

Economics 101
 Spring 2015
 Answers to Homework #2
 Due Thursday, February 19, 2015

Directions: The homework will be collected in a box **before** the lecture. Please place your name 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, and 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. Yoshi, Tom and Gary help out Professor Kelly in handling the workload of the Econ 101. They take care of the homework, and they split their time between writing the problems and correcting the homework. The following table reports the amount of problems they can write and homeworks they can correct in 1 day if they **ONLY** write problems or **ONLY** correct homeworks:

	# of Problems Written	# of Homeworks Corrected
Tom	2	26
Yoshi	3	27
Gary	6	15

a) What is the opportunity cost to write one problem for each of these TAs? What is the opportunity cost of correcting one homework for each of these TAs?

Answer:

To calculate the opportunity cost of writing one problem in terms of corrected homeworks we take the ratio of the two as follow:

$$\# \text{ of Homeworks Corrected} / \# \text{ of Problema Written}$$

The table summarizes the results.

	OC of Writing one Problem	OC of Correcting one Homework
Tom	13 corrected homeworks	1/13 problems written
Yoshi	9 corrected homeworks	1/9 problems written
Gary	5/2 corrected homeworks	2/5 problems written

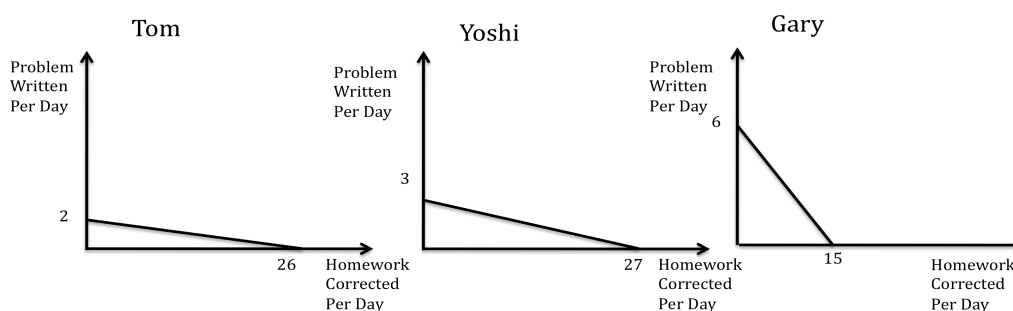
b) Who has an absolute advantage in writing problems? Who has an absolute advantage in correcting homeworks? Who has the comparative advantage in writing problems? Who has the comparative advantage in correcting homeworks? Explain your answers.

Answer:

For the absolute advantage we need to identify the TA who can absolutely write more problems or correct more homeworks per day: Gary has the absolute advantage in writing problems and Yoshi has the absolute advantage in correcting homeworks.

For the comparative advantage we need to identify the TA who can produce the good at lowest opportunity cost. Gary has a comparative advantage in writing problems. Tom has a comparative advantage in correcting homeworks.

c) In three separate graphs, draw the PPF for each TA, measuring problems written on the vertical axis and homeworks corrected on the horizontal axis. Make sure you label your graphs so that we know which PPF corresponds to which TA. After drawing the PPFs, write an equation for each TA's PPF.



Answer:

Let's start with Tom. If Tom only writes problems he can write a maximum of 2 problems. Thus, the y-intercept of Tom's PPF is 2. If Tom only corrects homeworks, he can correct 26 homeworks:

$$P = mH + b$$

$$P = mH + 2$$

$$m = \text{slope} = \text{rise/run} = -2/26 = -1/13$$

$$\text{Tom's PPF: } P = 2 - (1/13)H$$

We should notice that the absolute value of the slope is equal to the OC of correcting one homework for Tom.

Using the same technique we can find the PPFs for the other two TAs:

$$\text{Yoshi's PPF : } P = 3 - (1/9)H$$

$$\text{Gary's PPF : } P = 6 - (2/5)H$$

d) What are the terms of trade for which Tom and Yoshi would trade? That is, what is the range of acceptable prices that Tom and Yoshi will agree to for these two goods? To simply this let's consider the acceptable range for Tom and Yoshi for one written problem.

Answer:

We will focus on the acceptable terms of trade for one written problem from Tom and Yoshi's perspectives.

Yoshi has a lower OC of problems compared to Tom, 9 vs 13. Yoshi is willing to trade one written problem for nine or more corrected homeworks. Tom will pay 13 corrected homeworks or less for

one corrected problem. Therefore, we will observe trade between Tom and Yoshi for any price between 9 and 13 corrected homeworks for one written problem.

e) What are the terms of trade for which Gary and Yoshi would trade? That is, what is the range of acceptable prices that Gary and Yoshi will agree to for these two goods? To simply this let's consider the acceptable range for Gary and Yoshi for one written problem.

Answer:

We will focus on the acceptable terms of trade for one written problem from Gary and Yoshi's perspectives.

Gary has a lower OC of problems compared to Yoshi, $5/2$ vs. 9. Gary is willing to trade one written problem for $5/2$ or more corrected homeworks. Yoshi will pay 9 corrected homeworks or less for one corrected problem. Therefore, we will observe trade between Gary and Yoshi for any price between $5/2$ and 9 corrected homeworks for one written problem.

f) What are the terms of trade for which Gary and Tom would trade? That is, what is the range of acceptable prices that Gary and Tom will agree to for these two goods? To simply this let's consider the acceptable range for Gary and Tom for one written problem.

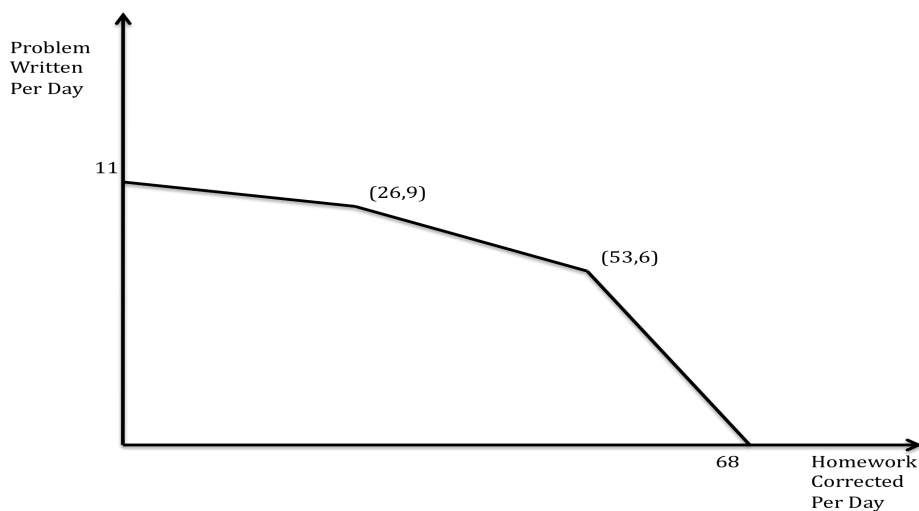
Answer:

We will focus on the acceptable terms of trade for one written problem from Gary and Tom's perspectives.

