

Directions: The homework will be collected in a box **before** the lecture. Please place your name, TA name and section number on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade. Late homework will not be accepted so make plans ahead of time. **Please show your work.** Good luck!

Please realize that you are essentially creating “your brand” when you submit this homework. Do you want your homework to convey that you are competent, careful, professional? Or, do you want to convey the image that you are careless, sloppy, and less than professional. For the rest of your life you will be creating your brand: please think about what you are saying about yourself when you do any work for someone else!

1. Answer each of the following questions by drawing a graph that represents the initial situation and the new situation. Label these graphs completely and carefully. Provide a verbal explanation as well.

a. Consider the market for soda pop in New York City. The mayor in NYC has engaged in a campaign to try to discourage people from drinking soda pop due to health concerns about the dangers of obesity and diets high in sugar. At the same time, the price of corn syrup, a major ingredient in soda pop, decreases. Depict the market for soda pop in New York City initially and label the initial equilibrium price, P_1 ; the initial equilibrium quantity, Q_1 ; and the initial supply and demand curves, S_1 and D_1 . Then, illustrate the effect of the described changes on this market: be careful and thorough in your labeling. Finally provide a verbal statement of your prediction about how these changes will impact the equilibrium price and quantity in this market. Explain your answer verbally.

b. Consider the market for college education in the U.S. and assume that this market is initially in equilibrium at P_1 and Q_1 . Suppose that there is an increase in the number of foreign-born students seeking a college education in the U.S. Illustrate this market's initial equilibrium as well as its new equilibrium (Q_2 , P_2) in a well labeled graph. Make sure you indicate the direction of any shift that occurs in this market. Explain your answer verbally.

c. Consider the market for leather boots and assume that this market is initially in equilibrium at P_1 and Q_1 . Suppose that there is a decrease in income and that leather boots are a normal good. Illustrate this market's initial equilibrium as well as its new equilibrium (Q_2 , P_2) in a well labeled graph. Make sure you indicate the direction of any shift that occurs in this market. Explain your answer verbally.

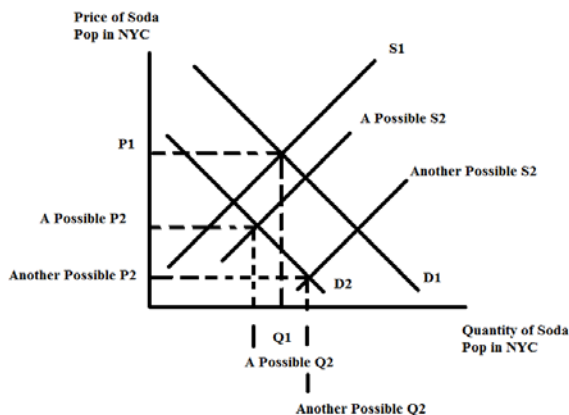
d. Consider the market for smartphones and assume that this market is initially in equilibrium at P_1 and Q_1 . Suppose that there is a decrease in the price of labor used to manufacture the smartphones and, at the same time, there is an increase in the tastes and preferences for smartphones. Illustrate this market's initial equilibrium as well as its new equilibrium (Q_2 , P_2) in a well labeled graph. Make sure you indicate the direction of any shift that occurs in this market. Explain your answer verbally.

e. Consider the market for noodles and assume that this market is initially in equilibrium at P_1 and Q_1 . Suppose that there is an increase in income and that noodles are an inferior good. At the same time there is a decrease in the number of noodle making firms. Illustrate this market's initial equilibrium as well as its new equilibrium (Q_2 , P_2) in a well labeled graph. Make sure you indicate the direction of any shift that occurs in this market. Explain your answer verbally.

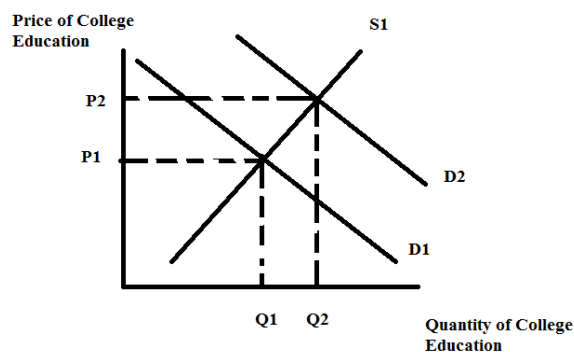
f. Consider the market for candy and assume that this market is initially in equilibrium at P_1 and Q_1 . Suppose that there is a decrease in the price of sugar which is a major input in the production of candy. At the same time, there is a decrease in the number of firms producing candy. Illustrate this market's initial equilibrium as well as its new equilibrium (Q_2 , P_2) in a well labeled graph. Make sure you indicate the direction of any shift that occurs in this market. Explain your answer verbally.

