



# Analysis of Supply

## Introduction to Supply

All markets include *buyers* and *sellers*. The buyers in a market demand the product, but the sellers supply it.

**Definition of Supply:** a schedule or curve showing how much of a product producers will supply at each of a range of possible prices during a specific time period.

- Different producers have different costs of production.
- Some firms are more efficient than other thus can produce their products at a lower marginal cost.
- Firms with lower costs are willing to sell their products at a lower price.
- However, as the price of a good rises, more firms are willing and able to produce and sell their good in the market, as it becomes easier to cover higher production costs.

- **The Law of Supply**

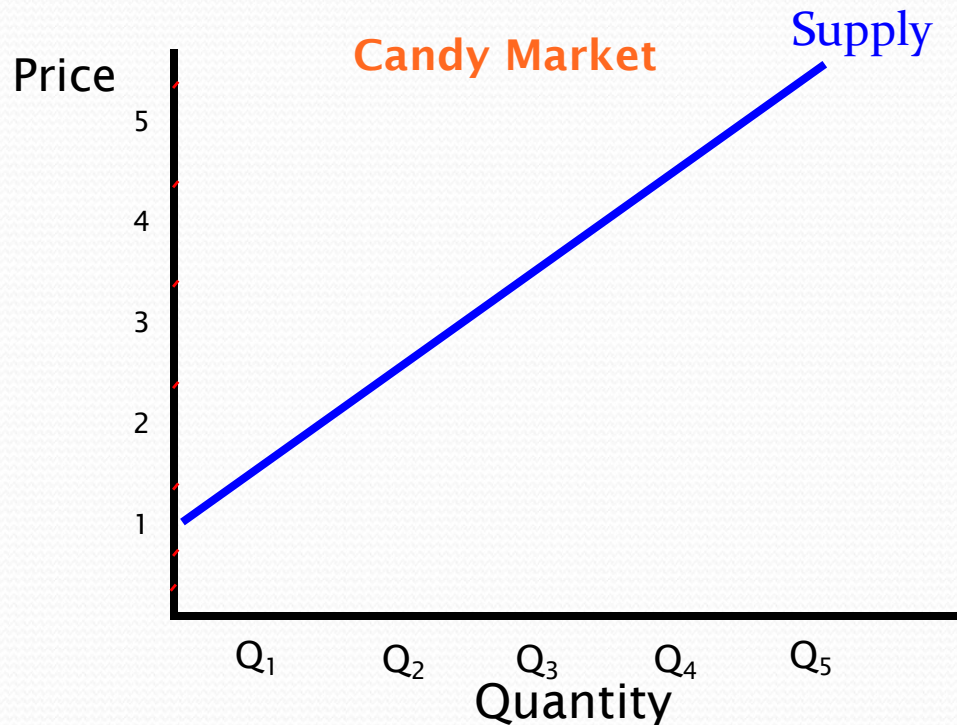
*Ceteris paribus*, there exists a direct relationship between price of a product and quantity supplied. As the price of a good increases, firms will increase their output of the good. As price decreases, firms will decrease their output of the good.



## The Law of Supply – the supply curve

The supply curve slopes upward, reflecting the law of supply, indicating that

- At lower prices, a lower quantity is supplied, and
- At higher prices, firms wish to supply more candy



### Notice that:

- The supply curve intersects the price-axis around \$1. This is because no firm would be able to make a profit selling candy for less than \$1. The P-intercept of supply will *almost always* be greater than zero.
- You cannot see where the supply curve crosses the Q-axis. This is because below \$1, there is no candy supplied. The Q-intercept would, in fact, be negative.

# The non-Price Determinants of Supply

A change in price will lead to a change in the quantity demanded. But a change in a non-price determinant of supply will shift the supply curve and cause more or less output to be supplied at EACH PRICE.

## The non-Price Determinants of Supply (Supply shifters)

<b>Subsidies and Taxes</b>	<b>Subsidies:</b> government payment to producers for each unit produce, will increase supply. <b>Taxes:</b> Payments from firms to the government, will decrease supply.
<b>Technology</b>	New technologies make production more efficient and increase supply.
<b>Other related goods' prices</b>	Substitutes in production. If another good that a firm <i>could</i> produce rises in price, firms will produce more of it and less of what they used to produce.
<b>Resource costs</b>	If the costs of inputs falls, supply will increase. If input costs rise, supply decreases.
<b>Expectations of producers</b>	If firms expect the prices of their goods to rise, they will increase production now. If they expect prices to fall, they will reduce supply now.
<b>Size of the market</b>	If the number of firms in the market increases, supply increases. Vice versa.