Gary has a lower OC of problems compared to Tom, $5/2$ vs. 13. Gary is willing to trade one written problem for $5/2$ or more corrected homeworks. Tom will pay 13 corrected homeworks or less for one corrected problem. Therefore, we will observe trade between Gary and Tom for any price between $5/2$ and 13 corrected homeworks for one written problem.

g) Draw the Joint PPF measuring problems written on the Y-axis and the homeworks corrected on the X-axis.

Answer:



h) Today Professor Kelly asks them to write 8 new problems. If they write these 8 problems, how many homeworks will they be able to correct today? Who will write the problems and who will grade the homework? Explain your answer fully.

Answer:

Tom, Gary and Yoshi first need to decide who should write the problems and who should correct the homeworks. Gary has the lowest opportunity cost of writing problems but he can only write 6 problems in a day. So Gary will only write problems. We still need 2 more problems and Yoshi has a lower opportunity cost of writing problems than Tom, so Yoshi will write these 2 problems. That leaves Yoshi with enough time to correct 9 homeworks. To see this, use Yoshi's PPF: $P = 3 - (1/9)H$ and if $P = 2$, then H will equal 9. Tom will fully specialize in correcting homeworks: he can correct 26 homeworks in a day. So, with both Tom and Yoshi grading, we can get 35 corrected homeworks.

2. Use the framework of the supply and demand model to answer these questions. Assume that each market described is initially in equilibrium and then evaluate what happens to the market given the provided scenario.

a) A new technology increases the mileage per gallon of any car currently being operated. Given this new technology and holding everything else constant, what happens to the demand curve and supply curve for gasoline? What happens to the equilibrium price and quantity of gasoline? Explain your answer fully.

Answer:

The demand for gasoline shifts to the left because at every price for gasoline consumers now demand less gas due to their more efficient cars. The supply curve for gasoline is unchanged, but we will see a movement along the supply curve for gasoline due to the shift in the demand curve for gasoline. We will observe a decrease in both the equilibrium price and quantity of gasoline.

b) Apple is preparing to launch the Iphone6S next March, earlier than expected. Given this information and holding everything else constant, what will happen to the demand curve and supply curve for Iphone6 (a different phone older than the Iphone6s). What will happen to the equilibrium price and quantity in the Iphone6 market?

Answer:

The expectation of the incoming launch of the Iphone6S earlier than expected will induce consumers to postpone their decision to buy a new smartphone until they are able to buy the new Iphone6s. So, we can expect the demand for the Iphone6 (old style phone) to shift to the left. The supply curve for the Iphone6 will be unchanged, but we will see a movement along the supply curve due to the shift in demand. We will observe a decrease in the equilibrium price and quantity of Iphone6 phones.

c) The city of Madison establishes a new higher, minimum wage for coffee shop worker. Assume that this is an effective minimum wage in the Madison labor market. Given this change in the minimum wage and holding everything else constant, what happens to the demand curve and supply curve for coffee from coffee shops in Madison? What happens to the equilibrium price and quantity of coffee at Madison coffee shops?

Answer:

The new minimum wage will cause the supply curve for coffee to shift to the left as coffee shop owners find their costs of producing their coffee has increased. There will be a movement along the

demand for coffee curve. The equilibrium price of coffee in Madison coffee shops will increase and the equilibrium quantity of coffee sold in these coffee shops will decrease.

d) Suppose the price of diesel fuel decreases because of a new refinery process being used to produce diesel fuel. Given this change and holding everything else constant, what is the effect on the market for diesel cars? What happens to the equilibrium price and quantity of diesel cars?

Answer:

Diesel fuel is a complementary good for diesel car. Cheaper diesel fuel will cause a rightward shift in the demand curve for diesel cars and a movement along the supply curve for diesel cars. The equilibrium price and equilibrium quantity of diesel cars will increase.

e) Suppose the price of diesel fuel decreases because of a new refinery process being used to produce diesel fuel. Given this change and holding everything else constant, what is the effect on the market for gasoline-powered cars? What happens to the equilibrium price and quantity of gasoline-powered cars?

Answer:

In (d) we saw that the demand for diesel cars increased and the price of diesel cars increased due to this decrease in the price of diesel fuel. Diesel cars are substitutes for gasoline-powered cars: so holding everything else constant, we will see a leftward shift in the demand for gasoline-powered cars. This will cause a movement along the supply curve for gasoline-powered cars: the equilibrium price and quantity of gasoline-powered cars will decrease.

f) Five Guys is the best burger joint in Madison. The price of their main raw material, meat, decreases by 45%. At the same time a strong competitor from California, In&Out, decides to open a burger joint on State Street. What is the effect of these two changes on the demand for Five Guys burgers? How do these changes impact the equilibrium price and quantity of Five Guys burgers?

Answer:

This problem is more complicated. The decrease in the price of meat will induce a shift to the right of the supply curve for Five Guys burgers. However, some of the Five Guy customers may buy their burgers from In&Out, causing the demand curve for Five Guys burgers to shift to the left. Since both curves are shifting and we do not know the magnitude of the shifts we know that one of the variables we are trying to predict will be indeterminate: these shifts will definitely result in a lower equilibrium price, but the equilibrium quantity of Five Guys burgers may increase, decrease, or remain the same after these shifts.

3. Joe decides to open a quarterback's academy in San Francisco. The supply equation for quarterback lessons is given by the following equation where S_{Joe} is the quantity of hour-long lessons supplied and P is the price per lesson:

$$S_{Joe} = 7P - 56$$

The demand for quarterback lessons in San Francisco is represented by the following equation where D_{Joe} is the quantity of hour-long lessons demanded and P is the price per lesson:

$$D_{QB} = 19 - 1/2P$$

a) Given this information, calculate the equilibrium price and quantity of quarterback lessons in this market. Show your work.

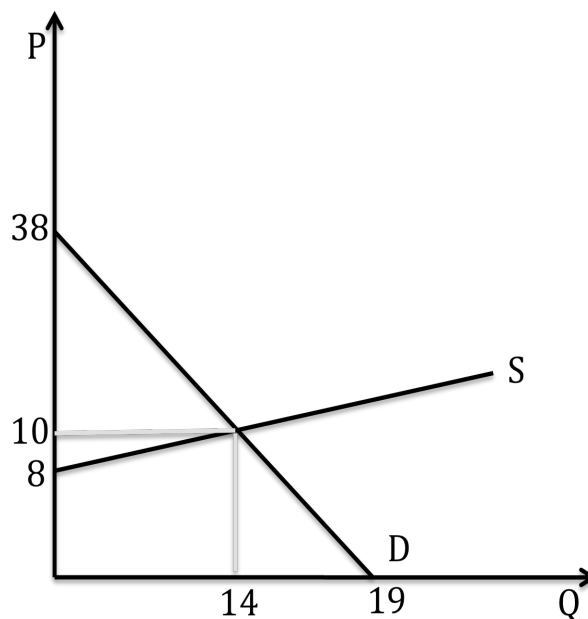
Answer:

We calculate equilibrium price by setting demand equal to supply:

$$S_{Joe} = 7P - 56 = 19 - 1/2P = D_{QB} \Rightarrow 15/2P = 75 \Rightarrow P = \$10 \text{ per lesson and } Q = 14 \text{ lessons}$$

b) Draw a graph of the market for quarterback lessons in San Francisco. Make sure you label your graph carefully and completely.

