

BasicMicro. Economics: An Outline

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Part II Chapter eight

Demand and Supply in a Market System

The market system is an interrelated set of markets for goods, services and inputs. A market is defined as the interaction of all potential buyers and sellers of a good or class of goods that are close substitutes. The economic analysis that is used to analyze the overall equilibrium that results from the interrelationships of all markets is called a "general equilibrium" approach. Partial equilibrium is the analysis of the equilibrium conditions in a single market (or a select subset of markets in a market system). In principles of economics, most models deal with partial equilibrium.

In a partial equilibrium model, usually the process of a single market is considered. The behavior of potential buyers is represented by a market demand function. Supply represents the behavioral pattern of the producers/sellers.

A. Demand Function

A demand function that represents the behavior of buyers, can be constructed for an individual or a group of buyers in a market. The market demand function is the horizontal summation of the individuals' demand functions. In models of firm behavior, the demand for a firm's product can be constructed.

The nature of the "demand function" depends on the nature of the good considered and the relationship being modeled. In most cases the demand relationship is based on an inverse or negative relationship between the price and quantity of a good purchased. The demand for purely competitive firm's output is usually depicted as horizontal (or perfectly elastic). In rare cases, under extreme conditions, a "Giffen good" may result in a positively sloped demand function. These Giffen goods rarely occur.

It is important to identify the nature of the "demand function" being considered.

(1) Individual Demand Function

The behavior of a buyer is influenced by many factors; the price of the good, the prices of related goods (compliments and substitutes), incomes of the buyer, the tastes and preferences of the buyer, the period of time and a variety of other possible variables. The quantity that a buyer is willing and able to purchase is a function of these variables.

An individual's demand function for a good (Good X) might be written:

$$Q_x = f_x(P_x, P_{\text{related goods}}, \text{income } (M), \text{preferences}, \dots)$$

- Q_x = the quantity of good X

- P_x = the price of good X
- $P_{\text{related goods}}$ = the prices of compliments or substitutes
- Income (M) = the income of the buyers
- Preferences = the preferences or tastes of the buyers

The demand function is a model that "explains" the change in the dependent variable (quantity of the good X purchased by the buyer) "caused" by a change in each of the independent variables. Since all the independent variable may change at the same time it is useful to isolate the effects of a change in each of the independent variables. To represent the demand relationship graphically, the effects of

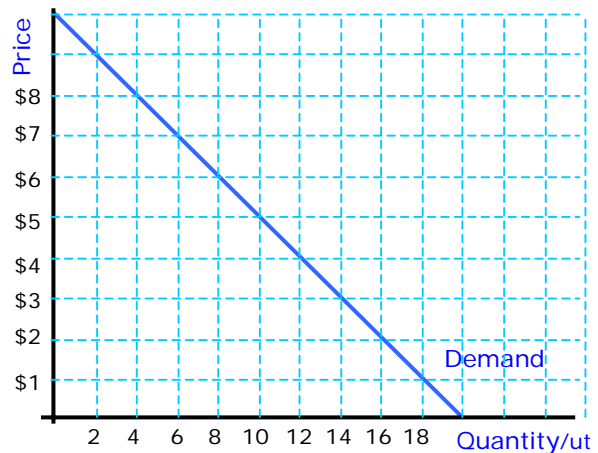


Figure III.A.1

a change in P_x on the Q_x are shown. The other variables, ($P_{\text{related goods}}$, M, preferences, . . .) are held constant. Figure III.A.1 shows the graphical representation of demand. Since ($P_{\text{related goods}}$, M, preferences, . . .) are held constant, the demand function in the graph shows a relationship between P_x and Q_x in a given unit of time (ut).

The demand function can be viewed from two perspectives.

The demand is usually defined as a schedule of quantities that buyers are willing and able to purchase at a schedule of prices in a given time interval (ut), *ceteris paribus*.

$$Q_x = f(P_x), \text{ given incomes, price of related goods, preferences, etc.}$$

Demand can also be perceived as the maximum prices buyers are willing and able to pay for each unit of output, *ceteris paribus*.

$$P_x = f(Q_x), \text{ given incomes, price of related goods, preferences, etc.}$$

It is important to remember that the demand function is usually thought of as $Q = f(P)$ but the graph is drawn with quantity on the X-axis and price on the Y-axis. While demand is frequently stated $Q = f(P)$, remember that the graph and calculation of total revenue (TR) and marginal revenue (MR) are calculated on the basis of a change in quantity (Q). $TR = f(Q)$ The calculation of "elasticity" is based on a change in quantity (Q) caused by a change in the price (P). It is important to clarify which variable is independent and which is dependent in a particular concept.

(2) Market Demand Function

When property rights are nonattenuated (exclusive, enforceable and transferable) the individual's demand functions can be summed horizontally to obtain the market demand function.

