 3 (x Is an Inferior Good) with a Downward-Sloping Demand Curve

As the price of food drops from P_{x_1}, to P_{x_2}, the substitution effect leads tc an increase in the amount of food consumed from x_A to x_B (so the substitution effect is The income effect on food consumption is negative ($x_C - x_B < 0$). The overall effect on food consumption is $x_C - x_A > 0$. When a good is inferior. the income and substitution effects work in opposite directions.



Income and Substitution Effects: Case 4 (x Is a Giffen Good)

As the price of food drops from P_{x_1}, to P_{x_2}, the substitution effect leads tc an increase in the amount of food consumed from x_A to x_B (so the substitution effect is The income effect on food consumption is negative ($x_C - x_B < 0$). The overall effect on food consumption is $x_C - x_A > 0$.

Case 4, in Figure. 9, illustrates the case of a so-called Giffen good. In this case, the indifference curves indicate that food is a strongly inferior good, with the final basket C lying not only to the left of the decomposition basket B, but also to the left of the initial basket A. The income effect is so strongly negative that it more than cancels out the positive substitution effect.

What about the demand curve for food in the case illustrated by Figure 5. 9? When the price of food drops from P_{X_1} to P_{x_2}, the quantity of food actually decreases from X_A to X_C, so the demand curve for food will be upward sloping over that range of prices. A Giffen good has a demand curve with a positive slope over part of the curve.

As we have already noted, some goods are inferior over some price ranges for some consumers. For instance, your consumption of hot dogs may fall if your income rises, if you decide to eat more steaks and fewer hot dogs.

But expenditures on inferior goods typically represent only a small part of a consumer's income. Income effects for individual goods are usually not large, and the largest income effects are usually associated with goods that are normal rather than inferior, such as food and housing, for an inferior good to have an income effect large enough to offset the substitution effect, the income elasticity of demand would have to be negative and the expenditures on the good would need to represent a large part of the consumer's budget , thus, while the Giffen good is intriguing, it is not of much practical concern.

While researchers have not yet found data that confirm the existence of a Giffen good for human beings, some economists have suggested that the Irish potato famine (see Applications. 2) came close to creating the right environment. However, as Joel Mokyr observed, for people with a very low income, potatoes might have well been a normal good. But consumers with higher levels of income could afford other types of food, and therefore consumed fewer potatoes. Thus, while expenditures on potatoes did constitute a large part of consumer expenditures, potatoes may not have been inferior at low incomes. This may explain why researchers have not shown the potato to have been a Giffen good at that time.

Finding Income and Substitution Effects Algebraically

In learning By Doing exercises. We met a consumer who purchases two goods food and clothing. He has the utility function U((x,y) − xy, where x denotes the amount of food consumed and y the amount of clothing. His marginal utilities are MU_X = y and MU_y = x. Now suppose that he has an income of $\$72$ per week and that the price of clothing is P_y = $\$1$ per unit. Suppose that the price of food is initially P_{X_1} −− $\$9$ per unit, and that the price subsequently falls to P_{X_2} = $\$4$ per unit.

Change in The Price of a Good: Substitution Effect and Income Effect solution

To find the income and substitution effects, we follow the procedure explained earlier in this section.

Step 1. Find the initial consumption basket A when the price of food is $\$9$. We know that two conditions must be satisfied at an optimum. First, an optimal basket will be on the budget line. This means that P_{X_x} + P_{X_y} = I, or with the given information, 9 x + y = 72.

Second, since the optimum is interior the tangency condition must hold. From equation (4.3), we know that at a tangency, $MU_X/\ MU_y$ = P_X / P_y, which with the given information simplifies to y = 9x.

When we solve these two equations with two unknowns, we find that x = 4 and y = 36. So at basket A the consumer purchases 4 units of food and 36 units of clothing each week.

Step 2. Find the final consumption basket C when the price of food is $\$4$. We repeat step 1, but now with price of a unit of food of $\$4$, which again yields two equations with two unknowns:

4x + y = 72 (coming from the budget line) y = 4x (coming from the tangency condition)

When we solve these two equations, we find that X = 9 and y = 36. So at basket C, the consumer purchases 9 units of food and 36 units of clothing each week.

Step 3. Find the decomposition basket B. The decomposition basket must satisfy two conditions. First, it must lie on the original indifference curve U_1 along with basket A. recall that this consumer's utility function is U(X,y) = y, so at basket A, utility $U_1 = 4(36) = 144$. At basket B the amounts of food and clothing must also satisfy xy = 144. Second, the decomposition basket must be at the point where the decomposition budget line is tangent to the indifference curve. Remember that the price of food P_X on the decomposition budget line is the final price of $4. The tangency occurs when $MU_x / MU_y = P_X / P_y$ that is, when y/x = $4/1$, or y = 4x. When we solve the two equations Xy = 144 and y = 4x , we find that, at the decomposition basket, x = 6 units of food and y = 24 units of clothing.

Now we can find the income and substitution effects. The substitution effect is the increase in food purchased as the consumer moves along initial indifference curve U_1 from basket A (At which he purchases 4 units of food) to basket B (at which he purchases 6 units of food) the substitution effect is therefore $6 - 4 = 2$ unit of food.

The income effect is the increase in food purchased as he moves from basket B at which he purchases 6 units of food) to basket C (at which he purchases 9 units of food,). The income effect is therefore $9 - 6 = 3$ unit of food.

Figure, 10 graphs the income and substitution effects. In this exercise food is a normal good. As expected, the income and substitution effects have the same sign. The consumer's demand curve for food downward sloping because the quantity of food he purchases increases when the price of food falls.

Exercises

Chapter Three

1)

Suppose the utility function is U = XY and consumer income I = 1000 suppose also Px1 = 50 PY = 10

a- Find the optimal combination from X and Y by algebraically and graphically

b- suppose the X price is decrease from Px1 = 50 to Px2 = 12.5

1- find the optimal combination from X and Y

2- find by algebraically and graphically approach the substitute effect and income effect.

2)

Suzie purchases two goods, food and clothing. she has the utility function U(X,Y) = XY, where X denotes the amount of food consumed and Y the amount of clothing Show that the equation for her demand curve for clothing Y = $\frac{1}{2Py}$

- Is clothing a normal good? Draw her demand curve for clothing when the level of income is I = 200 label this demand curve D1. Draw the demand curve when I = 300 and label this demand curve D2.

-What can be said about the cross price elasticity of demand of food with respect to the price to clothing?

3)

Rick purchase two goods food (X) and clothing (Y). he has utility function U = Xy.

(a) Calculate his optimal basket when Px = 4 and Py = 1

(b) Calculate his income and substitution effects of decrease in the price of food to Px = 3.

Exercises

Chapter Three

The theory of consumer behavior

Part A: True- false Questions

Circle whether the following statements are true (T) or false (F)

1- Utility of every addition unit is called marginal utility.

2- When total utility reach at maximum marginal utility becomes positive.

3- The law of diminishing marginal utility states that the consumer consumes more of a commodity the utility of every additional unit (MU) consumed diminishes

4- A higher in difference cure represent a higher level of satisfaction

5- Indifference curve s are convex to the origin

6- MU = TUn + TUn -1

7- Price effect is equal to income effect

8- Utility mean want satisfying power of a commodity

10- A change in total utility resulting from a one – unit change in the consumption of a commodity at particular point of time is called marginal utility

11- Total utility is the sum of marginal utility

12- The magnitude of the slope of an indifference curve is the marginal rate of substitution

13- A consumption point inside the budget line is possible to afford but has some unspent income

Part B multiple choice questions

Circle the appropriate answer

1- Marginal utility measures

a- the total utility of all your consumption

b- the total utility divided by the price of the good

c- the increase in utility from consuming one additional unit

d- none of the above

2- A curve showing all the output combinations that yield the same level of satisfaction is called

a- an indifference curve b- a supply curve

c- a cost curve d- an isoquant curve

3- Normally a price change moves an individual to a new indifference curve at the new prices, the amount of income necessary to move the individual to the old level of utility is called

a- an equivalent variation b- a slutsky variation

c- Marshallian consumer surplus d- a compensating variation

4- When comparing equivalent and compensating variation, we know that

a- the two figure will be the same

b- equivalent variation will be greater

c- compensating variation will be greater

d- none of the above

5- MU is equal to:

a- TUn + TUn-1 b- TUn – Tun-1

c- TUn – Tun+1 d- TUn +TUn+1

6- As the consumer consumes more of a commodity, the utility of every additional unit (MU) consumed diminishes this is

a- law of diminishing marginal utility

b- equi-diminishing marginal utility

c- indifference curve theory

d- revealed preference theory

7- The condition for equilibrium of the consumer is

a- Mux/Px = Muy/Py b- Mux/ Muy = Py /Px

c- a & b d- Mux = Muy

8- What are true for indifference curves?

a- indifference curves slope downward to the right

b- indifference curves are convex to the origin

c- A higher indifference curves represent a higher level of satisfaction

d- all of the above are correct

9- The convexity of indifference curves is due to

a- diminishing MRS

b- increasing MRs

c- constant MRs

d- none

10- The slope of indifference curve is known as

a- marginal rate of substitution b- marginal utility

c- elasticity of substitution d- none

11- In indifference curve analysis, the consumer will be in equilibrium when

a- A given budget line must be tangent to an indifference curve

b- the indifference curve must be convex to the origin at the point of tangency

c- a & b

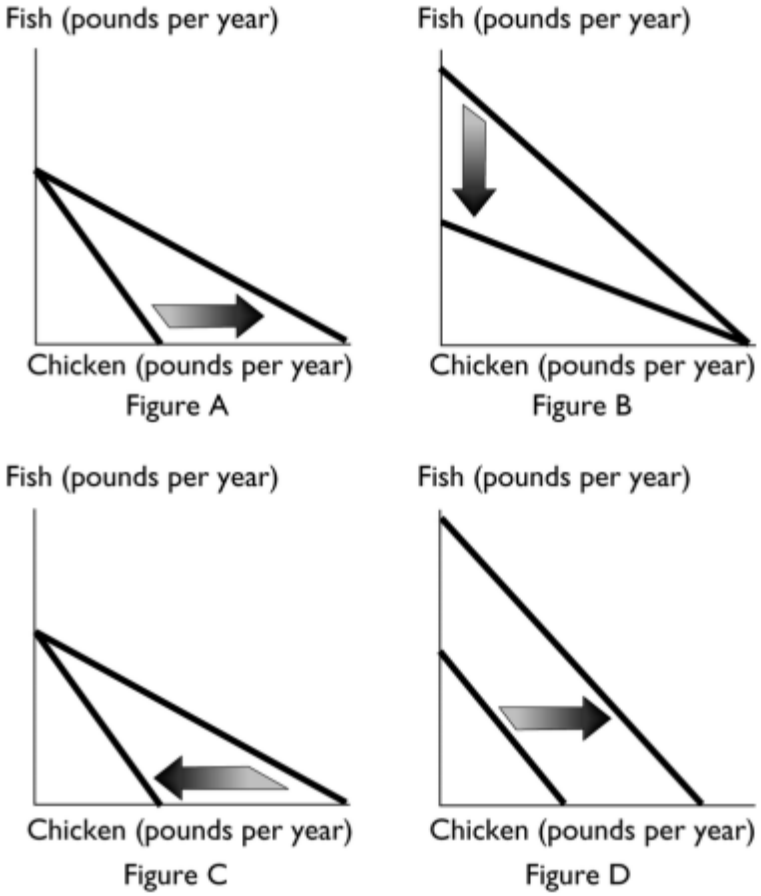
d- none of the above

12- Price effect is equal to

a- substitution effect b- income effect

c- a + b d- a – b

According to the following figure answer the questions of (13) to (16)



13- In the above figure, which one reflects an increase in the price of chicken?

a- figure a b- figure B c- figure C d- figure D

14- In the above figure, which one reflects a decrease in the price of chicken?

a- figure A b- figure B c- figure C d- figure D

15- In the above figure, which one reflects an increase in the consumer's income?

a- figure A b- figure B c- figure C d- figure D

16- In the above figure, which one reflects an increase in the price of fish?

a- figure a b- figure B c- figure C d- figure D

17- Moving along an indifference curve the

a- consumer prefers some of the consumption points to others

b- marginal rate of substitution for good increases as more of the good is consumed

c- marginal rate of substitution is constant

d- consumer does not prefer one consumption point to another

18- The marginal rate of substitution of one good for another is measured by moving

a- among different indifference curve

b- along a budget line,

c- among different budget lines

d- along an indifference curve

19- Suppose a consumer has $100 to spend on two goods shoes and shirts, if the price of a pair of shoes is $20 per pair and the price of a shirt is $15 each, which of the following combination is unaffordable to the consumer?

a- 0 pair of shoes and 0 shirts

b- 2 pair of shoes and 4 shirts

c- 5 pair of shoes and 0 shirts

d- 0 pair of shoes and 7 shirts

20- Which of the following describes what happens to a consumer's budget line if that consumer's budget increases? The budget line

a- become steeper

b- shifts farther away from the origin of the graph

c- does not change

d- becomes more horizontal

Problem

Problem 1

Suppose the Px1 = 50 Py = 10 I= 1000

required

1- Calculate the optimal combination from (X) and (Y) with graphic

2- Suppose the price of (X) reducing to Px2 = 12.5 calculate the optimal combination from (X) and (Y) with graphic

3- Calculate the substitution effect and income effect

4- Calculate the equivalent variation and compensation variation with graphic

Problem 2

Suppose the Px1 = 16 Py = 2 I= 128

required

1- Calculate the optimal combination from (X) and (Y) with graphic

2- Suppose the price of (X) reducing to Px2 = 4 calculate the optimal combination from (X) and (Y) with graphic

3- Calculate the substitution effect and income effect

4- Calculate the equivalent variation and compensation variation with graphic.

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Chapter Four

Short–Run Costs and Output Decisions

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Short-Run Costs and Output Decisions

That main goal of this chapter is to understand

- Costs in the short run.

- The relationship between average total cost and marginal cost.

- Fixed costs.

- Total variable cost.

- Average variable cost.

- The relationship between average cost and marginal cost.

- Exercises+*7+

Chapter Four

Short run costs and output decisions

This chapter continues our examination of the decisions that lie behind competitive supply and demand curve. You have seen that firms in perfectly competitive industries make three very specific decisions. (See Figure 1.) These decisions are

1- How much output to supply

2 How to produce that output (that is, which production technique to use); and

3- What quantity of each input to demand

Remember though that all types of firms make these decisions. We continue to use perfectly competitive firms as a teaching device, but much of the material in this chapter applies to firms in noncompetitive industries as well.

We have assumed so far that firms are in business to earn profits and that they make choices in order to maximize those profits. remember that profit is the difference between revenues and costs). Because firms in perfectly competitive makers are price takers in both input and output markets, many decisions depend upon prices over which firm have no control. Like households, firms also face market constraints.

Decisions	Information
1- the quantity of output to supply	1- the price of inputs*
2- how to produce that output (which technique to use	2- techniques of production available*
The quantity of each input to demand	3-The price of output
	*determines production costs

This chapter focuses on costs of production. To calculate costs, a firm must know two things: the quantity and combination of input it needs to produce its product and how much those inputs cost. as we begin to examine how technology and input prices determine costs, we focus first on input markets. By the end of the chapter, we will have enough information to Figure out how much of its product a firm is likely to supply (that is, how much output to produce) at each possible price. In other words, we will have derived the supply curve of a competitive firm in the short run.

Costs in The Short Run

Our emphasis in chapter is on costs in the short run only. You have seen that the short run is that period during which two conditions hold (1) Existing firms face limits imposed by some fixed factor of production and (2) new firms cannot enter and existing firms cannot exist, an industry.in the short run, all firms (competitive and noncompetitive) have costs that they must bear regardless of their output. Some costs, in fact, must be paid even if the firm stops producing (that is, even if output is zero). These kinds of costs are called fixed costs, and the important thing to remember about them is that firms can do nothing in the short run to avoid them or to change them. In the long run, a firm has no fixed costs, because it can change its scale of operation or exit the industry.

Firms do have certain costs in the short run that depend on the level of output they have chosen. these kinds of costs are called variable costs. Fixed costs and variable costs together make up total costs:

$$TC = TFC + TVC$$

Where TC denotes total costs, TFC denotes total fixed costs, and TVC denotes total variable costs.

Fixed Costs

Total Fixed cost (TFC) the total of all fixed costs is sometimes referred to as overhead. If you operate a factory, you must heat the building to keep the pipes from freezing in the winter.

Even if no production is taking place, you may have to keep the roof from leaking, pay a guard to protect the building from vandals, and make payments on a long-term lease. There may also be insurance premiums, taxes, and city fees to pay, as well as contract obligations to workers.

Fixed costs represent a larger portion of total costs for some firms than for others. Electric companies, for instance, maintain generating plants, thousands of miles of distribution wires, poles, transformers, and so forth usually, such plants are financed by issuing bonds to the public (that is, by borrowing). The interest that must be paid on these bonds represents a substantial part of the utilities operating cost and is a fixed cost in the short run, no matter how much, if any, electricity is being produced

For the purposes of our discussion in this chapter, we will assume that firms use only two inputs: labor and capital recall that capital is both produced and yields services over time in the production of other goods and services. It is the plant and equipment of a manufacturing firm; the computers, desks, chairs, doors, and walls of a law office; and the boat that bill and Colleen built on their desert island. It is sometimes assumed that capital is a fixed input in the short run and that labor is the only variable input. To be a bit more realistic, however, we will assume that capital has both a fixed and a variable component. After all, some capital can be purchased in the short run.