Answer:

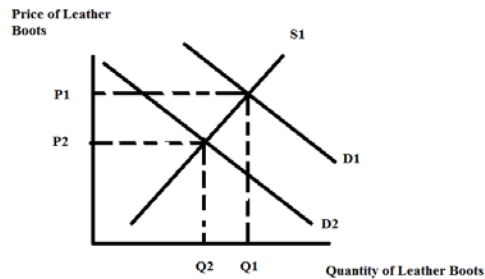
a. The mayor's campaign will cause the demand curve for soda pop to shift to the left: people's tastes and preferences for soda pop will decrease as they become more aware of the health issues posed by consumption of these beverages. So, D_1 shifts to D_2 . The decrease in the price of corn syrup will reduce the costs of producing soda pop and this will cause the supply curve for soda pop to shift to the right: S_1 to S_2 . We have two shifts occurring in this market without knowledge of the size of the two shifts: this implies that we will have a situation of indeterminacy: in this case, we know with certainty that P_2 is less than P_1 , but we do not know if Q_2 is greater than, less than, or equal to Q_1 . Here is a graph to illustrate two of these possibilities:



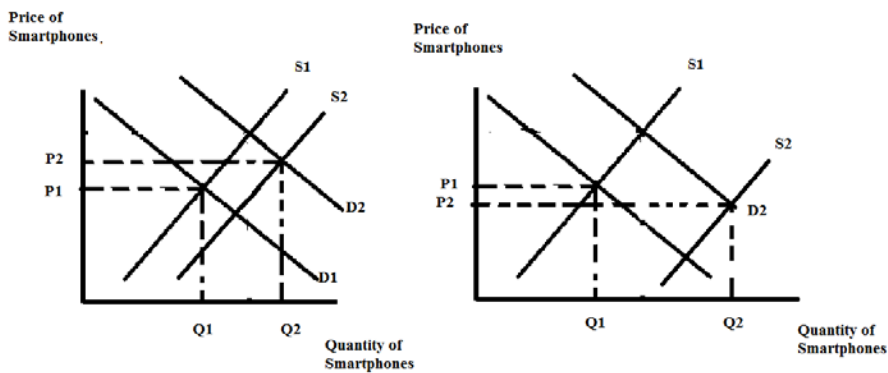
b. An increase in the number of foreign-born students seeking a college education in the U.S. will shift the demand curve to the right from D_1 to D_2 . The equilibrium price, P_2 , will rise relative to P_1 ; the equilibrium quantity, Q_2 , will rise relative to Q_1 . The graph below illustrates this market.



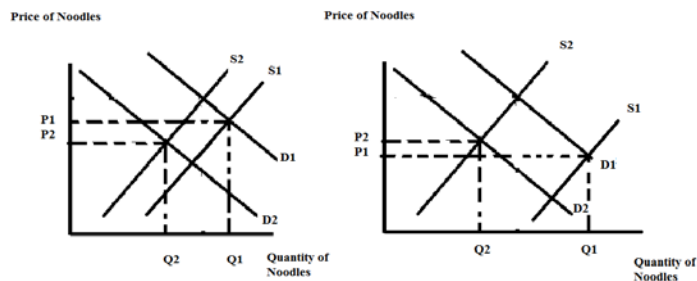
c. A decrease in income will cause the demand curve for leather boots to shift to the left from D_1 to D_2 since leather boots are a normal good. Recall that for a normal good, an increase in income results in an increase in the quantity demanded of the good and a decrease in income results in a decrease in the quantity demanded of the good. The graph below illustrates this market.



d. A decrease in the price of labor used in manufacturing the smartphones will cause the supply curve to shift to the right from S_1 to S_2 . An increase in tastes and preferences in favor of smartphones will cause the demand curve to shift to the right from D_1 to D_2 . The new equilibrium quantity, Q_2 , will be greater than the initial equilibrium quantity, Q_1 . But, the new equilibrium price, P_2 , may be greater than, less than, or equal to the initial equilibrium price of P_1 . That is, the new equilibrium price will be indeterminate. Here are two graphs that illustrate that outcome.