Answer:



c) What is the value of Consumer Surplus (CS) in this market? What is the value of Producer Surplus (PS) in this market? What is the value of Total Surplus (TS) in this market? Highlight the Consumer and Producer Surplus on the graph you drew for (b).

Let's start by calculating CS. CS is equal to the difference between the consumers' willingness to pay and the price consumers pay for the good. This is equivalent to the area of the blue triangle.

First, rearrange the demand in term of quantity, as $P = 38 - 2D_{QB}$. Then, we can calculate the CS as:

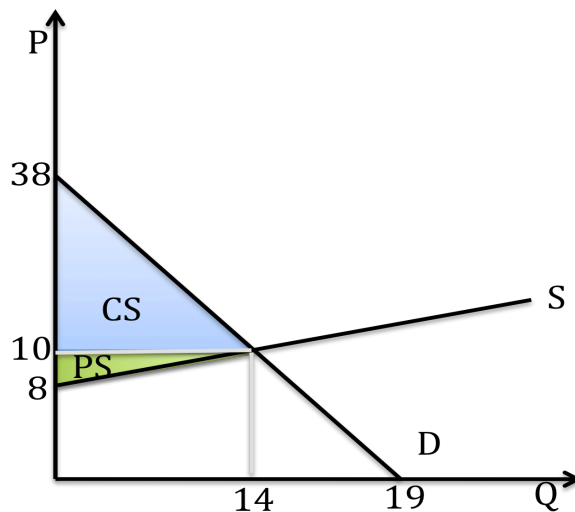
$$CS = (1/2)(38 - 10)(14) = \$196$$

The PS follows a similar logic: PS is equal to the difference between the price paid and the price producers are willing to sell each unit of lessons for. This is equivalent to the area of the green triangle.

First, rearrange the supply in term of quantity, as $P = 8 + 1/7S_{JOE}$. Then, we can calculate the CS as:

$$PS = (1/2)(10 - 8)(14) = \$14$$

The total surplus, TS, is equal to the sum of CS plus PS or \$210.



Suppose Joe is a really good coach and more students want to participate to his academy and this increase in interest results is a shift in the demand curve for his quarterback lessons. The new demand curve is given by the following equation:

$$D_{QB} = 34 - 1/2P$$

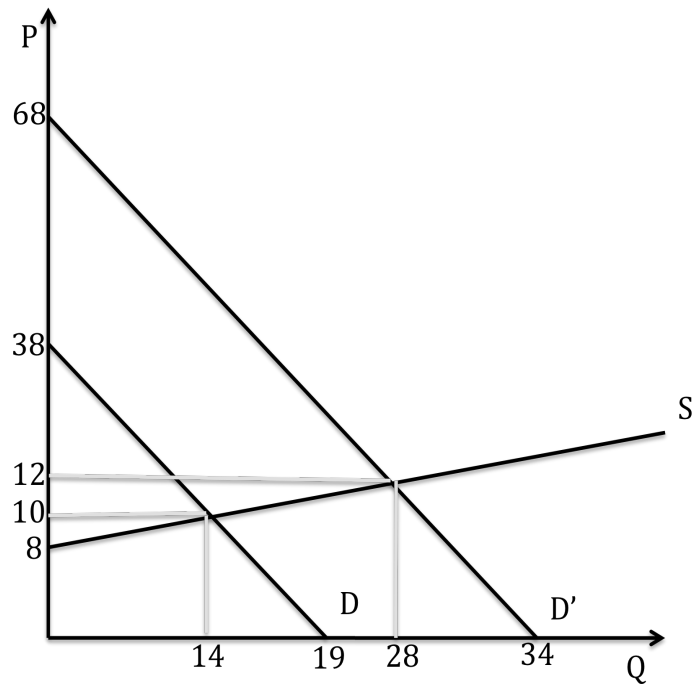
d) Given this new demand curve and holding everything else constant, find the new equilibrium quantity and price in the market for quarterback lessons in San Francisco. Show your work.

Answer:

We set demand equal to supply and we get that:

$$S_{Joe} = 7P - 56 = 34 - 1/2P = D_{QB} \Rightarrow 15/2P = 90 \Rightarrow P = \$12 \text{ per lesson and } Q = 28 \text{ lessons}$$

e) Draw a new graph that illustrates the initial demand curve, the new demand curve and the supply curve. Mark the initial equilibrium price and quantity and the new equilibrium price and quantity.



f) Given the new demand curve, calculate the value of Consumer Surplus (CS') and Producer Surplus (PS'). What is the value of Total Surplus (TS') now? Illustrate these areas in your graph that you drew in (f).

Answer:

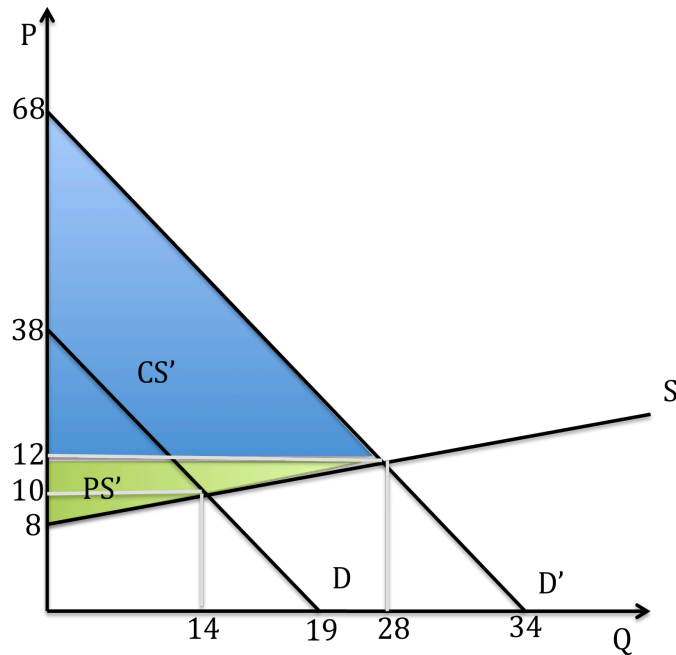
We follow the same procedure as before. First, rearrange the demand in term of quantity, as $P = 68 - 2D_{QB}$. Then, we can calculate the CS' as:

$$CS' = (1/2)(68 - 12)(28) = \$784$$

Let's rearrange the supply in term of quantity, as $P = 8 + 1/7S_{JOE}$. Then, we can calculate the PS' as:

$$PS' = (1/2)(12 - 8)(28) = \$56$$

The Total Surplus, TS', is equal to the sum of the two, \$840.