Consider a small consulting firm that employs several economists, research assistants, and secretaries. It rents space in an office building and has a five- year lease. The rent it pays on the office space can be thought of as a fixed cost in the

short run. The monthly electrics and heating bills are also essentially fixed (although the amounts may vary slightly from month to month). So are the salaries of the basic administrative staff. Payments on some capital equipment–a large copying machine, for instance, and the main word processing system–can also be thought of as fixed.

The same firm also has costs that vary with output. When there is a lot of work, the firm hires more employees at both the professional and research assistant level. The capital used by the consulting firm may also vary, even in the short run. Payments on the computer system do not change, but the firm may rent additional computer time when necessary. It can buy additional personal computers and word processing terminals quickly, if need be. It must pay for the copy machine, but the machine costs more when it is running than when it is not.

Total fixed costs (TFC), then, are those costs that do not change with output, even if output is zero. Table 1 presents data on the fixed costs of a hypothetical firm. Fixed costs are $1000 at all levels of output. Figure2 a shows total fixed costs as a function of output. Since TFC does not change with output, the graph is simply a straight horizontal line at $1000. The important thing to remember here is that:

Firms have no control over fixed cost in the short run for this reason fixed costs are sometimes called sunk costs.

Average fixed cost (AFC) average fixed cost (AFC) is total fixed cost (TFC) divided by the number of units of output (q):

$$AFC = \frac{TFC}{q}$$

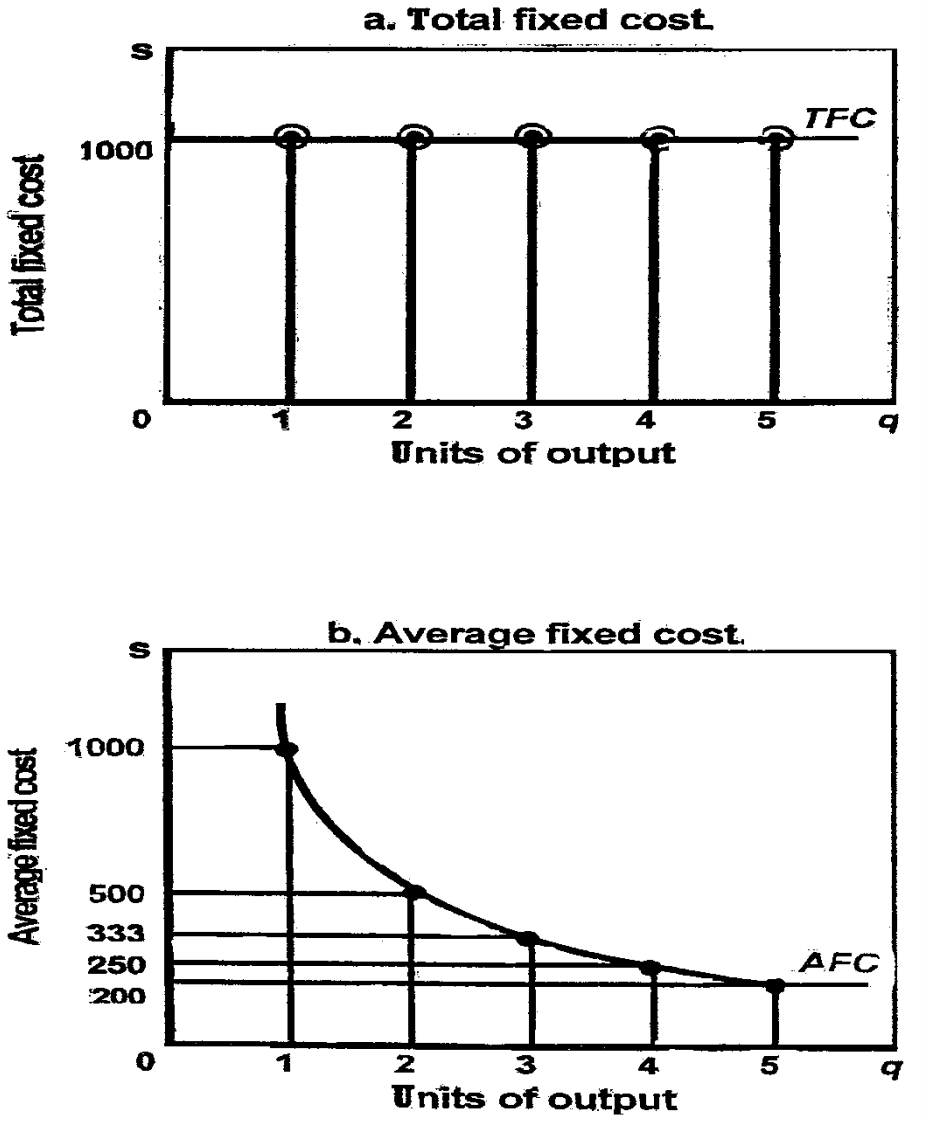


Figure 8.2

Short –run cost (total and average) of a Hypothetical Firm. Average fixed cost is simply total fixed cost divided by the quantity of output. As output increase, average fixed cost declines because we are dividing a fixed number ($1000) by a larger and larger quantity

For example, if the firm in Figure 2 produced three units of output, average fixed costs would be $333 ($1000 divided by three,). If the same firm produced five units of output, average fixed cost would be $200 ($1000 divided by five). Average fixed cost falls as output rises, because the same total is being spread over, or divided by, a larger number of units (see Table1) .this phenomenon is sometimes called spreading overhead.

Graphs of average fixed cost, like that in Figure 2b (which presents the average fixed cost data from Table 1), are downward- sloping curves. Notice that AFC approaches zero as the quantity of output increases. If output were 100,000 units, average fixed cost would equal only one cent per unit in our example of ($1,000 ÷ 100,000 = $.01). Of course, AFC approaches but never actually reaches zero.

Variable Costs

Total variable cost (TVC) total variable costs (TVC) are those costs that depend on, or vary with, output in the short run. To produce more output, a firm uses more inputs. The cost of additional output depends directly on the additional inputs that are required and how much they cost.

As you saw in last chapter, input requirements are determined by technology. Firms generally have a number of production techniques available to them, and the option they choose is assumed to be the one that produces the desired level of output at the least cost. To find out which technology involves the least cost, a firm must compare the total variable costs of producing that level of output using different production techniques.

This is as true of small businesses as it is of large manufacturing firms. Suppose, for example, that you are a small farmer. A certain amount of work has to be done in order to plant and harvest your 120 acres. You can get this work done in a number of ways. You might hire four farm hands and divide up the tasks, or you might buy several pieces of complex farm machinery (capital) and do the work single- handedly. Clearly, your final choice depends on a number of things. What machinery is available? What does it do? Will it work on small fields such as yours? How much will it cost to buy each piece of equipment? What wage will you have to pay farm hands? How many will you need to get the job done? if machinery is expensive and labor is cheap, you will probably choose the labor intensive technology. If farm labor is expensive and the local farm equipment dealer is going

out of business, you might get a good deal on some machinery and choose the capitals intensive method.

Having compared the costs of alternative production techniques, the firm may be influenced in its choice by the current scale of its operation. Remember, in the short run a firm is locked into a fixed scale of operations. A firm currently producing on a small scale may find that a labor-intensive technique is the least costly, whether or not labor is comparatively expensive; the same firm producing on a larger scale might find a capital- intensive technique less costly.

The total variable cost curve is a graph that shows the relationship between total variable cost and the level of a firm's output (q). At any given level of output, total variable cost depends on (1) the techniques of production that are available and (2) the prices of the inputs required by each technology. To examine this relationship in more detail, let us look at some production Figures for some hypothetical items called "Frumps".

Table2 presents an analysis that might lie behind three points on the total variable cost curve of a typical frump firm. In this case, there are two production techniques available, one somewhat more capitals intensive than the other. We will assume that the price of labor is S1 per unit and the price of capital is S2 per unit. For the purposes of this example, we focus on variable capital-- that is, on capital that can be changed in the short run. In practice, some capital (such as buildings and large, specialized machines) is fixed in the short run. in our example, we will use k to denote variable capital. Remember, however, that the firm has other capital, capital that is fixed in the short run.

Analysis reveals that to produce on unit of output, the labor intensive technique is least costly. Technique A requires four units of both capital and labor, which would cost a total of $12. Technique B requires six units of labor but only two units of capital for a total cost of only $10. To maximize profits, the firm would use

technique B to produce one frump. The total variable cost of producing one unit of output would thus be $10.

The relatively labor-intensive technique B is also the best method of production for two units of output. Using B, the firm can produce two Frumps for $18. If the firm decides to produce three Frumps, however, technique A is the cheaper. Using the least- cost technology (A), the total variable cost of production is $24. The firm will use nine units of capital at $2 each and six units of labor at $1 each.

Produce	Using technique	Units of units of input (production function		Total variable cost assuming P_k = \$2, P_L = \$1 TVC = K(P_k) +L(P_L)
		K	L	
1 unit of output	A	4	4	(4x\$2) +(4x\$1) =\$12
	B	2	6	(2x\$2) +(6x\$1) =\$10
2 unit of output	A	7	6	(7x\$2) +(6x\$1) =\$20
	B	4	10	(4x\$2) +(10x\$1) =\$18
3 unit of output	A	9	6	(9x\$2) +(6x\$1) =\$24
	B	6	14	(6x\$2) +(14x\$1) =\$26

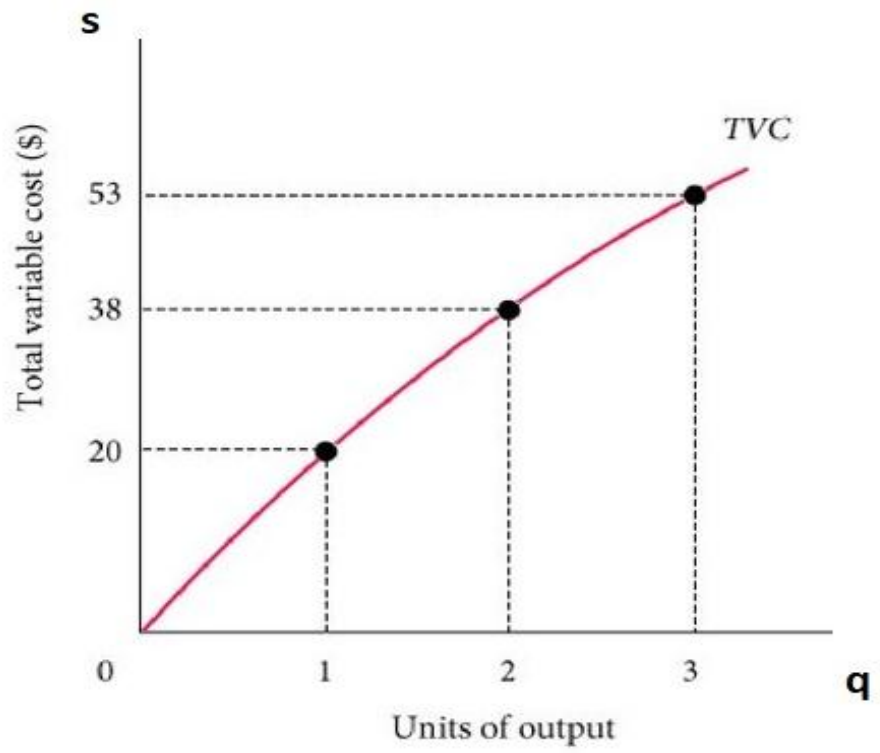


Figure 3 graphs the relationship between variable costs and output based on the data in Table8.2, assuming the firm chooses, for each output, the least cost technology.

The important point to remember here is that:

The total variable cost curve embodies information about factor, or input prices and technology. It shows the cost of product using the best available technique at each output level given current factor prices.

Marginal cost (MC) the most important of all cost concepts is that of marginal cost (MC), the increase in total cost that results from the production of one more unit of output. Let us say, for example, that a firm is producing 1,000 units of output and decides to raise output to 1,001. Producing the extra unit raises cost, and the increase (that is, the cost of producing the 1,001st unit) is the marginal cost.

Focusing on the margin is one way of looking at variable costs: marginal costs reflect variable costs because they vary when output changes. Fixed costs do not change when output changes.

Table 3 shows how marginal cost is derived from total variable cost by simple subtraction. The total variable cost of producing the first frump is $10. Raising production from one unit to two units increases total variable cost from S10 to S18; the difference is the marginal cost of the second unit, or S8. Raising output from two to three units increases total variable cost from S18 to S24. The marginal cost of the third unit, therefore, is S6.

Table 3

Derivation of Marginal Costs

Cost from total variable

Unit of output (Frumps)	Total variable costs ($)	Marginal costs ($)
0	0	—
1	10	10
2	18	8
3	24	6

Table 4

Derivation of marginal cost from total variable cost, technology, and factor prices

	Least-cost technology	Input requirements K	L		Total variable cost
Unit 2	B	2	6	(2x$2) + (6 x$1)=	$ 10
Unit 1	B	4	10	(4x$2) + (10 x$1)=	$18
	Additional inputs needed	+ 2	+ 4		↓
	X Price of inputs	X $2	X $1		
	= Marginal cost (of unit 2)	$4	$4	→	$8 =MC
Unit 2	B	2	10	(4x$2) + (10 x$1)=	$18
Unit 1	A	9	6	(4x$2) + (6 x$1)=	$24
	Additional inputs needed	+ 5	− 4		↓
	X Price of inputs	X $2	X $1		
	= Marginal cost (of unit 3)	$10	− $4	→	$6 = MC

Table 4 shows that marginal cost is simply the cost of the additional inputs, or resources, needed to produce the marginal unit of output. You saw in Table 8.2 that the least expensive method of producing one frump or two Frumps was technique B. Here is what happens when the firm raises output from one unit to two units: to produce one unit of output, it uses of capital at $2 per unit and six units of labor as $1 per unit, for a total variable cost of S10 technique B requires four units of capital (at S2 per unit) and ten units of labor (at S1 per unit) to produce two units of output, for the total variable cost of $18. To produce the second unit, therefore, our frump producer needs to use two units of additional capital (at $2 each) and four units of additional labor (at $1 each), for a total additional cost $8. Thus, the marginal cost of the second unit is $8-- the cost of the added resources needed to produce it.

But what happens when total output goes up by one more unit? To produce three Frumps, the firm switches to technique A, which requires nine units of capital (at $2 each), more than twice as much capital as it took to produce two Frumps. Why spend so much more on variable capital? Because this expenditure means that the firm can cut down on the amount of labor it uses. producing two Frumps required ten units of labor (at $1 each); producing three Frumps requires only six. Although increasing output from two Frumps to three requires the firm to spend an additional $10 on capital (five additional units at $2 each), it also means that it can cut back on labor, using four fewer units (at S 1 each) and saving the firm $4. The marginal cost of the third unit is thus $6 ($10-$4).

In reality, firms generally do not hire less labor when output rises. When firms in the real world expand, they normally use more capital and hire more labor, as our firm does in moving from one unit of output to two. Still, this example should drive home two points: (1) that costs at any level of output depend on technology and

factor prices and (2) that the technology appropriate at one level of production may not be appropriate at other levels of production.

While the easiest way to derive marginal cost is to look at total variable cost subtract (as in Table3), don't lose sight of fact that. When a firm increases its output level, it hires or demands more inputs. Marginal cost measures the additional cost of inputs required to produce each successive unit of output.

The Shape of the Marginal Cost Curve in the Short Run

The assumption of a fixed factor of production in the short run means that a firm is stuck at its current scale of operation (in our example, the size of the plant) as a firm tries to increase its output, it will eventually find itself trapped by that scale. Thus, our definition of the short run also implies that marginal cost eventually rises with output. The firm can hire more labor and use more materials–that is, it can add variable inputs–but diminishing returns eventually set in. now recall the sandwich shop, with one grill and too many workers trying to prepare sandwiches on it, from last chapter. With a fixed grill capacity, more laborers could make more sandwiches, but the marginal product of each successive cook declined as more people tried to use the grill. if each additional unit of labor adds less and less to total output, it follows that it requires more labor to produce each additional unit of output. Thus, each additional unit output costs more to produce. In other words diminishing returns, or decreasing marginal product, implies increasing marginal cost (see Figure 4).

Recall too the accountant who makes a living by helping people file their tax returns. He has an office in his home and works alone. His fixed factor of production is his own time: there are only so many hours in a day, and he has only so much stamina. In the long run, he may decide to hire and train an associate, but

in the meantime (the short run) he has to decide how much to produce, and that decision is constrained by his current scale of operations. The fact that he has no trained associate and that each day contains only 24 hours constrains the number of clients that he can face on. the biggest component of the accountant's cost is time. When he works, he given up leisure and other things that he could do with his time with more and more clients, he works later and later into the night; as he does so, he becomes less and less productive, and his hours become more and more valuable for sleep and relaxation. In other words, the marginal cost of doing each successive tax return rises.