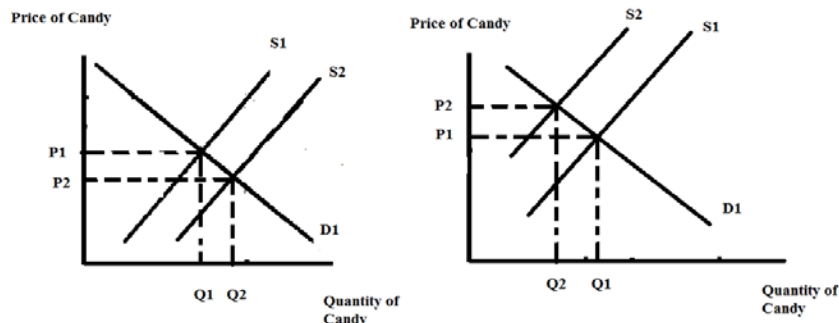


e. The demand curve for noodles will shift to the left with the increase in income since noodles are an inferior good: as the level of income increases, the quantity of noodles demanded at any price decreases. The supply curve for noodles will also shift to the left due to the decrease in the number of firms producing noodles. The new equilibrium quantity, Q_2 , will be lower than the initial equilibrium quantity, Q_1 . The new equilibrium price, P_2 , may be higher than, lower than or equal to the initial equilibrium price, P_1 . That is, the new equilibrium price will be indeterminate. Here are two graphs that illustrate that outcome.



f. The decrease in the price of sugar will cause the supply curve to shift to the right since sugar is a major input in the production of candy. The decrease in the number of firms will cause the supply curve to shift to the left. The question does not tell us the magnitude of these two shifts, so we cannot conclude what happens to the equilibrium price or the equilibrium quantity relative to the initial equilibrium price and

quantity. If the rightward shift of the supply curve dominates then the equilibrium price will fall relative to P_1 and the equilibrium quantity will increase relative to Q_1 . If the leftward shift of the supply curve dominates then the equilibrium price will increase relative to P_1 and the equilibrium quantity will decrease relative to Q_1 . Here are two graphs to illustrate this idea.



2. Consider the market for paintbrushes. The market demand and supply curves are given by the following equations where Q is the quantity of paintbrushes and P is the price per paintbrush:

$$\text{Demand: } Q = 50 - (1/2)P$$

$$\text{Supply: } Q = (1/8)P - (20/8)$$

- Given the above information, find the equilibrium quantity of paintbrushes and the equilibrium price for a paintbrush. Show your work.
- Given the above information, find the value of consumer surplus (CS), producer surplus (PS), and total surplus (TS). Show your work.
- Draw a well labeled graph of the market for paintbrushes. In your graph indicate the equilibrium price and the equilibrium quantity. Also, identify the area that corresponds to CS and the area that corresponds to PS.
- Suppose that the market demand curve changes to the following:
New Market Demand: $P = 100 - 8Q$
Given this new market demand curve and holding everything else constant, fill in the following table with your prediction of what will happen to each of the items listed in the table.

Item	Prediction of direction of change relative to initial values that were calculated (predictions should be no change, increase or decrease)
New equilibrium price, P_e'	
New equilibrium quantity, Q_e'	
New CS'	
New PS'	
New TS'	

- Calculate the values of P_e' , Q_e' , CS', PS', and TS'. Show your work.

Answer:

- To find the equilibrium price and equilibrium quantity, set the demand equation equal to the supply equation: thus,

$$50 - (1/2)P = (1/8)P - (20/8)$$

$$50 \cdot 8 - 8(1/2)P = P - 20$$

$$400 - 4P = P - 20$$

$$420 = 5P$$

$$P = \$84 \text{ per paintbrush}$$

Then, use the demand or the supply curve to find the equilibrium quantity:

$$Q = 50 - (1/2)(84) = 8 \text{ paintbrushes}$$

$$\text{Or, } Q = (1/8)(84) - 20/8 = 64/8 = 8 \text{ paintbrushes}$$

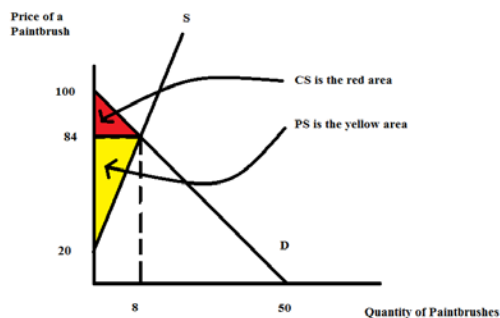
b. You may find it helpful to draw a graph of this market before you do the calculations, but here are the calculations and answer (c) will provide the graph.

$$CS = (1/2)(\$100/\text{unit} - \$84/\text{unit})(8 \text{ units}) = \$64$$

$$PS = (1/2)(\$84/\text{unit} - \$20/\text{unit})(8 \text{ units}) = \$256$$

$$TS = CS + PS = \$64 + \$256 = \$320$$

c. Here's the graph:



d.

