Supply and Demand
       Fundamental tool of economic analysis
       Used to discuss unemployment, value of $, protection of the environment, etc.

Chapter Outline:
       (a) Demand is the consumer side of the market.
       (b) Supply is the seller side of the market.
       (c) Describe how prices and quantities are determined by the market equilibrium.
       (d) Attempts by the government to restrain market prices with price ceilings.
       (e) Discuss how responsive consumer purchases are to a change in price.
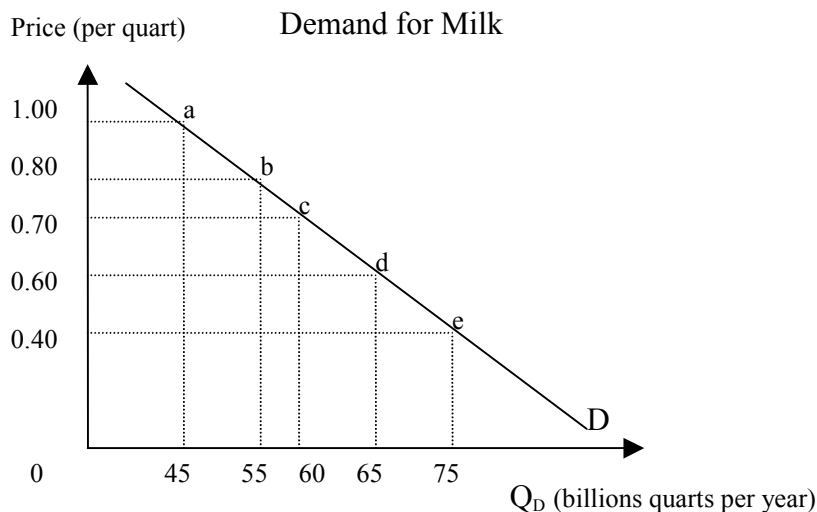
Demand and Quantity Demanded

Quantity demanded will depend on price as well as population size, consumer incomes, tastes, and the prices of other products. But we want to focus on the relationship between the price of a good and the purchases of the good.

Consider the demand for milk:

Price (dollars per quart)	Quantity Demanded (billions of quarts per year)	Label for the graph
1.00	45	A
0.80	55	B
0.70	60	C
0.60	65	D
0.40	75	E

As the price of milk rises, quantity demanded falls because:
(1) People consume less milk.
(2) Some people drop out of the market for milk and drink tea or orange juice instead.

Price (per quart)   Demand for Milk

1.00 .... a
0.80 .... b
0.70 c
0.60 .... d
0.40 .... e
                                      D

0   45   55 60   65   75
                              Q_D (billions quarts per year)

Along the demand curve all other determinants of the quantity demanded for milk (e.g., consumer incomes, the price of orange juice and cereal) are held constant. The price of milk is the only determinant of demand for milk that is allowed to change.

Law of Demand:
The lower the price of the good, the larger the quantity consumers wish to purchase. In general, demand curves have a negative slope.

Shifts in the Demand Curve

The demand curve depicts the relationship between quantity demanded and price, holding everything else that affects quantity demand fixed. Changes in consumer incomes, the price of related goods, or consumer tastes will shift the entire demand curve, even if the price of the good stays constant.

A change in price produces a <u>movement along a fixed demand curve</u>. A change in any other factor that affects quantity demanded produces a <u>shift in the entire demand curve</u>.