# Changes in Supply vs. Changes in Quantity Supply

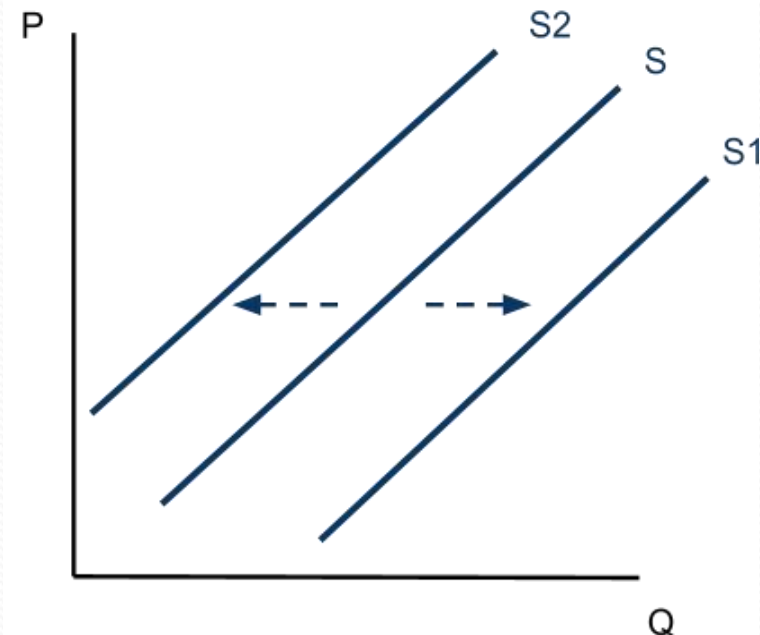
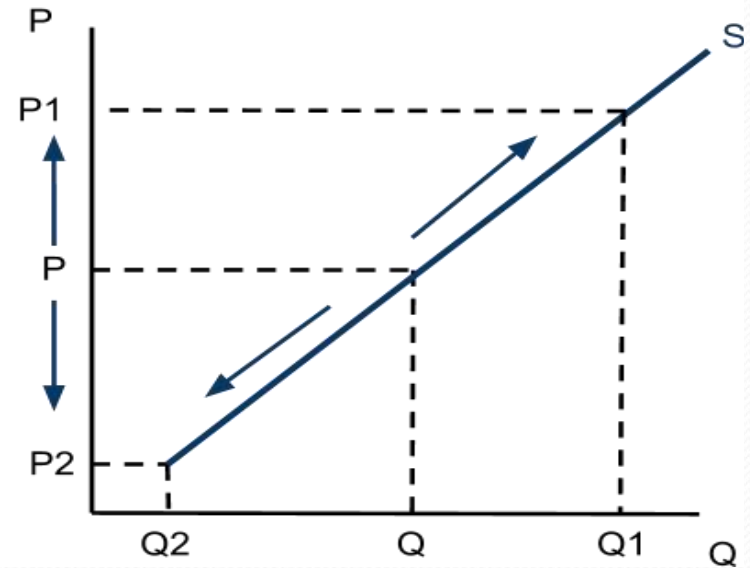
A change in the price of a good causes the quantity supplied to change. This is different than a change in supply, which is caused by a change in a non-price determinant of supply

## A change in price: Can be seen in graph (A)

- Firms already in the market will wish to increase their output to earn the higher profits made possible by the higher price.
- If price falls, firms will scale back production to maintain profits or reduce losses.

## A change in supply: Can be seen in graph (B)

- If resource costs decrease, a subsidy is granted, or if the number of firms increase, supply increases to  $S_1$
- If resource costs rise, if a tax is levied, or if the price of a similar good which firms can produce rises, supply decreases to  $S_2$ .



# Supply Function

- The supply function is a shorthand expression of the various factors affecting supply of a commodity.
- Thus, the supply of a commodity can be put as a function of price of that commodity, the price of all other commodities; the prices of factors of production, technology, the objectives of producers and other factors.
- This relationship must be expressed with the help of following symbols.
- $QS = f(P_1, P_2, P_3 \dots P_n, F_1 \dots F_n, T, O, OF)$  where QS stands for the supply of commodity .....  $P_1$  is the price of that commodity,  $P_2, P_3 \dots P_n$  are the prices of all other commodities,  $F_1 \dots F_n$  are the prices of all factors of production.
- T is the state of technology, O is the objective of the producer and OF stands for other factors influencing supply.



## Linear Supply Equations

Supply can also be expressed mathematically as an equation. We will examine linear supply equations, which are simple formulas that tell us the quantity supplied of a good as a function of the good's price and non-price determinants.

A typical supply equation will be in the form:

$$Q_s = c + dP$$

Where:

- 'Qs' = the quantity supplied for a particular good
- 'c' = the quantity supplied at a price of zero. This is the 'q-intercept' of supply, or where the supply curve would cross the Q-axis
- 'd' = the amount by which quantity will change as price changes, and
- 'P' = the price of the good

## Linear Supply Equations

Consider the demand for bread in the same small village as in our demand analysis, which can be represented by the following equation:

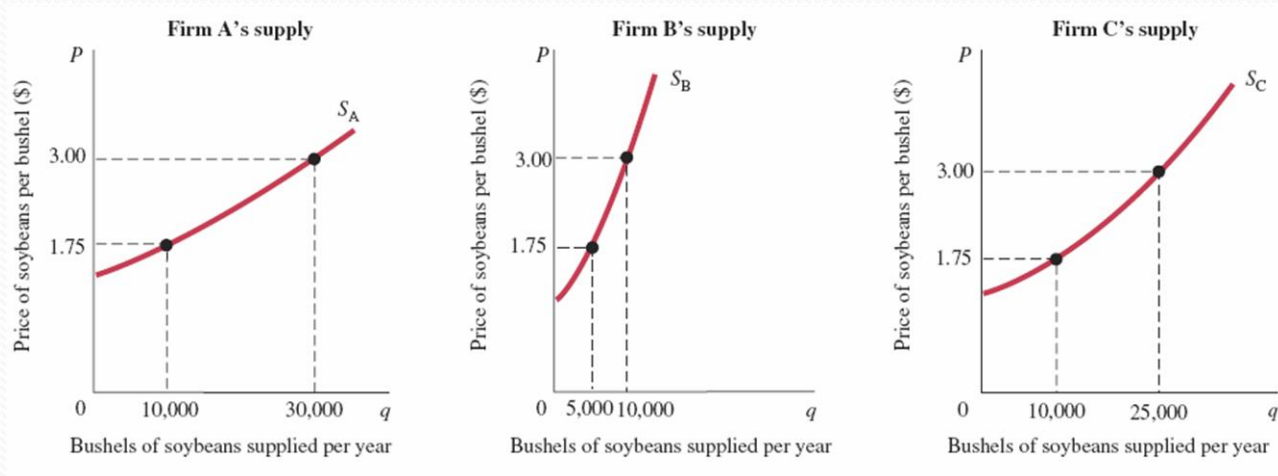
$$Q_s = -200 + 150P$$

What do we know about the supply of bread from this function? We know that:

- If bread were free (e.g. if the price = 0), -200 loaves of bread would be demanded. *Plug zero into the equation to prove that  $Q_s = -200$  at a price of zero.* Of course, -200 cannot be supplied, so if  $P=0$ , no bread will be produced.
- For every \$1 increase in the price of bread above zero, 150 additional loaves will be supplied. Plug the following prices into the equation to prove this:
  - \$1 -  $Q_d = -200 + 150(1) = -50$
  - \$2 -  $Q_d = -200 + 150(2) = 100$
  - \$3 -  $Q_d = -200 + 150(3) = 250$
  - \$4 -  $Q_d = -200 + 150(4) = 400$
- We can also calculate the price at which the supply curve will begin. This is known as **the P-intercept** (because it's where the supply curve crosses the P-axis. To find this, set Q equal to zero and solve for P.  $0 = -200 + 150(P)$ . ..  $P = 1.33$

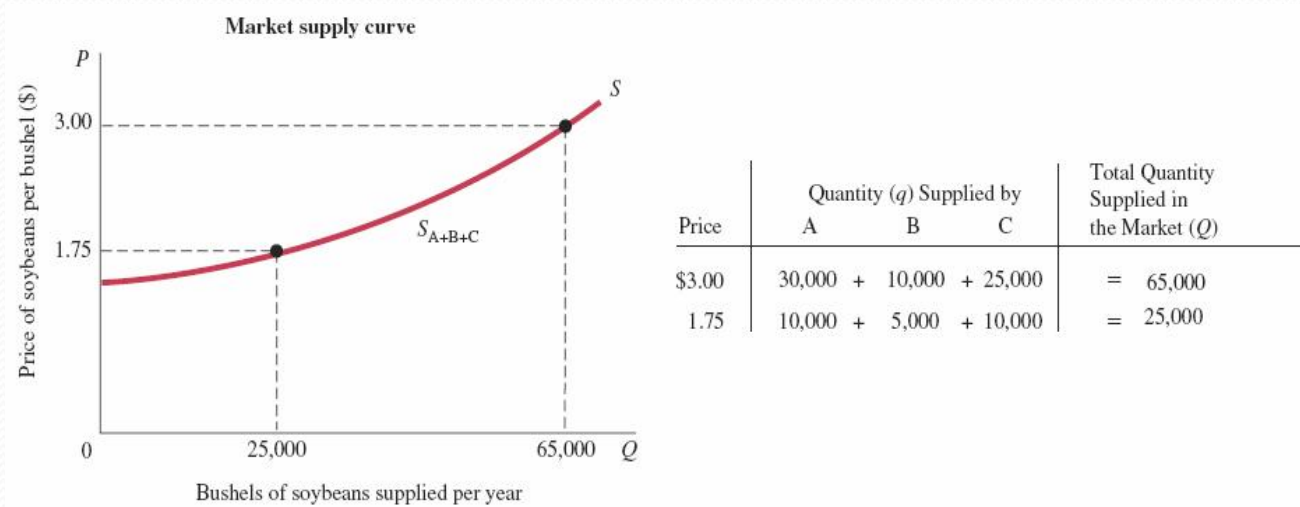


**FIGURE 3.8 Deriving Market Supply from Individual Firm Supply Curves**



Total supply in the marketplace is the sum of all the amounts supplied by all the firms selling in the market. It is the sum of all the individual quantities supplied at each price.

**FIGURE 3.8 Deriving Market Supply from Individual Firm Supply Curves (cont'd)**



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## Market Equilibrium

We have now examined several concepts fundamental in understanding how markets work, including:

- Demand, the law of demand, and linear demand equations
- Supply, the law of supply and linear supply equations

The next step is to put supply and demand together to get...

