Economics 102
Fall 2015
Answers to Homework #2
Due Monday, October 5, 2015

Directions:

- The homework will be collected in a box **before** the large 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. Comparative Advantage, Joint PPF

Suppose that the United States and China both produce computers and shirts and that each country has a linear production possibility frontier with respect to the production of these two goods. Suppose that in a year an American worker can produce 100 shirts and 0 computers or 20 computers and 0 shirts, while a Chinese worker can produce 100 shirts and 0 computers or 10 computers and 0 shirts.

a. In the United States, what is the opportunity cost of producing an additional shirt (measured in terms of foregone computers)? In China, what is the opportunity cost of producing an additional shirt (measured again in terms of foregone computers?

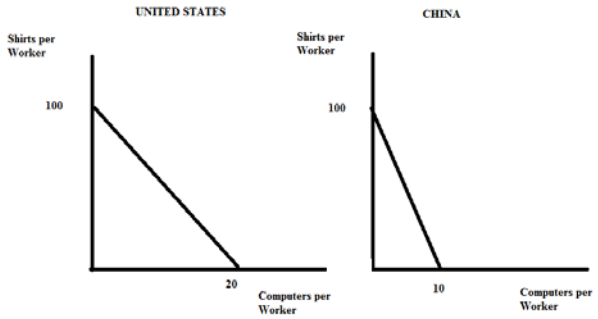
Answer:
An additional shirt in the United States costs 1/100 worker-years (1 worker working for 1 year), and freeing up the necessary 1/100 worker years in the United States would mean (1/100 * 20) = 0.2 fewer computer produced. Therefore, relevant opportunity cost of producing an additional shirt in the United States is 0.2 computers.

Similarly, in China, an additional shirt also costs 1/100 worker-years that would have to come at the expense of the production of (1/100 * 10)= 0.1 fewer computers. Thus the relevant opportunity cost of producing an additional shirt in China is 0.1 computers.

b. Given the above information, draw the PPF for the United States with computers per worker measured on the x-axis and shirts per worker measured on the y-axis. In a separate graph, draw the PPF for China. For both PPFs assume that you are drawing the PPF per worker (that is, assume that you are drawing a PPF based on each economy

employing a single worker). What does the slope of the PPF signify in terms of opportunity cost? Provide a clear explanation in your answer.

Answer:
Here are the PPFs for the United States and China. Multiplying the (slope of the PPF)*(-1) gives us the opportunity cost of an additional unit of the good measured on the horizontal axis or, in this case, the opportunity cost of producing an additional computer.



c. Suppose that the United States and China each have 100 workers that can produce computers and/or shirts. If each country devotes half of these workers to the production of computers and half to the production of shirts, how many shirts and computers does each country produce? Assuming that the only producers of shirts and computers in the world are China and the United States, what is the world output of shirts and computers?

Answer:
Devoting half of the 100 workers to work in each industry, each country will have 50 worker-years in either industry over a year. From the table it is clear that this would mean:

Americans produce 50*100 = 5000 shirts and 50*20 = 1000 computers.

The Chinese produce 50*100 = 5000 shirts and 50*10 = 500 computers.

The world output is thus 5000 + 5000 =10000 shirts and 1000 + 500 = 1500 computers.

d. Suppose we now assume that each country specializes by devoting all of its workers (100 for each country) to the industry in which it has a comparative advantage. In this case, what is the world output of shirts and computers? Show your work and explain your answer fully.

Answer:
From the answer in (a), we note that China has a comparative advantage in shirt production. The United States must therefore have a comparative advantage in

producing the other good, i.e. computers. Thus, China specializes in shirt production while the United States specializes in computer production.

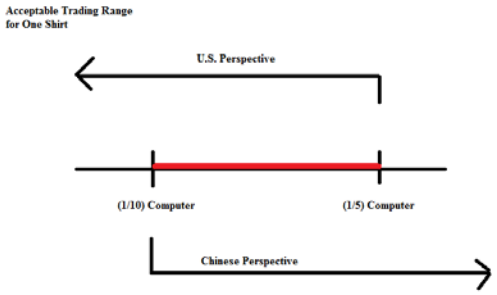
With 100 worker-years in computer production, the United States produces 100*20 = 2000 computers.

With 100 worker-years in shirt production, China produces 100*100 = 10,000 shirts.