If consumers want (less) more at any given price, the demand curve shifts out (in).
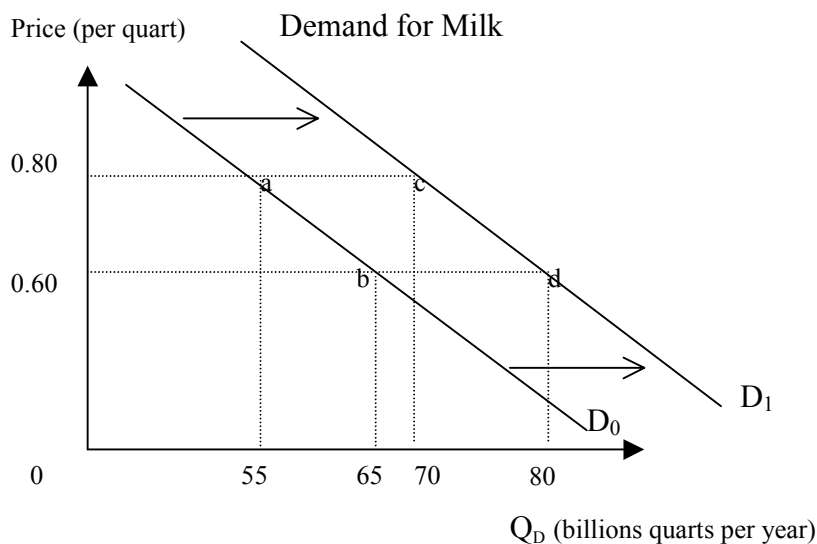
Movement along the demand curve: a to b (or c to d).
Outward shift in the demand curve: a to c (or b to d).

Factors that shift demand:

(1) Change in consumer income
    <u>Normal goods</u>: An increase in income shifts demand out.
    <u>Inferior goods</u>: An increase in income shifts demand in.

    What are some *examples* of inferior or normal goods?

(2) Change in the price of *related* goods
    (a) Two goods are <u>compliments</u> if they are consumed together.

    If a compliment good becomes cheaper this shifts the demand curve out. For example, a fall in the price of cereal will lead to an outward shift in the demand for milk.

        What will happen to the demand for milk if the price of Oreo cookies rises?

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(b) Two goods are <u>substitutes</u> if one can replace the other in consumption.

If a substitute good becomes cheaper this shifts the demand curve in. For example, a fall in the price of orange juice will lead to an inward shift in the demand for milk.

What will happen to the demand for milk if the price of tea rises?

(3) Change in consumer tastes

If consumers worry about their daily calcium intake, the demand for milk will shift outward.

Or as the population ages, the demand for milk may shift in. Studies have shown that milk consumption is highest among children and young adults.

Why have we seen an explosion in the number of milk ads on TV?

Supply and Quantity Supplied

Quantity supplied is not a fixed number and depends on many factors. For example, there is more milk if there are more dairy farmers, and less milk if bad weather kills cows or destroys their feed. But we want to focus on the relationship between the price of a good and the production of the good.

Consider the supply of milk:

Price (dollars per quart)	Quantity Supplied (billions of quarts per year)	Label for the graph
1.00	90	A
0.80	70	B
0.70	60	C
0.60	50	D
0.40	30	E

Farms require higher prices to supply more milk because their costs are rising as they produce more. Higher milk production requires more cows, feed, milking equipment, dairy workers, etc. Suppliers want to make profits and must raises their prices to cover their costs.

The Supply of Milk

Price (per quart)

Qs (billions of quarts per year)
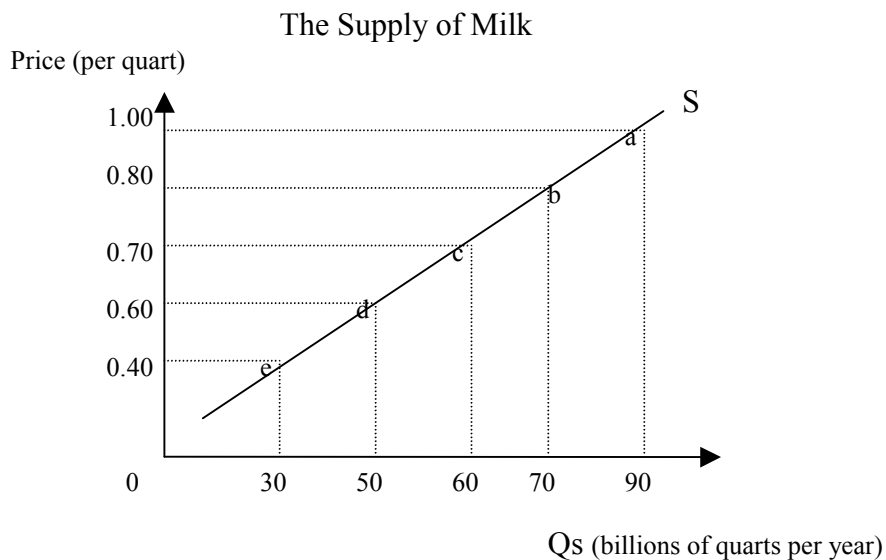
Along the supply curve all other determinants of quantity supplied (e.g., the price of feed, the weather, etc.) are held constant. The price of milk is the only determinant of the supply of milk that is allowed to change.