Item	Prediction of direction of change relative to initial values that were calculated (predictions should be no change, increase or decrease)
New equilibrium price, P_e'	Decrease
New equilibrium quantity, Q_e'	Decrease
New CS'	Decrease (though this is not obvious without doing the math, since the price decreases)
New PS'	Decrease
New TS'	Decrease

e. Start by finding the equilibrium price and quantity but this time set the new market demand curve equal to the supply curve: thus,

$$100 - 8Q = 20 + 8Q$$

Note that I rewrote the supply curve as $P = 20 + 8Q$

$$16Q = 80$$

$$Q_e' = 5 \text{ paintbrushes}$$

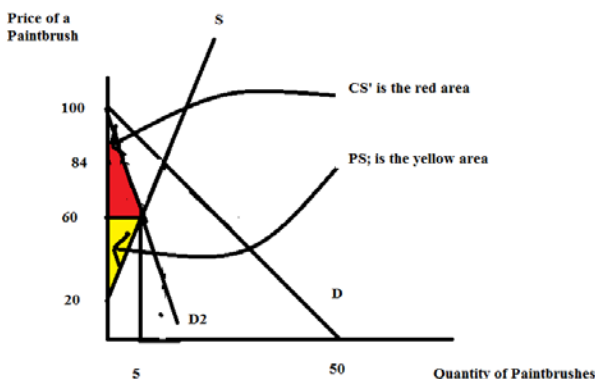
$$P_e' = 100 - 8(5) = \$60 \text{ per paintbrush}$$

$$CS' = (1/2)(\$100/\text{unit} - \$60/\text{unit})(5 \text{ units}) = \$100$$

$$PS' = (1/2)(\$60/\text{unit} - \$20/\text{unit})(5 \text{ units}) = \$100$$

$$TS' = \$200$$

Here's the graph:



3. Suppose there are two consumers in the market for doughnuts and their individual demand curves are given by the following equations where P is the price per doughnut and Q is the quantity of doughnuts:

Gwen's demand for doughnuts: $P = 20 - 4Q$

Howie's demand for doughnuts: $P = 10 - Q$

a. Draw two different graphs: in the first graph draw Gwen's demand for doughnuts and in the second graph draw Howie's demand for doughnuts. Make sure you label all axes and all intercepts clearly.

b. In a third graph draw the market demand curve for doughnuts. Make sure you label this demand curve carefully and completely; if there is a "kink" point label the coordinates of this point.

c. Based on your graph in (b), write the equation(s) for the market demand curve. Provide a range of price for any demand curve equation you provide.

Suppose that Barbara, a third consumer, enters this market and has the following demand for doughnuts:

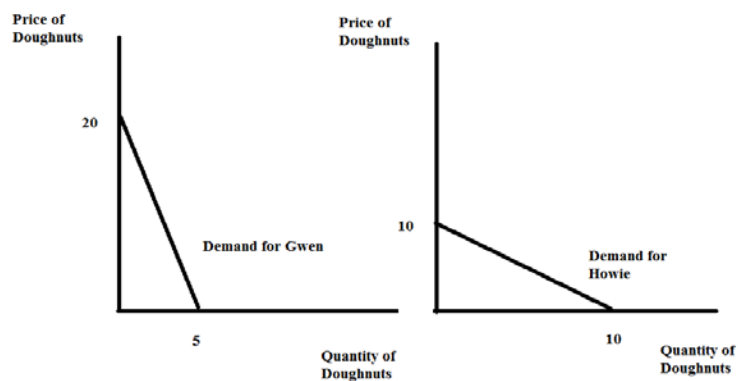
Barbara's demand for doughnuts: $P = 5 - (1/2)Q$

d. Draw a fourth graph that represents the market demand curve for doughnuts when the market includes Gwen, Howie, and Barbara. Label all intercepts, all axes, and all "kink" points clearly and carefully.

