

Economics 101  
Fall 2017  
Answers to Homework #2  
Due Tuesday, October 10, 2017

**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.
- **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 submit any work for someone else.**

Part I: PPF, Opportunity Cost, Trading prices, Comparative and Absolute Advantage

1) In the land of Ruritania there are two tribes growing wheat and corn. Tribe A has 100 workers and Tribe B has 200 workers. Assume that both tribes have linear production possibility frontiers. The workers in Tribe A can grow 1,000 tons of wheat or 600 tons of corn annually. The workers in Tribe B can grow 800 tons of wheat or 400 tons of corn annually.

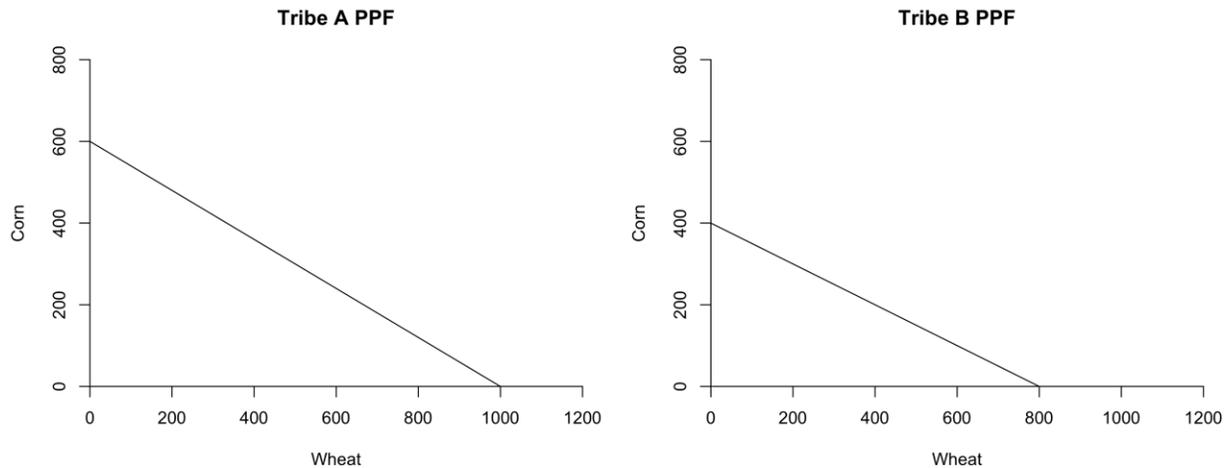
a. Plot the production possibility frontier (PPF) of each tribe in separate graphs, with wheat on the horizontal axis and corn on the vertical axis (restrict your attention to the first quadrant: that is, consider only values equal to or greater than zero for wheat and corn). Write each tribe’s PPF as an equation.

**Solution:**

$$\text{Tribe A: } \textit{corn} = 600 - \frac{3}{5} \textit{wheat}$$

$$\text{Tribe B: } \textit{corn} = 400 - \frac{1}{2} \textit{wheat}$$

**Plotting the PPFs:**



b. Which tribe has the absolute advantage in the production of corn and in the production of wheat? Which tribe has the comparative advantage in the production of corn and in the production of wheat? State each tribe's opportunity costs for the production of one ton of wheat and for the production of one ton of corn.

**Solution:**

Tribe A has absolute advantage in the production of both goods since it can grow 1000 tons (10 tons per worker) and 600 tons (6 tons per worker) of wheat and corn respectively. In contrast, Tribe B can produce 4 tons of wheat per worker or 2 tons of corn per worker. Tribe A can absolutely produce more than the 800 tons (4 tons per worker) of wheat and the 400 tons (2 tons per worker) of corn that Tribe B can grow. Tribe A has the comparative advantage in the production of corn and Tribe B has the comparative advantage in the production of wheat. This is apparent from the opportunity costs of each tribe:

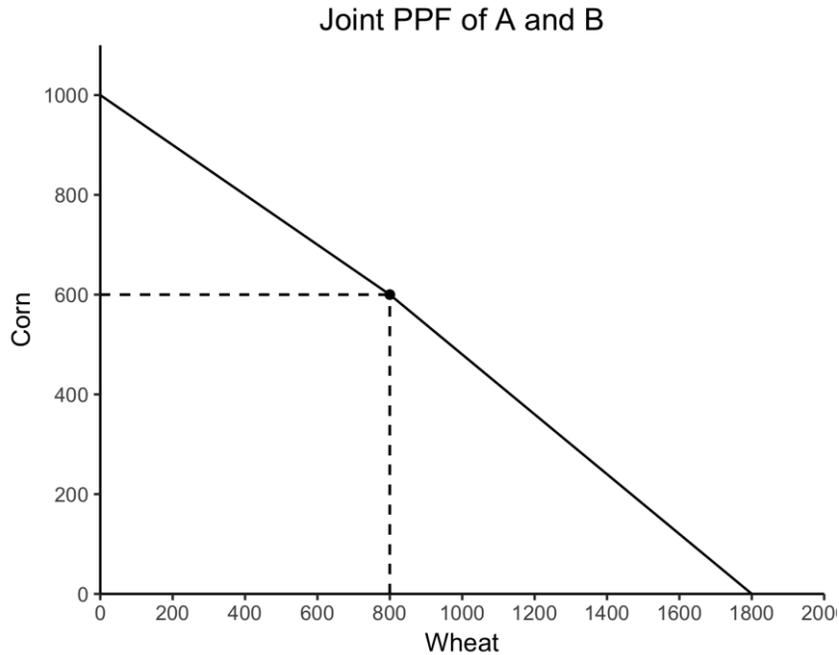
Tribe / Crop	OC of one ton of Wheat	OC of one ton of Corn
A	3/5 ton of corn	5/3 ton of wheat
B	1/2 ton of corn	2 ton of wheat

