

# Demand and Supply

## Review

### Basic Microeconomics

“ **Demand**” is a term that represents models that explain how a set of variables influence buyer or consumer behavior.

There are two ways to perceive demand:

- 1) Demand is a schedule of quantities that buyers are willing and able to purchase as a schedule of prices in a given time period, *ceteris paribus*.

$$Q_x = f(P_x)$$

- 2) Demand is schedule of the maximum prices that buyers are willing and able to pay for each unit of a good, *ceteris paribus*.

$$P_x = f(Q_x)$$

### Individual demand

A demand model of an individual buyer may be represented by:

$$Q_x = f_x(P_x, P_{\text{related}}, M, \text{Preferences}, \dots), \text{ where}$$

#### Dependent variable ( $Q_x$ )

$Q_x$  = the quantity that consumers or buyers are willing and able to buy given the independent variables in a specific time period (ut).

#### Independent variables ( $P_x$ , $P_{\text{related}}$ , $M$ , Preferences, ...)

$P_x$  = the price of the good being considered.

$P_{\text{related}}$  = the price or prices of relevant related goods. The goods considered are compliments and substitutes of good X.

$M$  = the income of the buyer. Can be measured as gross income, net income, disposable income or the most relevant measure of income.

**Preferences** = a class of variables that serve as proxies for a persons tastes or preferences. These might include

- Age
- Gender
- Religion
- Wealth
- Time of day, year, season etc.
- Ethnic background
- Etc.

(. . . ) = all other things that are not included in the model. Expectations, new stories, and the like are examples.

### Market Demand

Market demand is a model that represents the typical behavior of all the buyers in a market. Note that you must define the boundaries of the market that may be defined by geographical, demographic features or the product itself.

The market demand is derived by a horizontal summation of individual demand functions for goods with exclusive property rights. The equation for the demand model can be estimated through the use of statistical methods. The market demand may be

represented by adding an additional independent variable, the number of buyers or the population of the market, (#B). The market demand model may be expressed:

$$Q_x = f_x(P_x, P_{\text{related}}, M, \text{Preferences}, \dots, \#B),$$

Where, #B represents the population of the market.

### Demand Function or Demand Curve

It is useful to abstract and to identify how the price and changes in the price of the good effect buyer behavior by "holding all other things constant," or using *ceteris paribus*. If the prices of related goods, incomes and preferences are unchanged it is possible to describe the relationship between the price of the good ( $P_x$ ) and the quantity that will be purchased ( $Q_x$ ) in a given time (ut).

If,  $Q_x = f_x(P_x, P_{\text{related}}, M, \text{Preferences}, \dots, \#B)$  and the variables,  $P_{\text{related}}, M, \text{Preferences}, \dots, \#B$  do not change then

$Q_x = f_x(P_x)$  *ceteris paribus*. This can be considered a "demand curve" or "demand function."

#### Example

If the demand function is  $Q_x = 40 - 2P_x$ , the following table and graph can be used to demonstrate the same information.

DEMAND FOR GOOD X	
$P_x$	$Q_x$
0	40
\$1	38
\$2	36
\$5	30
\$10	20
\$15	10
20	0

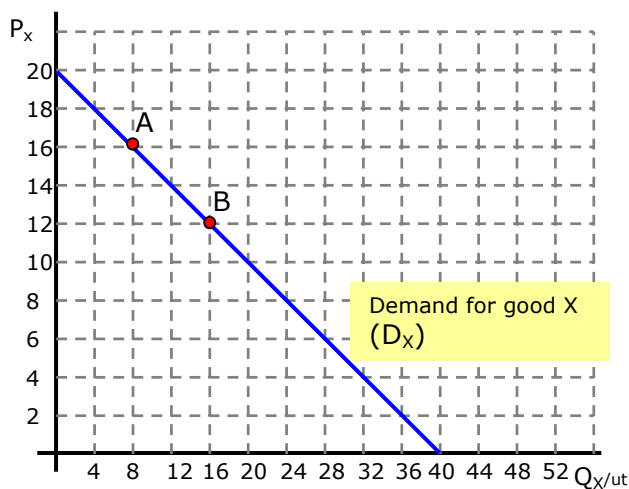


Figure 1

The Q-intercept is 40, the P-intercept is 20. The slope of the demand function given

$Q_x = f(P_x)$  is a negative 2 (-2). If the price of good X is \$20, no units of good X will be sold. If the good is "free" or has a price of 0, 40 units will be taken. For every \$1 change in P, the quantity of X ( $Q_x$ ) purchased will change by 2 units in the opposite direction.