World output is therefore 10,000 shirts and 2000 computers.

e. Assuming that the two countries are completely specializing (as in (d)), now allow the two countries to trade with each other. What is the range of acceptable trading prices for one shirt? Illustrate your answer using the number line approach presented in class: in your diagram make sure you represent both the United States' perspective as well as China's perspective.

Answer:



From our work we know that the opportunity cost of producing an additional shirt in China is (1/10) computer and that the opportunity cost of producing an additional shirt in the United States is (1/5) computer. China will be willing to sell a shirt provided the price it receives is at least (1/10) computer or more; the United States will be willing to buy a shirt provided the price it pays is no greater than (1/5) computer. The two countries will be able to agree on trade provided that the price of the shirt falls between (1/10) computer and (1/5) computer. This acceptable trading range is in red in the above diagram.

2. Qualitative Supply and Demand

The famous Italian pizza, Margherita, is made of tomatoes, basil and mozzarella. In this question, assume that ketchup, made from tomatoes, is a complement to pizza.

State whether the new equilibrium price and quantity is higher or lower in the market specified after the following changes. Assume that each market is initially in equilibrium and that you are analyzing the effect of the desired change on the equilibrium price and equilibrium quantity in the market relative to the initial equilibrium price and equilibrium quantity. (Hint: Drawing graphs might help!)

a. Consider the market for tomatoes. Suppose after a flood, tomatoes fields are destroyed.

Answer:
The supply curve for tomatoes shifts to the left since at all prices, the producers are able to supply less tomatoes. In the market for tomatoes the equilibrium price increases relative to the initial equilibrium price and the equilibrium quantity decreases relative to the initial equilibrium quantity.

b. Consider the market for mozzarella. Suppose the workers involved in the production of mozzarella unionize and all factories producing mozzarella must now pay their workers a higher wage.

Answer:
The supply curve for mozzarella shifts to the left since at all prices, the producers are willing and able to supply less mozzarella due to the increase in the price of labor, a necessary input in the production of mozzarella. In the market for mozzarella, the equilibrium price increases relative to the initial equilibrium price and the equilibrium quantity decreases relative to the initial equilibrium quantity.

c. Consider the market for basil. Suppose the government imposes a limit on how much basil may be produced. (Assume this limit is less than the current equilibrium quantity in the market for basil.)

Answer:
The government restriction on basil production is like a quota limit or quantity control. This quota limit will reduce the quantity exchanged so that this new quantity is smaller than the initial equilibrium quantity. The quantity control will also result in a higher price being charged for the basil than the initial equilibrium price.

d. Consider the market for ketchup. Suppose a government policy to limit the production of tomato paste is imposed where the quota limit on tomato paste is smaller than the equilibrium quantity in the tomato paste market. What is the impact of this quota limit on tomato paste on the market for ketchup? Assume that tomato paste is a primary ingredient in the making of ketchup.

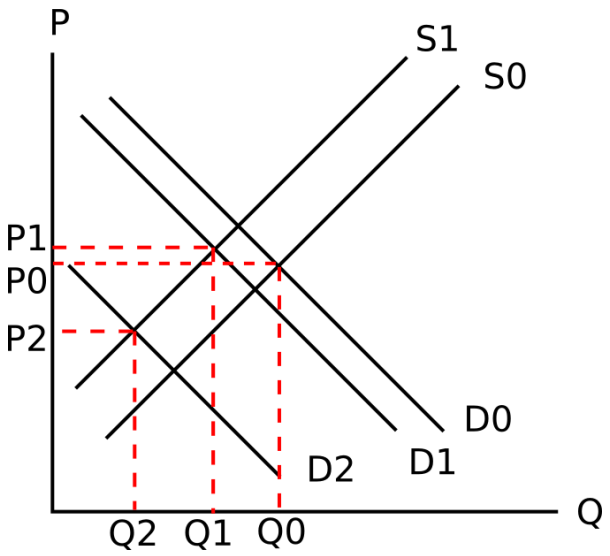
Answer:
Similar to our analysis in (c), this effective quota limit on tomato paste will result in the price of tomato paste rising. Since tomato paste is a primary ingredient in ketchup this implies that the supply curve for ketchup will shift to the left due to the rising price of this primary ingredient. Relative to the initial equilibrium price and quantity in the market for ketchup, the quota limit on tomato paste will result in an increase in the equilibrium price of ketchup and a decrease in the equilibrium quantity of ketchup.

e. Consider market for Italian Pizza, Margherita. Suppose that all the events described in (a), (b), (c) and (d) occur simultaneously. Explain your answer fully and illustrate your answer with a graph.