c. Plot the joint PPF of both tribes in a graph with wheat on the horizontal axis and corn on the vertical axis (restrict your attention to the first quadrant: that is, consider only values equal to or greater than zero for wheat and corn). Write the joint PPF as an equation.

**Solution:**

$$corn = \begin{cases} 1000 - \frac{1}{2}wheat, & \text{for } wheat \leq 800 \\ 1080 - \frac{3}{5}wheat, & \text{for } 800 < wheat \leq 1800 \end{cases}$$

The joint PPF has one kink point at  $(W, C) = (800, 600)$ .



Note: that although the PPF in this joint PPF looks linear, it is actually composed of two different segments that have different slopes and therefore these two segments are described by two different equations.

d. What is the range of acceptable trading prices for one unit of wheat and one unit of corn between the two tribes? Explain your answer.

Solution: Tribe A has the comparative advantage in the production of corn, therefore it would be willing to sell one ton of corn to Tribe B for a price equal to or higher than  $\frac{5}{3}$  tons of wheat. For any lower price, Tribe A would be better off growing its own wheat. Tribe B would be willing to buy one ton of corn at a price equal to or lower than 2 tons of wheat. For any higher price, Tribe B would be better off growing its own corn. Hence, the acceptable range of trading prices for one ton of corn would be  $\frac{5}{3} \text{ tons of wheat} \leq P_{\text{corn}} \leq 2 \text{ tons of wheat}$ .

The trading price for one ton of wheat is determined using the same logic. Tribe A would be willing to buy one ton of wheat if the trading price is equal to or lower than  $\frac{3}{5}$  tons of corn. Tribe B would be willing to sell one ton of wheat if the trading price is higher than  $\frac{1}{2}$  ton of corn. Therefore, the acceptable range of trading prices for one ton of corn would be  $\frac{1}{2} \text{ tons of corn} \leq P_{\text{wheat}} \leq \frac{3}{5} \text{ tons of corn}$ .

e. Suppose Tribe B makes a major breakthrough in agricultural technology and develops a faster growing type of corn. All other attributes of the corn are exactly the same. Tribe B can now grow with the same number of workers 800 tons of wheat or 800 tons of corn annually or any combination of corn and wheat that are on the straight line including these two production points. Describe the changes to the opportunity cost of producing one ton of each good, absolute advantage, and comparative advantage that arise from this technological breakthrough.

Solution: after the technological change, the opportunity costs would be:

Tribe / Crop	OC of one ton of Wheat	OC of one unit of Corn
A	3/5 tons of corn	5/3 tons of wheat
B	1 tons of corn	1 ton of wheat

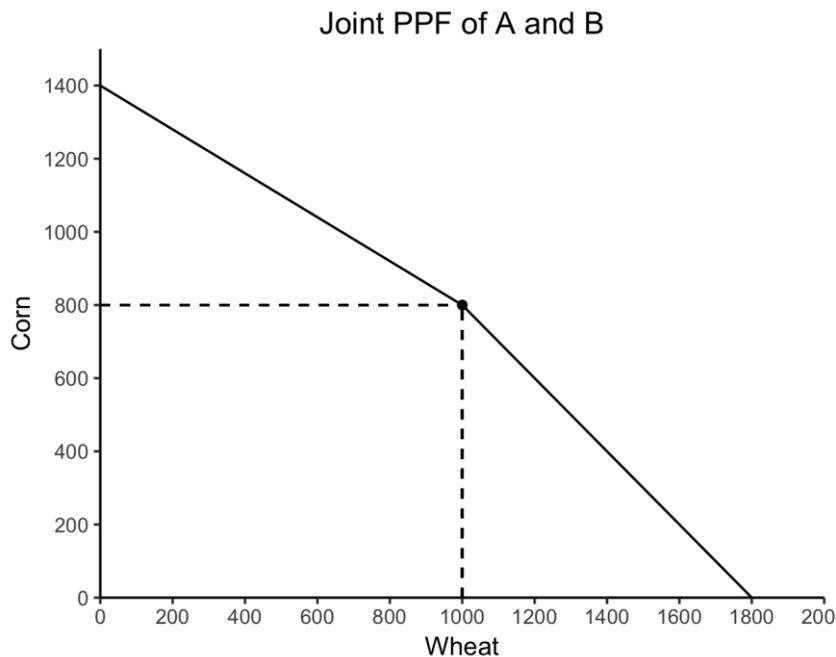
Tribe A still has the absolute advantage in the production of both goods since it can grow 10 tons per worker and 6 tons per worker of wheat and corn, respectively, while Tribe B can only produce 4 tons of wheat per worker or 4 tons of corn per worker.

