Economics 102
Spring 2018
Homework \#2
Due 2/22/18

## 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. Joint PPF and trading range of prices

Steven and Tim are both hired for 8 hours to work on a farm. Steven can pick 40 apples (A) in an hour, or 10 bananas (B) in an hour. Tim can pick 20 apples in an hour, or 60 bananas in an hour. Only 420 apples and 420 bananas grow on this farm, and no more fruits can be harvested if the job is finished early.
a. Who has a comparative advantage in picking apples, and who has a comparative advantage in picking bananas? Explain your answer using the concept of opportunity cost.

Answer: In an hour, Steven could pick either 40 apples or 10 bananas, so his opportunity cost for an apple is $10 / 40=0.25$ banana, and his opportunity cost of one banana is $40 / 10=4$ apples.

Similarly, Tim's opportunity cost for an apple is $60 / 20=3$ bananas, and his opportunity cost of one banana is $40 / 10=0.33$ apple.

Since $0.25<3$, Steven has a lower opportunity cost of picking apples, and so he has a comparative advantage in picking apples. Tim has a comparative advantage in picking bananas.
b. Draw the individual PPFs for Steven and Tim. Put apples (A) on the horizontal axis.

Answer: Notice that the farm only has 420 apples and 420 bananas. The individual PPFs, therefore, cannot extend to areas where A > 420 or B > 420 .

For Steven, the individual PPF is simple to draw:


For Tim, however, notice that if he picks bananas for 7 hours he will deplete the bananas on the farm. So he can either spend the 1 hour left picking 20 apples, or he could spend part of that hour and pick fewer than 20 apples. Either way, he cannot pick more than 420 bananas. So there will be a kink point on his PPF at $(20,420)$, at which point Tim's PPF becomes horizontal and does not extend to $(0,480)$.

c. Draw the joint PPF for the two people if they work together and trade.

Answer: Again, remember that the joint PPF cannot extend to areas where $\mathrm{A}>420$ or $\mathrm{B}>420$. To draw the joint PPF, you can first ignore the constraint and draw the "unconstrained" joint PPF, then only keep the part inside the $\mathrm{A}<420$ and $\mathrm{B}<420$ area.

The "unconstrained" joint PPF is composed of the grey thin lines in the following graph, with a kink point at $(320,480)$. Taking only the parts inside the $\mathrm{A}<420$ and $\mathrm{B}<420$ area gives you the three blue line segments, which compose the true joint PPF.

How to calculate the two kink points on the blue joint PPF:
If Tim spends 7 hours picking bananas, he depletes all bananas on the farm. He can spend the 1 hour left picking 20 apples. Together with the $40 * 8=320$ apples picked by Steven, we get $320+$ $20=340$ apples. So one of the kink points is $(340,420)$.

When Steven spends all 8 hours picking apples, he picks 320 apples. It only takes (420-320)/20 $=5$ more hours from Tim picking apples to deplete all apples on the farm. Then Tim still has 3 hours left to pick $60 * 3=180$ bananas. So the second kink point is $(420,180)$.

d. What is the trading range of prices for an apple?

Answer: The trading range of prices for an apple is between Steven's and Tim's opportunity costs for an apple, i.e. between 0.25 banana and 3 bananas.
e. If Steven and Tim work together, can they produce 400 apples and 240 bananas? If they produce this combination of the two goods, how many apples and bananas will they each produce?

Answer: Yes, since $(400,240)$ is on the blue line segment between $(420,180)$ and $(340,420)$, they can reach this point if working efficiently. Since $(400,240)$ is on the lower segment of the "unconstrained" joint PPF (whose slope comes from Tim's individual PPF), we know that Steven is spending all 8 hours producing apples, while Tim produces both fruits.

Specifically, Steven produces $8 * 40=320$ apples, so $400-320=80$ apples are produced by Tim. This means Tim spends $80 / 20=4$ hours on apples and 4 hours on bananas, so he produces $4^{*} 60$ $=240$ bananas.

## 2. Qualitative Supply and Demand

Big Macs, an iconic fast food item sold by McDonald's, are made of beef patties, cheese, and bread buns. Soda is usually consumed together with Big Macs. Many calorie-conscious consumers consider grilled chicken salad a healthier substitute for Big Macs.

State whether the new equilibrium price and quantity for Big Macs is higher or lower after the following changes. Assume that the market for Big Macs 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. Suppose that an outbreak of mad cow disease kills many cows and makes people afraid of eating beef.

Answer: Mad cow diseases kills cows, reducing the supply of beef and driving up the cost of beef patties, which is an ingredient in Big Macs. So the supply curve for Big Macs shifts to the left.

People are now averse to eating beef, so the demand for Big Macs shifts also to the left. Together, this means the equilibrium quantity has fallen, while the change to equilibrium price cannot be determined.
b. Suppose that the government levies a sugar tax on all soft drinks, and soda is now more expensive.

Answer: Soda is a complement to Big Macs. If the price of soda rises, the quantity demanded of soda decreases and this results in a decrease in the demand for Big Macs. The supply of Big Macs stays constant. Therefore, we get a lower equilibrium price and a lower equilibrium quantity.
c. Suppose that both soda and grilled chicken salad are now more expensive than before.