In Figure III.A.2 and Table III.A.2, a market demand function is constructed from the behavior of three people (the participants in a very small market). At a price of P_1 , Ann will voluntarily buy 2 units of the good based on her preferences, income and the prices of related goods. Bob and Cathy buys 3 units each. Their demand functions are

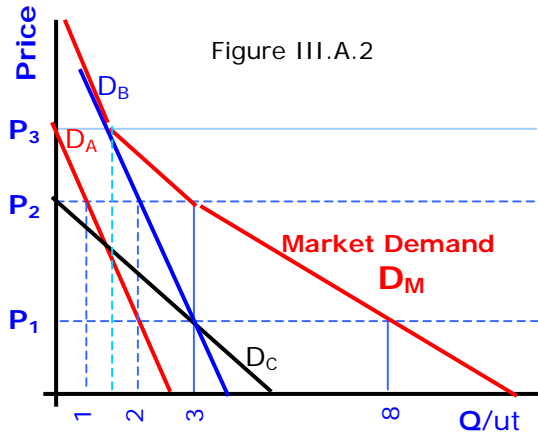


Figure III.A.2

Price	Ann's Demand	Bob's Demand	Cathy's Demand	Market Demand
P_1	2	3	3	8
P_2	1	0	2	3
P_3	0	0	1.5	1.5

represented by D_A , D_B and D_C in Figure III.A.2. The total amount demanded by the three individuals at P_1 is 8 units (2+3+3). At a higher price each buys a smaller quantity. The demand functions can be summed horizontally if the property rights to the good are exclusive; Ann's consumption of a unit precludes Bob or Cathy from the consumption of that good. In the case of public (or collective) goods, the consumption of national defense by one person (they are protected) does not preclude others from the same good.

The behavior of a buyer was represented by the function:

$$Q_X = f_X(P_X, P_{\text{related goods}}, \text{income } (M), \text{preferences}, \dots)$$

For the market the demand function can be represented by adding the number of buyers (#B, or population),

$$Q_X = f_X(P_X, P_{\text{related goods}}, \text{income } (M), \text{preferences}, \dots, \#B)$$

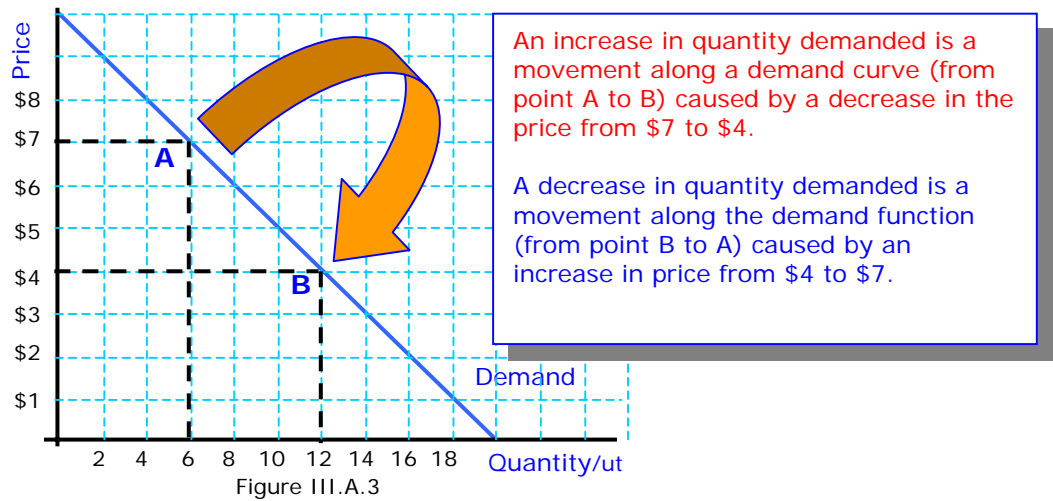
Where #B represents the number of buyers. Using ceteris paribus the market demand may be stated

$$Q_X = f(P_X), \text{ given incomes, price of related goods, preferences, } \#B \text{ etc.}$$

(1) **Change in Quantity Demand**

When demand is stated $Q = f(P)$ *ceteris paribus*, a change in the price of the good causes a "change in quantity demanded." The buyers respond to a higher (lower) price by purchasing a smaller (larger) quantity. Demand is an inverse relationship between price and quantity demanded. Only in unusual circumstances (a highly inferior good, a Giffen good) may a demand function have a positive relationship.