Answer:
Looking back at (a) through (d), we can summarize what is happening:

- in (a), the supply curve for tomatoes is shifting to the left due to the flood destroying the tomato crop, This decrease in the supply of tomatoes leads to an increase in their price and since tomatoes are an essential ingredient to the Margherita pizza we can interpret the impact of the flood as a leftward shift in the supply curve for Margherita pizzas.
- in (b), the union successfully achieves higher wages for mozzarella cheese producers. Since mozzarella is an essential ingredient in our Margherita pizzas this implies another reason for the supply curve for Margherita pizzas shifting to the left.
- in (c), the quota limit causes the price of basil an essential ingredient in the pizzas to rise: we can also interpret this impact as a leftward shift in the supply curve for Margherita pizzas.
- in (d), the price of ketchup increases and since ketchup and pizza are assumed to be complements this implies that as consumers consume less ketchup they will also consume less pizza at every price. The demand curve for Margherita pizzas will shift to the left.

Given that both the demand and supply curves for the Margherita pizzas are shifting, we know with certainty that the equilibrium quantity for Margherita pizzas decreases relative to its initial level; however we do not know if the equilibrium price for Margherita pizzas increase, decrease or remain the same relatively to its initial level. Here's a graph to illustrate this outcome where price is indeterminate and quantity decreases. Note: DO and SO are the original demand and supply curves while D1 and D2 represent two possible new demand curves and S1 represents the new supply curve.



3. Quantitative Supply and Demand

Consider the market demand for computers in which the initial demand curve and supply curves are given by the following equations where Q refers to the quantity of computers and P is the price per computers in dollars:

Demand curve: $Q_1^D = 1050 - 2P$

Supply curve: $Q_1^S = P - 300$

a) What is the initial equilibrium price and quantity in this market? Show your work.

Answer:
In equilibrium, $Q_1^D = Q_1^S$ so:
$1050 - 2P = P - 300$
$3P = 1350$
P = $450 per computer
Q = P – 300 = 150 computers
So the equilibrium price is $450 per computer and the equilibrium quantity is 150 computers.

b) Now suppose the demand curve shifts to the right and can now be expressed by the equation:

New Demand curve: $Q_2^D = 1200 - 2P$

Find the equilibrium price and quantity in the following cases, and for each case, show your work.

i) The supply curve remains the same, i.e. $Q_1^S = P - 300$

Answer:
In equilibrium, $Q_2^D = Q_1^S$ so:
$1200 - 2P = P - 300$
$3P = 1500$
P = $500 per computer and Q = 200 computers

ii) The supply curve shifts to the right and is now expressed by the equation:
$Q_2^S = P - 90$

Answer:
In equilibrium, $Q_2^D = Q_2^S$ so:
$1200 - 2P = P - 90$
$3P = 1290$
P = $430 per computer and Q = 340 computers

iii) The supply curve shifts to the right and is now expressed by the equation:
$Q_3^S = P - 150$

Answer:
In equilibrium, $Q_2^D = Q_3^S$ so:
$1200 - 2P = P - 150$
$3P = 1350$
P = $450 per computer and Q = 300 computers

c) What do you observe about the equilibrium quantity in each case in (b) with the initial equilibrium in (a)? What about the equilibrium price?

Answer:
In every case in (b) the quantity increased relative to the initial equilibrium quantity in (a). In case (b-i) the equilibrium price increased relative to the initial equilibrium price. In case (b-ii) the equilibrium price decreased relative to the initial equilibrium price. And, in case (b-iii) the equilibrium price stayed the same as the initial equilibrium price.

d) Given the increase in demand from the initial demand curve to the new demand curve, how big did the horizontal increase in the quantity supplied need to be in order to return the price in the market to its original equilibrium level? In your answer, assume that the new supply is parallel to the initial supply curve: that is, the two supply curves have the same slopes.