Suppose that Steve notices that quarterback lessons are a good business in San Francisco and he decides to move from Tampa to San Francisco. His supply curve for one hour of quarterback lessons is:

$$S_{\text{Steve}} = 3P - 15$$

g) (Assume that we are still using the new demand curve for the remainder of this problem.) Find the equation of the new market supply curve for quarterback lessons in San Francisco.

Answer:

To calculate the market demand equation we need to horizontally sum the two supply curves of Joe and Steve: to do this accurately, both supply curves must be written in x-intercept form! First we should notice that for any price lower than \$8 Joe would not offer any lessons. Therefore for any price below or equal to \$8 it is just Steve who is willing to supply quarterback lessons. At a price of \$8 per lesson, Steve is willing to offer 9 hours of lessons; at prices above \$8 per lesson, both Steve and Joe will offer quarterback lessons. Thus,

$$S_{\text{total}} = 3P - 15 \text{ if } P \leq \$8 \text{ and } S_{\text{total}} = 10P - 71 \text{ if } P > \$8$$

We can rearrange the market supply curves in y-intercept form as:

$$P = 5 + (1/3)S_{\text{total}} \text{ if } S_{\text{total}} \leq 9 \text{ and } P = 7.1 + (1/10)S_{\text{total}} \text{ if } S_{\text{total}} > 9$$

h) Given Steve's entry into the quarterback lesson market in San Francisco and holding everything else constant, what are the new equilibrium price and equilibrium quantity in this market? Show your work.

Answer:

Let's first check if the equilibrium price is above \$8 per lesson:

$$D_{QB} = 34 - (1/2)P = 10P - 71 = S \Rightarrow (21/2)P = 105 \Rightarrow P = \$10 \text{ per lesson and } Q = 29 \text{ lessons}$$

Given that the equilibrium price is above \$8, we have found the equilibrium. If the price we found using the above equations had been less than \$8 per lesson that would have told us that we needed to use the other segment of the market demand curve to find the equilibrium price and quantity in this market once Steve entered the market.

i) Given Steve's entry into the quarterback lesson market in San Francisco and holding everything else constant, what are the new Consumer and Producer Surplus, CS" and PS"? Show these areas in a well labeled graph. (This is a pretty tough question but we believe you can do it!!!!) Calculate the value of total surplus, TS", as well.

Answer:

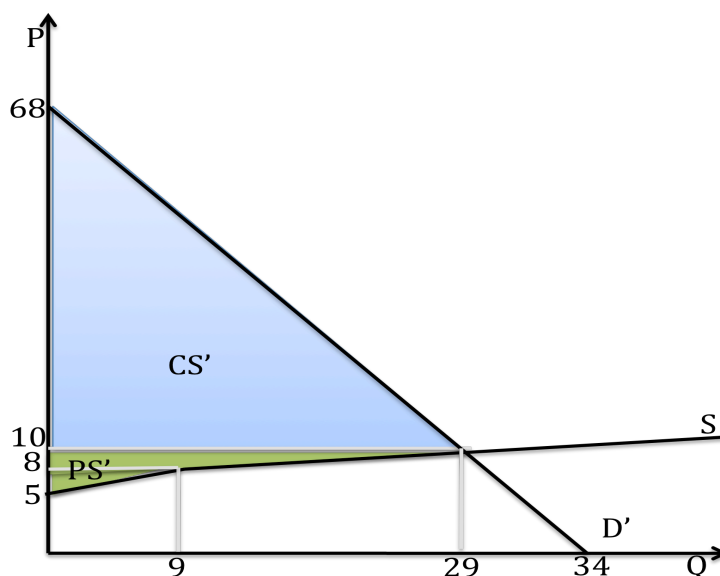
The CS" is easy to calculate and the procedure follows what we did in our earlier calculations:

$$CS'' = (1/2)(68-10)(29) = \$841$$

For the PS" you need to calculate the area in green. This time is not a triangle. We split the calculation in two parts. First we calculate the area of the bottom triangle. Then, we calculate of the trapezoid the bottom triangle and the CS. The PS is then:

$$PS'' = (1/2)(8-5)(9) + (10 - 8)(9) + (1/2)(10-8)(29 - 9) = 13.5 + 18 + 20 = \$51.5$$

The total surplus, TS', is equal to the sum of PS" and CS", \$892.5.

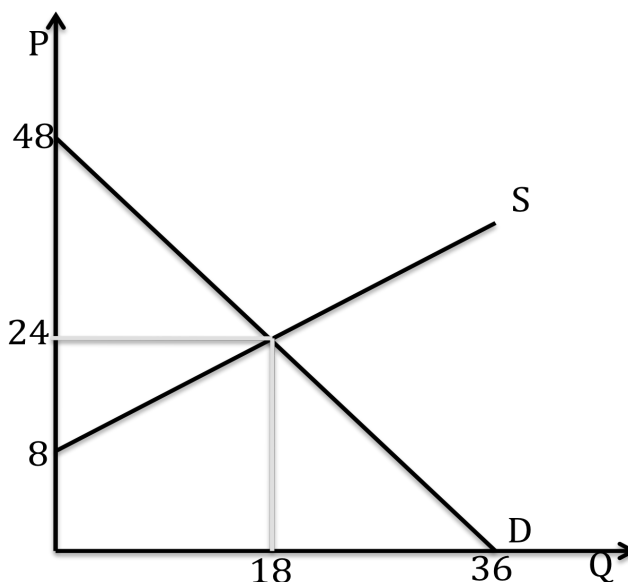


4. Uber is a famous app that allows an individual to book a taxi ride through their smart phone. Unlike cabs companies, Uber charges different prices according to the level of demand at the time the individual is requesting a ride: higher demand, the individual pays a higher price; lower demand, the individual pays a lower price. Suppose the demand and supply for Uber rides in Madison are given by the following equations where Q is the quantity of rides and P is the price per ride:

Supply of Uber rides in Madison: $Q = (9/8)P - 9$
 Demand for Uber riders in Madison: $Q = 36 - (3/4)P$

a) Draw a well labeled graph illustrating the demand and supply curves for Uber rides in Madison.

Answer:



b) Calculate the equilibrium price and quantity in the market for Uber rides in Madison. Show your work.

Answer:

We set demand and supply equal:

$Q_{\text{supply}} = (9/8)P - 9 = 36 - (3/4)P = Q_{\text{demand}} \Rightarrow (15/8)P = 45 \Rightarrow P = \24 per Uber ride and $Q = 18$ Uber rides

c) Calculate the value of Consumer Surplus, CS, and Producer Surplus, PS, in this market. Illustrate these areas in your graph. Calculate the value of Total Surplus, TS.