**Market Equilibrium:** *A market is in equilibrium when the price and quantity are at a level at which supply equals demand. The quantity that consumers demand is exactly equal to the quantity that producers supply.*

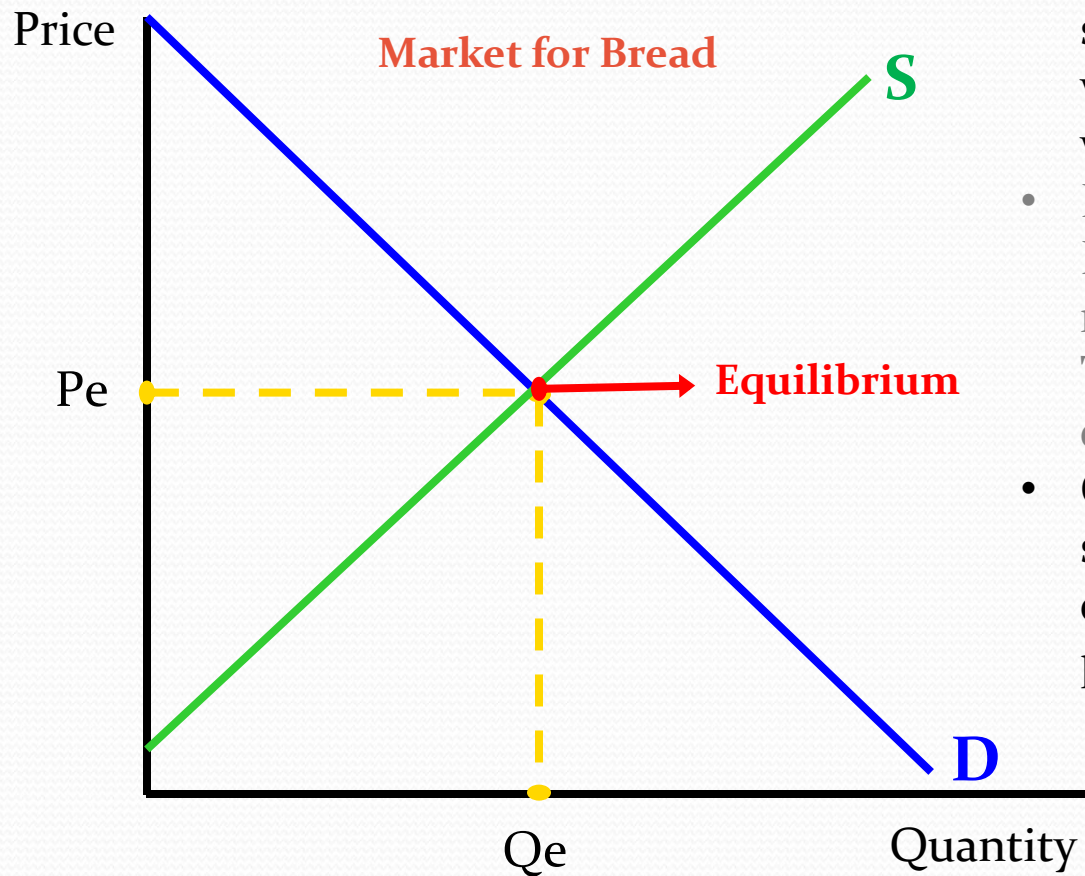
*In equilibrium, a market creates no shortages or surpluses, rather, the market “clears”. Every unit of output that is produced is also consumed.*

**Equilibrium Price ( $P_e$ ):** *The price of a good at which the quantity supplied is equal to the quantity demanded*

**Equilibrium Quantity ( $Q_e$ ) :** *The quantity of output in at which supply equals demand.*

# Market Equilibrium

Consider the market for bread below.

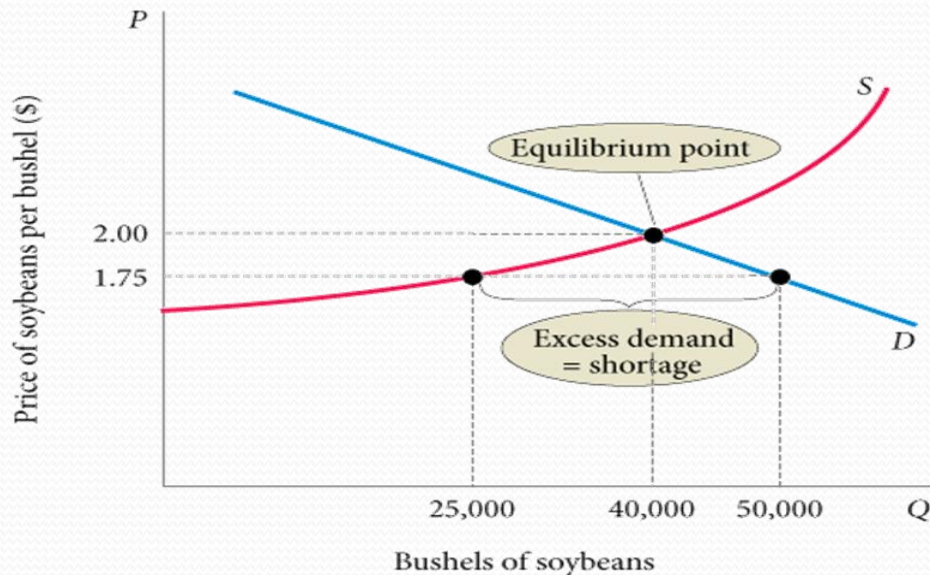


## Consider the following:

- If the price were anything greater than  $P_e$ , firms would wish to supply more bread, but consumers would demand less. The market would be out of equilibrium.
- If the price were anything less than  $P_e$ , consumers would demand more but firms would make less. The market would be out of equilibrium.
- Only at  $P_e$  does the quantity supplied *equal* the quantity demanded. This is the equilibrium point in the market for bread.