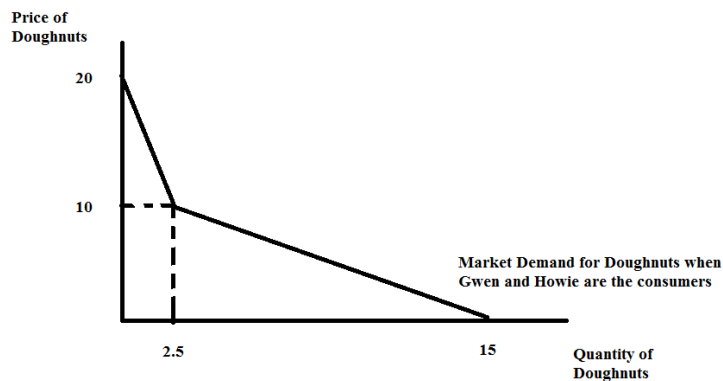
e. Based on your graph in (d), write the equation(s) for the market demand curve. Provide a range of prices for any demand curve equation you provide.

Answer:

a.



b.



c. There are two segments to the market demand curve:

i) For prices greater than or equal to 10, the market demand curve can be written as $P = 20 - 4Q$.

ii) For prices less than or equal to 10, the market demand curve is a harder equation to write. Here is the explanation: you know that the point (2.5, 10) is on this line and you also can compute the slope = rise/run = $-10/12.5 = -4/5$. So, then take the slope-intercept form: $y = mx + b$ and start plugging in what you know:

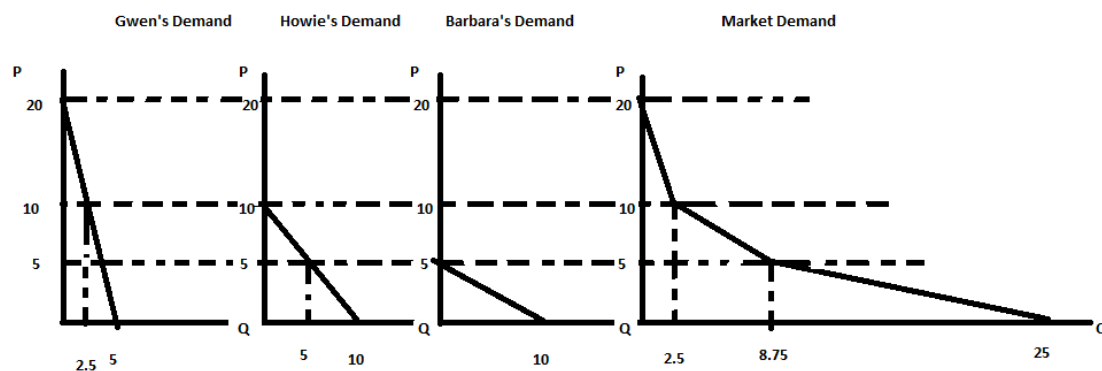
$$y = mx + b$$

$$P = (-4/5)Q + b \text{ and } (Q, P) = (2.5, 10) \text{ is on the line}$$

$$10 = (-4/5)(2.5) + b \text{ or } b = 12$$

The equation for the lower segment of the market demand curve is therefore: $P = (-4/5)Q + 12$

d.



e. The market demand curve has three segments now: in answer (c) we found the equations for the first two segments and they have not changed with the entry of Barbara into this market. We now just need to find the equation for the lowest segment of the demand curve: we know that the points (25, 0) and (8.75, 5) sit on this segment. To make sure you see this: hold price constant at 5 and ask what quantity Gwen, Howie, and Barbara will demand: Gwen will want 3.75 units (use her demand curve to get this quantity at this price), Howie will want 5 units (use his demand curve to get this quantity at this price), and Barbara will demand zero. Then similar work to the previous part will give $P = (100/13) - (4/13)Q$ for prices below 5.

4. Suppose that there are two firms that produce doughnuts and their individual firm supply curves are given as follows where P is the price per doughnut and Q is the quantity of doughnuts:

$$\text{Supply curve for Firm A: } P = 4 + 1.6Q$$

$$\text{Supply curve for Firm B: } P = 4 + 1.6Q$$

a. If there are just these two firms in the market, what is the market supply curve? Show how you found this answer.

b. Given the market demand curve you found in question 3e, and this new information about the firms that produce doughnuts, calculate the equilibrium price and quantity in the market for doughnuts.

c. Given your answer in (b), how many doughnuts will Gwen consume? How many doughnuts will Howie consume? How many doughnuts will Barbara consume? Show how you found your answer.