Answer:
New supply function is in the form of: $Q^S = P - 300 + c$ where "c" represents the amount of the horizontal shift in the supply curve from its initial position.
In equilibrium, $Q^S = Q^D_2$ so $1200 - 2P = P - 300 + c$
$1200 + 300 = 3P + c$
$1500 = 3P + 3c$
But, we know that we want P = initial price = 450. So,
$1500 = 3(450) + c$
$1500 - 1350 = c$
Therefore for P= 450 we must have c = 150. The new supply curve shifted horizontally to the right by 150 computers.

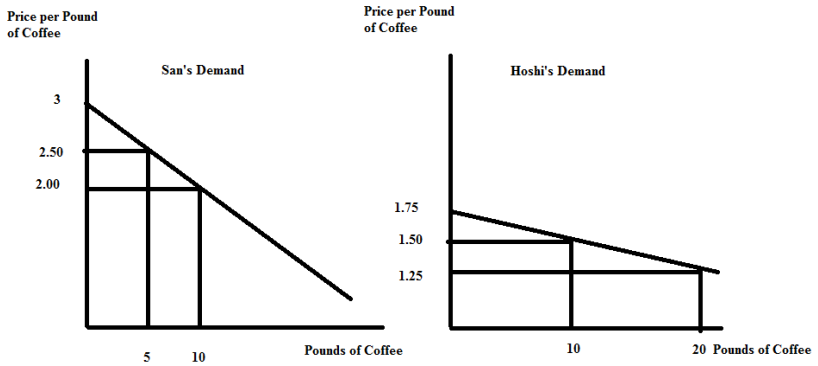
4. Aggregate Market Demand

Beantown is a small, closed economy with two espresso shops: SanCafe and HoshiCafe. SanCafe and HoshiCafe are the only consumers of coffee beans in Beantown. San at SanCafe most often buys 10 pounds of coffee beans at $2/pound, and sometimes he is willing to pay $2.50/pound but buys only 5 pounds of coffee beans. On the other hand, Hoshi at HoshiCafe is willing to pay $1.50/pound for 10 pounds of coffee beans, but most often she buys 20 pounds of coffee beans at $1.25/pound. Both San and Hoshi have linear demand curves for coffee. Assume that San and Hoshi are the only consumers in the market for coffee in Beantown.

a) Given the above information, draw two graphs: in the first graph represent San's demand curve and in the second graph represent Hoshi's demand curve. Write the equations for both of these demand curves.

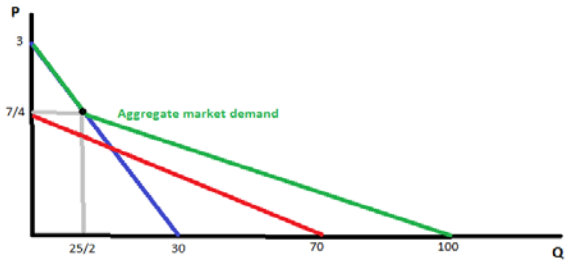
Answer:
San's demand curve: We are given two points that belong to San's demand curve: (Q, P) = (5, 5/2) and (10, 2). Therefore, San's demand is
P = 3 – (1/10)*Q

Hoshi's demand curve: The two points that belong to Hoshi's demand curve are (Q, P) = (10, 3/2) and (20, 5/4). Hoshi's demand is
P = (7/4) – (1/40)*Q



b) Draw the market demand curve for coffee beans in Beantown.

Answer:



c) Find the equations for the market demand curve. Make sure you provide the relevant range or domain for your equations. And, show your work in finding these equations!

Answer:
We can see from the graph and Hoshi's demand equation that if the price is above 7/4, she will not buy any beans. Therefore, above that price, the market demand for coffee beans comes only from San, so that segment of the market demand curve is represented

by $P = 3 - (1/10)*Q$.

As the price falls below 7/4, Hoshi demands coffee as well, so here we have to horizontally sum up the individual demand curves in order to get the market demand. At the kink point, P = 7/4, and if we plug this into San's demand equation, we get that Q = 25/2. Now, we also know that San and Hoshi demand 100 pounds of coffee beans if P = 0. Using these two points, (Q, P) = (100, 0) and (25/2, 7/4), we get that the equation for this lower segment of the market demand curve is:
$P = 2 - (1/50)*Q$.
So,

$$P = \begin{cases} 3 - (1/10)*Q & \text{if } Q \leq 25/2 \\ 2 - (1/50)*Q & \text{if } Q > 25/2. \end{cases}$$