Answer:

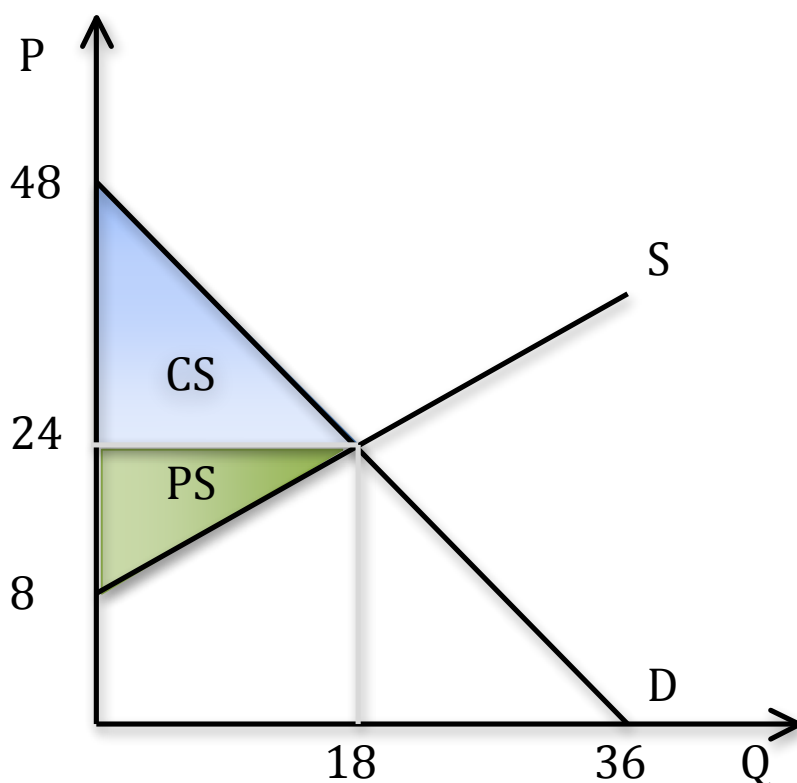
We follow the same procedure as before. First, rearrange the demand curve in slope-intercept form as $P = 48 - (4/3)Q$. Then, we can calculate the CS as:

$$CS = (1/2)(48 - 24)(18) = \$216$$

Let's rearrange the supply curve in slope-intercept form as $P = 8 + 8/9S$. Then, we can calculate the PS as:

$$PS = (1/2) (24 - 8)(18) = \$144$$

The Total Surplus, TS, is equal to the sum of the two, \$360.



Suppose a bad storm hits Madison and this storm causes the demand for Uber rides to increase dramatically. The new demand curve for Uber rides in Madison is given by the equation:

$$Q = 81 - (3/4)P$$

d) Given this new demand curve and holding everything else constant, what are the new equilibrium price and quantity in this market? Show your work.

Answer:

We set demand and supply equal:

$$Q_{\text{supply}} = (9/8)P - 9 = 81 - (3/4)P = Q_{\text{demand}} \Rightarrow (15/8)P = 90 \Rightarrow P = \$48 \text{ per lesson and } Q = 45 \text{ lessons}$$

e) Given this new demand curve and holding everything else constant, what are the new Consumer and Producer Surplus, CS' and PS'? Show these areas in a well-labeled graph. What is the value of the new Total Surplus, TS'?

Answer:

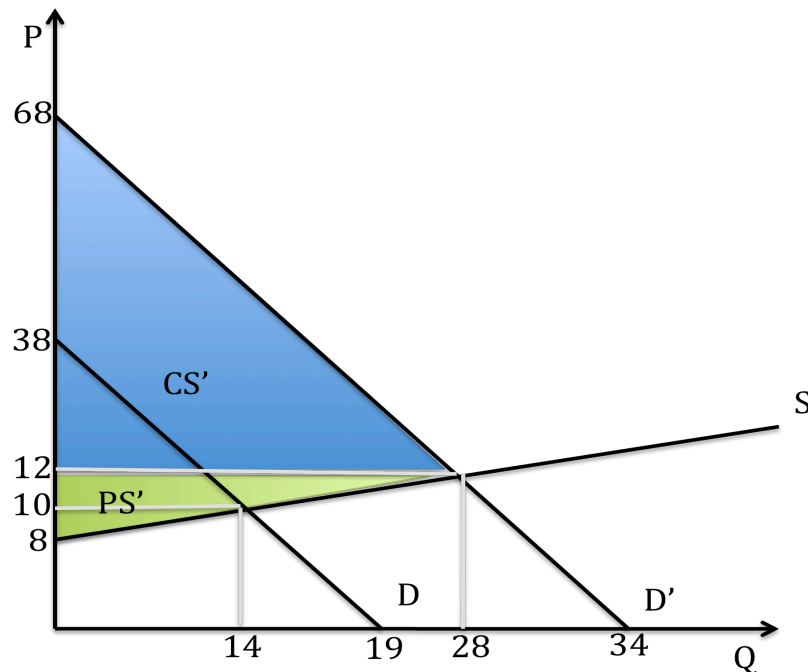
We follow the same procedure as before. First, rearrange the demand curve in slope-intercept form as $P = 108 - (4/3)Q$. Then, we can calculate the CS' as:

$$CS' = (1/2)(108 - 48)(45) = \$1350$$

Let's rearrange the supply curve in slope-intercept form as $P = 8 + (8/9)Q$. Then, we can calculate the PS' as:

$$PS' = (1/2)(48 - 8)(45) = \$900$$

The Total Surplus, TS' , is equal to the sum of the two, \$2250.



Suppose that the cab companies who compete with Uber argue that the pricing policy of Uber is harming consumers because this pricing policy results in consumers paying a higher price when there is greater demand. The municipal government in Madison decides to implement a price ceiling of \$36 per ride on Uber due to the cab companies' argument.

f) Calculate the effect of this new price ceiling on the market for Uber rides in Madison. First, do this analysis based on the original pre-storm demand curve. Then redo your analysis for the effect of this price ceiling on the post-storm demand curve. What prices will consumers pay under the two scenarios? What quantity of Uber rides will consumers take under the two scenarios? Is there a difference in the market outcome under the two scenarios? If so, describe that difference.

Answer:

Under the initial demand curve (low demand) the price ceiling will be not binding, therefore the equilibrium price and quantity will be the same as you calculated in (b).

In the case of high demand the ceiling is binding given that the equilibrium price is higher than the ceiling. This will generate a shortage of Uber rides. To calculate the size of the shortage we need to plug in the price ceiling into both the demand and the supply curves:

$$Q_{\text{demanded with price ceiling}} = 81 - (3/4)(36) = 54 \text{ Uber rides}$$

$$Q_{\text{supplied with price ceiling}} = (9/8)(36) - 9 = 31.5 \text{ Uber rides}$$

$$\Rightarrow \text{Shortage} = Q_{\text{demanded with price ceiling}} - Q_{\text{supplied with price ceiling}} = 54 - 31.5 = 22.5 \text{ Uber rides}$$

g) Analyze the impact of this price ceiling on consumer surplus and producer surplus. Do this analysis for the low demand scenario and then repeat it for the high demand scenario. With both

scenarios decide if there is a deadweight loss and if there is, calculate the value of this deadweight loss.