Answer:

a. To find the market supply curve we need to add the two individual supply curves together horizontally. We know that when the price is equal to 4, neither firm produces any doughnuts. Hence, the point (0, 4) is on each firm's supply curve, but it is also on the market supply curve. To find the market supply curve we need to find one more point on this curve: so, pick a price and then compute how many doughnuts each firm will produce at that price. For example, if the price was 10, then Firm A would be willing to produce 3.75 doughnuts as would Firm B. This implies that the point (7.5, 10) is on the market supply curve. We can now compute the slope of the market supply curve as $\text{rise/run} = 6/7.5 = .8$. Since we know the y-intercept of the market supply curve is (0, 4) and the slope we are now ready to write the equation for the market supply curve: $P = 4 + 0.8Q$.

b. Here the issue is trying to decide where the market supply curve intersects the market demand curve. We know that from 3e there are three segments to the market demand curve. Which is the right segment to use? One way to think about this is to consider each of the kink points on that demand curve relative to the supply curve:

i) Kink point (2.5, 10) sits on the market demand curve. If the quantity is 2.5, what price do you get from the market supply curve? So, $P = 4 + 0.8(2.5) = 6$. This tells us that the supply curve must cross the market demand curve below this first kink point.

ii) Kink point (8.75, 5) sits on the market demand curve. If the quantity is 8.75, what price do you get from the market supply curve? So, $P = 4 + 0.8(8.75) = 11$. This tells us that the supply curve must cross the market demand curve above this second kink point.

The logic of the above "thought experiment" tells us that we need to use the market demand equation for the range of prices between 5 and 10 to find the equilibrium price and quantity in this market. Thus, the market demand curve segment we need is $P = 12 - 0.8Q$ and the market supply equation is $P = 4 + 0.8Q$. Using these two equations we can find that the equilibrium quantity is 5 doughnuts and the equilibrium price is 8.

c. Given Gwen's demand is $P = 20 - 4Q$ and the equilibrium price in the doughnut market is 8, we can calculate Gwen's number of doughnuts as $8 = 20 - 4Q$ or $Q_{\text{gwen}} = 3$ doughnuts.

Given Howie's demand is $P = 10 - Q$ and the equilibrium price in the doughnut market is 8, we can calculate Howie's number of doughnuts as $8 = 10 - Q$ or $Q_{\text{howie}} = 2$ doughnuts.

Given Barbara's demand is $P = 5 - (1/2)Q$ and the equilibrium price in the doughnut market is 8, we can calculate Barbara's number of doughnuts as $8 = 5 - (1/2)Q$ and we get a negative number: BUT, negative quantities do not have any economic meaning! Barbara can only consume a positive or zero amount of doughnuts: so, she will consume zero doughnuts at the equilibrium price!

Notice: that the sum of doughnuts consumed by Gwen and Howie does equal the equilibrium quantity of doughnuts provided by the market: $3 + 2$ does equal the 5 doughnuts that were provided.

5. Suppose the market for peanuts is described by the following market demand and supply curves where P is the price per unit of peanuts and Q is the quantity of units of peanuts:

$$\text{Demand: } P = 100 - 2Q$$

$$\text{Supply: } P = 20 + 8Q$$

a. Suppose a price floor of \$70 is implemented in the peanut market. Describe the impact of this price floor on this market.

b. Suppose a price floor of \$92 is implemented in the peanut market. Describe the impact of this price floor on this market. Which side of the market is the “short” side of the market?

c. Given the price floor described in (b), calculate the value of consumer surplus (CS), producer surplus (PS), total surplus (TS), and deadweight loss (DWL). Show your work. Include a graph depicting this market, the price floor and the various areas mentioned.