### Changes in Demand and Changes in Quantity demanded

The behavior of buyers is altered by changes in the independent variables ( $P_x, P_{\text{related}}, M, \text{Preferences}, \dots, \#B$ ).

#### Change in quantity demanded

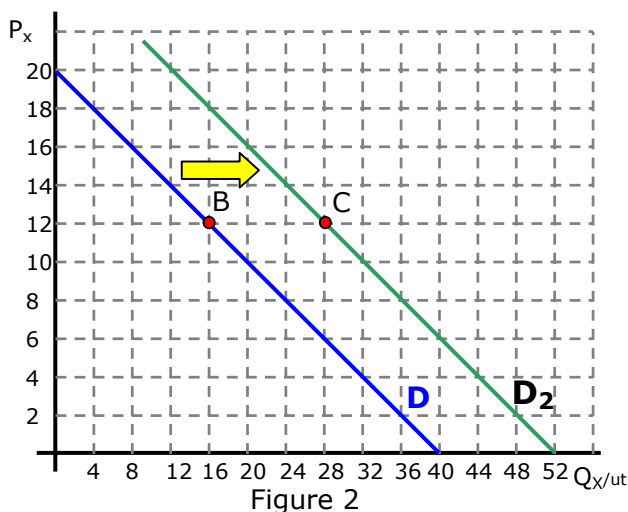
If the price of good X ( $P_x$ ) changes, the demand function is not altered; a change in the price of X causes a change in "quantity demanded" or  $\Delta P_x$  "causes" a  $\Delta Q_x$ . This is seen as a movement along the Demand function from point A to point B in Figure 1 above. If the price falls from \$16 to \$12 the quantity demand increases from 8 units to 16. A \$4 decrease in the price increases the quantity demanded by 8 units. A rise in price from \$12 to \$16 will decrease the quantity demand by 8 units.

#### Things that change Quantity Demanded

- An increase in the price of good X ( $P_x$ ) will decrease the "quantity demanded."
- A decrease in the price of good X ( $P_x$ ) will increase the "quantity demanded."

## Change in demand

If any of the other variables ( $P_{related}$ ,  $M$ , Preferences, ..., #B) change it will cause the demand curve or function to "shift." A "change in demand" occurs when the demand function shifts. For example, given the demand function,  $Q_x = 40 - 2P_x$ , a change in income ( $M$ ), the price of a related good or preferences will shift the demand curve. An "increase in demand" is a shift to the right; at each price buyers are willing and able to purchase larger quantity. In Figure 2, an increase in demand can be perceived as a shift from  $D$  to  $D_2$ . At a price of 0 the new demand intercept is 52 units, the new demand curve ( $D_2$ ) is  $Q_x^* = 52 - 2P_x$ . At  $P_x = \$12$ , 28 units will be demanded. This is a shift from point B to point C in Figure 2.



A decrease in demand is a shift of the demand function to the left; at each price a smaller quantity will be demanded.

### Things that shift Demand or "change the demand."

- An increase (decrease) income ( $M$ ) will increase (decrease) the demand for a normal good.
- An increase (decrease) in income will decrease (increase) the demand for an inferior good
- An increase in the price of a substitute good ( $P_Y$ ) will increase the demand for good X. A decrease in the price of a substitute will decrease the demand for good X.
- Increases in the price of a complimentary good will decrease the demand for good X. A decrease in the price of a complimentary good will increase the demand for good X.
- Any change in any independent variable other than the price of good X ( $P_X$ ) will shift the demand for good X.

**"Supply"** is a term that is used to describe a set of models that explains what variables influence the sellers of a good. There are two ways to perceive a supply function;

- 1) Supply is a schedule of quantities that will be produced and offered for sale at a schedule of prices during a specific interval of time, *ceteris paribus*.
- 2) Supply is a schedule of the minimum prices sellers will accept for each level of output in a given time, *ceteris paribus*.