The comparative advantage has changed, however. Now Tribe A has the comparative advantage in the production of wheat and Tribe B has the comparative advantage in the production of corn.

f. Plot the new joint PPF after the change to corn production in tribe B. Write the new equation for the joint PPF.

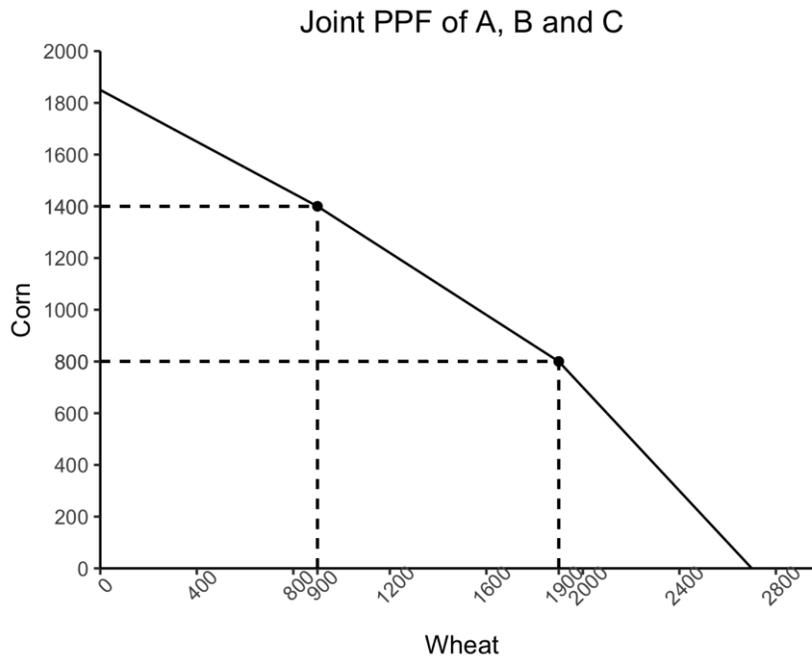
Solution:

$$\text{corn} = \begin{cases} 1400 - \frac{3}{5} \text{wheat}, & \text{for wheat} \leq 1000 \\ 1800 - \text{wheat}, & \text{for } 1000 < \text{wheat} \leq 1800 \end{cases}$$



g. A new Tribe, C, is discovered in a distant part of Ruritania. Tribe C has 150 workers and it can grow 900 tons of wheat or 450 tons of corn annually or any combination of corn and wheat that lie on the line including these two provided points. What are Tribe C's opportunity costs for the production of one ton of wheat and one ton of corn? Plot the new joint PPF of all the tribes in Ruritania (assuming tribe B can grow more corn as in (d)-(f)).

Solution: the opportunity cost for one ton of wheat is 1/2 tons of corn and the opportunity cost of one ton of corn is 2 tons of wheat.



## Part II: Demand and Supply Shifts

2) Suppose there are two types of smartphones in the economy: the iPhone and the Galaxy. The quantity demanded for each type of smartphone decreases as price increases and the quantity supplied for each type of smartphone increases as price increases. The two smartphones are substitutes for one another. Initially the markets for both types of smartphones are in equilibrium.

In each of the following questions describe the change to the demand and the supply (this could be a demand shift, a supply shift, a change in the quantity demanded, and/or a change in the quantity supplied) for both types of smartphones and explain how the equilibrium prices and quantities changed compared to the initial equilibrium prices and quantities for these two types of smartphones.

Before each scenario assume the market for these two smartphones has returned to the initial, original equilibrium.

a. Suppose there have been reports of several incidents of Galaxy phones igniting while being charged. These reports have caused a panic and badly hurt the reputation of Galaxy smartphones and consumers' willingness to buy this smartphone. Consumers are now more inclined to buy iPhones.

Solution: the demand curve for Galaxy smartphones shifts leftward since consumer's tastes and preferences make them less inclined to buy this phone. The demand curve for iPhones shifts rightward for the same reason. The equilibrium price and quantity of Galaxy smartphones is now lower than their initial levels, and the equilibrium price and quantity of iPhones is now higher than their initial levels.

b. A critical component of the iPhone is a chip produced by Apple. Suppose that Apple recently closed a major factory due to financial difficulties, causing a halt in the production of this chip. This event negatively affects the number of iPhones in the market. Furthermore, many consumers were employed in the Apple factory and are now facing a lower income due to their loss of employment.