Answer:

a. Setting demand equal to supply, we find that the equilibrium price and equilibrium quantity in this market can be calculated as follows:

$$100 - 2Q = 20 + 8Q$$

$$10Q = 80$$

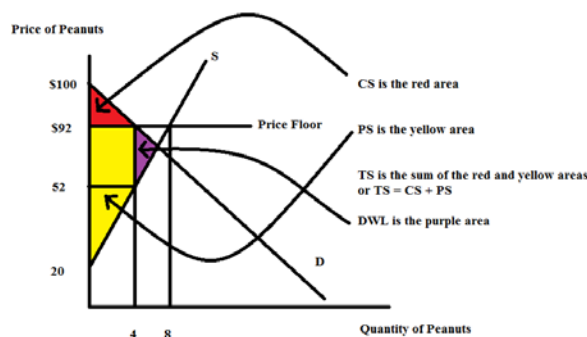
$$Q_e = 8$$

$$P_e = 100 - 2(8) = \$84 \text{ or } P = 20 + 8(8) = \$84$$

Thus, a price floor of \$70 will have no impact in this market since the price floor represents a minimum price that can be charged for the good. Since the equilibrium price is greater than the proposed price floor, the price floor will not be effective in this market.

b. With a price floor of \$92, we can calculate the quantity demanded at that price as $92 = 100 - 2Q_d$ or $Q_d = 4$ units and the quantity supplied at that price as $92 = 20 + 8Q_s$ or $Q_s = 9$ units. With a price floor of \$92 there will be excess supply of 5 units. The short side of the market is the demand side since at a price of \$92, the quantity demanded is less than the quantity supplied: the demand side of the market will determine the number of units sold and consumed in this market.

c. Here is the graph of this market:



$$CS = (1/2)(\$100 \text{ per unit} - \$92 \text{ per unit})(4 \text{ units}) = \$16$$

$$PS = (1/2)(\$52 \text{ per unit} - \$20 \text{ per unit})(4 \text{ units}) + (\$92 \text{ per unit} - \$52 \text{ per unit})(4 \text{ units}) = \$224$$

$$TS = CS + PS = \$16 + \$224 = \$240$$

$$DWL = (1/2)(\$92 \text{ per unit} - \$52 \text{ per unit})(8 \text{ units} - 4 \text{ units}) = \$80$$

6. Suppose the market for gasoline in Xerbia, a small economy is described by the following two equations where P is measured in dollars per gallon and Q is measured in gallons per month:

Market demand for gasoline: $P = 5 - (1/2000)Q$

Market supply of gasoline: $P = (1/3000)Q$

- a. Given this information, determine the equilibrium price and quantity in this market. Show your work.
- b. Suppose that the government of Xerbia decides that gasoline is too expensive and they decide there should be a price ceiling on gasoline. What must be true about this price ceiling in Xerbia if it is to be effective? Explain your answer carefully and with complete sentences.
- c. Suppose that the government of Xerbia decides that too much gasoline is being consumed in Xerbia and they decide to remedy the situation by imposing a price floor that results in 3000 gallons of gasoline being consumed each month. Determine the price floor price that the government has imposed given this information. Explain how you got your answer.

Answer:

a. To find the equilibrium price and quantity in this market, set demand equal to supply. Thus, $5 - (1/2000)Q = (1/3000)Q$ or $30,000 = 5Q$ and therefore $Q = 6,000$ gallons per month. The equilibrium price can be found by substituting $Q = 6,000$ into either the demand or the supply equation: thus, $P = 5 - (1/2000)(6000) = \2 per gallon or $P = (1/3000)(6000) = \$2$ per gallon.

b. For a price ceiling to be effective it must be set by the government at a level that is lower than the equilibrium price in the market. In this case the price ceiling must be set at a price less than \$2 per gallon in order for it to be effective. Recall that a price ceiling represents a maximum price that can be charged: for the price ceiling to be effective it must set a maximum limit on the price that is less than the equilibrium price.

c. The government sets a price floor so that consumers consume 3000 gallons of gasoline a month instead of 6000 gallons of gasoline a month. We can plug $Q = 3000$ into the demand curve to see what the price must be in order for demanders to only want to consume this amount. Thus, $P = 5 - (1/2000)(3000) = \3.50 per gallon. If the government sets the price ceiling to \$3.50 per gallon then they will reach their goal of reducing gasoline consumption to 3000 gallons per month. Notice that at \$3.50 per gallon there will be an excess supply of gasoline each month (suppliers will be willing to supply 10,500 gallons of gasoline per month while demanders will only demand 3000 gallons of gasoline per month): the short side of the market will be the demand side and it is the demand side that will determine the level of gasoline consumption once this price floor is imposed.