Answer: Soda is a complement to Big Macs, and chicken salad is a substitute. Both are more expensive, shifting the demand for Big Macs both to the left and to the right (the demand shifts to the left due to the increase in the price of soda and to the right due to the increase in the price of the grilled chicken salad). We cannot say for certain which effect is larger. Hence the changes to both the equilibrium price and quantity are indeterminant.
d. Suppose that McDonald's pays most of its workers the minimum wage, and now the federal minimum wage is raised by the government.

Answer: The cost of making Big Macs goes up, which causes the supply curve to shift to the left. Demand stays constant. The equilibrium price goes up, and the equilibrium quantity goes down.
e. Suppose that the government raises the tariff on chicken imported from Mexico, while lowing the tariff on beef imported from Argentina. (Assume the U.S. imports positive amounts of chicken and beef from the two countries.)

Answer: Due to this change in tariff policy, chicken is now more expensive, and beef is now cheaper. It is now cheaper to produce Big Macs, so the supply shifts right. Chicken salad is now more expensive, so more people want Big Macs instead, and the demand for Big Macs shifts right. The equilibrium quantity goes up, while the equilibrium quantity is indeterminant.
f. Suppose that more people are now into healthy food. At the same time, McDonald's is opening 500 new restaurants across the country.

Answer: Demand for Big Macs falls, while the supply goes up. As a result, equilibrium price goes down, and the equilibrium quantity is indeterminant.

## 3. International Trade

Prior to the 1978 market reform, China was a closed economy and did not trade with the United States. Suppose that the domestic supply and demand for socks in the U.S. are represented by the following equations:

Domestic Supply Curve: $\mathrm{Q}=\mathrm{P}-1$
Domestic Demand Curve: $\mathrm{Q}=10-0.5 \mathrm{P}$
where quantity $(\mathrm{Q})$ is in terms of thousands, and price $(\mathrm{P})$ is in terms of U.S. dollars (USD) per pair.
a. Prior to 1978 , what are the equilibrium price and quantity for socks in the United States? (Assuming that the U.S. did not import and export socks at the time.) Find the consumer surplus, producer surplus, and total surplus.

Answer: With no international trade allowed we can find the equilibrium by simply equating the supply equation to the demand equation. $\mathrm{P}-1=10-0.5 \mathrm{P}$ gives you $\mathrm{P}=22 / 3$, and $\mathrm{Q}=22 / 3-1$ $=19 / 3$.

To draw the graph, convert the equations into Q -intercept form.


Consumer surplus $=(20-22 / 3)^{*}(19 / 3)^{*}(1 / 2)=361 / 9=\$ 40.11$
Producer surplus $=(22 / 3-1) * *(19 / 3) *(1 / 2)=361 / 18=\$ 20.06$
Total surplus $=40.11+20.06=\$ 60.17$
b. After 1978, Chinese socks are imported into the U.S. Chinese socks are priced at 50 cents per pair in China, and it costs $\$ 1.50$ per pair to transport socks across the Pacific. Given this information, find the new equilibrium price and quantity of socks in the U.S. How many socks are produced by American companies, and how many socks are imported from China?

Answer: The price of each pair of imported socks is $0.50+1.50=2$ dollars.
Plugging this price into the demand equation, we get $\mathrm{Q}=9$, which is the total amount of socks purchased in the U.S. when the price of socks is $\$ 2$ per pair and imports are allowed. Plugging this price into the supply equation, we get $\mathrm{Q}=1$, which is the amount of socks produced by domestic companies when the price of socks is $\$ 2$ per pair and imports are allowed. The difference between these two quantities is the quantity of socks imported, which is 8 pairs of socks.

c. Calculate the consumer surplus, producer surplus and the total surplus once imported socks are allowed into the U.S. market. Who benefits from the trade? Who loses?

Answer: Consumer surplus $=(20-2) * 8 / 2=\$ 72$
Producer surplus $=(2-1) * 1 / 2=\$ 0.50$
Total surplus $=72+0.50=\$ 72.50$
Clearly, consumer surplus increases, so domestic consumers benefit from trade. The domestic producers are hurt.
d. What is the dead weight loss (DWL) if the U.S. bans the import of socks from China?

Answer: The DWL is the gray area in the following graph, i.e. the change in total surplus. DWL $=72.5-60.17=\$ 12.33$


## 4. International Trade with Tariff and Quota

In the region of Winterfell, there is a market for wildfire. The domestic demand, supply, and world price are described below.

Domestic Demand: $\mathrm{P}=10-\mathrm{Q}$
Domestic Supply: $\mathrm{P}=\mathrm{Q}$
World price of a unit of wildfire: $\mathrm{P}^{\text {world }}=2$
a. Assuming free trade, will Winterfell import or export wildfire? How many units of wildfire will be imported or exported?

Answer:
Since the world price of wildfire $\mathrm{P}^{\text {world }}=2$ is below the equilibrium price without trade in Winterfell, Winterfell will import wildfire. Plugging the world price of 2 into the demand and supply curves, you get that $Q^{S \_d o m e s t i c}=2$ and $Q^{\text {demand }}=8$. The excess demand will be covered with imports, so $Q_{\text {imported }}=8-2=6$ units of wildfire.

b. Calculate the consumer surplus, producer surplus and total surplus under free trade.