Solution: Let's start with what is happening in the market for iPhones. There has been a disruption in a major component of the iPhone and this tells us we should expect the supply curve for iPhones to shift to the left. This one change would lead us to expect that the price for the iPhone will increase and that the quantity traded will decrease relative to their initial levels. But we also have a change in income: as income falls we can expect the demand for the product to shift to the left if the good is a normal good and to the right if the good is an inferior good. iPhones are likely to be normal goods: so that implies that we also have a leftward shift of the market demand curve for iPhones. With certainty, we can predict that the new equilibrium quantity of iPhones traded in the market will be lower than the initial equilibrium quantity. But, we cannot know with certainty what happens to the new equilibrium price of the iPhone: it may increase, decrease, or remain the same as the initial equilibrium price (this is an example of indeterminacy).

So what's happening over in the market for Galaxy smartphones? No matter what is happening to the price of the iPhone we see that fewer iPhones are being purchased. This suggests that the demand for the Galaxy smartphones is increasing at every price. So, the demand curve for the Galaxy smartphone is shifting to the right, pushing price and quantity upward. However, the change in the income of consumers shifts the demand curve leftwards, as consumers now have overall lower income and we assume that Galaxy smartphones are a normal good. This change will result in a decrease in price and quantity. Therefore, with the combined effects of the two changes, it cannot be determined whether the new equilibrium price of the Galaxy smartphone will be higher or lower and the new equilibrium quantity of Galaxy smartphones will be greater or smaller than their initial equilibrium levels.

c. Suppose a new federal regulation regarding ionizing radiation in smartphones is implemented and this implementation increase consumers' confidence in this product and they are now more inclined to buy a smartphone. However, this regulation also resulted in additional compliance costs for the producers, raising their production costs.

Solution: for both types of smartphones, the supply curves will shift leftward reflecting the higher costs of production. The demand curves for both types of smartphones will shift rightward

reflecting the change in consumers' preferences. The overall effect will be an increase in the equilibrium price for both types of smartphones, while the change in the equilibrium quantity of both types of smartphones will be ambiguous.

d. Suppose a new technology becomes available, reducing the production costs for both types of smartphones. At the same time the new technology reduces the price of tablets. Tablets are produced by Apple and they are substitutes to the Galaxy smartphone, but complements to the iPhone.

Solution: Both types of smartphones will experience a rightward shift in their supply curves due to the impact of the new technology and its reduction in production costs. The demand curve for iPhones will also shift to the right reflecting the impact of the decrease in the price of the tablets (as the price of a complementary good decreases, the demand for its complement increases – there is a rightward shift in the demand curve for the complementary good). The equilibrium quantity of iPhones will increase, but the effect on the equilibrium price is ambiguous. The demand curve for Galaxy smartphones will decrease and the curve will shift leftward, reflecting the decrease in price of tablets which are substitutes for the Galaxy phone. The equilibrium price of the Galaxy smartphone will decrease, but the effect on the equilibrium quantity is ambiguous.

e. Not yet recovered from the effect of the igniting Galaxy phones, consumers decide to replace their Galaxy phones with a different model if their income will allow it. Fortunately, Apple just opened a new factory producing the necessary iPhone chip, so many consumers also got rehired at this factory. Furthermore, the number of iPhones in the market has risen thanks to the increase in the production of the chips.

Solution: Galaxy smartphones are now an inferior good (reread the first sentence in the prompt to see this). Therefore, an increase in income will shift the demand curve for Galaxy smartphones leftward. The equilibrium quantity and price of Galaxy smartphones will decrease. iPhone is still a normal good, therefore the increase in income will cause the demand curve for iPhones to shift rightward. Additionally, the increase in one of iPhone's production factors will shift the supply curve to the right. The overall effect is an increase in the equilibrium quantity of iPhones. The effect on the equilibrium price of iPhone is ambiguous.

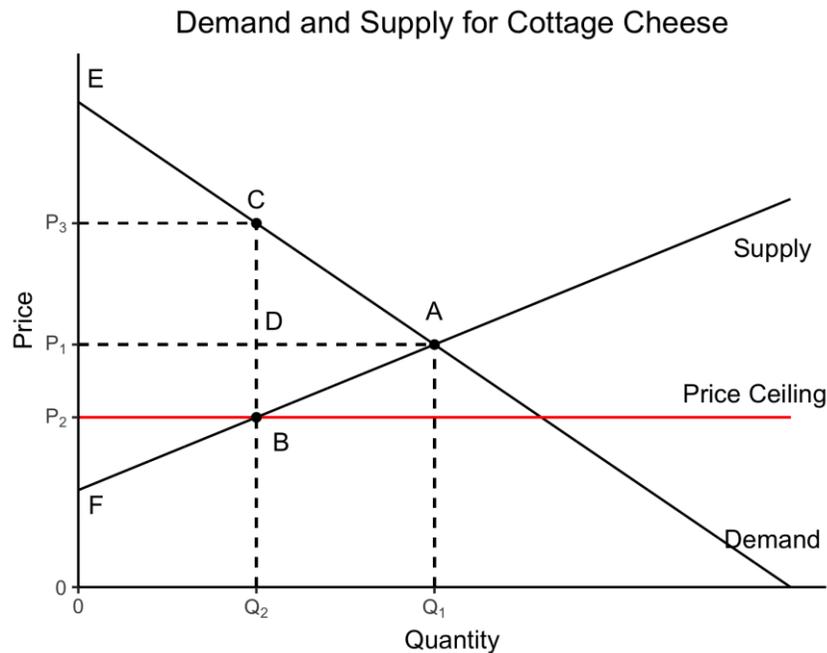
### Part III: Price Ceiling and Price Floor