7. Suppose that the market for corn can be described by the following equations where P is the price per bushel and Q is the quantity of bushels:

Market Demand: $P = 25 - (1/200)Q$

Market Supply: $P = 5 + (1/600)Q$

- a. Suppose that the government implements a price floor program in this market and sets the price floor at \$18 per bushel. Describe the effect of this price floor on this market: where possible make numerical calculations of the impact. Will this price floor be effective?
- b. Given the price floor described in (a), what is the direct cost to the government of this price floor? Assume that the government is willing to buy up any surplus in the market and store this surplus indefinitely. Show how you calculated this cost to the government.

- c. Given the price floor described in (a), what is the amount that consumers expend in buying this good? Show how you calculated this cost to the consumers.
- d. Given the information you have been given, draw a graph of this market clearly labeling all intercepts, axis, and intersection points. Also, include the price floor, the area that represents the direct cost to consumers of this price floor, and the area that represents the direct cost to the government of this price floor.
- e. Suppose that you are told that the storage costs for the government are equal to \$8 per bushel per year. What is the total annual cost of this program to the government including the cost of storage? Show how you computed your answer.

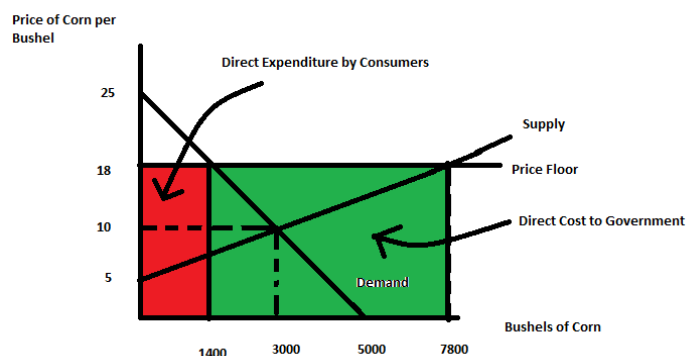
Answer:

a. If the government sets the price floor at \$18 per bushel this will be an effective price floor in this market. We can see that by taking the time to calculate the equilibrium price in this market if there is no price floor: the equilibrium price would be \$10 per bushel. So, the price floor (a minimum price that can be charged for the good) will be effective since it is set above the equilibrium price. At a price floor of \$18 per bushel, consumers will demand 1400 bushels of corn while suppliers will be willing to supply 7800 bushels: there will be an excess supply of corn at this price floor price. The government will need to buy this excess supply: answer (b) provides this calculation.

b. The government will buy the surplus of 7800 bushels – 1400 bushels or 6400 bushels at the price floor of \$18 per bushel. That is, the direct cost to the government will be equal to (7800 bushels – 1400 bushels)(\$18 per bushel) = \$115,200.

c. Consumers will purchase 1400 bushels at a price of \$18 per bushel: the expenditure by consumers will equal (1400 bushels)(\$18 per bushel) = \$25,200.

d.



e. Total cost of the price floor program including storage costs for the year = (7800 bushels – 1400 bushels)(\$18 per bushel) + (\$8 per bushel storage cost)(6400 bushels) = \$115,200 + \$51,200 = \$166,400.

8. Suppose that you have the same market as in (7), but instead of a price floor the government implements a price guarantee of \$12 per bushel.

a. Given this price guarantee, how many bushels of corn will consumers purchase? What will the price per bushel be for the consumer given this price guarantee? Explain how you got your answers.

- b. Given this price guarantee, how many bushels of corn will the government purchase? Explain your answer.
- c. What will the cost per bushel to the government of this price guarantee program? Explain your answer.
- d. What will be the total cost to the government of this price guarantee program? Explain your answer.

Answer:

- a. With a price guarantee of \$12 per bushel, producers will be willing to supply 4200 bushels. To see this, use the supply equation and the guaranteed price of \$12 per bushel: $12 = 5 + (1/600)Q_s$ or $Q_s = 4200$ bushels. Demanders are willing to consume this many bushels at a price of \$4 per bushel.
- b. With the price guarantee program the government will not buy any of the good: the price guarantee program simply tells producers what price is going to be guaranteed, the producers decide how much they want to produce at this price, and then they sell it for whatever price consumers are willing to pay for this quantity.
- c. The cost per bushel of corn produced to the government will be the difference between the guaranteed price of \$12 per bushel and the price consumers are willing to pay of \$4 per bushel. Thus, the cost per bushel will be \$8 per bushel.
- d. The total cost to the government of this price guarantee program will be $(4200 \text{ bushels})(\$8 \text{ per bushel})$ or \$33,600.