

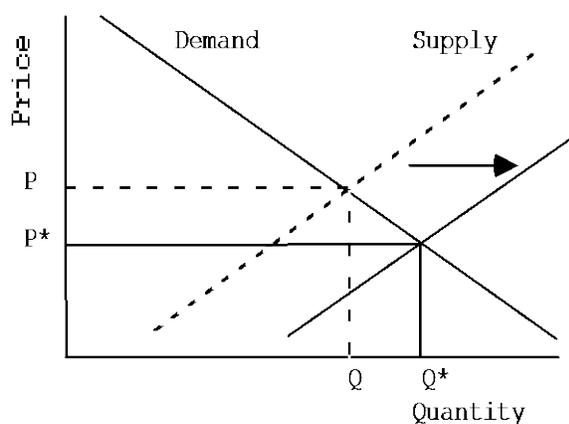
Solutions
EC302 - INTERMEDIATE MICROECONOMICS
Loyola University
Fall 2017

Problem Set 1

1. Consider the market for bread. Briefly describe what impact each of the following would have on demand, supply, equilibrium quantity, and equilibrium price of bread. Illustrate answers with graphs if helpful.
 - a. A new type for fertilizer increases the productivity of the wheat crop.
 - b. The price of butter rises due to a disease affecting cows.
 - c. Concern over food additives reduces the demand for bread.
 - d. A work stoppage by bread producers increases labor costs.
 - e. To support bread prices, the government agrees to buy all surplus bread and pay 10% more than the current market price.
 - f. To help reduce inflation, the government places a ceiling on the price of bread equal to the lower price that existed two years ago.

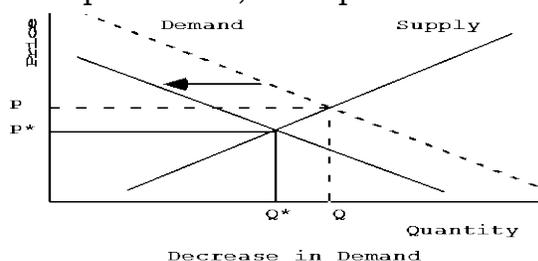
Solution

1. a. If a new type for fertilizer increases the productivity of the wheat crop, it will reduce the cost of producing bread. This will cause the supply curve to increase (shift right). At the old equilibrium price, there would now be an excess supply. Thus, market price will fall. As market price decreases, there is an increase in the quantity demanded (movement along the demand curve). At the new equilibrium, price will be lower and the quantity exchanged will be higher.

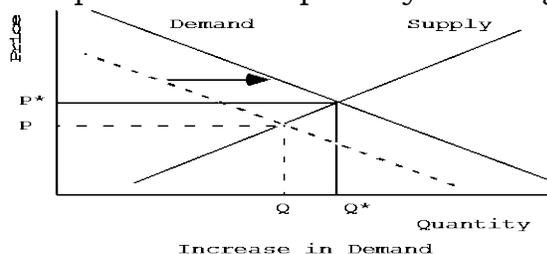


Increase in Supply

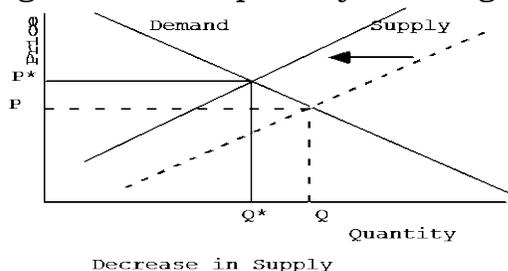
b. Butter and bread are compliments in consumption. Thus, an increase in the price of butter, due to the cow disease, will cause the demand for bread to decrease (shift left). At the old equilibrium price, there would now be an excess supply. Thus, market price will fall. As market price decreases, there is a decrease in the quantity supplied (movement along the supply curve). At the new equilibrium, both price and the quantity exchanged will be lower.



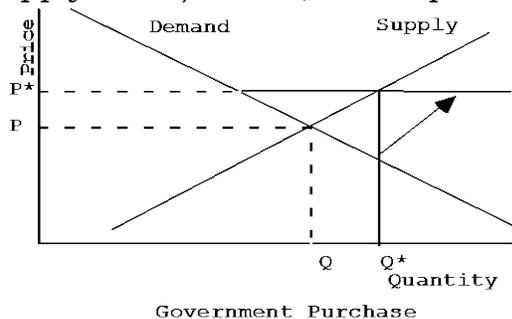
c. Bread and pho are substitutes in consumption. Thus, a decrease in the demand for pho will cause the demand for bread to increase (shift right). At the old equilibrium price, there would now be an excess demand. Thus, market price will rise. As market price increases, there is an increase in the quantity supplied (movement along the supply curve). At the new equilibrium, both price and the quantity exchanged will be higher.