3) In 2011 the government of Israel decided to abandon price supervision of cottage cheese. As a result, the price of cottage cheese jumped, causing public protests and widespread riots against the government. After public pressure, the government reinstated a price ceiling on cottage cheese.

a) Assume the demand for cottage cheese is a downward sloping line (that is, as price increases the quantity demanded of cottage cheese decreases holding everything else constant), and the supply of cottage cheese is an upward sloping line (that is, as price increases the quantity

supplied of cottage cheese increases holding everything else constant). Plot the demand and supply curves for cottage cheese in a graph measuring the quantity of cottage cheese on the horizontal axis and the price of cottage cheese on the vertical axis. Mark the equilibrium price in this market (assume it is a competitive market) as  $P_1$  and the equilibrium quantity in this market as  $Q_1$ . On the same graph, indicate how a price ceiling would change the quantities demanded and supplied and the prices consumers and producers face. Mark the price ceiling price as  $P_2$  and the price ceiling quantity as  $Q_2$ .

**Solution:**



The competitive equilibrium is point A, with equilibrium quantity  $Q_1$  and equilibrium price  $P_1$ . With a price ceiling set at  $P_2$ , producers will now produce a quantity of  $Q_2 < Q_1$ . Consumers can buy only  $Q_2$ , even though at a price of  $P_2$  they are willing to purchase a greater quantity.

b) What are the changes in consumer surplus, producer surplus and total welfare (in this example, total welfare = consumer surplus + producer surplus)?

**Solution:** consumer surplus will change. Consumer surplus before the implementation of the price ceiling was equal to the area  $AEP_1$ . Consumer surplus after the implementation of the price ceiling is equal to the area  $ECBP_2$ . It will decrease by the area of the triangle  $ADC$ , but will increase by the area of the rectangle  $DBP_2P_1$ . Therefore, it is unclear if the consumer surplus has increased or decreased overall.

The producer surplus will decrease. Producer surplus before the implementation of the price ceiling was area  $AFP_1$ . Producer surplus after the implementation of the price ceiling is area  $BFP_2$ . Producers will lose surplus equal to the area of  $ABP_2P_1$  (a surplus of  $DBP_2P_1$  will be transferred to consumers).

Total welfare will decrease. Total welfare before the implementation of the price ceiling was area EAF. Total welfare after the implementation of the price ceiling is area ECBF. There is a deadweight loss equal to the area of the triangle ABC.

c) Assume that the demand for cottage cheese is given by the equation:

$$P = 10 - \frac{1}{2}Q$$

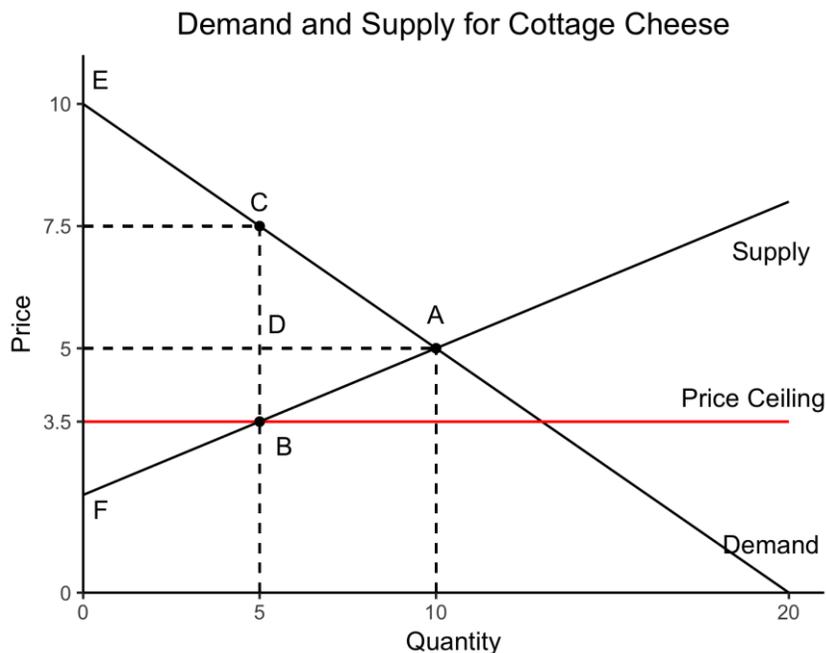
where P is the price of cottage cheese measured in dollars and Q is the quantity demanded of cartons of cottage cheese. The supply is given by the equation:

$$P = \frac{3}{10}Q + 2$$

The government's price ceiling is set at  $P = \$3.50$  per carton of cottage cheese.