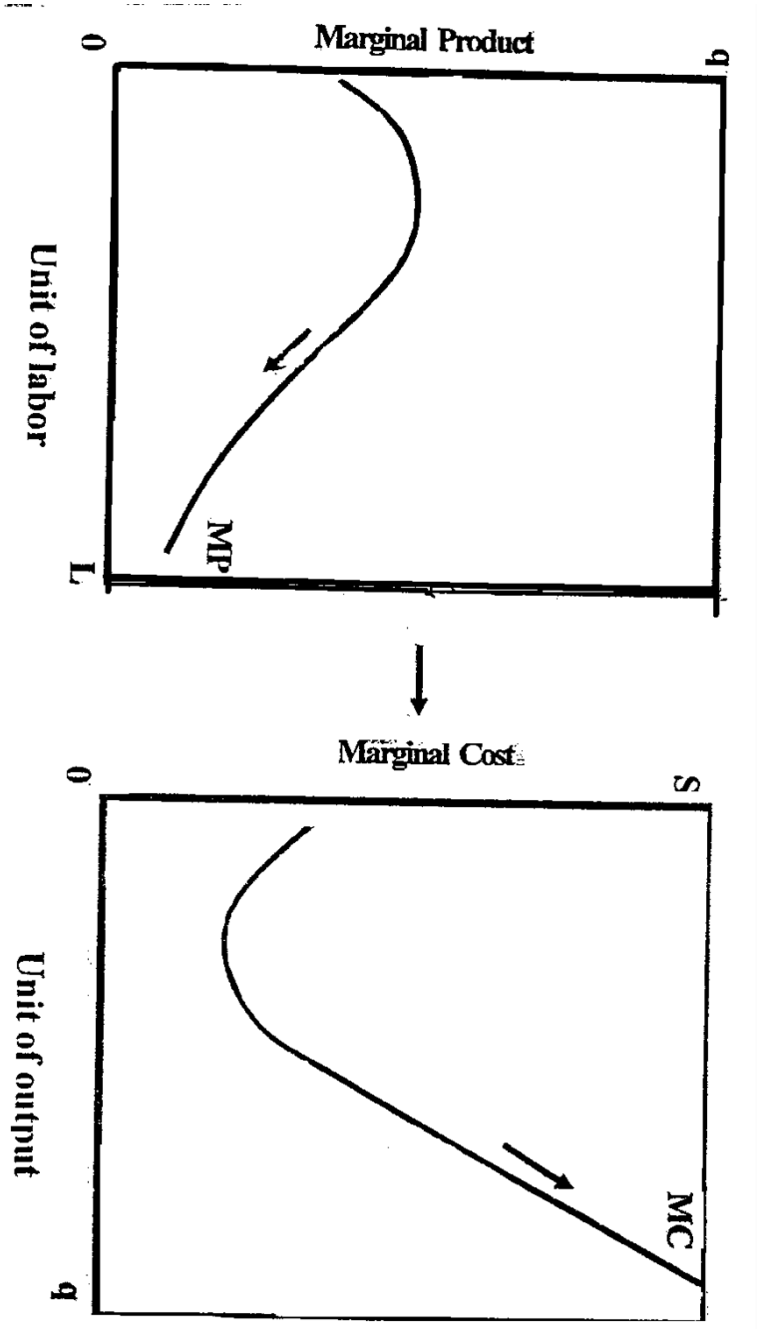


Figure 3

Declining marginal product implies that marginal cost will Eventually rise with output

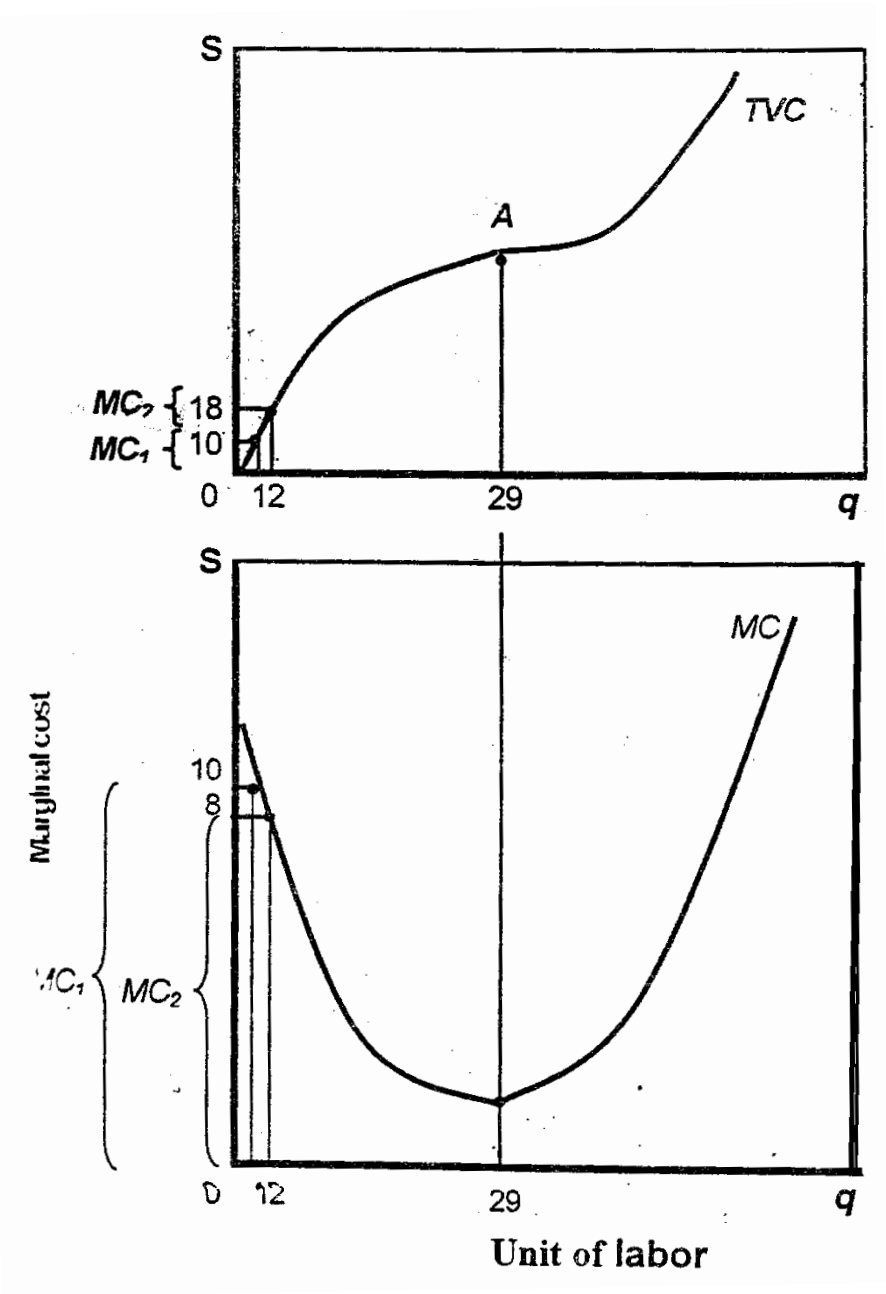
In the short run, every firm is constrained by some fixed factor of production. Having a fixed input implies diminishing returns) declining marginal product) and a limited capacity to produce.as that limit is approached marginal costs rise.

In the short-run, every firm is constrained by some fixed input that leads to diminishing returns to variable input and limits its capacity. As a firm approaches that to produce capacity, it becomes increasingly costly to produce successively higher levels of output marginal costs ultimately increase, with output in the short-run.

Graphing Total Variable Costs and Marginal Costs

Figure 5, shows how the total variable cost curve and the marginal cost curve of a typical firm might look. The numbers shown for the first two units of output are those arrived at by the frump producer (see Figure 3). Notice first that the shape of the marginal cost curve is consistent with short- run diminishing returns. At first MC declines, but eventually the fixed factor of production begins to constrain the firm, and marginal Cost rises. Up to 29 units of output, producing each successive unit of output costs slightly less than producing the one before. Beyond 29 units, however, the cost of each successive unit is greater than the one before.

Clearly, more output costs more in total than less output. Total variable costs (TVC), therefore always increase when output increases. Even though the cost of each additional unit changes total variable cost rises when output rises. Thus the total variable cost curve always has a positive slope.



The slope of the total variable cost curve varies, however. The slope of the curve reveals how quickly costs increase with output, and this relationship is reflected in marginal cost. Look carefully at the diagram in Figure 5. The marginal cost the first unit (MC_1) is $\$10$. Going from zero to one unit of output increases total variable cost by $\$10$, from zero to $\$10$. The point on the total variable cost curve at

two units is $18, but the cost of increasing production from one to two units – that is, the marginal cost of the second unit – is only $8.

Remember that the numerical value of the slope of a line is equal to the change in Y divided by the change in X; the slope of a total variable cost curve is thus the change in total variable cost divided by the change in output($\Delta TVC/\Delta q$). Since marginal cost is by definition the change in total variable cost resulting from an increase in output of one unit($\Delta q = 1$), marginal cost actually is the slope of the total variable cost curve:

$$\textbf{Slope of TVC} = \frac{\Delta\ \textbf{TVC}}{\Delta \textbf{q}} = \frac{\Delta\ \textbf{TVC}}{\textbf{1}} = \Delta\ \textbf{TVC} = \textbf{MC}$$

Notice that up to 29 units, marginal cost is decreasing and the variable cost curve is becoming flatter. The slope of the total variable cost curve is declining; that is, total variable cost increases, but at a decreasing rate. Beyond 29 units of output, marginal cost increases and the total variable cost curve gets steeper; total variable costs continue to increase, but at an increasing rate.

The point at which a decreasing slope becomes an increasing slope, or at which marginal cost stops declining and begins increasing, is referred to as inflection point. In Figure5, the inflection point is found at point A.

Average variable cost (AVC) A more complete picture of the costs of a hypothetical firm appears in Table 5. The second column shows total variable costs–derived, we assume, from information on input prices and technology. The third column derives marginal cost by simple subtraction. For example, raising output from three units to four units increases variable costs from $24 to $32, making the marginal cost of the fourth unit $8($32 – $240). The marginal cost of

the fifth unit is $\$10$, the difference between $\$32$(TVC) for four units and $\$42$ TVC for five units.

Average variable cost (AVC) is total variable cost divided by the number of units of output (q):

$$\text{AVC} = \frac{\text{AVC}}{\text{q}}$$

Table 5

Short-run cost of a hypothetical firm

(1) q	(2) TVC	(3) MC (ATVC)	(4) AVC (TVC/q)	(5) TFC	(6) TC (TVC+TFC)	(7) AFC (TFC/q)	(8) ATC TC/q or AFC +AVC
	$ 0	$	$	$1000	$1000	$	$
1	10	10	10	$1000	$1010	1000	1010
2	18	8	9	$1000	$1018	500	509
3	24	6	8	$1000	$1024	333	341
4	32	8	8	$1000	$1032	250	258
5	42	10	8.4	$1000	$1042	200	208.4
———	———	———	———	———	———	———	———
———	———	———	———	———	———	———	———
———	———	———	———	———	———	———	———
500	8000	20	16	1000	9000	2	18

In Table 5, the AVC in the fourth column is calculated by dividing the numbers in the second column (TVC) by the numbers in the first column (q). For example, if the total variable cost of producing five units of output is $42, then the average variable cost is $42 divided by five units, or $8.40.

The important distinction to remember here is as follows:

> **Marginal cost is the cost of one additional unit. Average variable cost is the average variable cost per unit of all the units being produced.**

The Relationship between Average Variable Cost and Marginal Cost

Average variable cost and marginal cost are related in a very specific way. When marginal cost is below average, average variable cost declines toward it. Think again of the test score analogy introduced in last chapter. If you have an average score of 85 on three exams, and you then receive a 75, your average will fall). In table 5, the average variable cost of producing two unit is $9 (TVC/q = $18 ÷ 2). The marginal cost of the third is $6, an amount lower than the marginal cost of the second unit. The average thus falls to $8 (24 ÷ 3).

Similarly, when marginal cost is above average variable cost, average variable cost increases toward it. If you had received a 95 on your last test instead of a 75, your average would have risen. In table 8.5 the average variable cost of four units is $8. The marginal cost of the fifth unit is $10, and the average rises to $8.40. It follows, then, that

> **Average variable cost always moves toward marginal cost.**

Graphing Total, Average Variable and Marginal Costs

The relationship between average variable cost and marginal cost can be illustrated graphically. Figure 6 duplicates the diagrams in Figure 5 but adds

average variable cost. As the graphs show, average variable cost follows marginal cost, but lags behind because it is the average of all previous units.

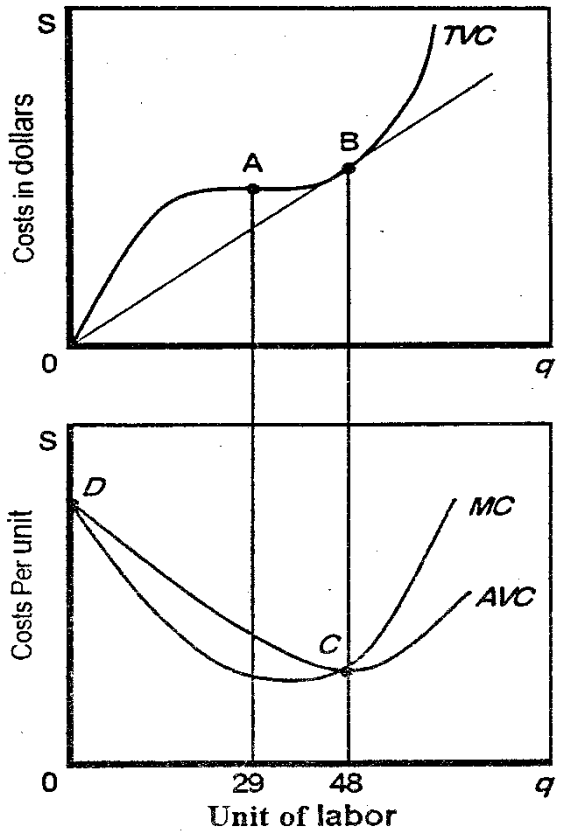


Figure 8.6

More short-Run Costs

The relationship between marginal cost and average cost is important. When marginal cost is below average cost, average cost is declining. When marginal cost is above average cost, average cost is increasing. If follows that rising marginal cost will intersect average variable cost at the minimum point of AVC. The marginal cost of the first unit is the same as the average variable cost of producing just that unit, so marginal cost and average variable cost start together at point D. (if the reason for this is not clear to you, go back to table 8.5 and review why for one unit AVC = MC = $10). Average variable costs from point D follow marginal cost down to point C. marginal cost begins to rise at 29 units,

but average cost does not begin to rise until marginal cost crosses it and rises above it this occurs at 48 units. Point C. it is always true that.

Marginal cost intersects average variable cost at the lowest, or minimum, point of AVC

Another example using test scores should help you to understand why this is so. Consider the following sequence of test scores: 95,85,92,88. The average of these four is 90. Now suppose you get an 80 on your fifth test. This score will drag down your average to 88. Now suppose that you get an 85 on your sixth test. This score is higher than 80, but it's still below your 88 average. As a result, your average continues to fall (from 88 to 97.5, even though your marginal test score rose. But if instead of an 85 you get an 89 – just one point over your average – you've turned your average around: it is now rising.

Total Costs

We are now ready to complete the cost picture by adding fixed costs to variable costs. Total cost (TC), you remember, is simply the sum of total fixed and total variable costs:

Total cost = total fixed cost + total variable cost

Total cost is graphed in figure 7, where the same vertical distance (equal to TFS which is constant) is simply added to TVC at every level of output. In table 5 the sixth column adds the fixed cost of $1000 to total variable cost to arrive at total cost.

Average total cost (ATC) average total cost (ATC) is total cost divided by the number of units of output (q)

$$\text{ATC} = \frac{\text{TC}}{\text{q}}$$

Column 8 in table 5 shows the result of dividing the numbers in column 6 by the numbers in column 1. For example, at five units of output, total cost is $1042; average total cost is $1042 divided by five, or $208.40. The average total cost of producing 500 units of output, however, is only $18- that is, 49000 divided by 500.

Another, more revealing, way of deriving average total cost is to add average variable cost and average fixed cost together:

$$\mathbf{ATC} = \mathbf{AFC} + \mathbf{AVC}$$

Look back at the derivation of average fixed cost in table 1 and figure 2. Because fixed cost is a constant number that does not change with output, average fixed cost, or TFC/q, is simply fixed cost (a constant number) divided by an ever-increasing number of units of output. This means that as output increases, average fixed cost declines steadily. If the output level is very high, average fixed cost is very small. The data used in figure 2, where the AFC of two units of output is $500, and in table 5, where the AFC drops to $200 at five units, show this quite clearly. If the firm goes on to produce 500 units of output, AFC declines to only $2 (see column 7 in Table 5)

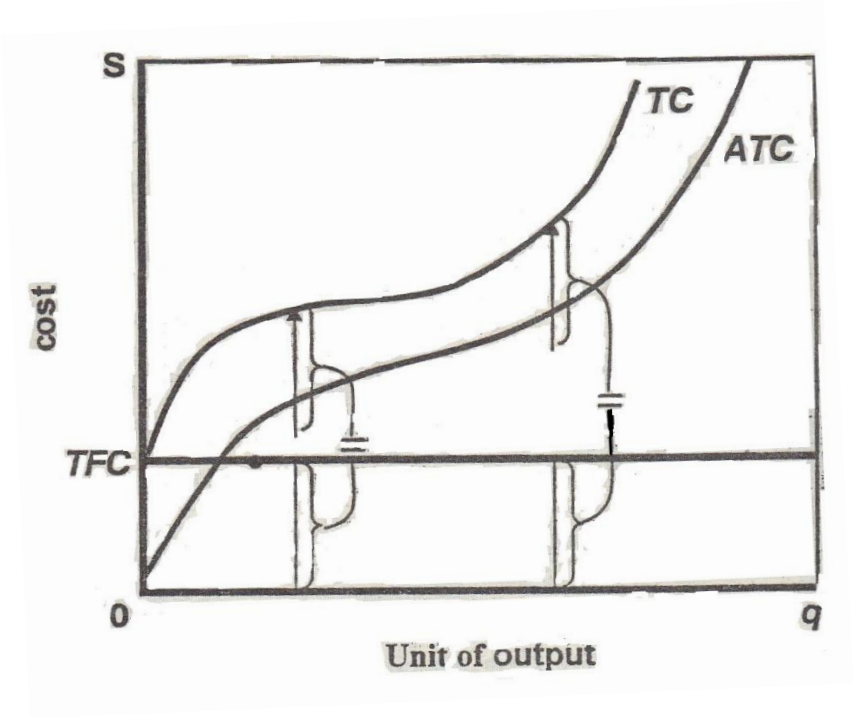


Figure 7

Total cost equal fixed cost plus variable cost

Adding total fixed cost to total variable cost means adding the same amount of total fixed cost to every level of total variable cost. Thus the total cost curve has the same shape as the total variable cost curve; it is simply higher by an amount equal to TFC.