Law of Supply:
The higher the price of a good, the larger the quantity firms want to produce. In general, supply curves have a positive slope.

Shifts in the Supply Curve

The supply curve depicts the relationship between quantity supplied and price, holding everything else that affects quantity supplied fixed. Changes in industry size, the price of inputs, or technology will shift the entire supply curve, even if the price of the good stays constant.

A change in price produces a <u>movement along a fixed supply curve</u>. A change in any other factor that affects quantity supplied produces a <u>shift in the entire supply curve</u>.

If producers sell more (less) at any given price, the supply curve shifts out (in).

The Supply of Milk

Price (per quart)

Qs (billions of quarts per year)
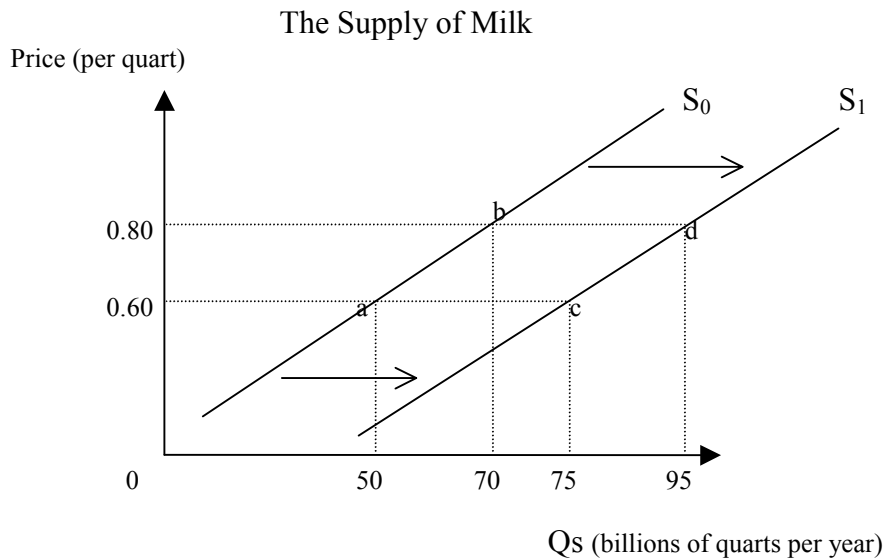
Movement along the supply curve: a to b (or c to d).
Outward shift in the supply curve: a to c (or b to d).

Factors that shift supply:

(1) Size of the industry
If the number of firms increases (decreases), the supply curve shifts out (in). For example, if the number of dairy farmers increases, more milk is produced and the supply shifts out.
    What happens to the supply of milk if the number of dairy farms decreases?

(2) Price of inputs
If the price of an input falls, producers costs fall and they are willing to supply more at any given price. This shifts the supply curve outward.
    What will happen to the supply of milk, if dairy workers unionize and negotiate higher wages?

(3) Technological progress
Improvements in technology allow producers to supply more at any given price, which shifts the supply curve out. For example, many dairy farmers use BGH to increase the output of milk per cow.

Equilibrium of Supply and Demand

In a free market, the quantity of goods and services is determined by the intersection of supply and demand.

In equilibrium, consumers are willing to buy exactly what producers are willing to sell.

Consider the following chart to understand how the milk market moves toward equilibrium:

Price (per quart)	Quantity Demanded	Quantity Supplied	Surplus or shortage?	Price response
1.00	45	90	surplus of 45	fall
0.80	55	70	surplus of 15	fall
0.70	60	60	neither	stay same
0.60	65	50	shortage of 15	rise
0.40	75	30	shortage of 45	rise

The equilibrium occurs at the price of 70 cents. The forces of supply and demand push prices toward this equilibrium.