A change in quantity demanded is a movement along a demand function caused by a change in price while other variables (incomes, prices of related goods, preferences, number of buyers, etc) are held



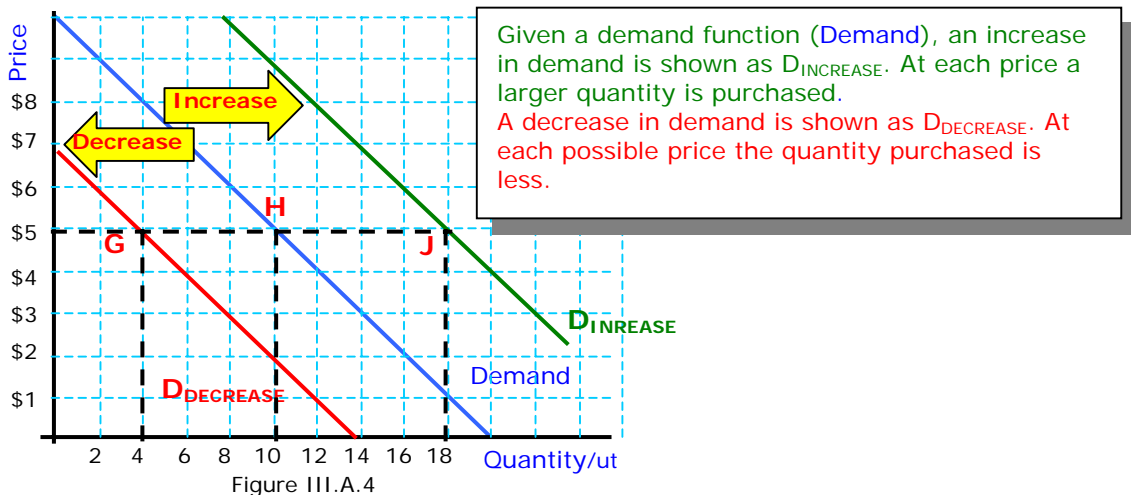
constant. A change in quantity demanded is shown in Figure III.A.3.

(2) Change in Demand

A change in demand is a "shift" or movement of the demand function. A shift of the demand function can be caused by a change in;

- incomes
- the prices of related goods
- preferences
- the number of buyers.
- Etc . . .

A "change in demand" is shown in Figure III.A.4. Given the original demand (Demand), 10 units will be purchased at a price of \$5. An increase in demand (D_{INCREASE}) is to the right and at every price a



larger quantity will be purchased. At \$5, eighteen units are purchased. A decrease in demand is a shift to the left. At a price of \$5 only 4 units

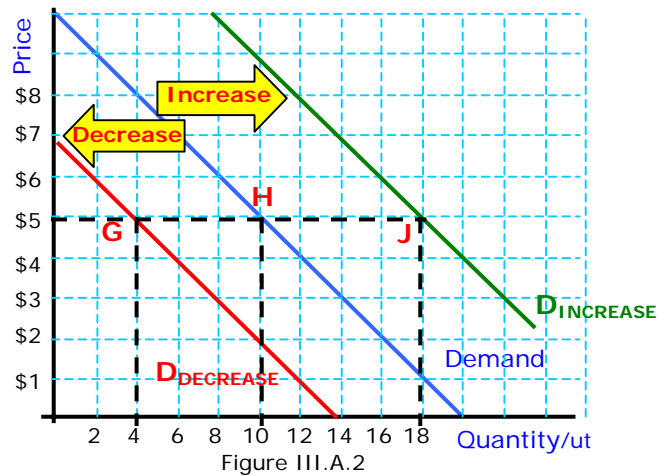
are purchased. A smaller quantity will be bought at each price.

(3) Inferior, Normal and Superior Goods

A change in income will usually shift the demand function. When a good is a "normal" good, there is a positive relationship between the change in income and change in demand; an increase in income will increase (shift the demand to the right) demand. A decrease in income will decrease (shift the demand to the left) demand.

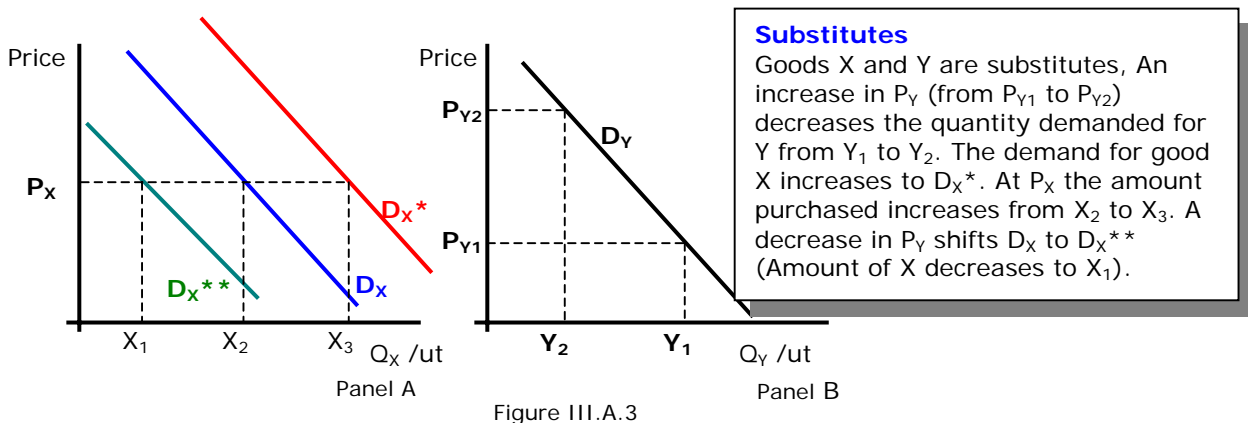
An inferior good is characterized by an inverse or negative relationship between the change in income and change in demand. An increase in the income will decrease demand while a decrease in income will increase demand.