5. International Trade

San and Hoshi keep making espressos in Beantown. They supply espresso according to the following equation where P is the price per cup of espresso and Q is the quantity of cups of espresso:

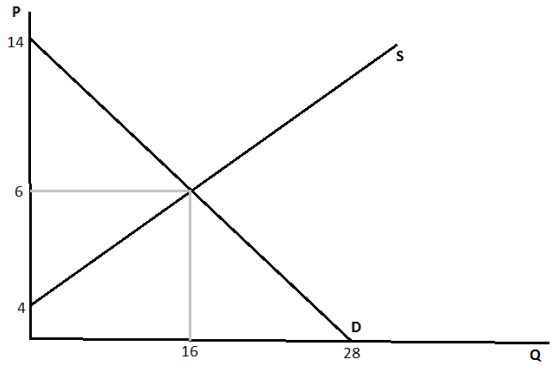
Market Supply: $P - (1/8)*Q^S = 4$

The espresso drinkers demand espresso according to the equation:

$P + (1/2)*Q^D = 14$

a) Given the above information, what is the equilibrium price and quantity in Beantown's espresso market? Show how you found your answer. Then, provide a graph of this market.

Answer:
To find the equilibrium price and quantity, we first rearrange the supply and demand equation with P on the left-hand side and everything else on the right-hand side, and then we set the two right-hand sides equal to each other:
$P = 4 + (1/8)*Q$
$P = 14 - (1/2)*Q$
$4 + (1/8)*Q = 14 - (1/2)*Q$
We can multiply by 8, and then rearrange to get:
$32 + Q = 112 - 4*Q$
$5Q = 80$
$Q = 16$ cups of espresso
Plugging this value into either of the equations gives P = 6 or $6 per cup of expresso.
Therefore, the equilibrium quantity and price are (16, 6).

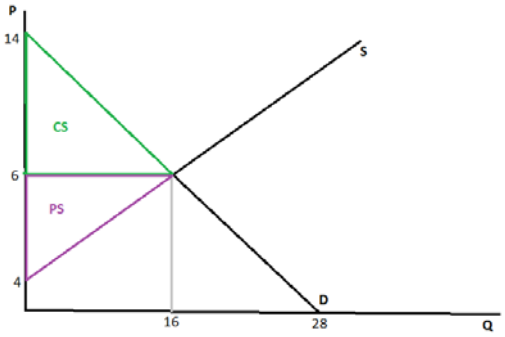


b) Find the consumer surplus (CS), producer surplus (PS) and the total surplus (TS) in this market. [Note: Drawing a graph would be helpful.]

Answer:
CS = (1/2)*(Price-intercept for the demand curve – equilibrium price)*(equilibrium quantity)
In our case, CS = (1/2)*(14-6)*16 = $64.

PS = (1/2)*(Equilibrium price – price-intercept for supply curve)*(Equilibrium quantity)
So, PS = (1/2)*(6-4)*16 = $16.

TS = PS + CS = 16 + 64 = $80.



Now, the Beantown government decides that trading espresso with the rest of the world would be good for the economy. The world price of espresso is $5.

c) How much do Beantowners pay for their espresso now? Do they buy more espresso at this price and, if so, what is the new quantity demanded domestically? How much of that demand is met by SanCafe and HoshiCafe? Is any espresso imported and if so, how many cups of espresso are imported?

Answer:
Once this market opens to trade, Beantown espresso drinkers pay the world price, so $5 per cup of espresso. Since the price has decreased, the domestic consumers in Beantown buy more espresso. There is a movement along the domestic demand curve, so we can use the same demand equation and the new price to calculate the new quantity

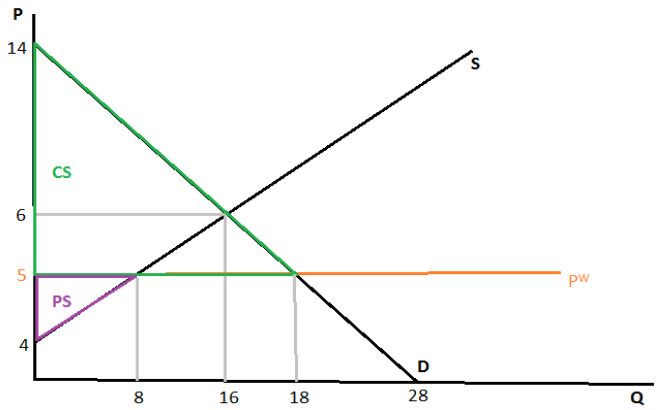
demanded:
$P = 14 – (1/2)*Q^D$
$5 = 14 – (1/2)*Q^D$
$Q^D = (14 - 5)*2 = 18.$
The new quantity demanded is 18 espressos.