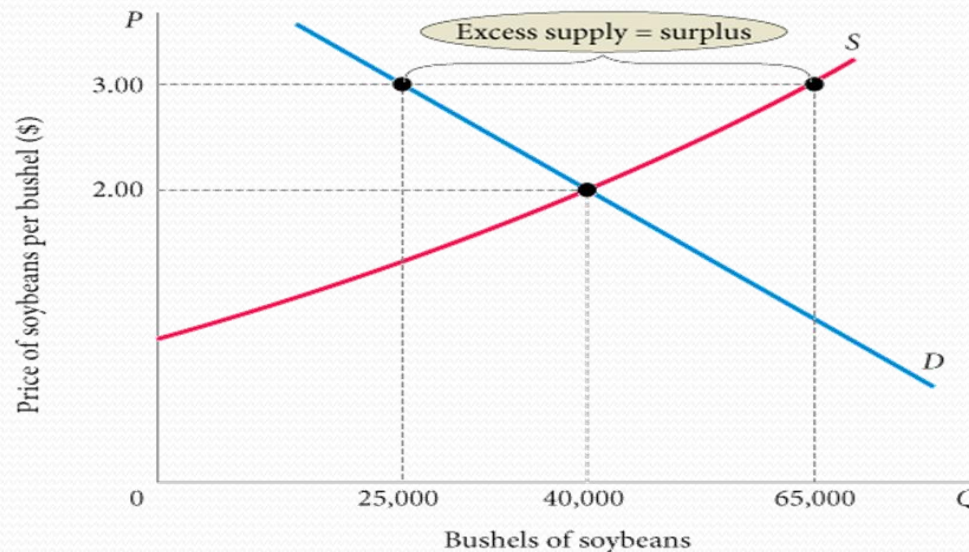


# Excess Demand, or Shortage



- At a price of \$1.75 per bushel, quantity demanded exceeds quantity supplied.
- When *excess demand* exists, there is a tendency for price to rise.
- When quantity demanded equals quantity supplied, excess demand is eliminated and the market is in equilibrium.
- Here the equilibrium price is \$2.00, and the equilibrium quantity is 40,000 bushels.
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# Excess Supply, or Surplus



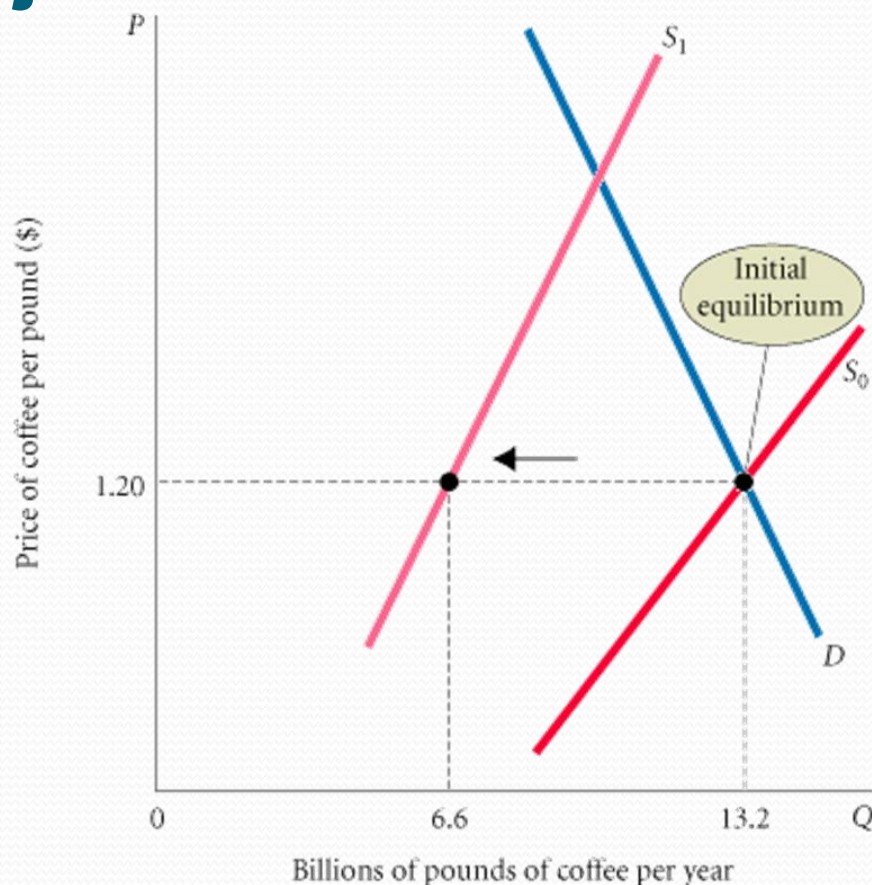
At a price of \$3.00, quantity supplied exceeds quantity demanded by 40,000 bushels.

This excess supply will cause the price to fall.



# The Coffee Market: A Shift of Supply and Subsequent Price Adjustment

- Before the freeze, the coffee market was in equilibrium at a price of \$1.20 per pound.
- At that price, quantity demanded equaled quantity supplied.
- The freeze shifted the supply curve to the left (from  $S_0$  to  $S_1$ ), increasing the equilibrium price to \$2.40.