A superior good is a special case of the normal good. There is a positive relationship between a change in income and the change in demand but, the percentage change in the demand is greater than the percentage change in income. In Figure III.A.2 an increase in income will shift the Demand function ("Demand") for a normal good to the right to $D_{INCREASE}$. For an inferior good, a decrease in income will shift the demand to the right. For a normal good a decrease in income will shift the demand to $D_{DECREASE}$.



(4) Compliments and Substitutes

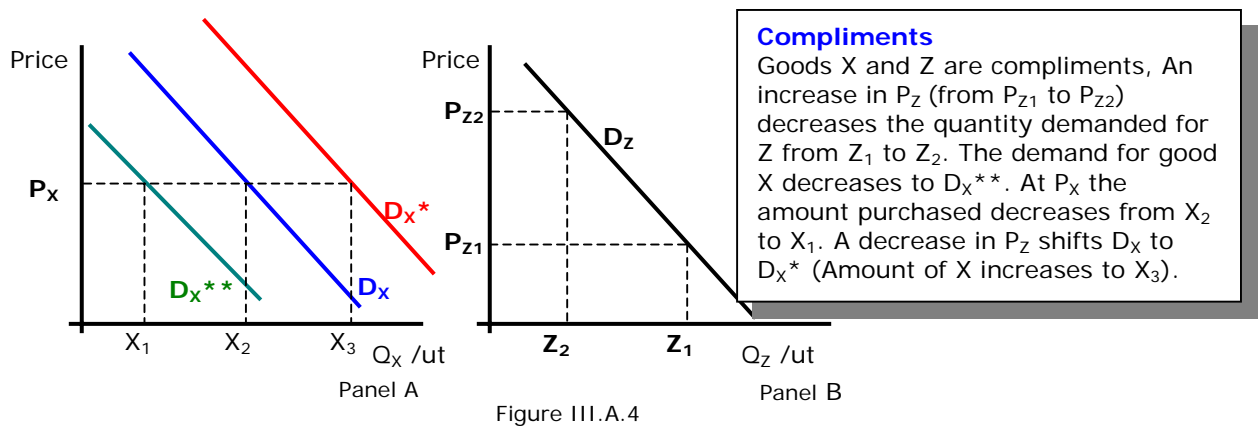
The demand for Xebecs (Q_X) is determined by the P_X , income and the prices of related goods (P_R). Goods may be related as substitutes (consumers perceive the goods as substitutes) or compliments (consumers use the goods together). If goods are substitutes, (shown in Figure III.A.3) a change in P_Y (in Panel B) will shift the demand for good X (in Panel A).



An increase in P_Y (from P_{Y1} to P_{Y2}) will reduce the quantity demanded for good Y (a move on D_Y). The reduced amount of Y will be replaced by purchasing more X. This is a shift of the demand for good X to the right (In Panel A, this is shown as a shift from D_X to D_X^* , an increase in the demand for good X). At P_X a larger amount (X_3) is purchased

A decrease in P_Y will increase the quantity demanded for good Y. This will reduce the demand for good X, the demand for good X will shift to the left (from D_X to D_X^{**} , a decrease). At P_X (and all prices of good X) a smaller amount of X (X_1) is purchased.

In the case of compliments, there is an inverse relationship between the price of the compliment (P_Z in Panel B, Figure III.A.4) and the demand for good X. An increase in the price of good Z will reduce the quantity demanded for good Z. Since less Z is purchased, less X is needed to compliment the reduced amount of Z (Z_2). The demand for X in Panel A decreases for D_X to D_X^{**} . An decrease in P_Z will increase the quantity demanded of good Z and result in an increase in the demand for good X (from D_X to D_X^* in Panel A).



(5) **Expectations**

Expectations about the future prices of goods can cause the demand in any period to shift. If buyers expect relative prices of a good will rise in future periods, the demand may increase in the present period. An expectation that the relative price of a good will fall in a future period may reduce the demand in the current period.

B. Supply Function

A supply function is a model that represents the behavior of the producers and/or sellers in a market.

$$Q_{XS} = f_S(P_X, P_{INPUTS}, \text{technology, number of sellers, laws, taxes, expectations} \dots \#S)$$

- P_X = price of the good,
- P_{INPUTS} = prices of the inputs (factors of production used)
- Technology is the method of production (a production function),
- laws and regulations may impose more costly methods of production
- taxes and subsidies alter the costs of production

#S represents the number of sellers in the market.