Answer:

Low Demand Scenario: As we said in (g) the implemented price ceiling has no impact in this market when the market is described by the low demand curve you were initially given. There is no change in the CS or the PS with the implemented price ceiling. There is no deadweight loss.

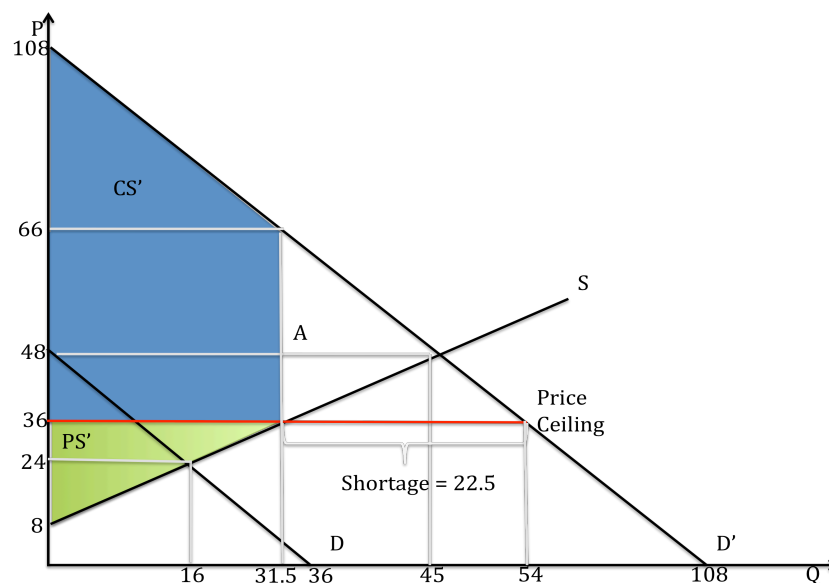
High Demand Scenario: There is a change in CS and PS under high demand scenario once the price ceiling is implemented.

$CS_{\text{with the price ceiling and high demand}} = (1/2)(108 - 66)(31.5) + (66 - 36)(31.5) = \1606.50 . It is shown in the figure below as the blue trapezoid.

$PS_{\text{with the price ceiling and high demand}} = (1/2)(36 - 8)(31.5) = \441 . It is shown in the figure below as the green triangle.

The deadweight loss, $DWL_{\text{with the price ceiling and high demand}}$, is equal to the triangle A (shown in pink) in the figure.

$$DWL_{\text{with the price ceiling and high demand}} = (1/2)(45 - 31.5) * (66 - 36) = \$202.5$$



h) Is the cab companies' argument that Uber's pricing method harms consumers and therefore there is need for government intervention in this market correct? Take a position on this and then make your argument. We want to see good strong writing here: so take your time to work on an answer that is expressive and that others can follow.

Answer:

The cab companies' argument is incorrect. In the high demand scenario the implementation of this price ceiling leads to a drop in total surplus relative to its level without the price ceiling. But the impact of this price ceiling is felt differently by the consumers of Uber rides and the producers of Uber rides: the price ceiling leads to a higher level of CS for these consumers and a lower level of PS for these producers. In short, the price ceiling changes the distribution of the surplus between

these two groups. However we should notice that only those consumers that find a Uber ride are gaining from the implementation of the price ceiling. There are a number of eager and willing potential consumers of Uber rides that are denied rides when the price ceiling is implemented and there is high demand.

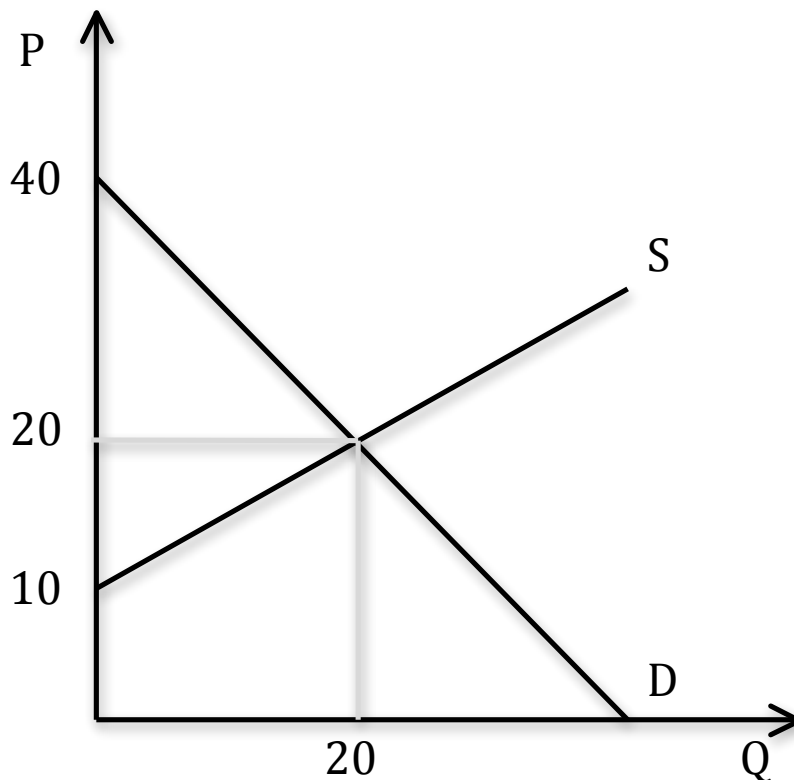
5. Ethanol is used as an additive in the production of car fuel and it is produced from corn. After a drop in the price of crude oil fuel, the demand for ethanol from fuel producers decreases. Consequently the market price of a unit of ethanol decreases from its original price of \$22 per unit. The demand and supply curve for ethanol after this drop in the price of crude oil are represented by the following equations where Q is the quantity of ethanol units and P is the price per ethanol unit:

$$\text{Supply: } Q = 2P - 20$$

$$\text{Demand: } Q = 40 - P$$

a) In a graph draw the demand and supply curves for ethanol. Calculate the equilibrium price and quantity of ethanol given the above equations. Mark this equilibrium in your graph and make sure the graph is completely and clearly labeled.

Answer:



To find the equilibrium, set demand equal to supply:

$$Q_{\text{supply}} = 2P - 20 = 40 - P = Q_{\text{demand}} \Rightarrow 3P = 60 \Rightarrow P = \$20 \text{ per unit of ethanol and } Q = 20 \text{ units of ethanol}$$

b) Given the above information and holding everything else constant, calculate the value of Consumer and Producer Surplus, CS and PS. What is the value of Total Surplus, TS? Show all your work.