## Market Equilibrium in Linear Demand and Supply Equations

Equilibrium is a concept that can be transferred to our analysis of linear demand and supply equations just as easily as it can be applied to graphs. Assume we have a market for bread in which demand and supply are represented by the equations:

$$Q_d = 600 - 50P \text{ and } Q_s = -200 + 150P$$

Equilibrium price and quantity occur when demand equals supply. So to calculate the equilibrium using these equations, we must set the two equal to each other and solve for price

$$600 - 50P = -200 + 150P$$

$$800 = 200P$$

$$P = \$4$$

Next, to find the equilibrium quantity, we must simply put the \$4 price into either the demand or supply equation (since they will both yield the same quantity)

$$Q_d = 600 - 50(4)$$

$$Q_d = 400$$

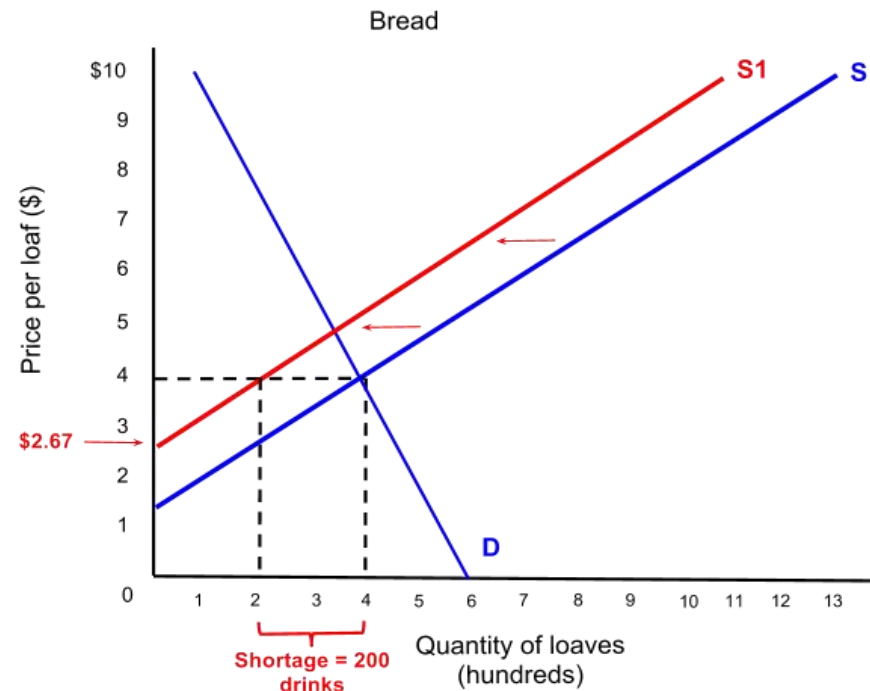
*The equilibrium price of bread is \$4 and the equilibrium quantity is 400 loaves*



## Changes to market equilibrium

As the supply decreases, the price of bread must rise, or else there will be shortages (as seen in graph A). Once the market adjusts to its new equilibrium, the shortages are eliminated and the  $Q_d$  once again equals the  $Q_s$  (as seen in graph B).

$$Q_s = -400 + 150P \text{ and } Q_d = 600 - 50P$$



## Changes to market equilibrium

What if the demand changes? Assume consumers become less responsive to change in the price of bread and the demand equation changes to