Like the demand function, supply can be viewed from two perspectives;

Supply is a schedule of quantities that will be produced and offered for sale at a schedule of prices in a given time period, *ceteris paribus*.

A supply function can be viewed as the minimum prices sellers are willing to accept for given quantities of output, *ceteris paribus*.

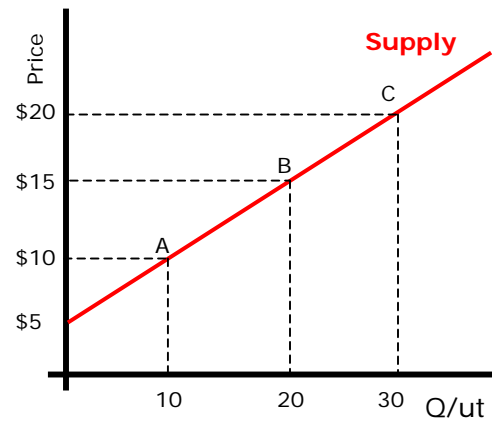


Figure III.A.5

(1) Graph of Supply

The relationship between the quantity produced and offered for sale and the price reflects opportunity cost. Generally, it is assumed that there is a positive relationship between the price of the good and the quantity offered for sale. Figure III.A.5 is a graphical representation of a supply function. The equation for this supply function is $Q_{\text{supplied}} = -10 + 2P$. Table III.A.5 also represents this supply function.

TABLE III.A.5	
SUPPLY FUNCTION	
PRICE	QUANTITY
\$5	0
\$10	10
\$15	20
\$20	30

(2) Change in quantity supplied

Given the supply function, $Q_{xs} = f_s(P_x, P_{\text{inputs}}, \text{Tech}, \dots)$, a change in the price of the good (P_x) will be reflected as a move along a supply function. In Figures III.A.5 and III.A.6 as the price increases from \$10 to \$15 the quantity supplied increases from 10 to 20. This can be visualized as a move from point A to point B on the supply function. A **change in quantity supplied is a movement along a supply function.** This can also be visualized as a movement from one row to another in Table III.A.5.

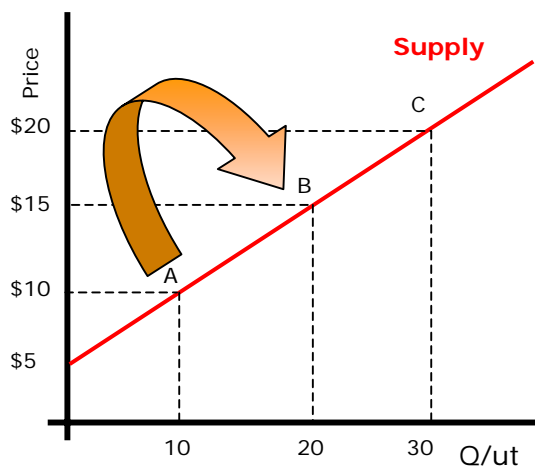


Figure III.A.6

A **change in quantity supplied** is a movement along a supply function that is "caused" by a change in the price of the good. In the graph to the right, as price increases from \$10 to \$15 the quantity supplied increases from 10 to 20. This can be visualized as a move from point A to point B along the supply function. A decrease in supply would be a move from point B to point A as price fell from \$15 to \$10

(3) Change in Supply

Given the supply function, $Q_{XS} = f_S(P_X, P_{\text{inputs}}, \text{Tech}, \dots, \#S)$, a change in the prices of inputs (P_{inputs}) or technology will **shift the supply function**. A shift of the supply function to the right will be called an increase in supply. This means that at each possible price, a greater quantity will be offered for sale. In an equation form, an increase in supply can be shown by an increase in the quantity intercept. A decrease in supply is a shift to the left; at each possible price a smaller quantity is offered for sale. In an equation this is shown as a decrease in the intercept.

A **change in supply** is a "shift" of the supply function. A decrease in supply is shown as a shift from **Supply** to **S_{decrease}** in the graph. At a price of \$15 a smaller amount is offered for sale. This decrease in supply might be "caused" by an increase in input prices, taxes, regulations or, . . . An increase in supply can be visualized as a movement of the supply function from **Supply** to **S_{increase}**.