If the price is below the equilibrium price, a shortage occurs. In this case, frustrated consumers will offer farmers higher prices to get the milk they desire, forcing prices up.
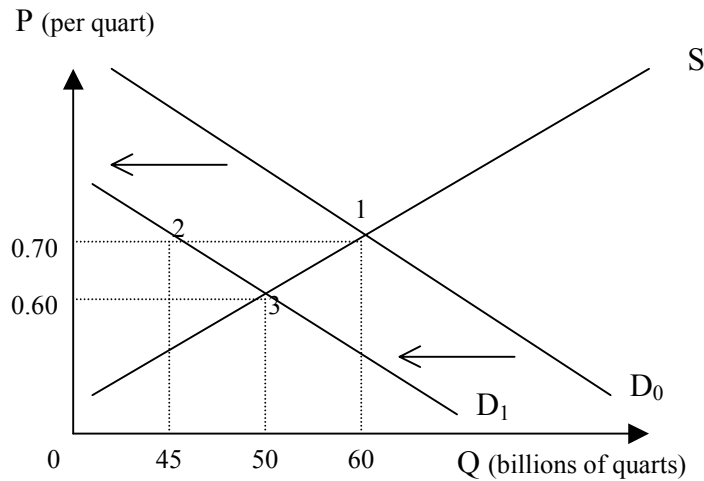
If the price is above the equilibrium price, a surplus occurs. In this case, frustrated sellers will lower prices to clear out their inventories, lowering milk prices.

Markets are not always in equilibrium, but free markets normally move toward equilibrium.

Adjustment to Shifts in Demand or Supply

Any shift in supply or demand alters the equilibrium price and quantity.

Consider a decrease in demand:

P (per quart)

[Graph showing supply curve S, demand curves D_0 and D_1, with points 1, 2, 3 marked. Price axis marks at 0.70 and 0.60. Quantity axis marks at 45, 50, 60. Arrows indicating inward shift of demand.]

Q (billions of quarts)

When the demand for milk falls, consumers wish to purchase less milk at any given price. Quantity demanded at the price of 70 cents falls from 60 to 45 billion. At point 2 there is a surplus of 15 billion quarts so prices must fall to clear the market. The price reduction encourages more consumption (point 2 to 3) and less production (point 1 to 3) thereby ending the surplus. Price falls until we reach a new equilibrium at point 3.

In general, any inward shift in demand lowers the equilibrium price and quantity.

Consider a decrease in supply:

P (per quart)

S₁

S₀

0.90

0.70

3

2

1

D

0   40   50   60
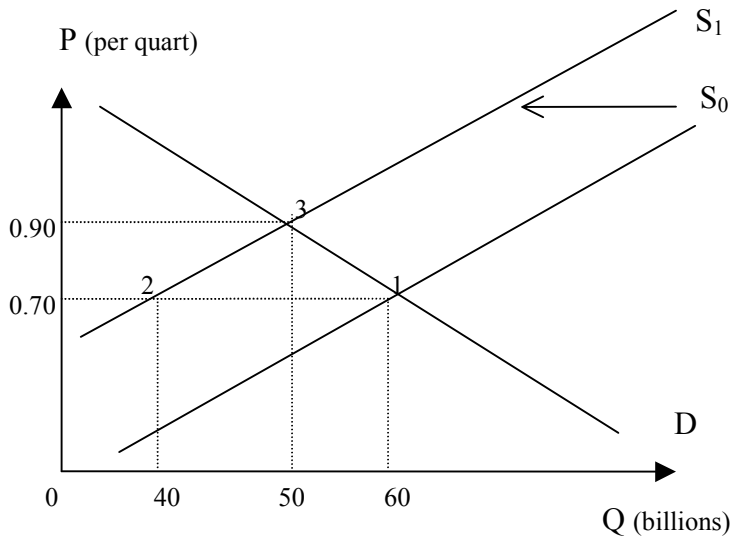
Q (billions)

When the supply of milk falls, sellers wish to produce less milk at any given price. Quantity supplied at the price of 70 cents falls from 60 to 40 billion. At point 2 there is a shortage of 20 billion quarts so prices must rise to clear the market. The price increase encourages less consumption (point 1 to 3) and more production (point 2 to 3) thereby ending the shortage. Price rises until we reach a new equilibrium at point 3.