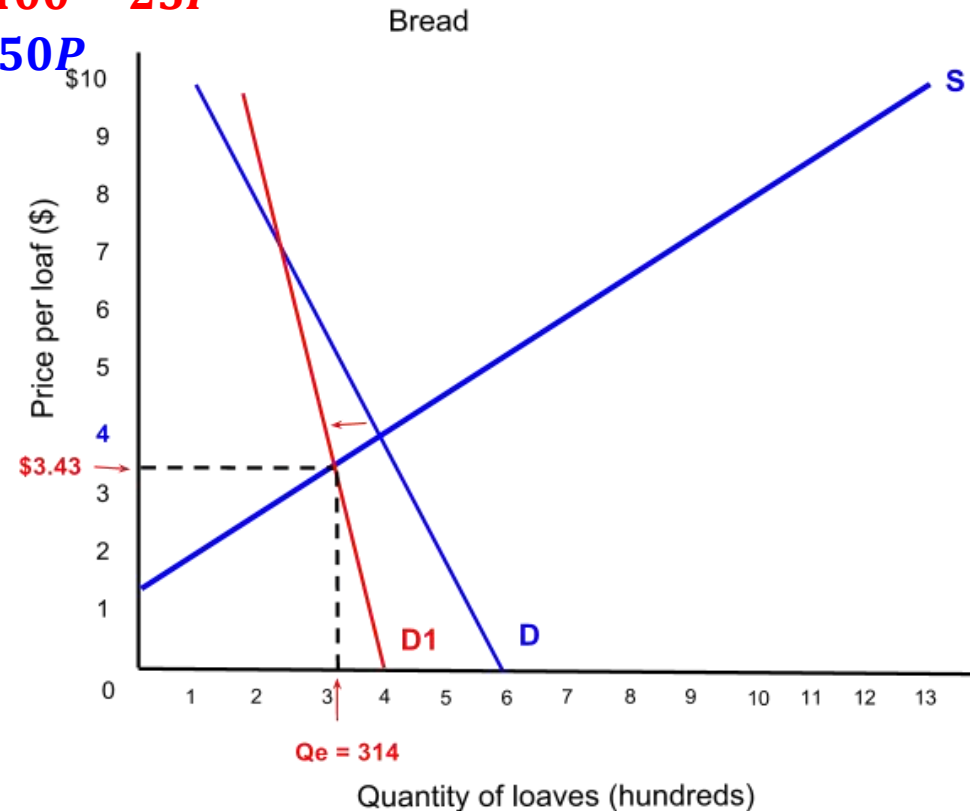
$$Q_d = 400 - 25P$$

Supply remains the same at  $Q_s = -200 + 150P$

If we go graph these two equations, we can see the new equilibrium price and quantity

- Demand has decreased and become steeper, indicating that consumers are less responsive to price changes, yet consumer a smaller quantity overall.
- The equilibrium price is lower (\$3.43 instead of \$4) and the quantity is lower (314 instead of 400)

Whenever either demand or supply change, the market equilibrium will adjust to a new *market clearing price and quantity!*



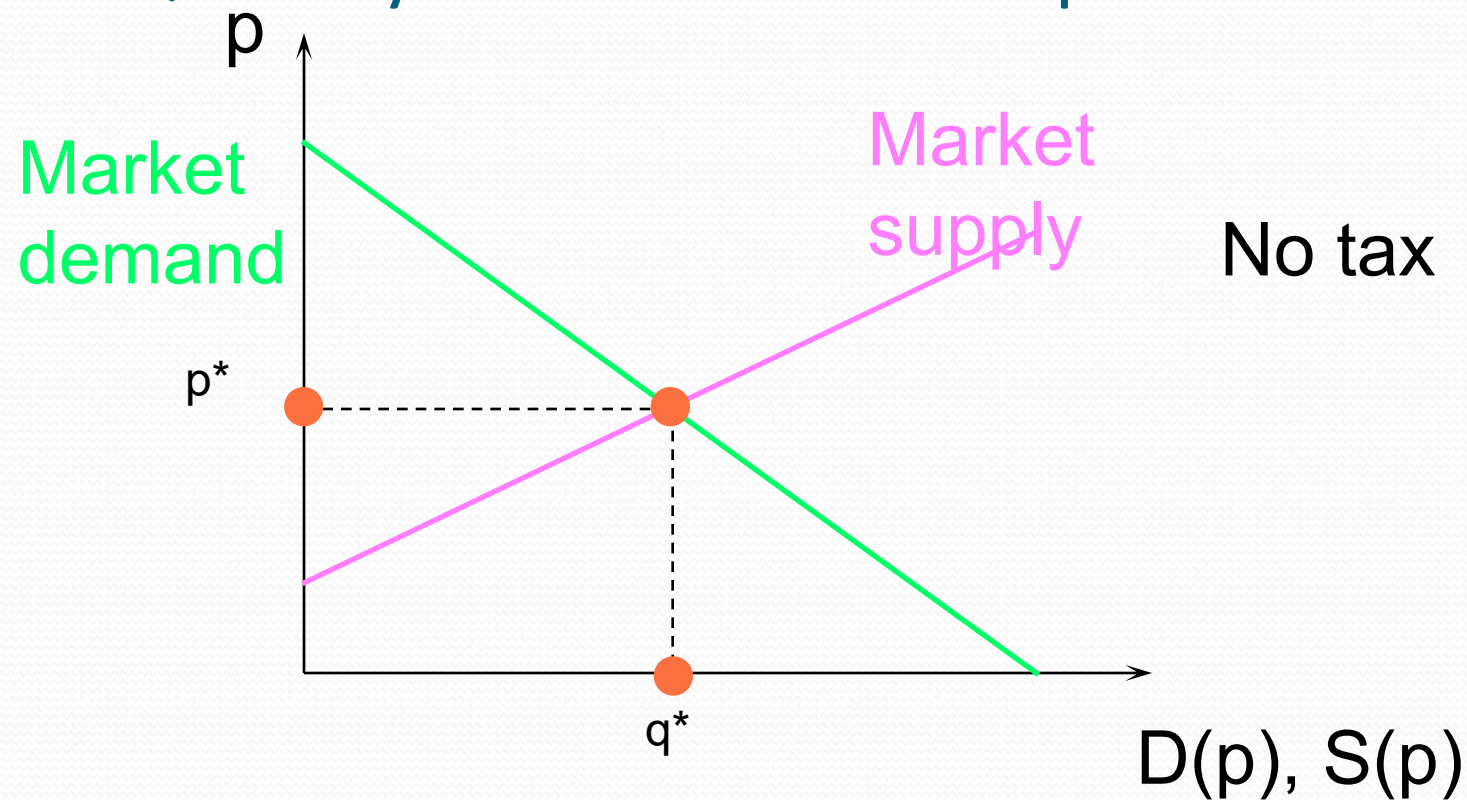


# Example

Suppose demand is governed by:  $Q_d = -3P + 24$  and supply by:  $Q_s = 2P + 4$ .  
Find Equilibrium price, Equilibrium level of Quantity demanded and supplied.  
If for some reasons, Supply function is revised and given as  $Q_s = 2.5P + 5$ .  
What will be the revised Equilibrium price, Equilibrium level of Quantity demanded and supplied.