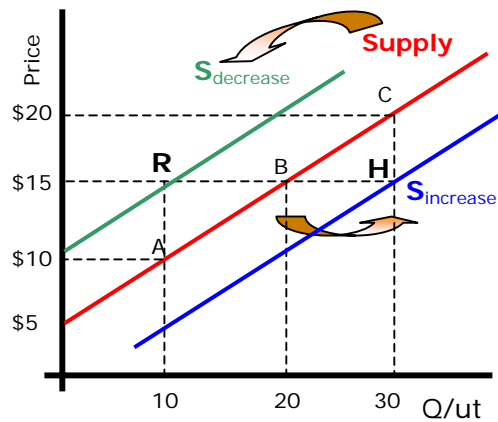


Figure III.A.7

C. Equilibrium

Webster's *Encyclopedic Unabridged Dictionary of the English Language* Defined equilibrium as "a state of rest or balance due to the equal action of opposing forces," and "equal balance between any powers, influences, etc." *The New Palgrave: A Dictionary of Economics* identifies 3 concepts of equilibrium:

- Equilibrium as a "balance of forces"
- Equilibrium as "a point from which there is no endogenous 'tendency to change'"
- Equilibrium as an "outcome which any given economic process might be said to be 'tending towards', as in the idea that competitive processes tend to produce determinant outcomes."

In Neoclassical microeconomics, "equilibrium" is perceived as the condition where the quantity demanded is equal to the quantity supplied; the behavior

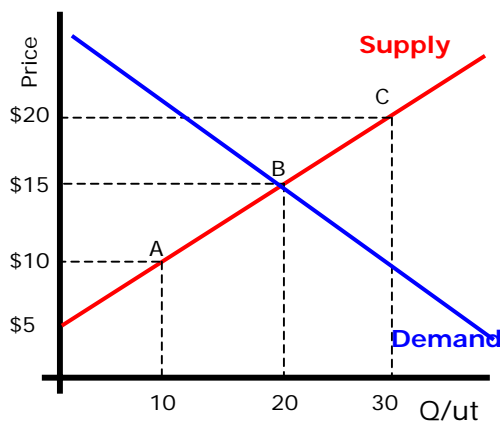


Figure III.A.8

In the graph to the left, equilibrium is at the intersection of the demand and supply functions. This occurs at point B. The equilibrium price is \$15 and the equilibrium quantity is 20 units.

At the equilibrium price the quantity that buyers are willing and able to buy is exactly the same as sellers are willing to produce and offer for sale.

of all potential buyers is coordinated with the behavior of all potential sellers.

There is an equilibrium price that equates or balances the amount that agents want to buy with the amount that is produced and offered for sale (at that price). There are no forces (from buyers or sellers) that will alter the equilibrium price or equilibrium quantity. Graphically, economists represent a market equilibrium as the intersection of the demand and supply functions. This is shown in Figure III.A.8. This notion of equilibrium is one of the fundamental organizing concepts of neoclassical economics

This is a mechanical, static conception of equilibrium. Neoclassical economics uses “comparative statics” as a method by which different states can be analyzed. In this approach to equilibrium in a market the explanation about how equilibrium is achieved does not consider the possibility that some variables change at different rates of time.

The process of achieving a state of equilibrium is based on buyers and sellers adjusting their behavior in response to prices, shortages and surpluses. In Figure III.A.9, If the price were at \$20, the price is “too high” and the market is not in equilibrium. The amount of the good that agents are willing and able to buy at this price (quantity demanded) is less than sellers would like to sell (quantity supplied). At \$20 buyers are willing and able to purchase 13 units while sellers produce and offer for sale 30 units. Sellers have 17 units that are not sold at this price. This is a surplus. In order to sell the surplus units, sellers lower their price. As the price falls from \$20 the quantity supplied decreases and the quantity demanded increases. (Neither demand nor supply are changed.) As the price falls, the quantity supplied falls and the quantity demanded increases. At a price of \$15 the amount that buyers are willing and able to purchase is equal to the amount sellers produce and offer for sale.

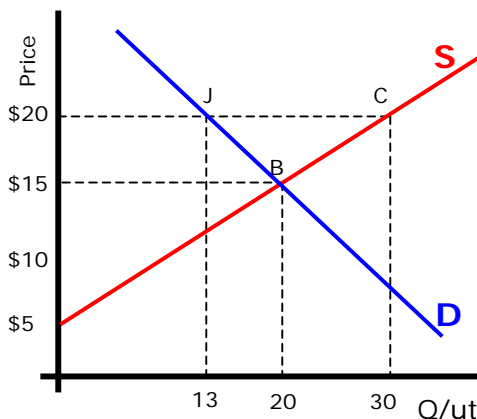


Figure III.A.9

When the market price is below the equilibrium price the quantity demanded exceeds the quantity supplied. At the price below equilibrium, buyers are willing and able to purchase an amount that is greater than the suppliers produce and offer for sale. The buyers will “bid up” the price by offering a higher price to get the quantity they want. The quantity demanded will fall while the quantity supplied rises in response to the higher price.

An economic system has many agents who interact in many markets. **General equilibrium is a condition where all agents acting in all markets are in equilibrium at the same time.** Since the markets are all interconnected a change or disequilibrium in one market would cause changes in all markets. Leon Walras [1801-1866] was a major contributor to the concept of general equilibrium. Kenneth Arrow [1921-] and Gérard Debreu [1921-], show the conditions that must be met to achieve general equilibrium.