We can also derive average total cost in a second way. The numbers in column 8 in table 5 can be derived either by dividing total cost by the quantity of output or by summing AVC and AFC from columns 4 and 7 respectively. In other words, ATC =AFC + AVC.

Figure 8 derives average total cost graphically. The bottom part of the figure graphs the average fixed cost from Figure 2. The top part shows the declining average fixed cost added to average variable cost at each level of output. Because AFC gets smaller and smaller, ATC gets closer and closer to AVC as output increases, but the two lines never cross.

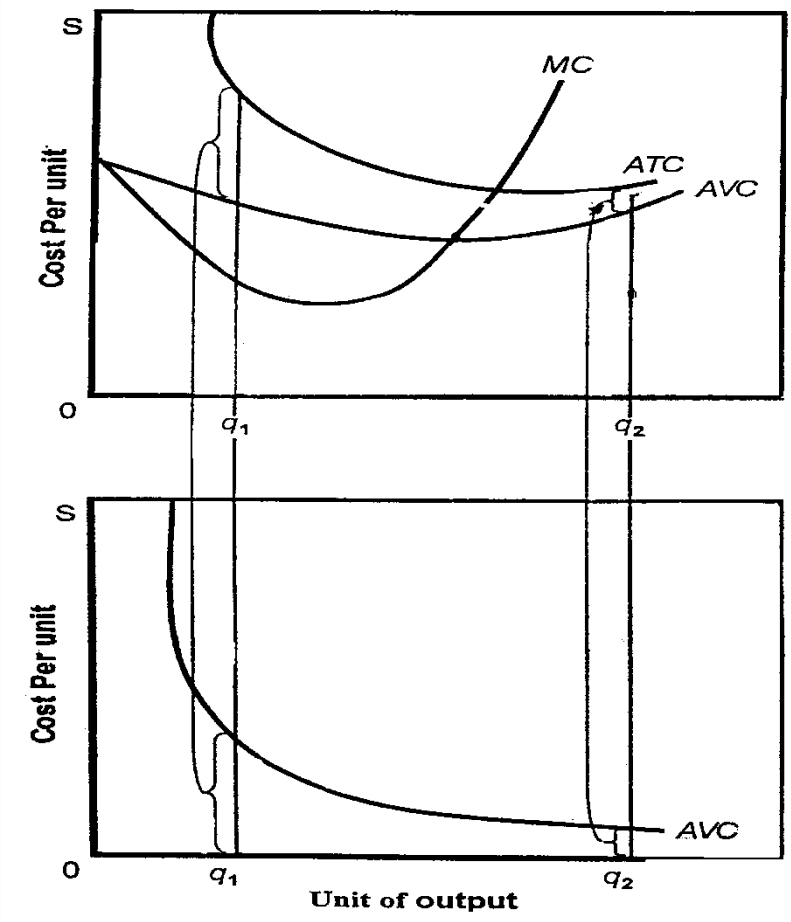


Figure 8

Average total cost = average variable cost + average fixed cost

To get average total cost, we add average fixed and average variable costs at all levels of output. Since average fixed cost falls with output, an ever-declining amount is added to AVC. Thus, AVC and ATC get closer together as output increases

The Relationship between Average Total Cost and Marginal Cost

The relationship between average total cost and marginal cost is exactly the same as the relationship between average variable cost and marginal cost. The average total cost curve follows the marginal cost curve, but lags behind because it is an average over all units of output. The average total cost curve lags behind the marginal cost curve even more than the average variable cost curve does, because the cost of each added unit of production is now averaged not only with the variable cost of all previous units produced, but with fixed costs as well.

Fixed costs equal $1000 and are incurred even when the output level is zero. Thus, the first unit of output in the example in Table 5 costs $10 in variable cost to produce. The second unit costs only $8 in variable cost to produce. The total cost of two unit is $1018; average total cost of the two is ($1010 + $8)/2, or 4509. The marginal cost of the third unit is only $6. The total cost of three units is thus $1024, or $1018 + $6, and the average total cost of three units is ($1010 + $8 + $7) /3, or $341.

As you saw with the test scores example, the marginal cost is what drives the changes in average total cost:

If marginal cost is below average total cost, average total cost will decline toward marginal cost, if marginal cost is above average total cost. Average total cost will increase. As a result, marginal cost intersects average total cost at ATC's minimum point, for the same reason that it intersects the average variable cost curve at its minimum point.

Short-Run Costs: A Review

Let us now pause for a moment to review what we have learned about the behavior of firms. We know that firms make three basic choices: how much product or output to produce or supply, how to produce that output, and how much of each input to demand in order to produce what they intend to supply. We assume that these choices are made in order to maximize profits. Profits are equal to the difference between a firm's revenue from the sale of its product and the costs of producing that product: profits = total revenue minus total cost.

So far, we have looked only at costs, but costs are only one part of the profit equation. To complete the picture, we must turn to the output market and see how these costs compare with the price that a product commands in the market before we do so, however, it is important to consolidate what we have said about costs.

Before a firm does anything else, it needs to know the different methods that it can use to produce its product. The technologies available determine the combinations of inputs there are needed to produce each level of output. Firms choose the technique that produces the desired level of output at least cost. The cost curves that result from the analysis of all this information show the cost of producing each level of output using the best available technology.

Remember that so far we have talked only about short-run costs. The curves we have drawn are therefore short-run cost curves. The shape of theses curves s determined in large measure by the assumptions that we make about the short run, especially the assumption that some fixed factor of production leads to diminishing returns. Given this assumption, marginal costs eventually rise, and average cost curves are likely to be U-shaped. After gaining a complete knowledge of how to produce a product and how much it will cost to produce it at each level of output, the firm turns to the market to find out what it can sell its product for. It is to the output market that we now turn our attention.

Exercises

Chapter Four

Short run costs and output decisions

Part A: True- false Questions

Circle whether the following statements True are (T) or false (F)

1- Variable costs are costs that change with the level of production

2- A firm's marginal cost is the change in its total cost divided by the change in its output

3- A firm's average total cost is $100 its average variable cost is $90, and its total fixed cost is $1,000. Its output is between 120 and 170 units.

4- A firm's average total cost is $80, its average variable cost is $75, and its output is 50 units its total fixed cost is between $200 and $300.

5- A firm's average variable cost is $60, its total fixed cost is $3,000, and its output is 600 units its average total cost is more than $64

6- The vertical distance between a firm's total cost (TC) and its total variable cost (TVC) curve is equal to the total fixed cost TFC

7- The marginal cost (MC) curve intersects the ATC and AVC curves at their minimum points.

8- The vertical distance between a firm's total cost curve (ATC) and its average variable cost curve (AVC) increases as output increases.

9- Total revenue equals price times quantity sold

10- For a monopoly the industry demand curve is the firm's demand curve

11- Monopolists are price takers.

Circle the appropriate answer

1- The firm's short-run marginal cost is the change in the short-run

a- total cost due to the use of one more unit of input

b- average cost due to the use of one more unit of input

c- total cost due to the production of more unit of output

d- average cost due to the production of one more unit of output

2- A firm profit-maximizing level of output generates a total revenue of $2000. The firm's costs are as follows: total cost = $4000, total variable cost = $1500, total fixed cost = $2500 in the short-run the firm should

a- leave output at its current level

b- increase output

c- decrease output

d- shut-down

3- The short run is a time period in which

A – all resources are fixed

b- the level of output is fixed

c- the size of the production plant is variable

d- some resources are fixed and other are variable

4- If you know that with 8 units of output average fixed cost is $12.50 and average variable cost is $81.25, then total cost at this output level is

a- $93.75 b- $97.78 c- $750 d- $880

5- With fixed costs of $400. A firm has average total costs of $3 and average variable costs of $2.50. its output is:

a- 200 units b- 400 units c- 800 units d- 1.600 units

6- If the short-run average variable costs of production for a firm are rising then this indicates that

a- average total costs are at a maximum

b- average fixed costs are constant

c- marginal costs are above average variable costs.

d- average variable costs are below average fixed costs.

7- Total cost is the sum of fixed costs and

a- implicit costs b- accounting costs

c- explicit costs d- variable costs.

8- Marginal cost is

a- all the costs of production of goods

b- all the costs of the fixed inputs

c- the change in the total cost resulting from a one unit change in output

d- all the costs that vary with output

9- A company could produce 99 units of a good for $\$316$ or produce 100 units of the same good for $\$320$. The marginal costs of 100^{th} unit

a- is $\$320$

b- is $\$3.20$

c- is $\$4.00$

d- cannot be calculated with this information

10- A company could produce 100 units of a good for $\$320$ or produce 101units of the same good for $\$324$. The $\$4$ difference in costs is

a- the marginal benefit of producing the 101^{st} unit.

b- the marginal cost of producing the 101^{st} unit.

c- both the marginal benefit and the marginal cost of producing the 101^{st} unit

d- neither the marginal benefit nor the marginal cost of producing the 101^{st} unit

11- Average total costs are total divided by

a- total fixed costs

b- total output

c- the total number of workers employed

d- total variable costs

According to the following table answer the questions of (12) to (17)

Cost schedule		
Output (units per day)	Total fixed cost (dollars)	Total variable cost (dollars)
0	20	0
4	20	25
9	20	50
13	20	75
16	20	100
18	20	125

12- In the above table the total cost of producing 9 units of output is

a- $20 b- $50 c- $70 d- $30

13- The above table shows a firm's

a- short-run and long-run costs

b- long -run costs

c- short-run costs

d- more information is needed to determine if the costs are long run costs or short-run costs

14- In the above table the total variable cost of producing 16 units of output is

a- $60 b- $20 c- $100 d- $120

15- Using the data in the above table when output increases from 4 to 9 units the marginal cost of one of those 5 units is

a- $4.25 b- $4.00 c- $6.25 d- $5.00

16- Using the data in the above table, the average fixed cost of product 9 units per day is

a- $2.22 b- $20.00 c- $5.00 d- $5.55

17- using the data in the above table, the average total cost of product 16 units per day is

a- $6.25 b- $1.25 c- $7.00 d- $7.50

According to the following table answer the questions of (18) to (23)

Cost schedule		
Output (units per day)	Total variable cost (dollars)	Total cost (dollars)
0	0	30
3	20	50
8	40	70
12	60	90
14	80	110
15	100	130

18- In the above table the total fixed cost is

a- $30 b- $50 c- $20 d- $0

19- In the above table the total fixed cost is 3 unit of output is

a- $30 b- $60 c- $90 d- $0

20- In the above table when output increases from 8 to 12 units, the marginal cost of one of those 4 unit is

a- $1.20 b- $15.00 c- $5.00 d- $2.00

21- In the above table, the average fixed cost of producing 15 units output is

a- $6.66 b- $0.50 c- $2.00 d- $8.66

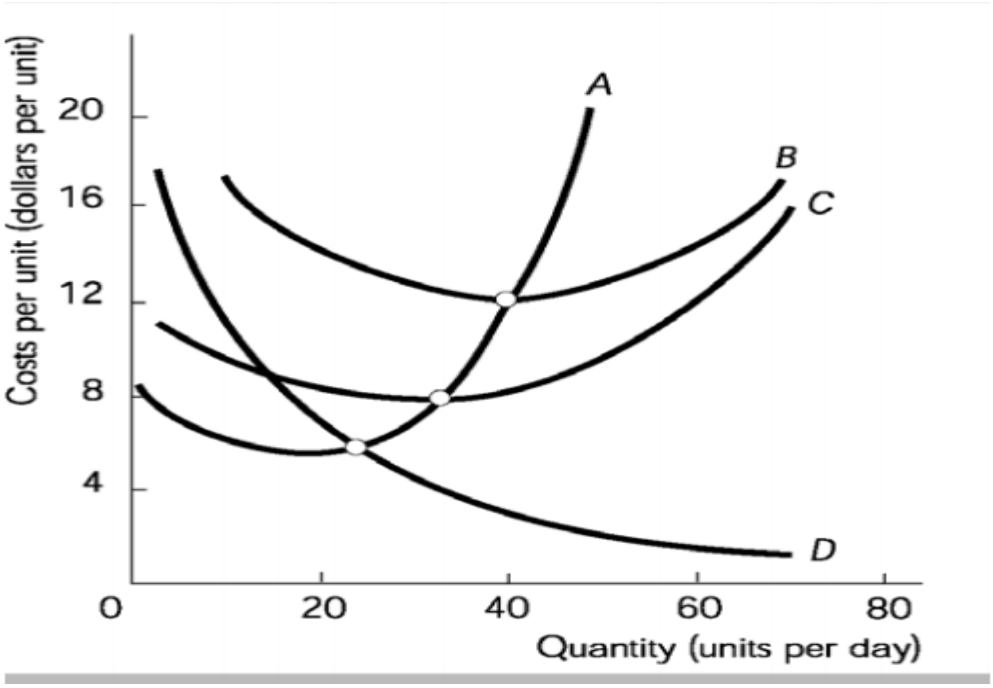
22- In the above table, the average variable cost of producing 14 units of output is

a- $0.175 b- $7.86 c- $5.71 d- $10.00

23- In the above table, the average total cost of producing 14 units output is

a- $5.71 b- $7.00 c- $7.86 d- $6.75

According to the following table answer the questions of (18) to (23)



24- In the above figure, the marginal cost curve is curve

a- A b- B c- C d- D

25- In the above figure, the average fixed cost curve is curve

a- A b- B c- C d- D

26- In the above figure, the average variable cost curve is curve

a- A b- B c- C d- D

27- In the above figure, the average total cost curve is curve

a- A b- B c- C d- D

28- In the above figure, as output increases. The distance between curves B and C decreases because

a- average fixed cost decreases as output increases

b- total cost decreases as output increases

c- there are increasing marginal costs as output increases

d- there are diminishing returns to average total cost

29- In the above figure, curve D slopes downward because

a- there are diminishing returns

b- average fixed cost decreases as output increases

c- all costs decrease as output increases

d- there are decreasing marginal costs

30- In the above figure, the intersection of curves A and C is the point at which

a- total product is maximized

b- average fixed cost is minimized

c- average variable cost is minimized

d- average total cost is minimized

31- In the above figure, the intersection of curves A and B is the point at which

a- average total cost is minimized

b- total product is maximized

c- average variable cost is minimized

d- average fixed cost is minimized

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Chapter Five

The Analysis Competitive Markets

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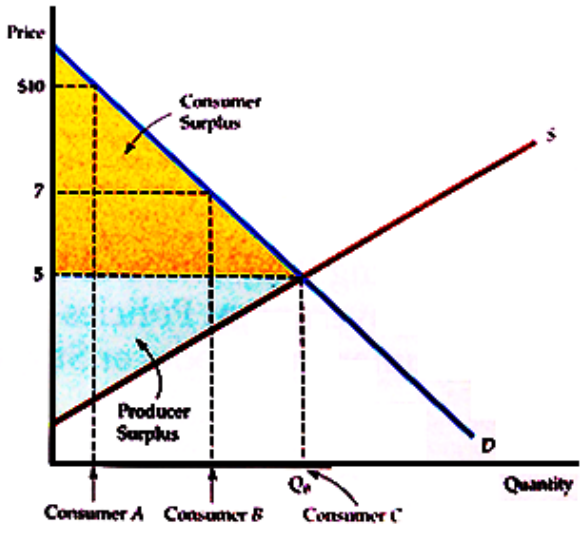
The Analysis Competitive Markets

Review of Consumer and Producer Surplus

In an unregulated, competitive market, consumers and producers buy and sell at the prevailing market price. But remember, for some consumers the value of the good exceeds this market price, they would pay more for the good if they had to Consumer surplus is the total benefit or value that consumers receive beyond what they pay for the good.

For example, suppose the market price is $5 per unit, as in Figure1. Some consumers probably value this good very highly and would pay much more than $5 for it Consumer A, for example, would pay up to $10 for the good. However, because the market price is only $5, he enjoys a net benefit of $5_the $10 value he places on the good, less the $5 he must pay to obtain it. Consumer B values the good somewhat less highly. She would be willing to pay $7, and thus enjoys a $2 net benefit. Finally, Consumer C values the good at exactly the market price, $5, He is indifferent between buying or not buying the good, and if the market price were one cent higher, he would forgo the purchase. Consumer C, therefore, obtains no net benefit.