Plot the demand and supply for cottage cheese. Indicate clearly the point of competitive equilibrium and the points of consumption and production with the price ceiling. What are the price and quantity in the competitive equilibrium? What are the prices and quantities with a price ceiling?

**Solution:** the quantity and price in the competitive equilibrium would be 10 cartons of cottage cheese and \$5 respectively. After the price ceiling, the price would be \$3.50 per carton of cottage cheese and the quantity would be 5 cartons of cottage cheese.



d) Calculate the consumer surplus, producer surplus, and deadweight loss. Who is better off due to the price ceiling and who is worst off, and why? What is the change in social welfare (consumers and producers) after the price ceiling is established and why? Here is a table where you can organize your answers to these questions.

	Before price ceiling	After price ceiling	Change
Consumer Surplus			
Producer Surplus			
Deadweight Loss			
Social Welfare			

Solution: the change in surplus will be as follows:

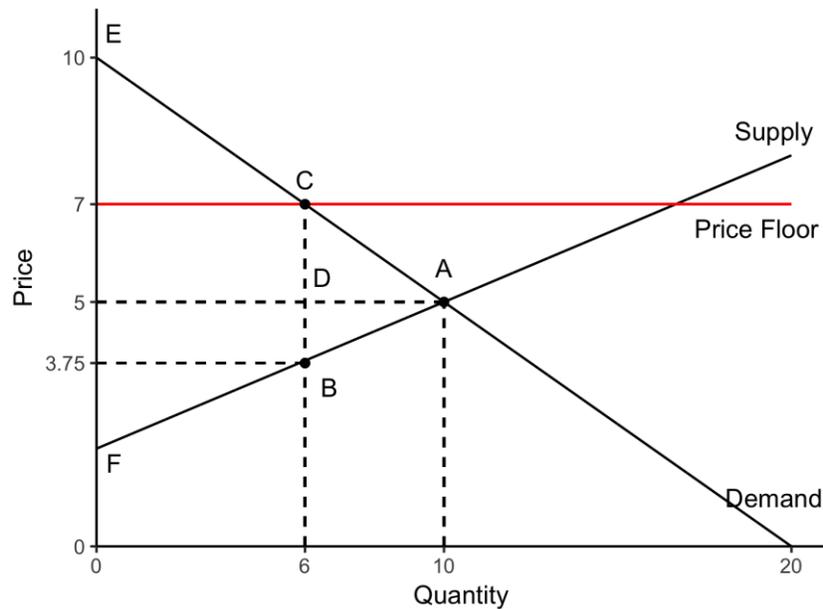
	Before price ceiling	After price ceiling	Change
Consumer Surplus	$\frac{10 * 5}{2} = \$25$	$\frac{2.5 * 5}{2} + 4 * 5 = \$26.25$	\$1.25
Producer Surplus	$\frac{10 * 3}{2} = \$15$	$\frac{1.5 * 5}{2} = \$3.75$	-\$11.25
Deadweight Loss	\$0	$\frac{4 * 5}{2} = \$10$	\$10
Social Welfare	\$40	\$30	-\$10

e) In an attempt to increase competition in the dairy market, the government lifts restrictions on the import of dairy goods. However, this hurts local farmers, who have a strong lobby. In order to help farmers, the government decides to set a price floor at  $P = \$7$  per carton of cottage cheese. Disregarding any changes described in the previous questions, repeat parts (c) and (d) with the price floor instead of price ceiling. Assume the demand and supply curves are given by the above equations. Here is a table where you can put some of the required answers for this question. Note that there are more questions to answer than are summarized in this table!

	Before price floor	After price floor	Change
Consumer Surplus			
Producer Surplus			
Deadweight Loss			
Social Welfare			

Solution: the quantity and price in the competitive equilibrium would be 10 cartons of cottage cheese and \$5 per carton of cottage cheese, respectively. After the price floor, the price would be \$7 per carton of cottage cheese and the quantity would be 6 cartons of cottage cheese.