Answer:

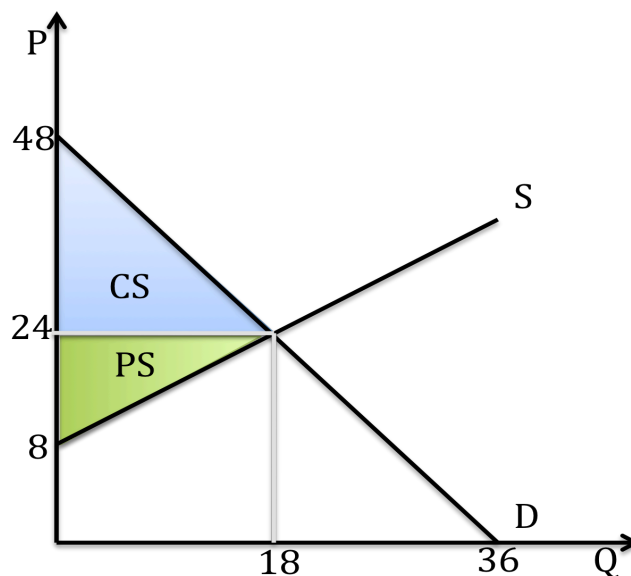
To calculate CS and PS we follow the same procedure as we have used in the previous problems in this homework. First, rewrite the demand curve in slope-intercept form as $P = 40 - Q_{\text{demand}}$. Then, we can calculate the CS as:

$$CS = (1/2)(40 - 20)(20) = \$200$$

Let's rearrange the supply curve in slope-intercept form as $P = 10 + (1/2)Q_{\text{supply}}$. Then, we can calculate the PS as:

$$PS = (1/2)(20 - 10)(20) = \$100$$

The Total Surplus, TS, is equal to the sum of the PS and CS, or \$300.



The US government decides to implement a program to help the farmers who have been affected by the decreases in the price of ethanol. There are two policies being considered as methods to help these farmers. The first program involves considering the impact of introducing a \$6 per unit subsidy on the production of ethanol. The second program involves considering the impact of setting a price floor of \$22 per unit of ethanol (remember this was the original price before the decrease in the price of crude oil).

c) Let's start with the analysis of the subsidy program. Given a subsidy to producers of ethanol of \$6 per unit of ethanol, what will be the price of ethanol for consumers, what will be the price of ethanol that producers receive including the subsidy, and what will be the quantity of ethanol produced with this program? Show how you calculated these answers. Then, draw a graph of the ethanol market that represents this subsidy program.

Answer:

A subsidy to the supplier reduces the cost of producing the good from the producer's perspective. So, the effect of a subsidy is to shift the supply curve to the right: the vertical distance between the initial supply curve and the new supply curve with the subsidy will be equal to the subsidy per unit which in this example is \$6 per unit of ethanol.

So if the initial supply curve is given as $P = (1/2)Q + 10$, the new subsidy curve with the subsidy is $P = (1/2)Q + 4$.

Use this new supply curve and the initial demand curve to find the quantity of ethanol that producers will be willing to supply once this subsidy is implemented:

$$(1/2)Q + 4 = 40 - Q \Rightarrow 24 \text{ units of ethanol will be supplied}$$

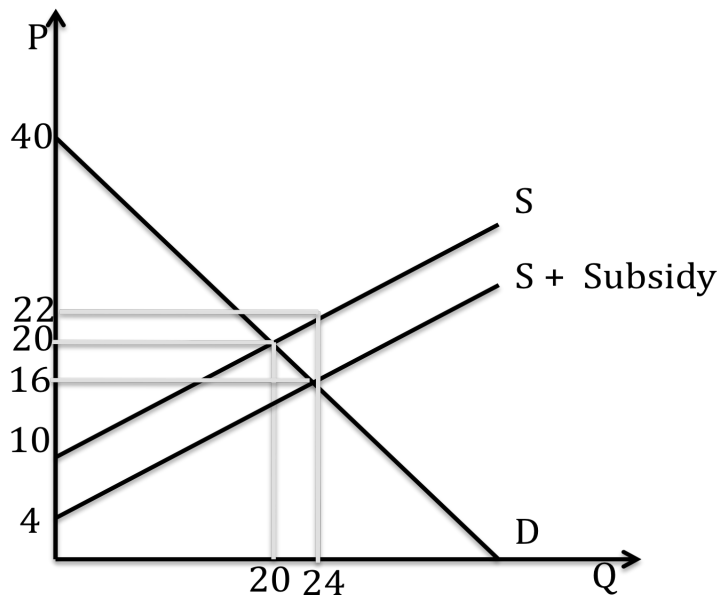
To find the price consumers will pay for this amount of ethanol, plug in this quantity into the original demand curve:

$$P_{\text{consumers pay with subsidy}} = 40 - Q = 40 - 24 = \$16 \text{ per unit of ethanol}$$

To find the price producers will receive for this amount of ethanol, add the subsidy per unit to the price per unit that consumers pay:

$$P_{\text{with subsidy}} = \$16 + \$6 = \$22 \text{ per unit of ethanol}$$

The graph below illustrates this subsidy program:



d) Now, for the analysis of the price floor. Given a price floor of \$22 implemented by the government in the market for ethanol, what will be the price of ethanol to consumers, what will be the quantity of ethanol consumed by consumers, and what will be the quantity of ethanol produced with this program? Show how you calculated these answers. Then, draw a graph of this market that represents this price floor.

Answer:

When the government implements a price floor of \$22 into the ethanol market, this is a binding price floor since the price floor has been set above the equilibrium price in this market when there is no intervention. Therefore, the implementation of this price floor will result in a surplus of production. To see this surplus, let's first calculate how many units of ethanol consumers will consume when the price of ethanol is set at \$22. To find this quantity we use the demand curve:

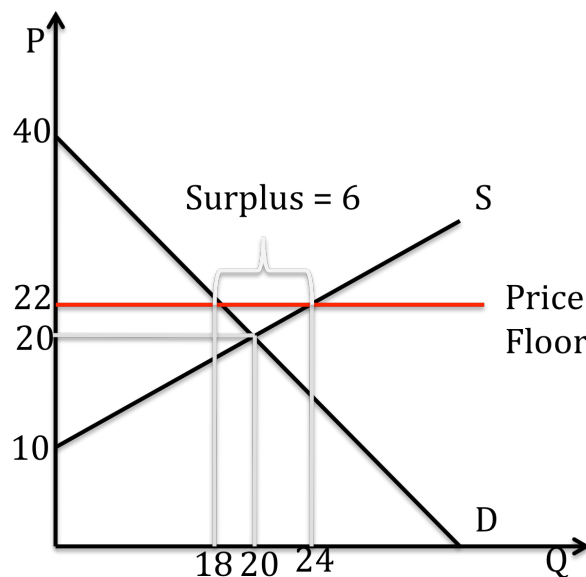
$$P = 40 - Q_{\text{demanded with price floor}} \Rightarrow 22 = 40 - Q_{\text{demanded with price floor}} \Rightarrow Q_{\text{demanded with price floor}} = 18 \text{ units of ethanol}$$

Then, use the supply curve to calculate the number of units of ethanol producers will produce given this price floor:

$$P = (1/2)Q_{\text{supplied with price floor}} + 10 \Rightarrow 22 = (1/2)Q_{\text{supplied with price floor}} + 10 \Rightarrow Q_{\text{supplied with price floor}} = 24 \text{ units of ethanol}$$

The surplus in the market when a price floor is implemented by the government will equal the difference between the quantity supplied at a price of \$22 and the quantity demanded at a price of \$22: the surplus is equal to 6 units of ethanol.