FIGURE .1
CONSUMER AND PRODUCER SURPLUS
Consumer A would pay $10 for a good whose market price is $5 and therefore enjoys a benefit of $5 umer Benjoys a benefit of $2, and Consumer C, who values the good at exactly the market ce, enjoys no benefit. Consumer surplus, which measures the total benefit to all consumers, is the yellow-shaded area between the demand curve and the market price. Producer surplus measures the total profits of producers, plus rents to factor inputs. It is the green-shaded area between the supply curve and the market price. Together, consumer and producer surplus measure the welfare benefit of a competitive market.



For consumers in the aggregate, consumer surplus is the area between the demand curve and the market price (i.e., the yellow–shaded area in Figure 1). Because consumer surplus measures the total net benefit to consumers, we can measure the gain or loss to consumers from a government intervention by measuring the resulting change in consumer surplus.

Producer surplus is the analogous measure for producers. Some producers are producing units at a cost just equal to the market price. Other units, however, could be produced for less than the market price and would still be produced and sold even if the market price were lower. Producers, therefore, enjoy a benefit–a surplus–from selling those units. For each unit, this surplus is the difference between the market price the producer receives and the marginal cost of producing this unit.

For the market as a whole, producer surplus is the area above the supply curve up to the market price; this is the benefit that lower–cost producers enjoy by selling at the market price. In Figure 1, it is the green triangle. And because producer surplus measures the total net benefit to producers, we can measure the gain or loss to producers from a government intervention by measuring the resulting change in producer surplus.

Application of Consumer and Producer Surplus

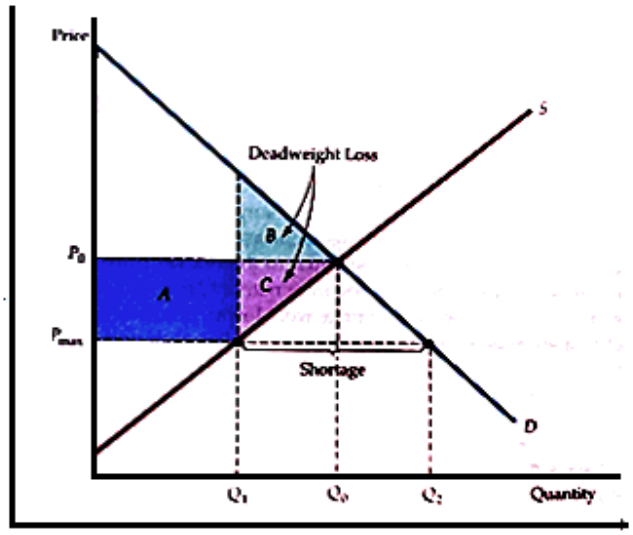
With consumer and producer surplus, we can evaluate the welfare effects of a government intervention in the market. We can determine who gains and who a loses from the intervention, and by how much. To see how this is done, let's return to the example of price controls that. The government makes it illegal for producers to charge more than a ceiling price set below the market–clearing level. Recall that by decreasing production and increasing the quantity demanded, such a price ceiling creates a shortage (excess demand).

Figure 2, it also shows the changes in consumer and producer surplus that result from the government price–control policy. Let's go through these changes step by step.

1. **Change in Consumer Surplus:** Some consumers are worse off as a result of the policy, and others are better off. The ones who are worse off are those who have been rationed out of the market because of the reduction in production and sales from Q_0, to Q_1. Other consumers, however, can still purchase the good (perhaps because they are in the right place at the right time or are willing to wait in line). These consumers are better off because they can buy the good at a lower price (P_{max} rather than P_0).

How much better off or worse off is each group? The consumers who can still buy the good enjoy an increase in consumer surplus, which is given by the blue–shaded rectangle A. This rectangle measures the reduction of price in each unit times the number of units consumers are able to buy at the lower price. On the other hand, those consumers who can no longer buy the good lose surplus; their loss is given by the green–shaded triangle B. This triangle measures the value to consumers, less what they would have had to pay, that is lost because of the reduction in output from Q_0 to Q_1. The net change in consumer surplus is therefore A–B. In Figure 2, because rectangle A is larger than triangle B, we know that the net change in consumer surplus is positive.

FIGURE .2
CHANGE IN CONSUMER AND PRODUCER SURPLUS FROM PRICE CONTROLS
The price of a good has been regulated to be no higher than P_{max} which is below the market-clearing price P_0. The gain to consumers is the difference between rectangle A and triangle B. The loss to producers is the sum of rectangle A and triangle C. Triangles B and C together measure the deadweight loss from price controls.



It is important to stress that we have assumed that those consumers who are able to buy the good are the ones who value it most highly, If that were not the case–e.g, if the output Q_1, were rationed randomly–the amount of lost consumer surplus would be larger than triangle B. In many cases, there is no reason to expect that those consumers who value the good most highly will be the ones who are able to buy it. As a result, the loss of consumer surplus might greatly exceed triangle B, making price controls highly inefficient.

In addition, we have ignored the opportunity costs that arise with rationing For example, those people who want the good might have to wait in line to obtain it In that case, the opportunity cost of their time should be included as part of lost consumer surplus.

2 Change in Producer Surplus: With price controls, some producers (those with relatively lower costs) will stay in the market but will receive a lower price for their output, while other producers will leave the market. Both groups will lose producer surplus. Those who remain in the market and produce quantity Q_1 are now receiving a lower price. They have lost the producer surplus given by rectangle A. However, total production has also dropped. The purple–shaded triangle C measures the additional loss of producer surplus for those producers who have left the market and those who have stayed in the market but are producing less.

Therefore the total change in producer surplus is – A – C Producers clearly lose as a result of price controls

3. Deadweight Loss: Is the loss to producers from price controls offset by the gain to consumers? No. As Figure 2. shows, price controls result in a net loss of total surplus, which we call a deadweight loss. Recall that the change in consumer surplus is A – B and that the change in producer surplus is – A – C . The total change in surplus is therefore (A – B) + (–A – C) = –B – C .We thus have a deadweight loss, which is given by the two triangles B and C in Figure 2. This deadweight loss is an inefficiency caused by price controls; the loss in producer surplus exceeds the gain in consumer surplus

If politicians value consumer surplus more than producer surplus, this deadweight loss from price controls may not carry much political weight However, if the demand curve is very inelastic, price controls can result in a net loss of consumer surplus, as Figure 3 shows. In that figure, triangle B, which measures the loss to consumers who have beer rationed out of the market, is larger than rectangle A, which measures the gain to consumers able to buy the good. Here, because consumers value the good highly, those who are rationed out suffer a large loss.

The demand for gasoline is very inelastic in the short run (but much more elastic in the long run). During the summer of 1979, gasoline shortages resulted from oil price controls that prevented domestic gasoline prices from increasing to rising world levels. Consumers spent hours waiting in line to buy gasoline. This was a good example of price controls making consumers–the group whom the policy was presumably intended to protect worse off.

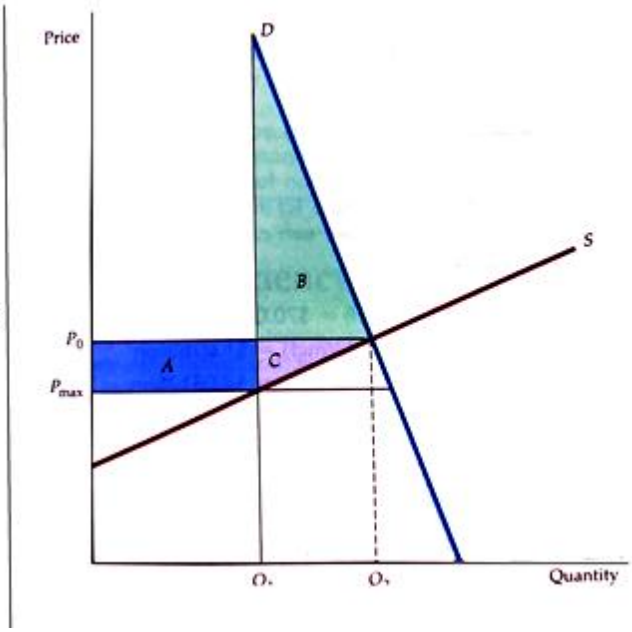


FIGURE 3
EFFECT OF PRICE CONTROLS WHEN DEMAND IS INELASTIC
If demand is sufficiently inelastic, triangle B can be larger than rectangle A. In this case, consumers suffer a net loss from price controls.

Price Supports and Production Quotas

Besides imposing a minimum price, the government can increase the price of a good in other ways. Much of American agricultural policy is based on a system of price supports, whereby the government sets the market price of a good above the free–market level and buys up whatever output is needed to maintain that price. The government can also increase prices by restricting production, either directly or through incentives to producers. In this section, we show how these policies work and examine their impact on consumers, producers, and the federal budget.

Price Supports

In the United States, price supports aim to increase the prices of dairy products, tobacco, con, peanuts, and so on, so that the producers of those goods can receive higher incomes. Under a price support program, the government sets a support price P_S, and then buys up whatever output is needed to keep the market price at this level. Figure 4 illustrates this. Let's examine the resulting gains and losses to consumers, producers, and the government.

CONSUMERS At price P_s, the quantity that consumers demand falls to Q_1, but the quantity supplied increases to Q_2, To maintain this price and avoid having inventories pile up in producer warehouses, the government must buy the quantity $Q_8 = Q_2 - Q_1$. In effect, because the government adds its demand Q_g, to the demand of consumers, producers can sell all they want at price P_s.

Because those consumers who purchase the good must pay the higher price P_s, instead of P_0, they suffer a loss of consumer surplus given by rectangle A. Because of the higher price, other consumers no longer buy the good or buy less of it, and their loss of surplus is given by triangle B. So, as with the minimum price that we examined above, consumers lose, in this case by an amount

$$\Delta CS = -A - B$$

PRODUCERS On the other hand, producers gain (which is why such a policy is implemented). Producers are now selling a larger quantity Q_2, instead of Q_0, and at a higher price P_s,Observe from Figure 4 that producer surplus increases by the amount

$$\Delta PS = A + B + D$$

THE GOVERNMENT But there is also a cost to the government (which must be paid for by taxes, and so is ultimately a cost to consumers). That cost is $(Q_2 - Q_1)P_s$.which is what the government must pay for the output it purchases. In Figure 4, this amount is represented by the large speckled rectangle. This cost may be reduced if the government can "dump" some of its purchases–i.e., sell them abroad at a low price. Doing so, however, hurts the ability of domestic producers to sell in foreign markets, and it is domestic producers that the government is trying to please in the first place.

What is the total welfare cost of this policy? To find out, we add the change in consumer surplus to the change in producer surplus and then subtract the cost to the government Thus the total change in welfare is

$$\Delta CS + \Delta PS \text{ Cost to Govt.} = D - (Q_2 - Q_1)P_S,$$

In terms of Figure 4, Society as a whole is worse off by an amount given by the large speckled rectangle, less triangle D.

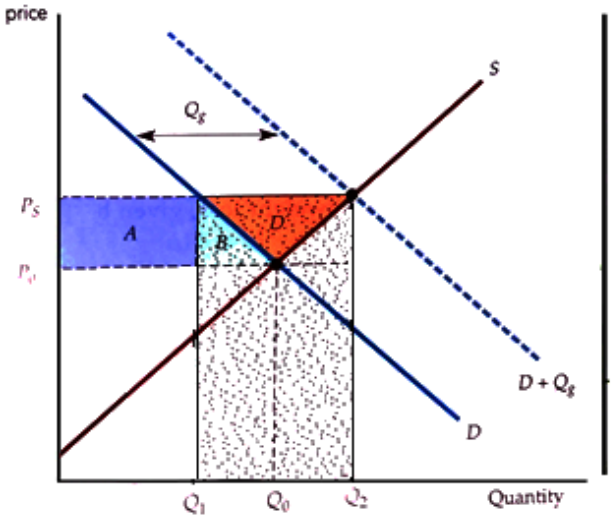


FIGURE 4
PRICE SUPPORTS

To maintain a price P_s above the market-clearing price P_0 the government buys a quantity Q_g. The gain to producers is $A + B + D$. The loss to consumers is $A + B$, the cost to the government is the speckled rectangle, the area of which is $P_s(Q_2 - Q_1)$.

As we will see, this welfare loss can be very large. But the most unfortunate part of this policy is the fact that there is a much more efficient way to help farmers. If the objective is to give farmers an additional income equal to A + B + D, it is far less costly to society to give them this money directly rather than via price supports. Because price supports are costing consumers A + B anyway, by paying farmers directly, society saves the large speckled rectangle, less triangle D. So why doesn't the government simply give farmers money? Perhaps because price supports are a less obvious giveaway and, therefore, politically more attractive.

Production Quotas

Besides entering the market and buying up output – thereby increasing total demand–the government can also cause the price of a good to rise by reducing supply. It can do this by decree–that is, by simply setting quotas on how much each firm can produce. With appropriate quotas, the price can then be forced up to any arbitrary level.

As we will see, this is how many city governments maintain high taxi fares. They limit total supply by requiring each taxicab to have a medallion, and then limit the total number of medallions. Another example is the control of liquor licenses by state governments, By requiring any bar or restaurant that serves alcohol to have a liquor license and then limiting the number of licenses, entry by new restaurateurs is limited, which allows those who have licenses to earn higher prices and profit margins.

The welfare effects of production quotas are shown in Figure 5. The government restricts the quantity supplied to Q_1, rather than the market–clearing level Q_0 Thus the supply curve becomes the vertical line S' at Q_1. Consumer surplus is reduced by rectangle A (those consumers who buy the good pay a higher price) plus triangle B (at this higher price, some consumers no longer purchase the good). Producers gain rectangle A (by selling at a higher price) but lose triangle C (because they now produce and sell Q_1 rather than Q_0). Once again, there is a deadweight loss, given by triangles B and C.

INCENTIVE PROGRAMS In US, agricultural policy, output is reduced by incentives rather than by outright quotas. Acreage limitation programs give farmers financial incentives to leave some of their acreage idle, Figure 5 also shows the welfare effects of reducing supply in this way. Note that because farmers agree to limit planted acreage, the supply curve again becomes completely inelastic at the quantity Q_1, and the market price is increased from P_0, to P_s.

As with direct production quotas, the change in consumer surplus is

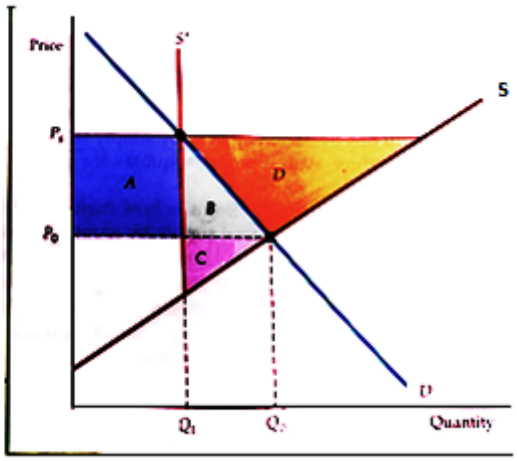
$$\Delta CS = - A - B$$

Farmers now receive a higher price for the production (Q_1, which corresponds to a gain in surplus of rectangle A. But because production is reduced from Q_0 to Q_1, there is a loss of producer surplus corresponding to triangle C. Finally, farmers

receive money from the government as an incentive to reduce production. Thus the total change in producer surplus is now

$$\Delta PS = A - C + \text{Payments for not producing}$$

FIGURE 5
SUPPLY RESTRICTIONS
To maintain a price P_s above the market-clearing price P_0, the government can restrict supply to Q_1 either by imposing production quotas (as with taxicab medallions) or by giving producers a financial incentive to reduce output (as with acreage limitations in agriculture) For an incentive to work, it must be at least as large as B + C + D, which would be the additional profit earned by planting, given the higher price P_s. The cost to the government is therefore at least B + C + D.



The cost to the government is a payment sufficient to give farmers an incentive to reduce output to Q_1 . That incentive must be at least as large as B + C + D because that area represents the additional profit that could be made by planting. given the higher price P_S. (Remember that the higher price P, gives farmers an incentive to produce more even though the government is trying to get them in produce less) Thus the cost to the government is at least B + C + D, and the total change in producer surplus is

$$\Delta PS = A - C + B + C + D = A + B + D$$

This is the same change in producer surplus as with price supports maintained by government purchases of output. (Refer to Figure 4.) Farmers, then, should be indifferent between the two policies because they end up gaining the same amount of money from each. Likewise, consumers lose the same amount of money.

Which policy costs the government more? The answer depends on whether the sum of triangles B + C + D in Figure 5 is larger or smaller than $(Q_2 - Q_1)P_S$ (the large

speckled rectangle) in Figure 4. Usually it will be smaller, so that an acreage–limitation program costs the government (and society) less than price supports maintained by government purchases.

Still, even an acreage–limitation program is more costly to society than simply handing the farmers money, The total change in welfare (ΔCS + ΔPS – Cost to Govt.) under the acreage–limitation program is

$$\Delta\text{Welfare} = -A - B + A + B + D - B - C - D = -B - C$$

Society would clearly be better off in efficiency terms if the government simply gave the farmers A + B + D, leaving price and output alone. Farmers would then gain A + B + D and the government would lose A + B+ D, for a total welfare change of zero, instead of a loss of B + C. However, economic efficiency is not always the objective of government policy

Import Quotas and Tariffs

Many countries use import quotas and tariffs to keep the domestic price of a product above world levels and thereby enable the domestic industry to enjoy higher profits than it would under free trade. As we will see, the cost to taxpayers from this protection can be high, with the loss to consumers exceeding the gain to domestic producers.