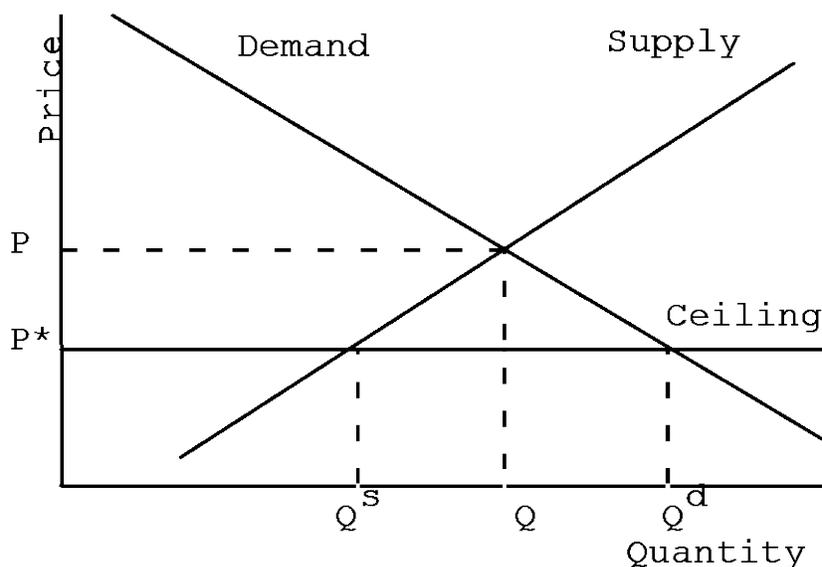
d. Bread workers are an input in the production of bread. An increase in the price of inputs will decrease supply (shift left). At the old equilibrium price, there would now be an excess demand. Thus, market price will increase. As market price increases, there is a decrease in the quantity demanded (movement along the demand curve). At the new equilibrium, price will be higher and the quantity exchanged will be lower.



e. If the government agrees to buy all surplus bread at a price 10% above the current market price, there is equivalent to an increase in the number of consumers. As a result, the demand for hamburgers will increase (shift). In fact, the demand curve becomes horizontal at $P^* = (1.1)P$ showing that the government will buy an unlimited amount at this price. Equilibrium price to P^* . As price increases, the quantity supplied increases (movement along the supply curve). Thus, both equilibrium output and price increase.



f. A price ceiling will hold the price of bread below the equilibrium value. As price decreases, the quantity supplied decreases and the quantity demanded increases (movements along both curves). The quantity exchanged will be limited to the amount supplied. This creates an excess demand, but prices cannot increase to eliminate it. As a result, an alternative allocation mechanism – such as a black market - may develop.



2. You have estimated the inverse demand functions for coffee for the following groups in an economics class. The inverse demand curves are

$$\text{Male student demand} = P_c = 100 - Q_{cm}$$

$$\text{Female student demand} = P_c = 100 - 2Q_{cf}$$

Compute the Total demand curve for the entire class

Solution

$$P_c = 100 - Q_{cm} \text{ or } Q_{cm} = 100 - P_c$$

$$P_c = 100 - 2Q_{cf} \text{ or } Q_{cf} = 50 - 0.5P_c$$

Adding together the two demand curves

$$Q_{dc} = Q_{cm} + Q_{cf} = 100 - P_c + 50 - 0.5P_c$$

$$Q_{dc} = 150 - 1.5P_c \text{ or } P_c = 100 - 0.67Q_{cc}$$

3. Using the information in problem 2, now suppose you are able to determine the supply curve for Coffee as

$$Q_{sc} = 30 + 0.5P_c$$

- What is the equilibrium price and quantity for coffee for the class?
- If a lump sum tax of 16 is imposed on this market (on the supplier) what is the new price and quantity?
- What is the Tax Revenue?

Solution

Equating Supply and Demand (setting $Q_{dc} = Q_{sc}$ yields

$$150 - 1.5P_c = 30 + 0.5P_c \text{ thus, } 2P_c = 120$$

$$P_c = 60 \quad Q_c = 60$$

b. We need to solve the supply curve for P_c

$$Q_{sc} = 30 + 0.5P_c \quad \text{or} \quad 0.5P_c = -30 + Q_{sc}$$

$$\text{Solving for } P: P_c = -60 + 2Q$$

$$\text{Add tax of 16: } P_c = -44 + 2Q$$

$$\text{Equating } S \text{ and } D: -44 + 2Q_{sc} = 100 - 0.67Q_{dc}$$

$$144 = 2.67Q$$

$$Q = 54$$

$$P = 64$$

c. Tax Revenue is $(\text{Tax})(Q) = 16 \times 54 = 864$

4. Using the information in problem 3, assume that instead of a lump sum tax, a proportional tax of 10% is placed on suppliers, what happens to price and quantity for the entire market?