Antoine Augustin Cournot, [1801-1877] adopted the concept of **partial equilibrium** in 1838 out of mathematical expediency. (*The New Palgrave*) Alfred Marshall [1842-1924] approach was to introduce the concept of time and the process of analyzing one market at a time. Neoclassical microeconomics tends to focus on partial equilibrium. It was Marshall who introduced the concept of *ceteris paribus* as a means to isolate and analyze each market separately. Marshall understood that all markets were interconnected but chose

to analyze each market individually. The concept of partial equilibrium is used in introductory economics courses and for some analysis.

(D) Market Adjustment to Change

Market systems are favored by Neoclassical economists for three primary reasons. First, agents only need information about their own objectives and alternatives. The markets provide information to agents that may be used to identify and evaluate alternative choices that might be used to achieve objectives. Second, each agent acting in a market has incentives to react to the information provided. Third, given the information and incentives, agents within markets can adjust to changes. The process of market adjustment can be visualized as changes in demand and/or supply.

(1) Shifts or Changes in Demand

The demand function was defined from two perspectives;

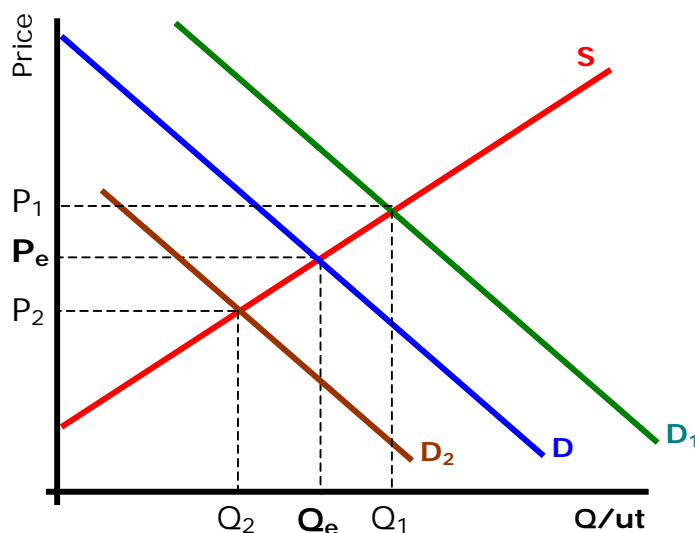
- A schedule of quantities that individuals were willing and able to buy at a schedule of prices during a given period, *ceteris paribus*.
- The maximum prices that individuals are willing and able to pay for a schedule of quantities or a good during a given time period, *ceteris paribus*.

In both cases the demand function is perceived as a negative or inverse relationship between price and the quantity of a good that will be bought. The relationship between price and quantity is shaped by other factors or variables. Income, prices of substitutes, prices of compliments, preferences, number of buyers and expectations are among the many possible variables that influence the demand relationship. The demand function was expressed:

$$Q_x = f_x(P_x, P_c, P_s, M, \text{Preferences, \#buyers, } \dots)$$

P_c is the price of complimentary goods. P_s is the price of substitutes. M is income. Such proxies as gender, age, ethnicity, religion, etc represent preferences. Remember that a change in the price of the good (P_x) is a change in quantity demanded or a movement along a demand function. A change in any other related variable will result in a shift of the demand function or a change in demand.

In Figure III.A.10 the effects of a shift in demand are shown. If supply



Given the supply (**S**) and the demand (**D**), the equilibrium price in the market is P_e . The equilibrium quantity is Q_e .

An increase in demand is represented by a shift of demand from **D** to **D₁**. This will cause an increase in equilibrium price from P_e to P_1 and equilibrium quantity from Q_e to Q_1 .

A decrease in demand to **D₂** will cause equilibrium price to fall to P_2 and quantity to Q_2 .

Figure III.A.10

is constant, an increase in demand will result in an increase in both equilibrium price and quantity. A decrease in demand will cause both

the equilibrium price and quantity to fall.

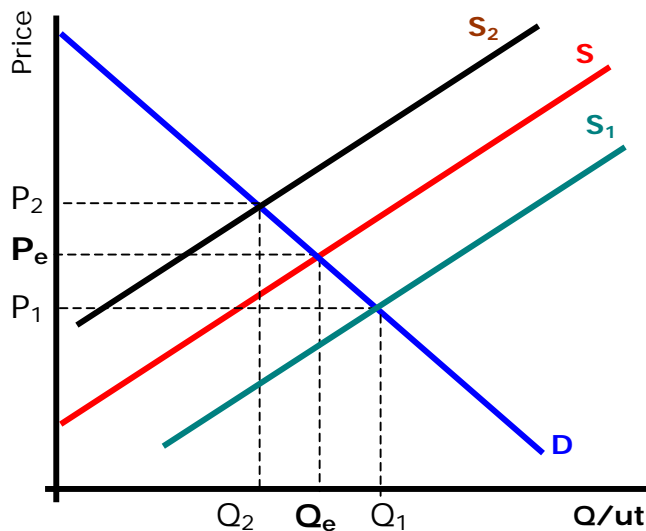
(2) Shift of Supply

Remember that the supply function was expressed,

$$Q_{XS} = f_S (P_X, P_{\text{inputs}}, \text{Tech, regulations, \# sellers, } \dots \#S),$$

A change in the price of the good changes the quantity supplied. A change in any of the other variables will shift the supply function.