Demand and Supply for Cottage Cheese



the change in surplus will be as follows:

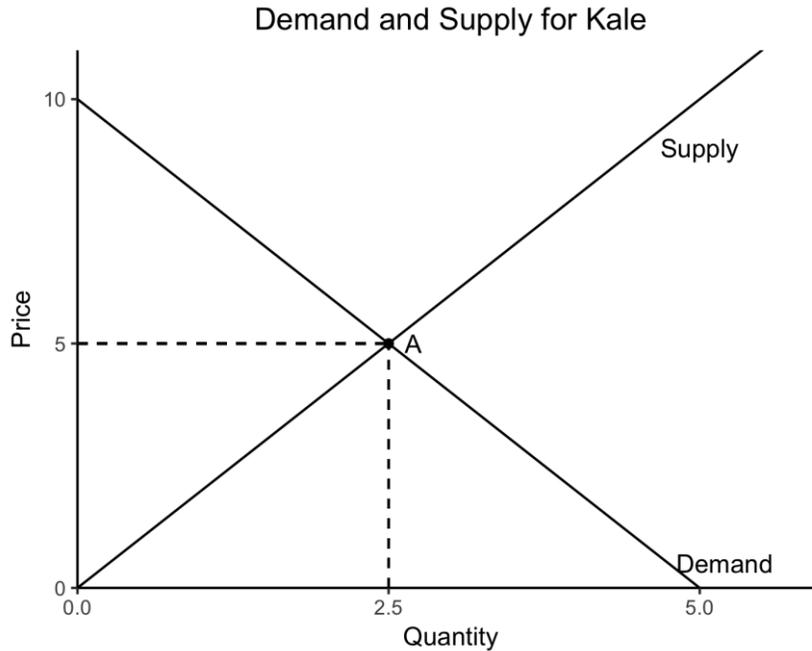
	Before price floor	After price floor	Change
Consumer Surplus	$\frac{10 * 5}{2} = \$25$	$\frac{6 * 3}{2} = \$9$	-\$16
Producer Surplus	$\frac{10 * 3}{2} = \$15$	$3.2 * 6 + \frac{1.8 * 6}{2}$ $= 19.2 + 5.4 = \$24.60$	\$9.60
Deadweight Loss	\$0	$ACB = \frac{3.2 * 4}{2} = \$6.40$	\$6.40
Social Welfare	\$40	\$33.60	-\$6.40

Part IV: Agricultural Markets: Price Support and Price Guarantee Systems

4) The government conducts a large-scale research study and concludes that there are health benefits to eating kale. Officials in the Department of Agriculture propose a plan to support farmers who grow kale. Under this program, the government will buy any excess quantity of kale at a price that will be determined. The demand for kale is given by  $P = 10 - 2Q$  and the supply for kale is given by  $P = 2Q$ , where P is the price of kale per pound measured in dollars and Q is the quantity of kale in millions of lbs.

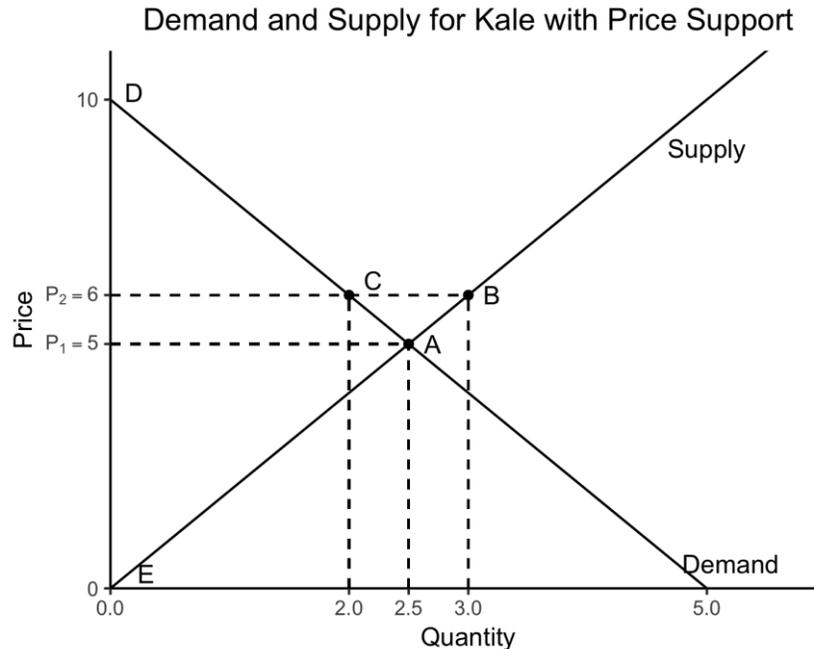
a. What are the price and quantity of kale in a competitive equilibrium, before any government intervention? Plot the supply and demand curves and the point of equilibrium in a graph.

Solution: in the competitive equilibrium, the price of kale would be \$5 per pound and the quantity of kale would be 2.5 million lbs.



b. The government decides to buy any excess supply from farmers at a price of \$6 per pound of kale. Given the implementation of this program, what quantity would be purchased by consumers? What quantity would be purchased by the government? Given this program, how much do consumers spend on kale? What is the cost to the government of this program? What is the total revenue to the farmers from this program?