At this new price, San and Hoshi supply less espresso. Their new supply is:
$P = 4 + (1/8)Q^S$
$5 = 4 + (1/8)Q^S$
$Q^S = 8$ espressos
San and Hoshi supply 8 espressos.

Imports = Quantity Demanded Domestically – Quantity Supplied Domestically
Imports = 18 – 8 = 10 espressos
Since domestic demand is greater than domestic supply, Beantown now imports 10 espressos.

d) Calculate CS, PS and TS for this open economy and compare them to those in the closed economy. Are San and Hoshi happy with the espresso market being opened to trade? Explain your answer.

Answer:



We use the same formulas as above, but with the new espresso price:
CS with open economy = (1/2)*(14 – 5)*18 = $81
PS with open economy = (1/2)*(5 – 4)*8 = $4
TS with open economy = $85.
Consumer surplus is higher in the open economy than in the closed economy, so consumers are happy with this trade.
On the other hand, San and Hoshi suffer as their surplus decreases with the espresso trade because they are now forced to sell their espresso at a lower price and they sell fewer cups of espresso.

Soon after Beantown starts trading in the espresso market, there is a big protest in front of the State Capitol. Among the many banners there are signs saying “We Stand With San and Hoshi”, “Buy Local” and “Trade Destroys Domestic Jobs”. The government,

worried about the upcoming elections, calms the protestors by announcing a tariff of 50 cents on each imported espresso.

e) What is the price of an espresso after the new tariff is imposed? How many espressos are sold in total at this price? How many of the sold espressos are produced domestically and how many are imported?

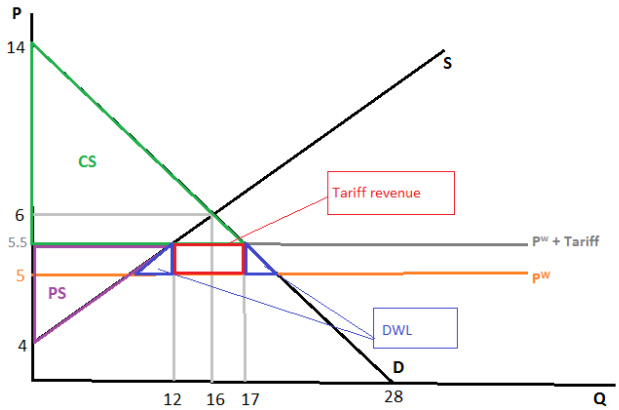
Answer:
With the tariff, the new price of espresso is $5.50.
Espressos sold are:
$P = 14 - (1/2)*Q^D$
$5.5 = 14 - (1/2)*Q^D$
$Q^D = (14 - 5.5)*2 = 17$ espressos

Domestic supply is now:
$P = 4 + (1/8)Q^S$
$5.5 = 4 + (1/8)Q^S$
$Q^S = (5.5 - 4)*8 = 12$ espressos

The new quantity demanded is 17 espressos, while the new quantity supplied domestically by San and Hoshi is 12 espressos. Therefore, Beantown imports 17 – 12 = 5 espressos.

f) Calculate CS, PS and TS when the tariff described in (e) is implemented. Does the government benefit from the tariff and, if so, how much? What is the deadweight loss?

Answer:



CS with the tariff = 1/2*(14 – 5.5)*17 = $72.25
PS with the tariff = 1/2*(5.5 – 4)*12 = $9
Tariff Revenue for the government = (17 – 12)*$0.5 = $2.50
TS with the tariff = CS with the tariff + PS with the tariff + Tariff Revenue for the government = $72.25 + $9 + $2.50 = $83.75.