The graph below represents this price floor of \$22 being implemented into this market.



e) Compare the two policies in terms of their cost to the government, the values of Consumer Surplus and Producer Surplus, and the size of the deadweight loss. Show how you found all of these values. Assume that the government is NOT buying the surplus with the price floor program. After you provide the work showing your analysis, put your answers into the following table:

Results when there is no intervention in the Ethanol Market		Results when there is a \$6 per unit subsidy in the Ethanol Market		Results when there is a price floor of \$22 in the Ethanol Market	
CS		CS		CS	
PS		PS		PS	
Cost to Govt.		Cost to Govt.		Cost to Govt.	
DWL		DWL		DWL	

Answer:

Let's start with the analysis of the subsidy program. The CS with the subsidy program is equal to the sum of the areas A, G, C and H:

CS with the subsidy program = $(40 - 16) \cdot 24 / 2 = \288 or alternatively,
 CS with the subsidy program = $(1/2)(40 - 16)(24) = \$288$

The PS with the subsidy program is equal to the area B:

$$PS \text{ with the subsidy program} = (1/2)(16 - 4)(24) = \$144$$

The Government Expenditure, or cost to the government, due to the implementation of this program is equal to the size of the subsidy and the equilibrium quantity, graphically the rectangle G, C, H, E and F.

Cost to the government of subsidy program = (subsidy per unit)(number of units produced)
 Cost to the government of subsidy program = $(6)(24) = \$144$

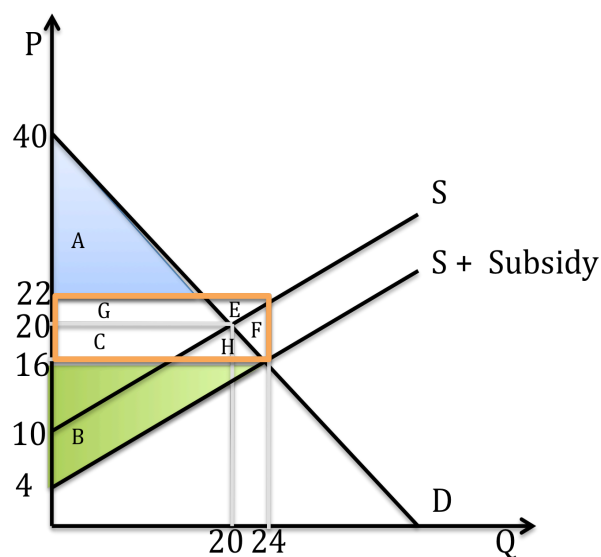
Total Surplus with the subsidy program = (CS with the subsidy program) + (PS with the subsidy program) - (Cost to the government of subsidy program)
 TS with the subsidy program = $\$288 + \$144 - \$144 = \288

Now, let's compare the Total Surplus with the subsidy program, \$288, to the Total Surplus that we had prior to the government's intervention in this market (return to your answer in (b)), \$300. There has been a loss in Total Surplus with the implementation of this subsidy program! This means there must be a deadweight loss. And, our numbers suggest that DWL is equal to \$12, the difference between the TS of \$300 before the program and the TS of \$288 with the implementation of this program. Let's look at our graph to find the area of DWL.

The deadweight loss with the subsidy program is equal to the triangle F

$$DWL \text{ with the subsidy program} = (1/2)(22 - 16)(24 - 20) = \$12$$

The DWL occurs because the subsidy program results in the market once the subsidy is implemented producing too much of the good!



Now, for the analysis of the price floor program:

The CS with the price floor is the area of the blue triangle in the graph below:

$$\text{CS with the price floor} = (1/2)(40 - 22)(18) = \$162$$

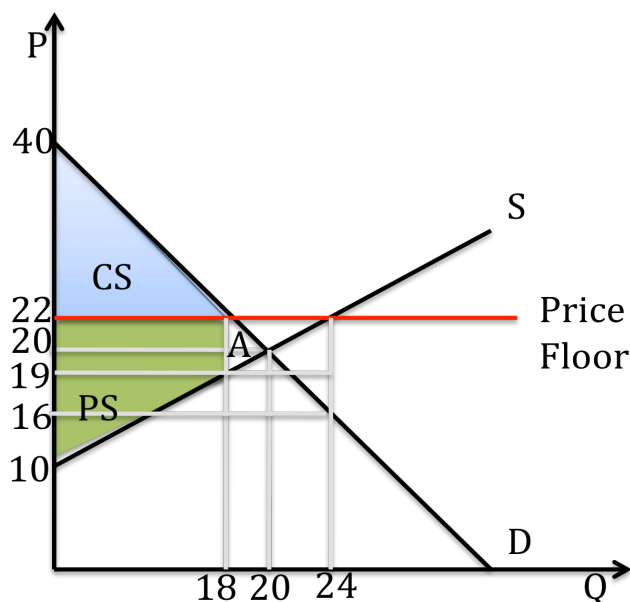
The PS with the price floor is the area of the green trapezoid in the graph below:

$$\text{PS with the price floor} = (1/2)(19 - 10)(18) + (3)(18) = \$135$$

Total Surplus with the price floor is equal to the sum of CS with the price floor plus PS with the price floor, or \$297. If we compare the TS with the price floor to the TS with no government intervention in the market (see your answer in (b)) we see that TS with the price floor is now \$3 smaller than it was when the government did not intervene in the market. Thus, we expect that the Deadweight Loss with the price floor is equal to \$3. Where is this DWL in the figure below?

The deadweight loss with the price floor is the triangle A:

$$\text{DWL with the price floor} = (1/2)(22 - 19)(20 - 18) = (1/2)(3)(2) = \$3$$



Results when there is no intervention in the Ethanol Market		Results when there is a \$6 per unit subsidy in the Ethanol Market		Results when there is a price floor of \$22 in the Ethanol Market	
CS	\$200	CS	\$288	CS	\$162
PS	\$100	PS	\$144	PS	\$135
Cost to Govt.	\$0	Cost to Govt.	\$144	Cost to Govt.	\$0

DWL	\$0	DWL	\$12	DWL	\$3
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f) We have three options:

Option I: no intervention in the ethanol market by the government

Option II: government intervenes in this market and implements a subsidy of \$6 per unit of ethanol

Option III: government intervenes in this market with a price floor of \$22 per unit of ethanol (government does NOT buy the surplus)

Given these three options and your analysis in (f), which option will consumers of ethanol prefer?

Which option will producers of ethanol prefer?

Answer:

Both consumers of ethanol and producers of ethanol will prefer Option II even though Option II has a larger deadweight loss to society and it carries significant government cost. Here we see yet another example of how important distributional consequences are in helping us understand the impact of different policies and in understanding the support for these policies.