In general, any inward shift in supply lowers the equilibrium quantity and raises the equilibrium price.

Government Intervention in Markets: Price Floors

A price floor is a legal minimum on the price that may be charged for a commodity. The government imposes price floors to help the sellers in a market. Examples include minimum wage legislation and agricultural price supports.

Milk price supports began in 1933 when farmers were going broke in record numbers. It was meant to be a temporary program but still exists today even though the farming population is $1/6^{th}$ of what it was then.

The government buys the milk surplus, which is usually stored as cheese. The government also pays to store the surplus and to eventually dispose of the cheese. The estimated cost of these activities is between 10 and 12 billion dollars a year.

Problems associated with price floors:

(1) Persistent surplus develops
   Agricultural surpluses have long been a problem in the U.S. The problems are worse in the EEC where the Common Agricultural Policy holds prices even higher. The Europeans frequently export the surplus abroad, which depresses world prices for U.S. exporters and leads to trade disputes.

(2) Disposal of the goods
   The government has to purchase, store, and dispose of the agricultural surplus. If the surplus is not purchased and destroyed prices would fall because frustrated sellers would offer lower prices to eliminate their inventories.

(3) Sellers offer perks or discounts to get around the law
   For example, airlines competed in food quality when they were regulated. Today they compete in price and have lousy food.

(4) Encourages over-investment in the industry
   Inefficient businesses can survive with a high enough price floor. But once the price floor is lifted many firms cannot survive. This happened during the 1980s when the airline and trucking industries had massive layoffs once government regulation was ended.

Consider a graph of milk price supports:
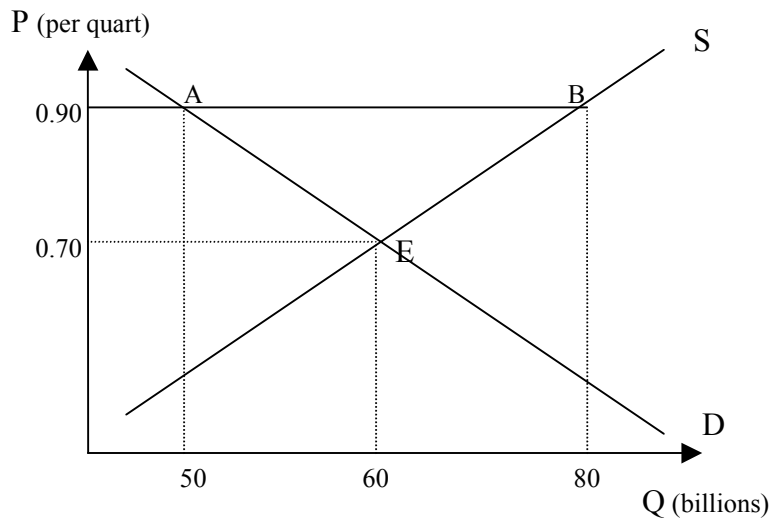
There is a surplus of 30 billion (from A to B) at the price floor of 90 cents. The government maintains this high price by purchasing the surplus, which costs $27 billion in our example. Without government intervention, the price would fall to eliminate the surplus. The surplus will rise over time. The price floor encourages more dairy farms to enter the industry leading to an outward shift in supply (with no change in demand).
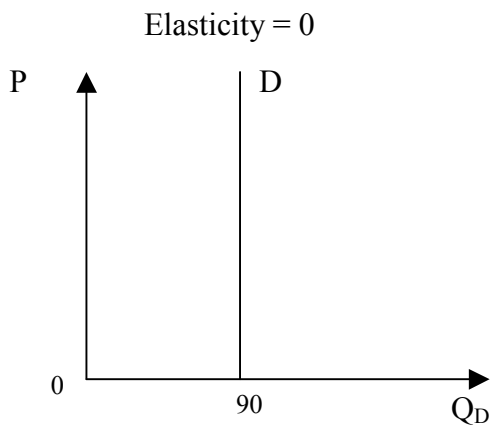
Elasticity of Demand

Elasticity of demand measures how responsive consumer purchases are to a change in price.

Demand elasticity is important to firms. If consumers reduce purchases sharply after a price increase, the firm may not want to raise prices because their total revenues will fall.