Note: The government revenue is the amount of imported goods times the tariff per unit of imported good. In our case, there are 5 espressos imported and the tariff is $0.50, so Govt. Revenue = (17 – 12)*$0.5 = $2.5

The deadweight loss is the cost of an inefficient market. The tariff imposed increases the price, so some consumers will not buy espresso at this price. The monetary loss of losing consumers because of the higher price is not fully offset by revenues the government collects. To calculate DWL:

$DWL = 1/2*(P^{tariff} – P^{world})*(Q^{S\text{-}Ptariff} – Q^{S\text{-}Pworld}) + 1/2*(P^{tariff} – P^{world})*(Q^{D\text{-}Pworld} – Q^{D\text{-}Ptariff})$

$DWL = 1/2*(5.5 – 5)*(12 – 8) + 1/2*(5.5 – 5)*(18 – 17) = \$1.25$

Notice that $DWL = TS^{without\ tariff} – TS^{with\ tariff}$.

6. A PhD student in economics from Beantown decides to do research on the effect of an import quota instead of a tariff. In her model of an open economy, she assumes an import quota of 6 espressos. [The demand and supply equations are the same as in the previous problem, and the world price of espresso is $5.]

a) What is the price of one espresso with this import quota? How many espressos are purchased in total? How many of these are domestically produced? (Your answers may end up having fractional prices and quantities.)

Answer:
We are told that the import quota is 6 espressos. This means that the difference between the quantity demanded domestically and the quantity supplied domestically is 6 espressos. Given this information, we need to back out the new price of espresso given this quota. First, write down the supply and demand equations with quantity on the left-hand side and everything else on the right-hand side:

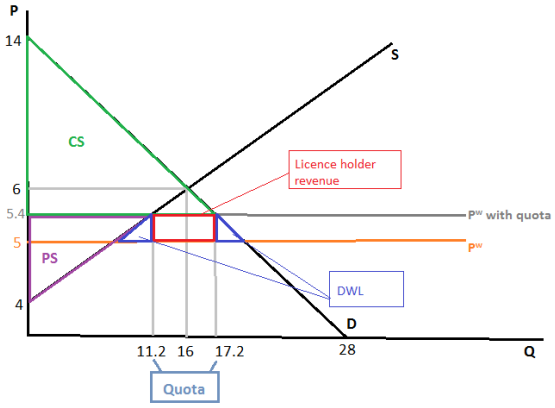
$P = 1/8*Q^S + 4 \rightarrow Q^S = 8*P – 32$
$P = -1/2*Q^D + 14 \rightarrow Q^D = 28 – 2*P$
Now, $Q^S + 6 = Q^D$, so
$8*P – 32 + 6 = 28 – 2*P$
$10*P = 54$
$P = \$5.40$ per espresso
The new price per espresso with the import quota is $5.40.
Now that we know the price, we can plug it back into our domestic supply and domestic demand equations:
Q^S = quantity supplied domestically = $8*P – 32$
$Q^S = 8*5.4 – 32$
$Q^S = 11.2$ cups of espresso supplied domestically

Since domestic supply is 11.2 espressos and we know that there are 6 espressos imported, Q^D or the quantity demanded domestically is 17.2 espressos.

b) Calculate CS and PS given this import quota. Does the government benefit from this quota? Do license holders (in this case, businesses that are licensed to import espresso) benefit and, if so, what is their revenue? Explain your answer fully.

Answer:
CS with the import quota of 6 imports = 1/2*(14 – 5.4)*17.2 = $73.96
PS with the import quota of 6 imports = 1/2*(5.4 – 4)*11.2 = $7.84
License Holder Revenue = (5.4 – 5)*6 = $2.40
TS with the import quota of 6 imports = CS with the import quota of 6 imports + PS with the import quota of 6 imports + License Holder Revenue = $84.20

The license holders benefit from the quota because they buy espressos at the world price but sell it at a higher price. The government does not benefit from the quota (unless the government is "savvy" enough to auction off these licenses whereby the government can "capture" the license holder revenue).



c) What is the deadweight loss incurred as a result of the import quota? What does the DWL reflect? In your own words, explain why the DWL areas represent efficiency loss in the economy.

Answer:
DWL = TS Without Govt. Intervention – TS With Quotas. Recall from problem 4, part (d) that the total surplus in the open economy without any government intervention is $85. Therefore,
DWL^{quota} = 85 – 84.20 = $0.80.
Let's check this another way. DWL is the area of the two triangles on the graph:
DWL = (1/2)*(5.4 – 5)*(11.2 – 8) + (1/2)*(5.4 – 5)*(18 – 17.2)
DWL = 0.64 + 0.16 = $0.80