

## Exercise 1

### Marginal Thinking and Trade Protectionism

1. You are considering the number of hamburgers that you plan to order. Based on the following table, complete the table and answer the following questions.

a. How many units of hamburgers should you order? Why?

We should buy 4 hamburgers because  $MC = MB$ .

b. Suppose you decide to order 2 hamburgers. Is this underallocation or overallocation?

Explain. How much is your deadweight loss?

It is underallocation if we order only 2 hamburgers because  $MB > MC$  for every unit below the 4th. It is possible to get more net benefit by consuming more hamburgers. The deadweight loss is 20 (we get net benefit of 100 instead of 120).

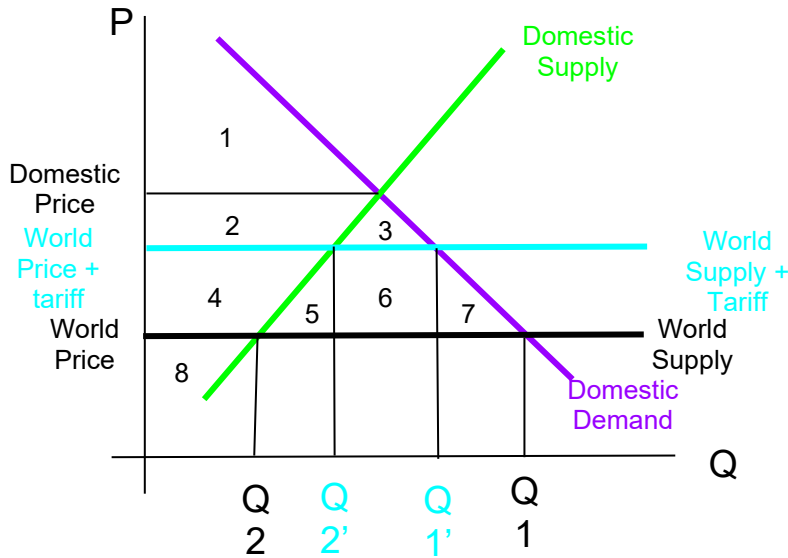
c. Suppose you decide to order 5 hamburgers. Is this underallocation or overallocation?

Explain. How much is your deadweight loss?

It is overallocation if we order only 5 hamburgers because  $MB < MC$  for every unit above the 4th. It is possible to get more net benefit by consuming less hamburgers. The deadweight loss is 20 (we get net benefit of 100 instead of 120).

Quantity	Total Benefit	Marginal Benefit	Total Cost	Marginal Cost	Total Net Benefit
1 <sup>st</sup>	80	80	20	20	60
2 <sup>nd</sup>	140	60	40	20	100
3 <sup>rd</sup>	180	40	60	20	120
4 <sup>th</sup>	200	20	80	20	120
5 <sup>th</sup>	200	0	100	20	100

2. With diagrams, explain the differences between tariff and quota. Also, explain the impact on domestic stakeholders (consumers, producers, and government), i.e., who is better off and who is worse off? Why?



### Tariffs

A tariff causes the world price to increase as it makes imports more expensive, raising World Price to World Price + tariff.

At World Price + tariff, quantity demanded falls to  $Q1'$  but quantity supplied rises to  $Q2'$ .

Quantity imported without tariff is  $Q1 - Q2$  units. With tariff, quantity imported becomes  $Q1' - Q2'$ .

Before tariffs, the consumer surplus is area 1, 2, 3, 4, 5, 6, and 7.

After tariffs, the consumer surplus is area 1, 2 and 3.

Consumers are worse off by losing area 4, 5, 6, and 7.

Before tariffs, the producer surplus is area 8.

After tariffs, the producer surplus is area 4 and 8.

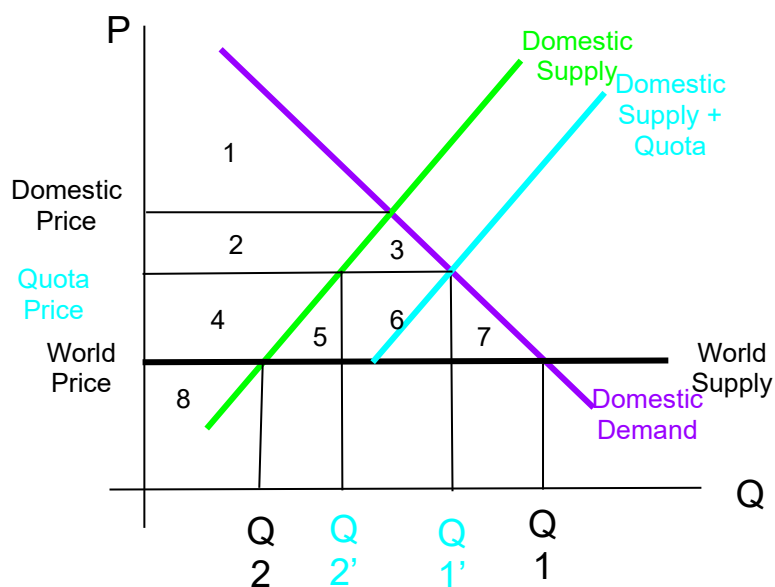
Producers are better off by gaining area 4.

Before tariffs, there is no tax revenue to the government.

After tariffs, the government revenue is area 6.

Before tariffs, there is no deadweight loss.

After tariffs, the deadweight loss is area 5 and 7.



### Quota

The quota limits the amount of imports: if quota is 10 units, it means the country can import up to 10 units. The domestic supply shifts to the right by the amount of quota. The quota which also represents the quantity imported is given by  $Q1' - Q2'$ . With quota, world supply becomes irrelevant because the domestic market cannot import more than what is allowed. Hence, there is a new equilibrium in the domestic market where Domestic Supply + Quote meets Domestic Demand with the new price equals Quota Price.