Without a quota or tariff, a country will import a good when its world price is below the price that would prevail domestically were there no imports. Figure 6 illustrates this principle. S and D are the domestic supply and demand curves. If there were no imports, the domestic price and quantity would be P_0, and Q_0, which equate supply and demand But because the world price P_w is below P_0, domestic consumers have an incentive to purchase from abroad and will do so if imports are not restricted. How much will be imported? The domestic price will fall to the world priceP_w ; at this lower price, domestic production will fall to Q_s, and domestic

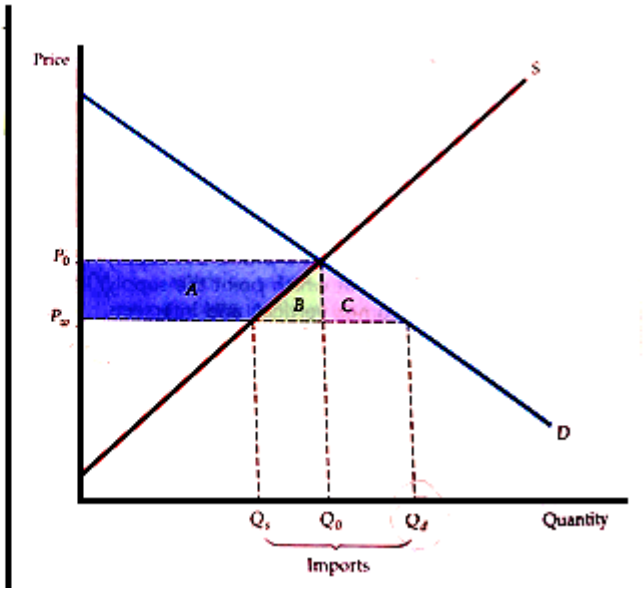
consumption will rise to Q_d, Imports are then the difference between domestic consumption and domestic production, $Q_d - Q_s$.

Now suppose the government, bowing to pressure from the domestic industry, eliminates imports by imposing a quota of zero–that is, forbidding any importation of the good. What are the gains and losses from such a policy?

With no imports allowed, the domestic price will rise to P_0. Consumers who still purchase the good (in quantity Q_0) will pay more and will lose an amount of surplus given by trapezoid A and triangle B. In addition, given this higher price, some consumers will no longer buy the good, so there is an additional loss of consumer surplus, given by triangle C. The total change in consumer surplus is therefore

$$\Delta CS = - A - B - C$$

FIGURE 6
IMPORT TARIFF OR QUOTA THAT ELIMINATES IMPORTS
In a free market, the domestic price equals the world price P_W. A total Q_d is consumed, of which Q_s is supplied domestically and the rest imported.
When imports are eliminated, the price is increased to P_0. The gain to producers is trapezoid A. The loss to consumers is A + B + C, so the deadweight loss is B+C.



What about producers? Output is now higher (Q_0 instead of Q_s) and is sold at a higher price (P_0, instead of P_w). Producer surplus therefore increases by the amount of trapezoid A:

$$\Delta PS = A$$

The change in total surplus, ΔCS + ΔPS, is therefore – B – C. Again, there is a deadweight loss–consumers lose more than producers gain.

Imports could also be reduced to zero by imposing a sufficiently large tariff. The tariff would have to be equal to or greater than the difference between P_0, and P_w With a tariff of this size, there will be no imports and, therefore, no government revenue from tariff collections, so the effect on consumers and producers would be the same as with a quota.

More often, government policy is designed to reduce but not eliminate imports. Again, this can be done with either a tariff or a quota, as Figure 7 shows. Under free trade, the domestic price will equal the world price P_w, and imports will be Q_d – Q_s. Now suppose that a tariff of T dollars per unit is imposed on imports. Then the domestic price will rise to P* (the world price plus the tariff); domestic production will rise and domestic consumption will fall.

In Figure 7, this tariff leads to a change of consumer surplus given by

$$\Delta CS = - A - B - C - D$$

The change in producer surplus is again

$$\Delta PS = A$$

Finally, the government will collect revenue in the amount of the tariff times the quantity of imports, which is rectangle D. The total change in welfare, ΔCS plus ΔPS plus the revenue to the government, is therefore – A – B – C – D + A + D = – B – C Triangles B and C again represent the deadweight loss from restricting imports. (B represents the loss from domestic overproduction and C the loss from too little consumption.)

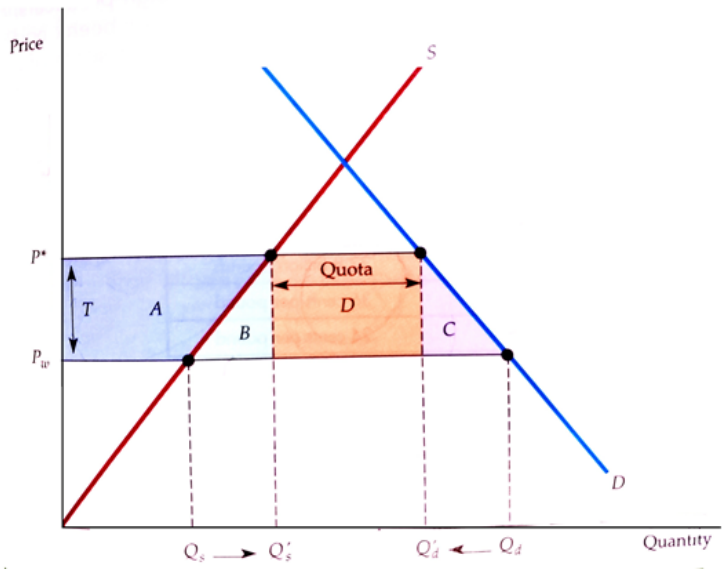


FIGURE 7
IMPORT TARIFF OR QUOTA (GENERAL CASE)
When imports are reduced, the domestic price is increased from P_W to P^*, This can be achieved by a quota, or by a tariff $T = P^* - P_W$, Trapezoid A is again the gain to domestic producers. The loss to consumers is A + B + C + D. If a taritt is used, the government gains D, the revenue irom the tariff, so the net domestic loss is B+ C. If a quota is used instead, rectangle D becomes part of the profits of foreign producers, and the net domestic loss is B+C+ D.

Suppose the government uses a quota instead of a tariff to restrict imports: Foreign producers can only ship a specific quantity $(Q'_d, - Q'_s$ in Figure 7) to the United States and can then charge the higher price P* for their U.S. sales. The changes in U.S. consumer and producer surplus will be the same as with the tariff, but instead of the U.S. government collecting the revenue given by rectangle D, this money will go to the foreign producers in the form of higher profits. The United States as a whole will be even worse off than it was under the tariff, losing D as well as the deadweight loss B and C.

This situation is exactly what transpired with automobile imports from Japan in the 1980s. Under pressure from domestic automobile producers, the Reagan administration negotiated "voluntary" import restraints, under which the Japanese agreed to restrict shipments of cars to the United States. The Japanese could therefore sell those cars that were shipped at a price higher than the world level and capture a higher profit margin on each one. The United States would have been better off by simply imposing a tariff on these imports.

The Impact of a Tax or Subsidy

What would happen to the price of widgets if the government imposed a$1 tax on every widget sold? Many people would answer that the price would increase by a dollar, with consumers now paying a dollar more per widget than they would have paid without the tax. But this answer is wrong.

Or consider the following question. The government wants to impose a 50 cent–per– gallon tax on gasoline and is considering two methods of collecting it Under Method 1, the owner of each gas station would deposit the tax money (50 cents times he number of gallons sold) in a locked box, to be collected by a government agent. Under Method 2, the buyer would pay the tax (50 cents times the number of gallons purchased) directly to the government. Which method costa the buyer more? Many people would nay Method 2, but this answer is also wrong

The burden of a tax (or the benefit of a subsidy) falls partly on the consumer and partly on the producer. Furthermore, it does not matter who puts the money in the collection box (or sends the check to the government)_Methods 1 and 2 both cost the consumer the same amount of money. As we will see, the share of a tax borne by consumers depends on the shapes of the supply and demand curves and, in particular, on the relative elasticities of supply and demand, As for our first question, a $1 tax on widgets would indeed cause the price to rise, but usually by less than a dollar and sometimes by much less. To understand why, let's use supply and demand curves to see how consumers and producers are affected when a tax is imposed on a product, and what happens to price and quantity.

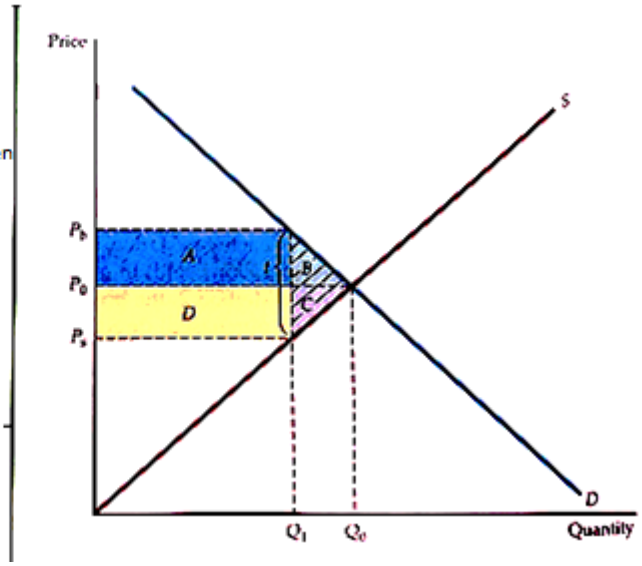
THE EFFECTS OF A SPECIFIC TAX For the sake of simplicity, we will consider a specific tax a tax of a certain amount of money per unit sold. This is in contrast to an ad valorem (i.e., proportional) tax, such as a state sales tax. (The analysis of an ad valorem tax is roughly the same and yields the same qualitative results) Examples of specific taxes include federal and state taxes on gasoline and cigarettes.

Suppose the government imposes a tax of t cents per unit on widgets. Assuming that everyone obeys the law, the government must then receive t cents for every widget sold. This means that the price the buyer pays must exceed the net price the seller receives by t cents. Figure 8 illustrates this simple accounting relationship– and its implications. Here, P_0, and Q_0, represent the market price and quantity before the tax is imposed. P_b, is the price that buyers pay, and P_s, is the net price that sellers receive after the tax is imposed. Note that $P_b - P_s$= t, so the government is happy.

How do we determine what the market quantity will be after the tax is imposed, and how much of the tax is borne by buyers and how much by sellers? First, remember that what buyers care about is the price that they must pay: P_b The amount that they will buy is given by the demand curve; it is the quantity that we read off of the demand curve given a price P_b, Similarly, sellers care about the net price they receive, P_s. Given P_s, the quantity that they will produce and sell is read off the supply curve Finally, we know that the quantity sold must equal the quantity bought. The solution, then, is to find the quantity that corresponds to a price of P_b, on the demand curve, and a price of P_s on the supply curve, such that the difference P_b, – P_s, is equal to the tax t. In Figure 8, this quantity is shown as Q_1.

Who bears the burden of the tax? In Figure 8, this burden is shared roughly equally by buyers and sellers. The market price (the price buyers pay) rises by half of the tax, and the price that sellers receive falls by roughly half of the tax.

FIGURE 8
INCIDENCE OF A TAX
P_b, is the price (including the tax) paid by buyers
P_s is the price that sellers receive, less the tax.
Here the burden of the tax is split evenly between buyers and sellers. Buyers lose A + B sellers lose D + C and the government earns A + Din revenue.
The deadweight loss is B + C



As Figure 8 shows, market clearing requires Jour conditions to be satisfied after the tax is in place:

1. The quantity sold and the buyer's price P_b, must lie on the demand curve (because buyers are interested only in the price they must pay).

2. The quantity sold and the seller's price P_s must lie on the supply curve (because sellers are concerned only with the amount of money they receive net of the tax).

3. The quantity demanded must equal the quantity supplied (Q_1 in the figure).

4. The difference between the price the buyer pays and the price the seller receives must equal the tax t.

These conditions can be summarized by the following four equations:

$$Q^D = Q^D(P_b) \qquad (9.1a)$$

$$Q^s = Q^s(P_s) \qquad (9.1b)$$

$$Q^D = Q^s \qquad (9.1c)$$

$$P_b - P_s = t \qquad (9.1d)$$

If we know the demand curve $Q^D(P_b)$, the supply curve $Q^s(P_s)$, and the size of the tax t, we can solve these equations for the buyers' price P_b, the sellers' price P_s, and the total quantity demanded and supplied. This task is not as difficult as it may seem.

Figure 8 also shows that a tax results in a deadweight loss. Because buyers pay a higher price, there is a change in consumer surplus given by

$$\Delta CS = -A - B$$

Because sellers now receive a lower price, there is also a change in producer surplus given by

$$\Delta PS = -C - D$$

Government tax revenue is tQ_1, the sum of rectangles A and D. The total charnge in welfare, ΔCS plus ΔPS plus the revenue to the government, is therefore $-A - B - C - D + A + D = -B - C$. Triangles B and C represent the deadweight loss from the tax.

In Figure 8, the burden of the tax is shared almost evenly between buyers and sellers, but this is not always the case. If demand is relatively inelastic and supply is relatively elastic, the burden of the tax will fall mostly on buyers. Figure **9**. (a) shows why: It takes a relatively large increase in price to reduce the quantity demanded by even a small amount, whereas only a small price decrease is needed to reduce the quantity supplied. For example, because cigarettes are addictive, the elasticity of demand is small (about -0.4); thus federal and state cigarette taxes are borne largely by cigarette buyers.

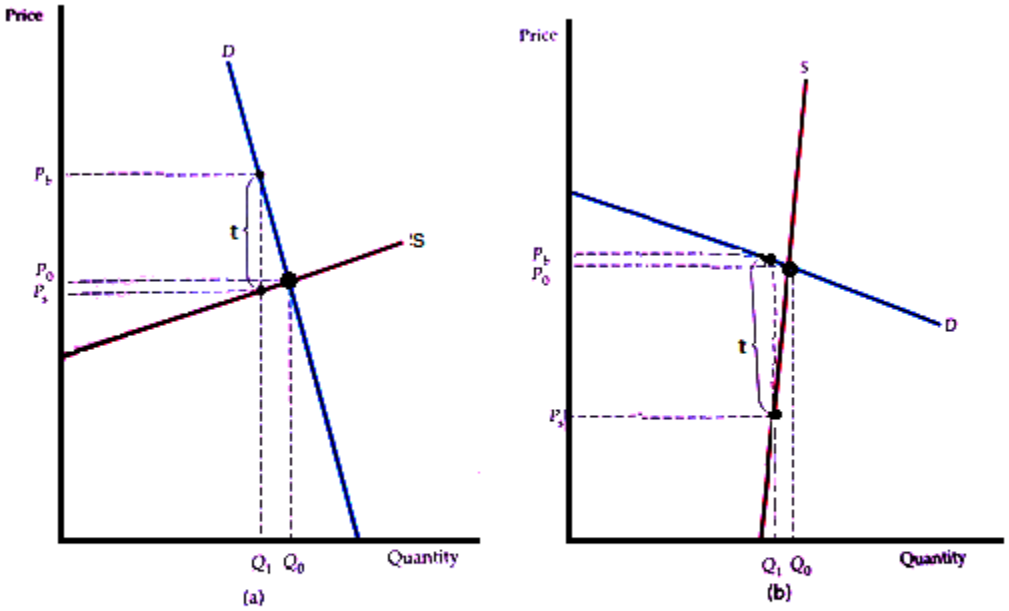


FIGURE 9

MPACT OF A TAX DEPENDS ON ELASTICITIES OF SUPPLY AND DEMAND

a) If demand is very inelastic relative to supply, the burden of the tax falls mostly on buyers

b)If demand is very elastic relative to supply, it falls mostly on sellers.

Figure 9. (b) shows the opposite case: If demand is relatively elastic and supply is relatively inelastic, the burden of the tax will fall mostly on sellers.

So even if we have only estimates of the elasticities of demand and supply at a point or for a small range of prices and quantities, instead of the entire demand and supply curves, we can still roughly determine who will bear the greatest burden of a tax (whether the tax is actually in effect or is only under discussion as a policy option). In general, a tax falls mostly on the buyer if E_d/E_s is small, and mostly on the seller if E_d/E_s, is large.

In fact, by using the following "pass–through" formula, we can calculate the percentage of the tax borne by buyers:

$$\text{Pass–through fraction} = E_s/(E_s, - E_d)$$

This formula tells us what fraction of the tax is "passed through" to consumers in the form of higher prices. For example, when demand is totally inelastic, so that E_d, is zero, the pass–through fraction is 1 and all the tax is borne by consumers. When

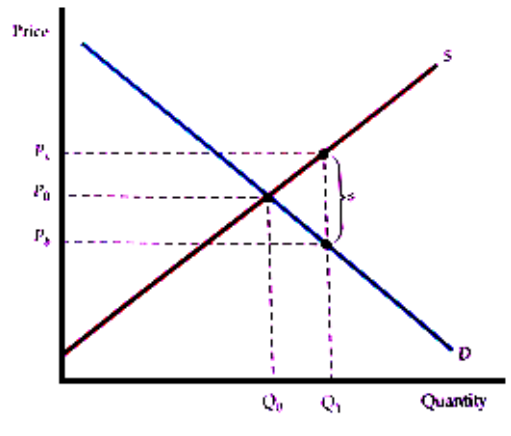
demand is totally elastic, the pass–through fraction is zero and producers bear all the tax. (The fraction of the tax that producers bear is given by $-E_d/(E_s, -E_d)$.