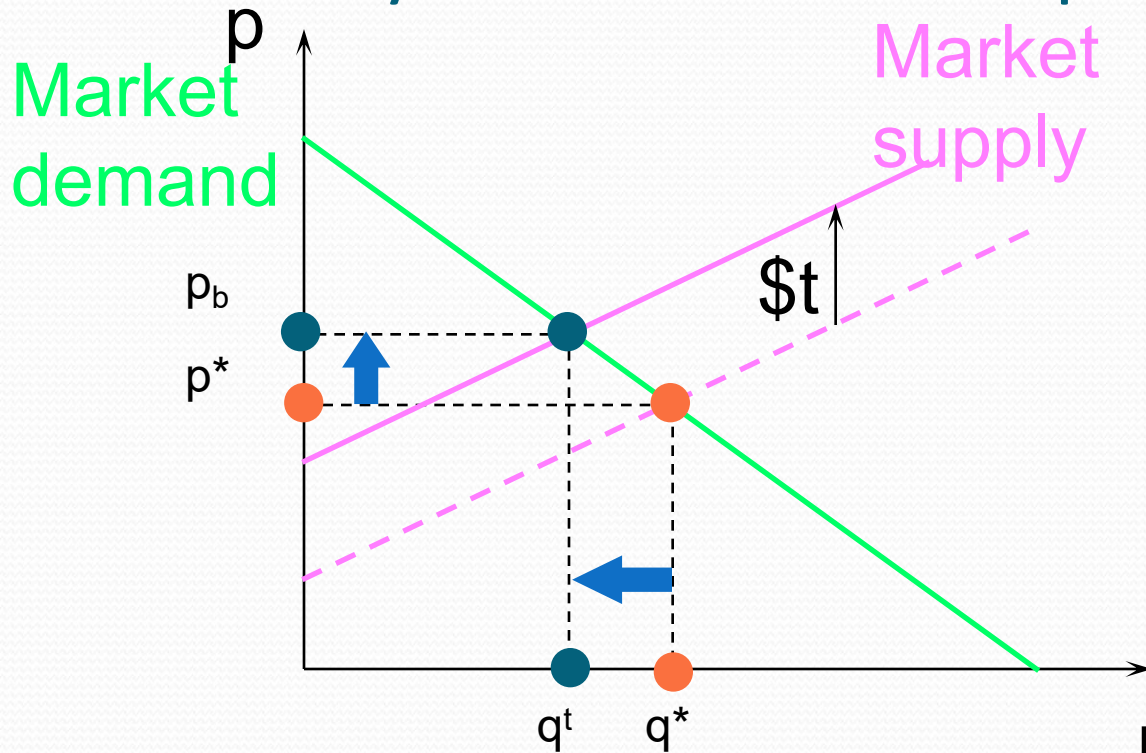
A quantity tax levied at a rate of  $\$t$  is a tax of  $\$t$  paid on each unit traded.

# Quantity Taxes & Market Equilibrium





# Quantity Taxes & Market Equilibrium



An excise tax raises the market supply curve by  $\$t$ , raises the buyers' price and lowers the quantity traded.

$D(p), S(p)$

## Questions (1 Marks)

1.  $Q_D = 20 + 4P$  and  $Q_S = 50 - 2P$  Find out the equilibrium price and quantity from following demand and supply function.
2. The Market Price of microchips is fixed at ₹50 by demand and supply equilibrium. If a GST of ₹10 per unit is imposed by the government then (i) Supply curve will shift to left and price will increase (ii) Supply curve will shift to right and price will decrease (iii) Both supply condition and price will remain unchanged (iv) None of these
3. There is a shift of supply curve for sea fish because of bumper production of the same in the rainy season. The demand condition remaining constant, this will cause (i) An increase in quantity and rise in price (ii) An increase in quantity and fall in price (iii) A decrease in quantity and fall in price (iv) None of these
4. Price of mixture is fixed at Rs.160 at the market equilibrium point in October, 2021. In November, 2021 because of cold condition the demand curve for mixture shifts to the right, as a result (i) The equilibrium price will decrease (ii) The equilibrium price will increase (iii) The equilibrium price will remain unchanged (iv) None of these



## Questions (5 Marks)

1. Given the market demand and supply function for a product

$$Q = 1000 - P \text{ (Demand)}$$

$$Q = 700 + 2P \text{ (Supply)}$$

(i) Find the equilibrium price and Quantity of the product.

(ii) The supply curve is revised as  $Q = 400 + 2P$  because of an increase in the input price, how this will influence the equilibrium price and quantity.

(iii) Draw a suitable diagram with the help of demand and supply curves to present the above conclusions.

2. Given the market demand and supply curve of a product

$$Q = 1300 - P \text{ (Demand)}$$

$$Q = 700 + 2P \text{ (Supply)}$$

(i) Find the equilibrium price and quantity

(ii) If a GST of `20 per unit is imposed on the product find its effect on the equilibrium price. Is the buyer less elastic? Why?

(iii) Draw a suitable diagram to demonstrate the effect of the GST on the price of the product.



THANK YOU