Price elasticity is calculated as: $\eta = \dfrac{\%\Delta Q_D}{\%\Delta P}$

Price Elasticity and the Shapes of Demand Curves

The shape of demand curves conveys some information about elasticity.

Elasticity = 0

This demand curve is perfectly inelastic. The quantity demanded is 90 regardless of price and the $\%\Delta Q_D$ is zero. Thus, consumer purchases are completely unresponsive to a change in price.

What type of goods has this kind of demand curve?

Salt, shoe laces, or necessities.

Consider another odd looking demand curve:

P

Elasticity = ∞

$5 ────────────── D

0   Q_D
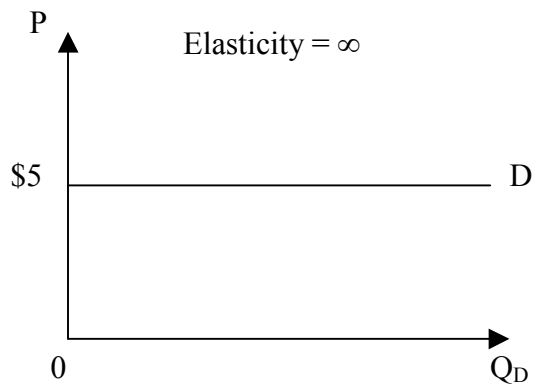
This demand curve is perfectly elastic. A slight increase in price above $5 reduces quantity demanded to zero. Thus, a small change in price results in an infinitely large change in quantity demanded. Consumers are completely responsive to price changes.

Example: Demand for a firm that produces an undifferentiated good.

Consider a straight-line demand curve:
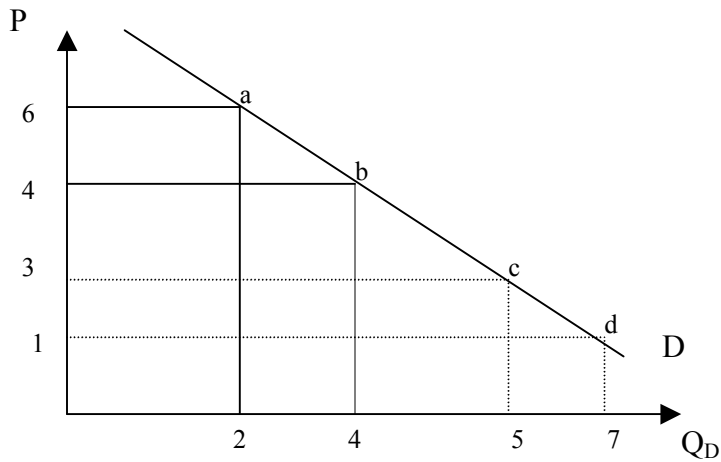
The slope of a straight-line demand curve is constant, but the slope is changing.

Calculate elasticity between any two points on the demand curve:

$$\eta = \frac{\%\Delta Q_D}{\%\Delta P} = \frac{\dfrac{\Delta Q_D}{\overline{Q}}}{\dfrac{\Delta P}{\overline{P}}}$$ where $\overline{Q}$ is the average of the 2 quantities and $\overline{P}$ is the average of the

2 prices.

Applying this formula to points a and b versus c and d yields:

$$\eta_{(a-b)} = \frac{\dfrac{2}{3}}{\dfrac{2}{5}} = 1.67 \text{ and } \eta_{(c-d)} = \frac{\dfrac{2}{6}}{\dfrac{2}{2}} = .33$$

Notice that we ignore the negative sign when calculating elasticity of demand and focus on absolute values.

As we move down the demand curve the elasticity is getting smaller, because the average quantity is getting larger while the average price is getting smaller.