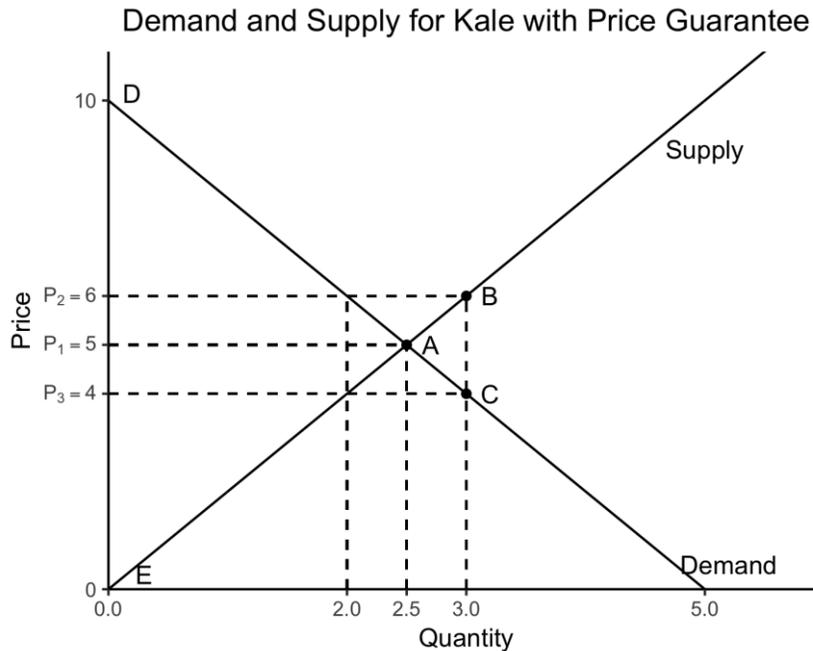
Solution: the government is willing to buy any quantity of kale at a price of \$6 per pound of kale, therefore farmers will sell kale at this price. The quantity produced would be 3 million lbs. At this price, consumers will reduce their consumption of kale and will only buy 2 million lbs. The government would buy the excess quantity that consumers won't buy – that is, 1 million lbs. The amount consumers spend on kale with this program is now equal to (\$6 per pound)\*(2 million pounds of kale) or \$12 million. The cost to the government is the amount of excess demand it had to purchase times the price:  $(3 - 2) * 6 = \$6$  million. The total revenue for the farmers is equal to (\$6 per pound of kale)(3 million pounds of kale) = \$18 million.



c. In light of the costs of the price support program, the government decides to cancel the program and instead initiate a price guarantee program. Under this program the government will ensure that consumers can purchase the total quantity of kale in the economy that farmers are willing to produce at a price of \$6 per pound of kale by subsidizing the producers of kale so that they receive \$6 per pound of kale after receipt of the subsidy. This is the amount that you computed in part (b). In order to develop this plan, the government hires a strategic consulting firm that was paid for this project 25% of the total subsidy the government paid to the farmers. Given this program, what quantity of kale would be purchased by consumers? What is the price per pound of kale to consumers with this price subsidy program? What is the price per pound of kale for farmers given this price subsidy program? Given this program, what is the consumer expenditure on kale? What is the cost to the government of this subsidy program? What is the total revenue to the farmers given this subsidy program?

**Solution:** the government is now subsidizing a production of 3 million lbs. of kale. Plug 3 in the demand equation to get that the price consumers pay for kale is  $P = 10 - 2 * 3 = \$4$  per pound of kale. At this price, farmers would have only produced  $4 = 2Q$  or 2 million lbs. of kale, so the government has to pay them a subsidy of \$2 per pound of kale to get the farmers to grow 3 million pounds of kale. The total price of the kale that farmers receive will therefore be \$4 per pound of kale + \$2 per pound of kale or \$6 per pound of kale. Consumer expenditure with the subsidy program will be (\$4 per pound of kale)(3 million pounds of kale) = \$12 million. The direct cost to the government of this subsidy program is (the subsidy per unit)(3 million pounds of kale) = (\$2 per pound of kale)(3 million pounds of kale) = \$6 million. But the government also has to pay 25% of the subsidy paid to farmers to the strategic consulting firm: so the total cost of the subsidy program to the government is \$6 million plus  $(.25)(\$6 \text{ million}) = \$6 \text{ million} +$

\$1.5 million = \$7.5 million. Farmer total revenue from this subsidy program is (\$6 per pound of kale)(3 million pounds of kale) = \$18 million.



d. Compare the two programs. Which program would consumers prefer? Which program would producers prefer? Which program would the government prefer?

Solution: consumers would prefer the price guarantee or subsidy program (the second program), since it enables them to buy more kale at a lower price. Producers are indifferent between the two programs since their total revenue is \$18 million in each program. The government would prefer the price support or price floor program (the first program) since it only costs them \$6 million while the price guarantee or subsidy program (the second program) costs the government \$7.5 million.

e. Besides the cost of the programs to the government, what other considerations could impact the government's choice between the price support and the price guarantee program? Explain your answer fully and completely.

Solution: the government decided to put forward those plans in order to promote the consumption of kale motivated by public health consideration. Under the first plan, the consumption of kale actually decreases, while under the second plan the consumption of kale rises. Therefore, just because the second plan costs more than the first plan, that does not mean that the government will definitely prefer the first plan. The government might still want to implement the second plan since it advances their goal of greater kale consumption.