The Effects of a Subsidy

A subsidy can be analyzed in much the same way as a tax–in fact, you can think of a subsidy as a negative tax. With a subsidy, the sellers' price exceeds the buyers' price, and the difference between the two is the amount of the subsidy. As you would expect, the effect of a subsidy on the quantity produced and consumed is just the opposite of the effect of a tax–the quantity will increase.

Figure 10 illustrates this. At the presubsidy market price P_0, the elasticities of supply and demand are roughly equal. As a result, the benefit of the subsidy is shared roughly equally between buyers and sellers. As with a tax, this is not always the case. In general, the benefit of a subsidy accrues mostly to buyers if E_d/E_s, is small and mostly to sellers if E_d/E_s, is large.

FIGURE 10
SUBSIDY
A subsidy can be thought of as a negative tax. Like a tax, the benefit of a subsidy is split between buyers and sellers, depending on the relative elasticities of supply and demand.



As with a tax, given the supply curve, the demand curve, and the size of the subsidy s, we can solve for the resulting prices and quantity. The same four conditions needed for the market to clear apply for a subsidy as for a tax, but now the difference between the sellers' price and the buyers' price is equal to the subsidy. Again, we can write these conditions algebraically:

$$Q^D = Q^D(P_b) \quad (.2a)$$

$$Q^s = Q^s(P_s) \quad (.2b)$$

$$Q^D = Q^s \quad (.2c)$$

$$P_s - P_b = t \quad (.2d)$$

Chapter Six

Market Power: Monopoly and Monopsony

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In a perfectly competitive market, the large number of sellers and buyers of a good ensures that no single seller or buyer can affect its price. The market forces of supply and demand determine price. Individual firms take the market price as a given in deciding how much to produce and sell, and consumers take it as a given in deciding how much to buy.

Monopoly and monopsony, the subjects of this chapter, are the polar opposites of perfect competition. A monopoly is a market that has only one seller but many buyers, A monopsony is just the opposite: a market with many sellers but only one buyer. Monopoly and monopsony are closely related, which is why we cover them in the same chapter.

Fist we discuss the behavior of a monopolist. Because a monopolist is the sole producer of a product, the demand curve that it faces is the market demand curve. This market demand curve relates the price that the monopolist receives to the quantity it offers for sale. We will see how a monopolist can take advantage of its control over price and how the profit–maximizing price and quantity differ from what would prevail in a competitive market.

In general, the monopolist's quantity will be lower and its price higher than the competitive quantity and price. This imposes a cost on society because fewer consumers buy the product, and those who do pay more for it. This is why antitrust laws exist which forbid firms from monopolizing most markets. When economies of scale make monopoly desirable– for example, with local electric power companies– we will see how the government can increase efficiency by regulating the monopolist's price.

Pure monopoly is rare, but in many markets only a few firms compete with each other. The interactions of firms in such markets can be complicated and often involve aspects of strategic gaming, a topic covered. In any case, the firms may be able to affect price and may find it profitable to charge a price higher than marginal cost. These firms have monopoly power. We will discuss the determinants of monopoly power, its measurement, and its implications for pricing.

Next we will turn to monopsony. Unlike a competitive buyer, a monopsonist pays a price that depends on the quantity that it purchases. The monopolist's problem is to choose the quantity that maximizes its net benefit from the purchase–the value derived from the good less the money paid for it. By showing how the choice is made, we will demonstrate the close parallel between monopsony and monopoly.

Although pure monopsony is also unusual, many markets have only a few buyers who can purchase the good for less than they would pay in a competitive market. These buyers have monopsony power. Typically, this situation occurs in markets for inputs to production. For example, General Motors, the larges U.S. car manufacturer, has monopsony power in the markets for tires, car batteries, and other parts. We will discuss the determinants of monopsony power, its measurement, and its implications for pricing.

Monopoly and monopsony power are two forms of market power: the ability–of either a seller or a buyer–to affect the price of a good. Because sellers or buyers often have at least some market power (in most real–world markets), we need to understand how market power works and how it affects producers and consumers.

Monopoly

As the sole producer of a product, a monopolist is in a unique position. If the monopolist decides to raise the price of the product, it need not worry about competitors who, by charging lower prices, would capture a larger share of the market at the monopolist's expense. The monopolist is the market and completely controls the amount of output offered for sale.

But this does not mean that the monopolist can charge any price it wants–at least not if its objective is to maximize profit. This textbook is a case in point. Pearson Prentice Hall owns the copyright and is therefore a monopoly producer of this book. So why doesn't it sell the book for $\$500$ a copy? Because few people would buy it, and Prentice Hall would earn a much lower profit.

To maximize profit, the monopolist must first determine its costs and the characteristics of market demand. Knowledge of demand and cost is crucial for a firm's economic decision making. Given this knowledge, the monopolist must then decide how much to produce and sell. The price per unit that the monopolist receives then follows directly from the market demand curve. Equivalently, the monopolist can determine price, and the quantity it will sell at that price follows from the market demand curve

Average Revenue and Marginal Revenue

The monopolist's average revenue–the price it receives per unit sold is precisely the market demand curve. To choose its profit–maximizing output level, the monopolist also needs to know its marginal revenue: the change in revenue that results from a unit change in output. To see the relationship among total, average, and marginal revenue, consider a firm facing the following demand curve:

$$P = 6 - Q$$

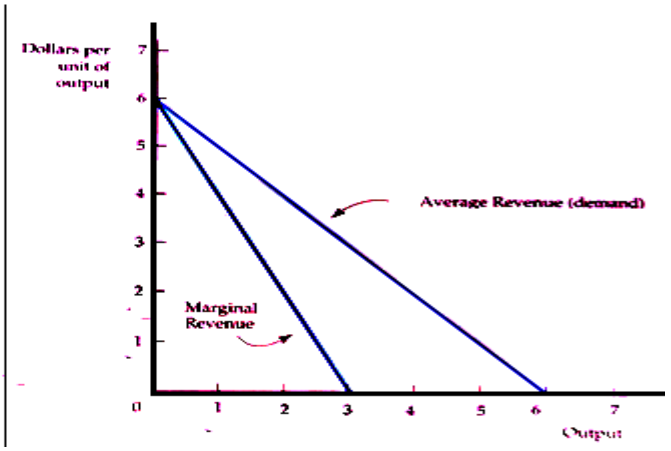
Table 1 shows the behavior of total, average, and marginal revenue for this demand curve. Note that revenue is zero when the price is $6: At that price, nothing is sold. At a price of $5, however, one unit is sold, so total (and marginal) revenue is S5. An increase in quantity sold from 1 to 2 increases revenue from $5 to $8, marginal revenue is thus $3. As quantity sold increases from 2 to 3, marginal revenue falls to $1, and when Quantity increases from 3 to 4, marginal revenue becomes negative. When marginal revenue is positive, revenue is increasing with quantity, but when marginal revenue is negative, revenue is decreasing.

TABLE 1	TOTAL, MARGINAL, AND AVERAGE REVENUE			
PRICE (P)	QUANTITY (Q)	TOTAL REVENUE (R)	MARGINAL REVENUE (MR)	AVERAGE REVENUE (AR)
$6	0	$0	—	—
5	1	5	$5	$5
4	2	8	3	4
3	3	9	1	3
2	4	8	−1	2
1	5	5	−3	1

When the demand curve is downward sloping, the price (average revenue) is greater than marginal revenue because all units are sold at the same price. If sales are to increase by I unit, the price must fall. In that case, all units sold, not just the additional unit, will earn less revenue. Note, for example, what happens in Table 1 when output is increased from 1 to 2 units and price is reduced to $4. Marginal revenue is $3: $4 (the revenue from the sale of the additional unit of output) less $1 (he loss of revenue from selling the first unit for $4 instead of $5). Thus, marginal revenue ($3) is less than price ($4).

Figure.1 plots average and marginal revenue for the data in Table 1. Our demand curve is a straight line and, in this case, the marginal revenue curve has twice the slope of the demand curve (and the same intercept).

FIGURE 1
AVERAGE AND MARGINAL REVENUE
Average and marginal revenue are shown for the demand curve P= 6– Q.



The Monopolist's Output Decision

What quantity should the monopolist produce? We saw that to maximize profit, a firm must set output so that marginal revenue is equal to marginal cost. This is the solution to the monopolist's problem. In Figure 2, the market demand curve D is the monopolist's average revenue curve. It specifies the price per unit that the monopolist receives as a function of its output level. Also shown are the corresponding marginal revenue curve MR and the average and marginal cost curves, AC and MC. Marginal revenue and marginal cost are equal at quantity Q*. Then from the demand curve, we find the price P* that corresponds to this quantity Q*.

How can we be sure that Q* is the profit–maximizing quantity? Suppose the monopolist produces a smaller quantity Q_1, and receives the corresponding higher price P– As Figure 2 shows, marginal revenue would then exceed marginal cost. In that case, if the monopolist produced a little more than Q_1, it would receive extra profit (MR– MC) and thereby increase its total profit. In fact, the monopolist could

keep increasing output adding more to its total profit until output Q*, at which point the incremental profit earned from producing one more nit is zero. So the smaller quantity is not profit maximizing even though it allows the monopolist to charge a higher price IF the monopolist produced Q_1 instead of Q*, its total profit would be smaller by an amount equal to the shaded area below the MR curve and above the MC curve, between Q_1 and Q*.

In Figure 2 the lager quantity Q_2 is likewise not profit maximizing. At this quantity cost exceeds marginal revenue. Therefore, if the monopolist produced a little less than Q_2 it would increase its total profit (by MC –MR). It could increase its profit even more by reducing output all the way to Q*. The increased profit achieved by producing Q* instead of Q_2 is given by the area below the MC curve and above the MR curve, between Q* and Q_2.

We can also see algebraically that Q* maximizes profit. Profit π is the difference between revenue and cost, both of which depend on Q :

$$\pi\,(Q) = R(Q) - C(Q)$$

As Q is increased from zero, profit will increase until it reaches a maximum ad then begin to decrease. Thus the profit–maximizing Q is such that the incremental profit resulting from a small increase in Q is just zero (i.e., $\Delta\pi/\Delta Q = 0$). Then

$$\Delta\pi/\Delta Q = \Delta R/\Delta Q - \Delta C/\Delta Q = 0$$

But $\Delta R/\Delta Q$ is marginal revenue and $\Delta C\ //\Delta Q$ is marginal cost. Thus the profit maximizing condition is that MR – MC = 0,or MR = MC.

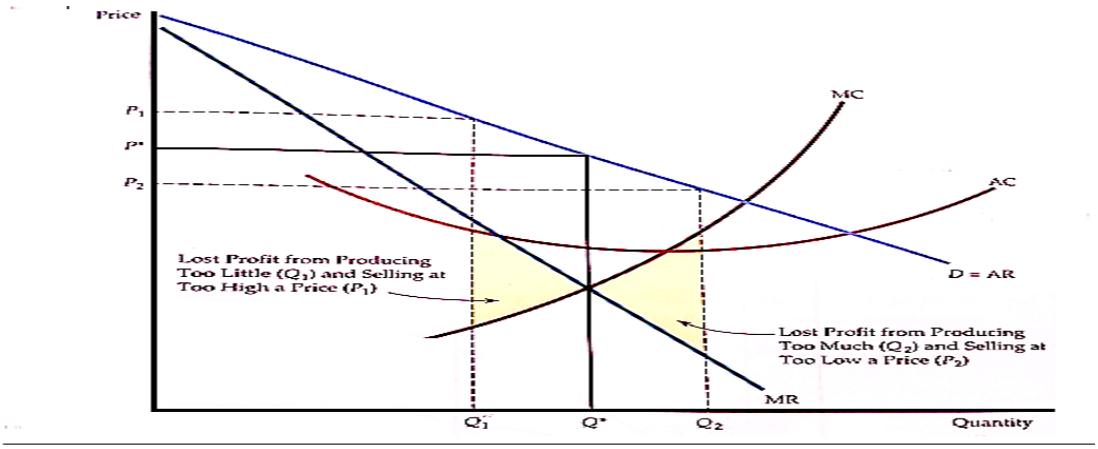


FIGURE 2
PROFIT IS MAXIMIZED WHEN MARGINAL REVENUE EQUALS MARGINAL COST
Q^* is the output level at which MR = MC. If the firm produces a smaller output—say, Q_1—it sacrifices some profit because the extra revenue that could be earned from producing and selling the units between Q_1 and Q^* exceeds the cost of producing them. Similarly, expanding output from Q^* to Q_2 would reduce profit because the additional cost would exceed the additional revenue.

An Example

To grasp this result more clearly, let's look at an example. Suppose the cost of production is

$$C(Q) = 50 + Q^2$$

In other words, there is a fixed cost of $\$50$, and variable cost is Q^2. Suppose demand is given by

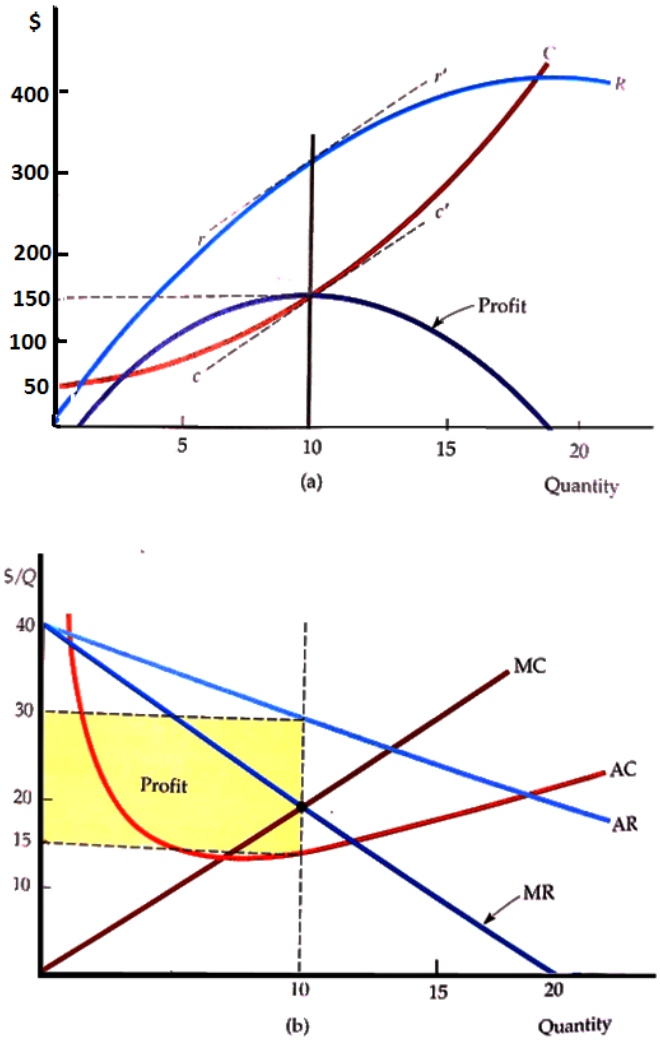
$$P(Q) = 40 - Q$$

By setting marginal revenue equal to marginal cost, you can verify that profit is maximized when $Q = 10$, an output level that corresponds to a price of $\$30$.

Cost, revenue, and profit are plotted in Figure $3(a)$. When the firm produces little or no output, profit is negative because of the fixed cost. Profit increases as Q increases, reaching a maximum of $\$150$ at $Q^* = 10$, and then decreases as Q is increased further. At the point of maximum profit, the slopes of the revenue and cost curves are the same. (Note that the tangent lines rr' and cc' are parallel.) The slope of the revenue curve is $\Delta R/\Delta Q$, or marginal revenue, and the slope of the cost curve is $\Delta R/\Delta Q$, or marginal cost. Because profit is maximized when marginal revenue equals marginal cost, the slopes are equal.

Figure 3(b) shows both the corresponding average and marginal revenue curves and average and marginal cost curves. Marginal revenue and marginal cost intersect at Q*= 10. At this quantity, average cost is $15 per unit and price is $30 per unit. Thus average profit is $30 – $15 = $15 per unit. Because 10 units are sold, profit is (10)($15) = $150, the area of the shaded rectangle.

FiGURE 3
EXAMPLE OF PROEIT MAXIMIZATION
Part (a) shows total revenue R, total cost C, and profit, the difference between the two. Part (b) shows average and marginal revenue and average and marginal cost. Marginal revenue is the slope of the total revenue curve, and marginal cost is the slope of the total cost cuve. The profit-maximizing output is Q* = 10, the point where marginal revenue equals marginal cost. At this output leve, the slope of the profit curve is zero, and the slopes of the total revenue and total cost curves are equal. The profit per unit is $15, the difference between average revenue and average cost Because 10 units are produced, total profit is $150



A Rule of Thumb for Pricing

We know that price and output should be chosen so that marginal revenue equals marginal cost, but how can the manager of a firm find the correct price and output level in practice? Most managers have only limited knowledge of the average and marginal revenue curves that their firms face. Similarly, they might know the

firm's marginal cost only over a limited output range. We therefore want to translate the condition that marginal revenue should equal marginal cost into a rule of thumb that can be more easily applied in practice.