Solution

$$P_c^* = (1.1)P_c = (1.1)(-60 + 2Q_{sc})$$

$$= -66 + 2.2Q_{sc}$$

Equating S and D

$$-66 + 2.2Q_{sc} = 100 - 0.67Q_{dc}$$

$$166 = 2.87Q$$

$$Q = 58(\text{rounded}) \quad \text{and} \quad P = 62(\text{rounded})$$

5. In Washington DC the metro system is priced lower during rush hours when demand is high and the price rises when fewer people are riding during non-rush hour times. Explain this strange pricing system using the market model.

Solution

The purpose of the metro is to take pressure off traffic congestion in the streets. Therefore the metro pricing is designed to reduce demand for car traffic during rush hour. In off hours there is less need to entice travelers off the roads. This shows the interconnectedness of markets and how the pricing system is interdependent between markets.

6. (Fill in the blanks) Suppose that the demand and supply functions for

good X are $Q_d = 75 - 3P$ and $Q_s = -20 + 6.5P$

- Equilibrium price is \$10 and equilibrium quantity is 45 units.
- If price is \$8, then a shortage of 19 units occurs.
- If price is \$12, then a surplus of 19 units occurs.

7. A new chemical cleaning solution is introduced to the market. Initially, demand is $Q_D = 1000 - 2P$ and supply is $Q_S = 100 + P$. Determine the equilibrium price and quantity. The government then decides that no more than 300 units of this product should be sold per period, and imposes a quota at that level. How does this quota affect the equilibrium price and quantity? Show the solution using a graph and calculate the numerical answer.

Solution

The equilibrium solution with no government intervention is

$$1000 - 2P = 100 + P$$

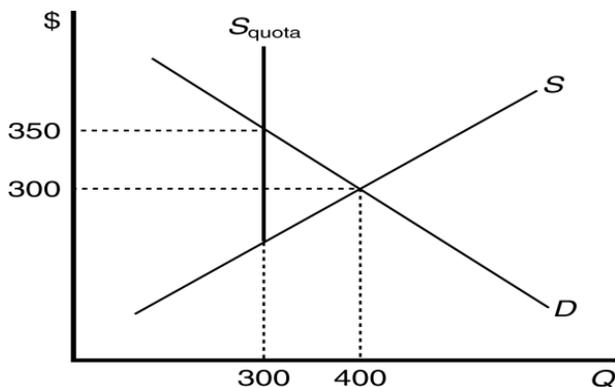
$$P^* = 300$$

$$Q^* = 400$$

When the quota is imposed at 300 units, supply cannot exceed that level, regardless of price. Thus the supply curve becomes vertical at 300 units. The new equilibrium quantity is 300 and price is determined by where the supply curve with the quota (S_{quota}) intersects the demand curve (see the figure below). To solve for the price, plug the quota value (300) into the demand equation.

$$1000 - 2P = 300$$

$$P^* = 350$$



8. If the demand for toy drums is described by the equation $Q_d = 300 - 5P$, and supply is $Q_s = 60 + 3P$, find the equilibrium price and quantity. How would your answer change if a decrease in consumer income shifted the demand curve to $Q_d = 220 - 5P$?

Solution

Set $Q_d = Q_s$ and solve.

$$\text{For } Q_s = 300 - 5P \quad 300 - 5P = 60 + 3P \quad P^* = 30 \quad Q^* = 150 \text{ units.}$$

$$\text{For } Q_d = 220 - 5P \quad 220 - 5P = 60 + 3P \quad P^* = 20 \quad Q^* = 120$$

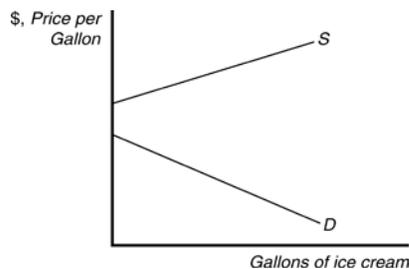
9. Suppose the demand for onion ice cream was described by the equation $Q_d = 20 - P$, and the supply was described by $Q_s = 40 + P$. What are the equilibrium price and quantity? Show your answer using a graph.

Solution.

Set $Q_s = Q_d$ and solve. $20 - P = 40 + P$

Notice that P is negative (assume cannot happen)

Equilibrium quantity is zero, because the demand curve lies below the supply curve at all prices where output is positive.



10. In a competitive labor market, demand for workers is $Q_D = 10,000 - 100W$, and supply is $Q_S = 2000 + 1900W$, where Q is the quantity of workers employed and W is the hourly wage. Suppose the government decides to impose a wage ceiling of \$3 per hour. What would the equilibrium in this labor market?

Solution

Without the wage ceiling, the equilibrium is given by

$$9,900 - 100W = 2000 + 1900W, \quad 2000W = 7900$$

where $W = 3.95$ and $Q = 9505$. With the wage ceiling of \$3 per hour, the market wage rate will be $W = 3$, and the amount of labor employed will be 7700.