A supply model can be expressed;

$$Q_{XS} = f_S(P_X, P_{inputs}, \text{technology, number of sellers, taxes, laws regulations,} \dots)$$

Where:

- $P_X$  = the price of the good
- $P_{inputs}$  = the prices of the inputs (or factors of production)
- **Technology** represents the methods and processes used to produce a good

The supply function often represents a positive relationship between the price of a good and the quantity that will be produced and offered for sale. If all the independent variables ( $P_{inputs}$ , **technology, number of sellers, taxes, laws regulations, . . .**) except ( $P_X$ ) were held constant the supply might be expressed:

SUPPLY TABLE	
$P_x$	$Q_x$
\$0	-4
\$1	-2
\$2	0
\$3	2
\$5	6
\$10	16
\$15	26
\$20	36

$Q_{XS} = f_S(P_x)$  ceteris paribus

$Q_{XS} = -4 + 2(P_x)$ , is an example of a possible supply function. This equation can be shown as a table or a graph (Figure 3).

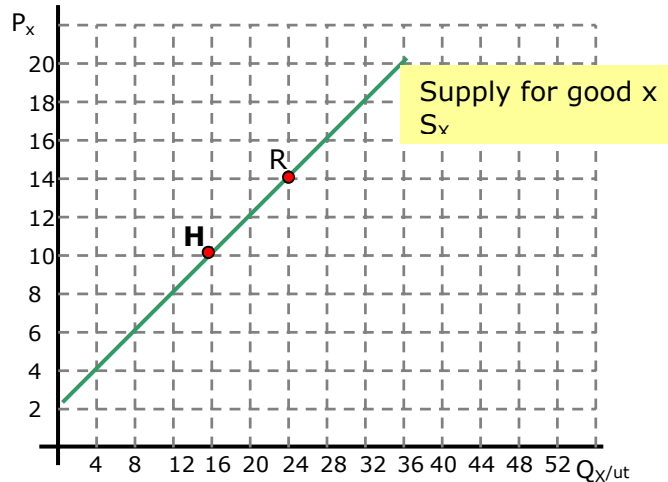


Figure 3

The equation ( $Q_{XS} = -4 + 2(P_x)$ ), the table and the graph represent the supply function. It indicates that

at a price of \$2, no units of good X will be produced and offered for sale. Negative output is not relevant in this case. For each \$1 increase in the price of the good, an additional 2 units will be produced and offered for sale.

### Changes in Supply and changes in Quantity Supplied

The behavior of sellers (the decision as to how much to produce and offer for sale,  $Q_{XS}$ ) is determined by the independent variables,  $P_x$ ,  $P_{inputs}$ , technology, number of sellers, taxes, laws regulations, . . .)

#### A change in Supply

A "change of supply" implies a shift of the supply function "caused" by a change in any of the *ceteris paribus* conditions, i.e. if  $P_{inputs}$ , technology, number of sellers, taxes, laws, regulations or etc. change it will shift the supply function. A decrease in supply can be perceived as a shift to the left (less is offered for sale at each price) while an increase in supply is a shift to the right (a larger quantity is offered for sale at each price). In Figure 4,  $S_1$  represents an increase in supply from S.  $S_2$  represents a decrease in supply from S.

#### A change in Quantity Supplied

A change in "quantity supplied" is a movement along a supply function caused by a change in the price of the good. In Figure 4 a movement from point H ( $P_x = \$10$ ,  $Q_x = 16$ ) to point R ( $P_x = \$14$ ,  $Q_x = 24$ ) is an increase in quantity supplied.