To do this, we first write the expression for marginal revenue:

$$\text{MR} = \frac{\Delta \boldsymbol{R}}{\Delta \boldsymbol{Q}} = \frac{\Delta(\boldsymbol{PQ})}{\Delta \boldsymbol{Q}}$$

Note that the extra revenue from an incremental unit of quantity, Δ (PQ)/ΔQ, has two components:

1. Producing one extra unit and selling it at price P brings in revenue (1)(P) = P.

2. But because the firm faces a downward–sloping demand curve, producing and selling this extra unit also results in a small drop in price ΔP/ΔQ which reduces the revenue from all units sold (i.e., a change in revenue Q[ΔP/ΔQ]):

Thus,

$$\textbf{MR} = \boldsymbol{P} + \boldsymbol{Q}\,\frac{\Delta \boldsymbol{R}}{\Delta \boldsymbol{Q}} = \textbf{P} + \textbf{P}\,\left(\frac{\boldsymbol{Q}}{\boldsymbol{P}}\right)\left(\frac{\Delta \boldsymbol{P}}{\Delta \boldsymbol{Q}}\right)$$

We obtained the expression on the right by taking the term Q(ΔP/ΔQ) and multiplying and dividing it by P. Recall that the elasticity of demand is defined as E_d = (P/Q) (ΔQ/ΔP). Thus (Q/P) (ΔP/ΔQ) is the reciprocal of the elasticity of demand, $1/E_d$, measured at the proft–maximizing output, and

$$\text{MR} = \text{P} + \text{P}(1/E_d)$$

Now, because the firm's objective is to maximize profit, we can set marginal revenue equal to marginal cost:

$$\text{P} + \text{P}(1/E_d) = \text{MC}$$

which can be rearranged to give us

$$\frac{P - MC}{P} = -\frac{1}{E_d} \qquad (1)$$

This relationship provides a rule of thumb for pricing. The left–hand side, (P–MC)/P, is the markup over marginal cost as a percentage of price. The relationship says that this markup should equal minus the inverse of the elasticity of demand.

(This figure will be a positive number because the elasticity. of demand is negative) Equivalently, we can rearrange his equation to express price directly as a markup over marginal cost:

$$\mathbf{P} = \frac{MC}{1+(1/E_d)} \qquad (2)$$

For example, if the elasticity of demand is -4 and marginal cost is $\$9$ per unit, price should be $\$9/(1-1/4)$ $\$9/.75$ =$\$12$ per unit.

How does the price set by a monopolist compare with the price under competition? We saw that in a perfectly competitive market, price equals marginal cost. A monopolist charges a price that exceeds marginal cost, but by an amount that depends inversely on the elasticity of demand. As the markup equation (1) shows, if demand is extremely elastic, E_d is a large negative number, and price will be very close to marginal cost. In that case, a monopolized market will look much like a competitive one. In fact, when demand is very elastic, there is little benefit to being a monopolist.

Also note that a monopolist will never produce a quantity of output that is on the inelastic portion of the demand curve–i.e., where the elasticity of demand is less than 1 in absolute value. To see why, suppose that the monopolist is producing at a point on the demand curve where the elasticity is -0.5. In that case, the monopolist could make a greater profit by producing less and selling at a higher price. (A 10–percent reduction in output, for example, would allow for a 20–percent increase in price and thus a 10–percent increase in revenue. If marginal cost were greater than zero, the increase in profit would be even more than 10 percent because the lower output would reduce the firm's costs.) As the monopolist reduces output and raises price, it will move up the demand curve to a point where the elasticity is greater than 1 in absolute value and the markup rule of equation (2) will be satisfied.

Suppose, however, that marginal cost is zero. In that case, we cannot use equation (2) directly to determine the profit–maximizing price. However, we can see from equation (1) that in order to maximize profit, the firm will produce at the point where the elasticity of demand is exactly -1. If marginal cost is zero, maximizing profit is equivalent to maximizing revenue, and revenue is maximized when E_d, = -1.

Monopoly Power

Pure monopoly is rare. Markets in which several firms compete with one another are much more common. We say more about the forms that this competition, But we should explain here why each firm in a market with several firms is likely to face a downward–sloping demand curve and, as a result, to produce so that price exceeds marginal cost.

Suppose, for example, that four firms produce toothbrushes and have the market demand curve Q– $50{,}000 - 20{,}000$P, as shown in Figure 4 (a). Let's assume that these four firms are producing an aggregate of $20{,}000$ toothbrushes per day $(5000$ each per day) and selling them at $\$1.50$ each. Note that market demand is relatively inelastic, you can verify that at this S1.50 price, the elasticity of demand is -15.

Now suppose that Firm A is deciding whether to lower its price to increase sales. To make this decision, it needs to know how its sales would respond to a change in its price. In other words, it needs some idea of the demand curve it faces, as opposed to the market demand curve. A reasonable possibility is shown in Figure 4(b), where the firm's demand curve D_A, is much more elastic than the market demand curve. (At the $\$1.50$ price the elasticity is -6.0.) The firm might predict that by raising the price from $\$1.50$ to $\$1.60$, its sales will drop say, from 5000 units to 3000–as consumers buy more toothbrushes from other firms. (If all firms raised their prices to $\$1.60$, sales for Firm A would fall only to 4500.) For several reasons, sales won't drop to zero as they would in a perfectly competitive

market. First, if Firm A's toothbrushes area little different from those of its competitors, some consumers will pay a bit more for them Second, other firms might also raise their prices. Similarly, Firm A might anticipate that by lowering its price from $150 to $140, it can sell more toothbrushes –perhaps 7000 instead of 5000.But it will not capture the entire market: Some consumers might still prefer the competitors' toothbrushes, and competitors might also lower their prices.

Thus, Firm A's demand curve depends both on how much its product differs from is competitors' products and on how the four firms compete with one another. We will discuss product differentiation and interfirm competition. But one important point should be clear: Firm A is likely to face a demand curve which is more elastic than the market demand curve, but which is not infinitely elastic like the demand curve facing a perfectly competitive firm.

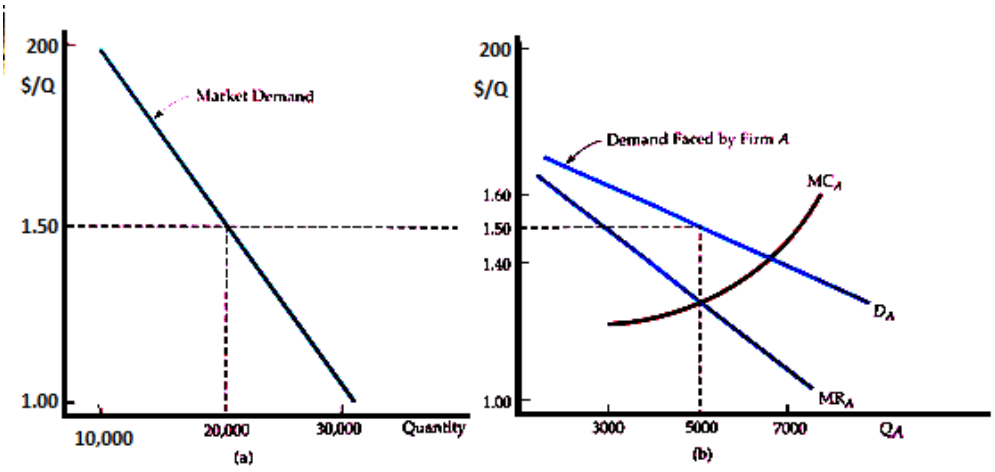


FIGURE 4
THE DEMAND FOR TOOTHARUSHES
Part (a) shows the market demand for toothbrushes. Part (b) show the demand for toothbrushes as seen by Firm A. At a market price of $1.50, elasticity of market demand is - 15. Firm A, however, sees a much more elastic demand curve D_A, because of competition from other firms. At a price of $1.50, Firm As demand elasticity is -6. Still, firm A has some monopoly power: Its profit-maximizing price is $1.50, which exceeds marginal cost.

Production, Price, and Monopoly Power

As we will see, determining the elasticity y of demand for a firm's product is usually more difficult than determining the market elasticity of demand. Nonetheless, firms will often use market research and statistical studies to estimate elasticities of

demand for their products, because knowledge of these elasticities can be essential for profit–maximizing production and pricing decisions.

Let's return to the demand for toothbrushes in Figure 4. Let's assume that Firm A in that figure has a good knowledge of its demand curve. In that case, how much should Firm A produce? The same principle applies: The profit–maximizing quantity equates marginal revenue and marginal cost. In Figure 4(b), that quantity is 5000 units. The corresponding price is $1.50, which exceeds marginal cost. Thus, although Firm A is not a pure monopolist, it does have monopoly power–it can profitably charge a price greater than marginal cost. Of course, its monopoly power is less than it would be if it had driven away the competition and monopolized the market, but it might still be substantial.

This raises two questions.

1. How can we measure monopoly power in order to compare one firm with another? (So far we have been talking about monopoly power only in qualitative terms.)

2. What are the sources of monopoly power, and why do some firms have more monopoly power than others?

Measuring Monopoly Power

Remember the important distinction between a perfectly competitive firm and a firm with monopoly power: For the competitive firm, price equals marginal cost; for the firm with monopoly power, price exceeds marginal cost. Therefore, a natural way to measure monopoly power is to examine the extent to which the profit–maximizing price exceeds marginal cost. In particular, we can use the markup ratio of price minus marginal cost to price that we introduced earlier as part of a rule of thumb for pricing. This measure of monopoly power, introduced by economist Abba Lerner in 1934, is called the Lerner Index of Monopoly Power. It is the difference between price and marginal cost, divided by price. Mathematically:

$$L = (P - MC)/P$$

The Lerner index always has a value between zero and one. For a perfectly competitive firm, P = MC, so that L = 0. The larger is L, the greater is the degree of monopoly power.

This index of monopoly power can also be expressed in terms of the elasticity of demand facing the firm. Using equation (1), we know that

$$L = (P - MC)/P = -1/E_d \qquad (3)$$

Remember, however, that E, is now the elasticity of the firm's demand curve, not the market demand curve. In the toothbrush example discussed previously, the elasticity of demand for Firm A is -6.0, and the degree of monopoly power is $1/6 = 0.167$.

Note that considerable monopoly power does not necessarily imply high profits. Profit depends on average cost relative to price. Firm A might have more monopoly power than Firm B but earn a lower profit because of higher average costs.

Sources of Monopoly Power

Why do some firms have considerable monopoly power while other firms have little or none? Remember that monopoly power is the ability to set price above marginal cost and that the amount by which price exceeds marginal cost depends inversely on the elasticity of demand facing the firm. As equation (10.4) shows, the less elastic its demand curve, the more monopoly power a firm has. The ultimate determinant of monopoly power is therefore the firm's elasticity of demand. Thus we should rephrase our question: Why do some firms (e.g., a supermarket chain) face demand curves that are more elastic than those faced by others (e.g., a producer of designer clothing)?

Three factors determine a firm's elasticity of demand.

1. The elasticity of market demand. Because the firm's own demand will be at least as elastic as market demand, the elasticity of market demand limits the potential for monopoly power.

2. The number of firms in the market. If there are many firms, it is unlikely that any one firm will be able to affect price significantly.

3. The interaction among firms. Even if only two or three firms are in the market, each firm will be unable to profitably raise price very much if the rivalry among them is aggressive, with each firm trying to capture as much of the market as it can.

Let's examine each of these three determinants of monopoly power.

The Elasticity of Market Demand

If there is only one firm–a pure monopolist–its demand curve is the market demand curve. In this case, the firm's degree of monopoly power depends completely on the elasticity of market demand. More often, however, several firms compete with one another, then the elasticity of market demand sets a lower limit on the magnitude of the elasticity of demand for each firm. Recall our example of the toothbrush producers illustrated in Figure 4 The market demand for toothbrushes might not be very elastic, but each firm's demand will be more elastic (In Figure 4, the elasticity of market demand is -1.5, and the elasticity of demand for each firm is -6.) A particular firm's elasticity depends on how the firms compete with one another. But no matter how they compete, the elasticity of demand for each firm could never become smaller in magnitude than -1.5.

Because the demand for oil is fairly inelastic (at least in the short run), OPEC could raise oil prices far above marginal production cost during the 1970s and early 1980s. Because the demands for such commodities as coffee, cocoa, tin, and copper are much more elastic, attempts by producers to cartelize these markets and

raise prices have largely failed. In each case, the elasticity of market demand limits the potential monopoly power of individual producers.

The Number of Firms

The second determinant of a firm's demand curve–and thus of its monopoly power–is the number of firms in its market. Other things being equal, the monopoly power of each firm will fall as the number of firms increases: As more and more firms compete, each firm will find it harder to raise prices and avoid losing sales to other firms.

What matters, of course, is not just the total number of firms, but the number of "major players" firms with significant market share. For example, if only two large firms account for 90 percent of sales in a market, with another 20 firms accounting for the remaining 10 percent, the two large firms might have considerable monopoly power. When only a few firms account for most of the sales in a market, we say that the market is highly concentrated

It is sometimes said (not always jokingly) that the greatest fear of American business is competition. That may or may not be true. But we would certainly expect that when only a few firms are in a market; their managers will prefer that no new firms enter. An increase in the number of firms can only reduce the monopoly power of each incumbent firm. An important aspect of competitive strategy is finding ways to create barriers to entry–conditions that deter entry by new competitors.
Sometimes there are natural barriers to entry. For example, one firm may have a patent on the technology needed to produce a particular product. This makes it impossible for other firms to enter the market, at least until the patent expires. Other legally created rights work in the same way–a copyright can limit the sale of a book, music, or a computer software program to a single company, and the need for a government license can prevent new firms from entering the markets for telephone service, television broadcasting, or interstate trucking. Finally, economies of scale

may make it too costly for more than a few firms to supply the entire market. In some cases, economies of scale may be so large that it is most efficient for a single firm–a natural monopoly—to supply the entire market. We will discuss scale economies and natural monopoly in more detail shortly.

The Interaction Among firms

The ways in which competing firms interact is also an important–and sometimes the most important determinant of monopoly power. Suppose there are four firms in a market. They might compete aggressively, undercutting one another's prices to capture more market share. This could drive prices down to nearly competitive levels. Each firm will fear that if it raises its price it will be undercut and lose market share. As a result, it will have little monopoly power.

On the other hand, the firms might not compete much. They might even collude (in violation of the antitrust laws), agreeing to limit output and raise prices. Because raising prices in concert rather than individually is more likely to be profitable, collusion can generate substantial monopoly power.

Now we simply want to point out that, other things being equal, monopoly power is smaller when firms compete aggressively and is larger when they cooperate.

Remember that a firm's monopoly power often changes over time, as its operating conditions (market demand and cost), its behavior, and the behavior of its competitors change. Monopoly power must therefore be thought of in a dynamic context. For example, the market demand curve might be very inelastic in the short run but much more elastic in the long run. (Because this is the case with oil, the OPEC cartel enjoyed considerable short–run but much less long–run monopoly power.) Furthermore, real or potential monopoly power in the short run can make an industry more competitive in the long run: Large short–run profits can induce new firms to enter an industry, thereby reducing monopoly power over the longer term.

Exercises

1. A monopolist firm faces a demand with constant elasticity of -2.0. It has a constant marginal cost of S20 per unit and sets a price to maximize profit. If marginal cost should increase by 25 percent, would the price charged also rise by 25 percent?

2. A firm faces the following average revenue (demand) curve:

$$P = 120 - 0.02Q$$

Where Q is weekly production and P is price, measured in cents per unit. The firm's cost function is given by $C = 60Q + 25{,}000$. Assume that the firm maximizes profits.

a. What is the level of production, price, and total profit per week?

b. If the government decides to levy a tax of 14 cents per unit on this product, what will be the new level of production, price, and profit?

3. The following table shows the demand curve facing a monopolist who produces at a constant marginal cost of S10:

PRICE	QUANTITY
18	0
16	4
|4	8
12	12
10	16
8	20
6	24
4	28
2	32
0	36

a. Calculate the firm's marginal revenue curve.

b. What are the firm's profit–maximizing output and price? What is its profit?

c. What would the equilibrium price and quantity be in a competitive industry?

4. Suppose that an industry is characterized as follows.

C = $100 + 2q^2$	each firm's total cost function
MC = 4q	firm's marginal cost function
P = $90 - 2$Q	industry demand curve
MR = $90 - 4$Q	industry marginal revenue curve

a. If there is only one firm in the industry, find the monopoly price, quantity, and level of profit.

b. Find the price, quantity, and level of profit if the industry is competitive.

c. Graphically illustrate the demand curve, marginal revenue curve, marginal cost curve, and average cost curve. Identify the difference between the profit level of the monopoly and the profit level of the competitive industry in two different ways Verify that the two are numerically equivalent.

5. Suppose a profit–maximizing monopolist is producing 800 units of output and is charging a price of $\$40$ per unit.

a. If the elasticity of demand for the product is -2, find the marginal cost of the last unit produced.

b. What is the firm's percentage markup of price over marginal cost?

c. Suppose that the average cost of the last unit produced is $\$15$ and the firm's fixed cost is $\$2000$. Find the firm's profit.

6. A monopolist faces the demand curve P = 11 – Q, where P is measured in dollars per unit and Qin thousands of units. The monopolist has a constant average cost of $\$6$ per unit.

a. Draw the average and marginal revenue curves and the average and marginal cost curves. What are the monopolist's profit–maximizing price and quantity? What is the resulting profit? Calculate the firm's degree of monopoly power using the Lerner index.

b. A government regulatory agency sets a price ceiling of $7 per unit. What quantity will be produced, and what will the firm's profit be? What happens to the degree of monopoly power?

c. What price ceiling yields the largest level of out–put? What is that level of output? What is the firm's degree of monopoly power at this price?