An increase in supply can be visualized as a shift to the right, at each price a larger quantity is produced and offered for sale. A decrease in supply is a shift to the left; at each possible price a smaller quantity is offered for sale. If the supply shifts and demand remains constant, the equilibrium price and quantity will be altered.



Given the demand (**D**) and the supply (**S**), the equilibrium price in the market is P_e . The equilibrium quantity is Q_e .

An increase in supply is represented by a shift of supply from **S** to **S₁**. This will cause a decrease in equilibrium price from P_e to P_1 and an increase in equilibrium quantity from Q_e to Q_1 .

A decrease in supply to **S₂** will cause equilibrium price to increase to P_2 and equilibrium quantity to fall to Q_2 .

Figure III.A.11

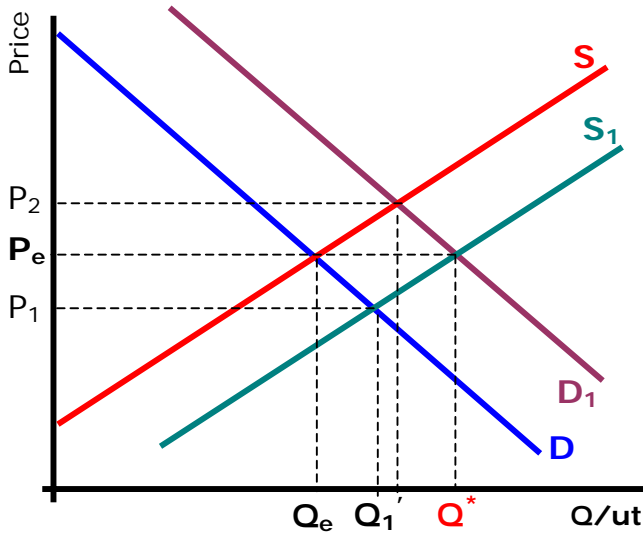
An increase in supply (while demand is constant) will cause the equilibrium price to decrease and the equilibrium quantity to increase. A decrease in supply will result in an increase in the equilibrium price and a decrease in equilibrium quantity.

(3) Changes in Both Supply and Demand

When supply and demand both change, the direction of the change of either equilibrium price or quantity can be known but the effect on the other is indeterminate. An increase in supply will push the market price down and quantity up while an increase in demand will push both market price and quantity up. The effect on quantity of an increase in both supply and demand will increase the equilibrium quantity while the effect on price is dependent on the magnitude of the shifts and relative structure (slopes) of supply and demand. The effect of an increase in both supply and demand is shown in Figure III.A.12.

Should demand decrease and supply increase, both push the equilibrium price down. However, the decrease in demand reduces the equilibrium quantity while the increase in supply pushes the equilibrium quantity up. The price must fall, the quantity may rise, fall or remain the same. Again it depends on the relative magnitudes of the shifts in supply and demand and their slopes.

When supply and demand both shift, the direction of change in either equilibrium price or quantity can be known but direction of change in the value of the other is indeterminate.



Given supply (**S**) and demand (**D**), the equilibrium price is P_e and quantity is Q_e .

An increase in supply to S_1 results in a drop in price from P_e to P_1 while quantity increases from Q_e to Q_1 .

If demand then increased to D_1 , the equilibrium quantity would increase to Q^* . The price however, is pushed up. In this case the price is returned to P_e . If the shift in demand were greater or less (or the slopes of **S** and **D**) were different, the equilibrium price might rise, fall or remain the same; the change is indeterminate until we have more information.

Figure III.A.12

(4) **Equilibrium and the Market**

Whether equilibrium is a stable condition from which there “is no endogenous tendency to change,” or an outcome which the “economic process is tending toward,” equilibrium represents a coordination of objectives among buyers and sellers. The demand function represents a set of equilibrium conditions of buyers given the incomes, relative prices and preferences. Each individual buyer acts to maximize his or her utility, *ceteris paribus*. The supply function represents a set of equilibrium conditions given the objectives of sellers, the prices of inputs, prices of outputs, technology, the production function and other factors.

The condition of equilibrium in a market, where supply and demand functions intersect (“quantity supplied is equal to the quantity demanded”) implies equilibrium conditions for both buyers and sellers.