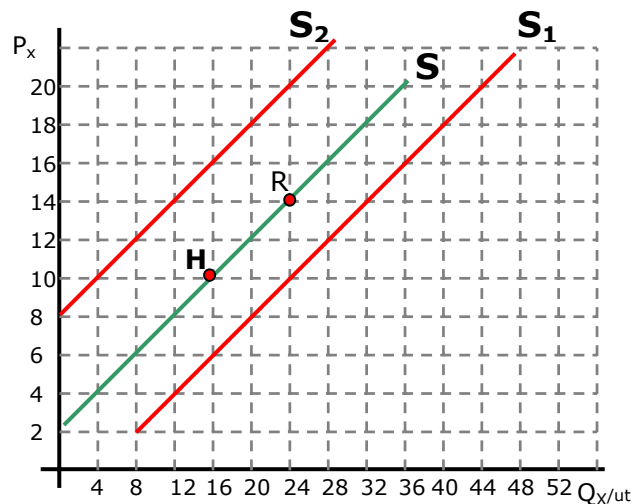


Figure 4

#### Important observation

Please note that the things that shift the supply curve and those that shift the demand curve are not the same things. Further, just because someone is willing and able to buy something at a price does not imply that anyone is willing and able to offer the good for sale at that price. Similarly, just because someone is willing to produce a large output for sale at a high price does not mean anyone wants to buy it at that price.

## Equilibrium

In economics, equilibrium is the market condition such that the amount the buyers are willing and able to buy at a price is equal to the amount the sellers want to sell at that price. It is where the quantity supplied is equal to the quantity demanded. Graphically it is the intersection of the supply and demand functions. Given the demand function,  $Q_x = 40 - 2(P_x)$  and the supply function,  $Q_{xS} = -4 + 2(P_x)$  shown in Figure 5, the equilibrium price (at point E) is approximately \$11.00 and the equilibrium quantity is approximately 17.5 units of good X.

Using the two equations;

$$Q_x = 40 - 2P_x = Q_{xS} = -4 + 2P_x$$

$$40 - 2P_x = -4 + 2P_x$$

Add 4 to both sides

$$44 - 2P_x = 0 + 2P_x$$

Add  $2P_x$  to both sides

$$44 = 4P_x$$

Divide both sides by 4

$$11 = P_x$$

The equilibrium price of good X is \$11. By substituting the equilibrium price (\$11) into either equation (we will use demand)  $Q_x = 40 - 2(11) = 40 - 22 = 18$ .

Check the equilibrium price in the supply function:  $Q_{xS} = -4 + 2(11) = -4 + 22 = 18$ .

Since the Quantity offered for sale at \$11 is the same as the quantity demanded at \$11, we have equilibrium.

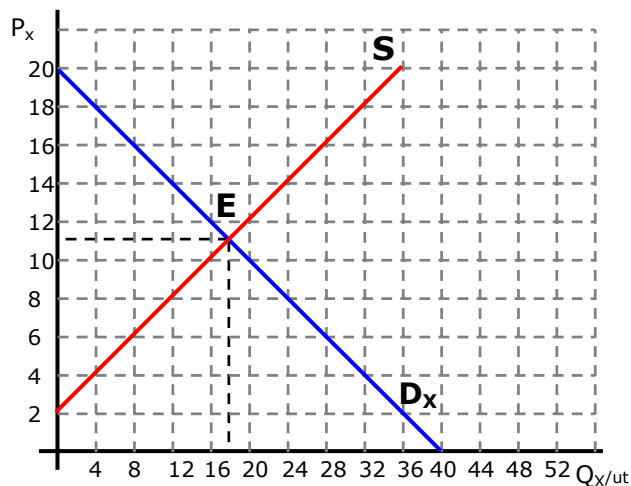


Figure 5

## Market Adjustment

The market provides information about both buyers and sellers. If the price is "too high," the quantity supplied exceeds the quantity demanded; this encourages sellers to lower prices. Lower prices will decrease the quantity supplied and increase the quantity demanded. If the price is "too low," the quantity demanded exceeds the quantity supplied so buyers cannot buy all they want at the low price. The buyers will "bid" up the price.

### Change in Demand

If the demand increases the equilibrium price will tend to increase and the equilibrium quantity will also increase.

A decrease in demand will result in a fall in both the equilibrium price and quantity.

### Change in Supply

A decrease in supply will tend to push the price up and quantity exchanged down. An increase in supply will reduce price and increase the quantity exchanged.

### Change in supply and demand

When demand and supply both change, the direction of change in price or quantity (but not both) can be known but the direction of change in the other will be "indeterminate" unless we know the magnitude of the changes in supply and demand and the elasticities of demand and supply.