Consider a unit-elastic demand curve:
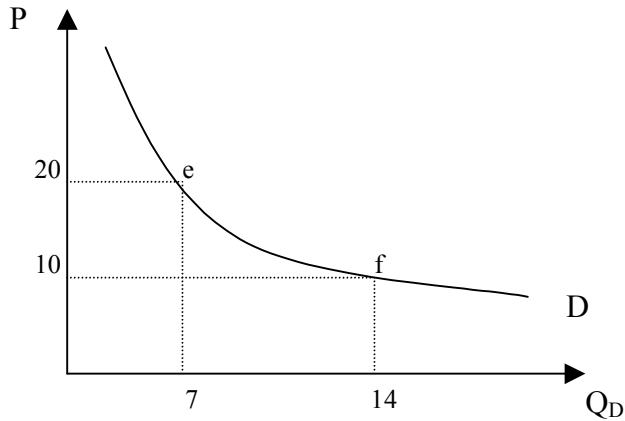
The elasticity of a unit-elastic demand curve is constant and equal to one, but the slope is always changing.

The elasticity between points e and f is: $\eta = \dfrac{\dfrac{7}{10.5}}{\dfrac{10}{15}} = 1$.

If elasticity is equal to one, then demand is unit elastic.
If elasticity is greater than one, then demand is elastic.
If elasticity is less than one, then demand is inelastic.

Price Elasticity and Total Expenditure

Firms want to know whether a price increase will raise or lower their revenues.

If demand is elastic, then an increase in price will lower total revenue.
If demand is inelastic, then an increase in price will raise total revenue.
If demand is unit-elastic, then an increase in price will not alter total revenue.

Note: total revenue = price x quantity demanded.

If price falls by 10 percent and purchases rise by 10 percent, then demand is unit elastic and total revenues are unchanged.

If price falls by 10 percent and purchases rise by 15 percent, then demand is elastic and total revenues rise.

If price falls by 10 percent and purchases rise by 5 percent, then demand is inelastic and total revenue falls.

What Determines the Elasticity of Demand?

(1) Nature of the good
    Necessities have very inelastic demands, while luxuries have elastic demands.

    For example, η potatoes = 0.3 and the η restaurant meals = 1.6. What do these numbers mean?

    A 10 percent rise in the price of potatoes reduces sales of potatoes by 3 percent. And a 10 percent rise in the price of restaurant meals reduces restaurant dining by 16 percent.

    This comes from the elasticity formula: $\%\Delta P * \eta = \%\Delta Q_D$

(2) Availability of a close substitute
    If consumers can buy a close substitute for a product whose price increased, they will readily switch.

    For example, the demand for gas is inelastic because you can't run a car without it. But the demand for Chevron gas is elastic because Mobile or Shell gasoline works just as well.

(3) Fraction of income absorbed
    Very inexpensive items have an inelastic demand. Who will use more salt if the price falls? However, very expensive items have elastic demands. Families will buy fewer homes if the price of housing increases.

(4) Passage of time
    The demand for products is more elastic in the long run than in the short run because consumers have more time to adjust their purchases.

    Suppose the recent rise in gasoline prices continued. In the short run, consumers may take fewer summer road trips to reduce their expenditures on gasoline. But in the long run, consumers can buy more fuel efficient cars to further reduce their gasoline outlays.

Elasticity is a general concept. Economists also study the income elasticity of demand for products and the elasticity of supply.

Cross Elasticity of Demand

The cross elasticity of demand is used to determine whether two goods are compliments or substitutes. It is calculated as:

$$\eta_{cross} = \frac{\%\Delta Q_D \text{ good X}}{\%\Delta P \text{ good Y}}$$

Two good are <u>compliments</u> if an increase in the quantity demanded for one good leads to an increase in the quantity demanded of the other good. Examples are ketchup and french fries or coffee and cream.

> If the price of coffee falls, purchases of coffee and cream will increase. The cross elasticity of demand for compliments is negative. As the price of coffee falls, the quantity demanded of cream rises.

Two goods are <u>substitutes</u> if an increase in the quantity demanded for one good leads to a fall in the quantity demanded for the other good. Examples are ice cream and frozen yogurt or cans of salmon and cans of tuna.

> If the price of ice cream rises, purchases of ice cream will fall and purchases of frozen yogurt will increase. The cross elasticity of demand for substitutes is positive. As the price of ice cream rises, the quantity demanded of frozen yogurt rises.

Cross elasticity of demand is often used in "anti-trust" lawsuits. If firms face strong competition, it is difficult to overcharge customers. A very high and positive cross elasticity indicates effective competition in a market.