Answer:

You can calculate the new consumer surplus and producer surplus with trade. A graph is very useful to identify this.
$\mathrm{CS}=(10-2) * 8 / 2=\$ 32$
$\mathrm{PS}=2 * 2 / 2=\$ 2$
$\mathrm{TS}=32+1=\$ 34$

c. Suppose that the ruler of Winterfell, Eddard Stark, implements a tariff of 2 gold coins on each unit of imported wildfire to prevent fires inside his castle. How many units of wildfire are now imported? How much money does Eddard Stark make from the tariff? Verbally explain where the tariff revenue comes from, and who pays for the tariff.

Answer:
A tariff of $\$ 2$ effectively increases the world price of imported wildfire from $\$ 2$ to $\$ 4$. The graph of imports and domestic production then is the following:


The quantity imported is now 2. Eddard Stark earns tariff*quantity imported $=2 * 2=\$ 4$ from the tariff (the brown square labelled Gov. Rev. in the graph).

The tariff is of course paid by foreign producers wishing to sell the 2 units of wildfire in Winterfell. However, ultimately the tariff burden is transferred to the consumers in Winterfell, as the tariff revenue area comes directly from consumer surplus under free trade. So the tariff is paid for by the domestic consumers in Winterfell.
d. Calculate the consumer and producer surpluses with the implementation of the tariff. Also calculate the resulting dead weight loss (DWL). Who benefits from the tariff and who loses?

Answer:
The total surplus (TS) is composed of three parts: consumer surplus (CS), producer surplus (PS) and tariff revenue (TR).
$\mathrm{CS}=(6 * 6) / 2=\$ 18$
$\operatorname{PS}=(4 * 4) / 2=\$ 8$
$\mathrm{TR}=(2 * 2)=\$ 4$
$\mathrm{TS}=18+8+4=\$ 30$
The dead weight loss (DWL) is the decrease in total surplus from before the free trade scenario, which is composed of two orange triangles in the graph.

DWL $=34-30=\$ 4$
e. Suppose that the tariff is now raised to a total of 4 gold coins per unit of imported wildfire. How many units of wildfire will be imported or exported?

Answer:
If adding the tariff of 4 to the world price 2 , we will obtain a price of 6 for imported wildfire. At this price level, the domestic producers are willing to supply 6 units, while domestic consumers are willing to buy 4 , so there is no need for import. In fact, as soon as the price for imported wildfire reaches 5 there will be no imports, and the market clears at the closed economy equilibrium.
f. Eddard Stark decides to implement an import quota on wildfire instead of a tariff. The quota is set at 2 units. How many units of wildfire will now be imported, and at what price?

Answer:
Since consumers want to import 4 units but are only allowed to import 2, they will simply import 2 units.

The easiest way to solve this question is to calculate the required price such that the difference between the quantity demanded by consumers and the quantity supplied domestically by producers is equal to 2 (the import quota). Let $\mathrm{Qd}=\mathrm{Qs}+2$, or $10-\mathrm{P}=\mathrm{P}+2$, you can get that P $=\$ 4, \mathrm{Qs}=4$, and $\mathrm{Qd}=6$.
g. Eddard Stark gives the exclusive right to import wildfire to his friend Littlefinger. How much money does Littlefinger make?

Answer:
Littlefinger becomes the "import license holder", i.e. the person who could buy wildfire in the world market at the world price 2 , and sell it in the domestic price at the domestic price of 4 . Therefore, he earns 4-2 = \$2 for every unit imported. Since the total number of imports is 2 units, he earns $2 * 2=4$ gold coins as profit.
h. Calculate the consumer and producer surpluses with the implementation of the quota. Also calculate the resulting dead weight loss (DWL). Which is better from an efficiency perspective a tariff of 2 gold coins or a quota of 2 units?

Answer:
The graph is as follows:

$\mathrm{CS}=[(10-4) * 6] / 2=\$ 18$
$\mathrm{PS}=(2 * 2) / 2+(2 * 2)+(2 * 2) / 2=\$ 8$
License Holder Revenue $=2 * 2=\$ 4$
$\mathrm{TS}=18+8+4=\$ 30$
The dead weight loss (DWL) is the decrease in total surplus from before the free trade scenario, which is composed of two orange triangles in the graph.

DWL $=34-30=\$ 4$
Since the DWL under the import quota is the same as the DWL under the tariff, the two policies are equivalent from an efficiency perspective.
i. Instead of giving it to Littlefinger, Eddard Stark decides to auction off the license to import wildfire. Every merchant could submit a bid with his or her price for the license. What will be the likely price for the license? How much profit does the license-holding importer make?

Answer:
Anyone who could obtain the license gets 4 gold coins from importing the good. Therefore, the willingness to pay for a license is $\$ 4$, and if the market is efficient (i.e. with enough merchants participating in the bid) the price for the license would be exactly $\$ 4$. The license holder would then earn zero profit.