Before quota, the consumer surplus is area 1, 2, 3, 4, 5, 6, and 7.

After quota, the consumer surplus is area 1, 2, and 3.

Consumers are worse-off by losing area 4, 5, 6, and 7.

Before quota, the producer surplus is area 8.

After quota, the producer surplus is area 4 and 8.

Producers are better-off by gaining area 4.

Before quota, there is no revenue to the import license holders.

After tariffs, the import license holder revenue is area 6, possibly a deadweight loss if license holders are foreign firms.

Before quota, there is no deadweight loss.

After quota, the deadweight loss is area 5 and 7 (and possibly 6).

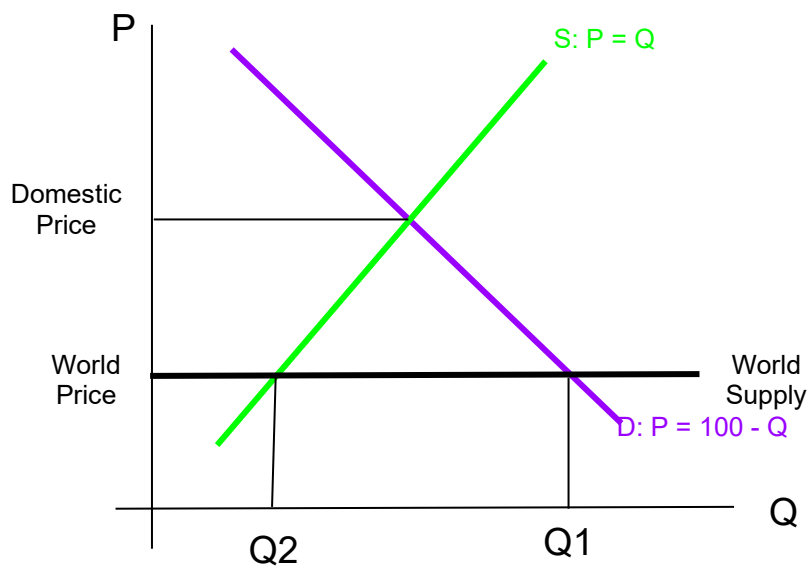
3. "small", open economy is engaging in international trade. Its domestic demand curve is given by  $P = 100 - Q$  and its domestic supply curve is given by  $P = Q$ . The world price of the good is 20\$.

Answer the following questions.

- a. What does it mean for a country to be "small"? What implication of being "small" has on the world supply curve?

In this case, a small country means the country is not powerful enough to manipulate the market i.e. whatever this country does will not affect the world supply curve.

- b. Explain why this country is considered to be an importing country. How many units of the goods is the country is currently importing under free trade?



Domestic Price:  $D = S \rightarrow 100 - Q = Q \rightarrow Q = 50 = P$  (Supply Curve  $P = Q$ )

We can see that the domestic price is \$50 while the world price is \$20. This means that imported goods are cheaper than domestic goods. This country will import.

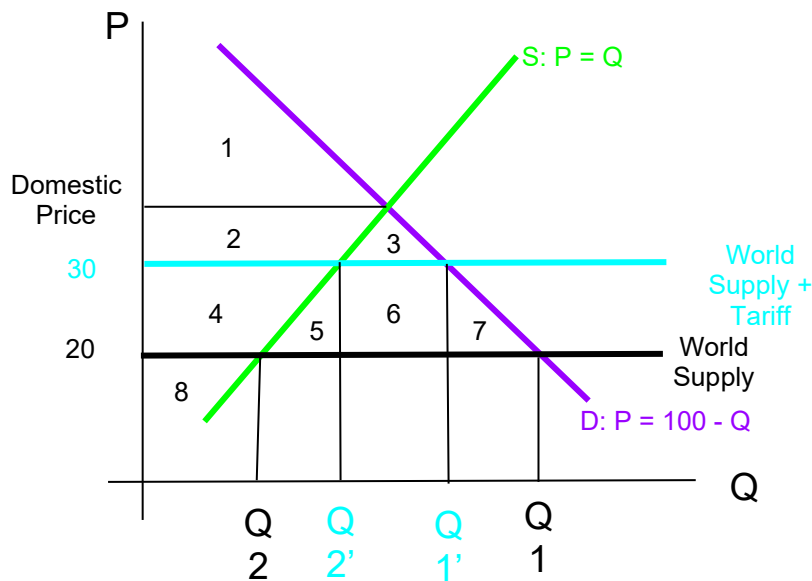
Amount of import goods:  $I = Q1 - Q2$

Find  $Q1$ ;  $20 = 100 - Q1 \rightarrow Q1 = 80$

Find  $Q2$ ;  $Q2 = 20 = P$

Therefore, this country will import  $80 - 20 = 60$  units of goods.

- c. Now suppose the government decides to intervene by imposing the import tariff of 10\$ per unit. Calculate



- i. Domestic consumer and producer surplus after the intervention

Consumer surplus: area 1, 2, and 3

$$CS = \frac{1}{2} * Q1' * (100 - 30)$$

$$Q1'; 30 = 100 - Q1' \rightarrow Q1' = 70$$

$$\text{Therefore, } CS = \frac{1}{2} * 70 * 70 = 2,450$$

Producer Surplus: area 4 and 8

$$PS = \frac{1}{2} * 30 * Q2' = \frac{1}{2} * 30 * 30 = 450$$

- ii. Tariff revenue

Tariff Revenue: area 6

$$\text{Tariff Revenue} = \text{net import} * \text{tariff} = 10 * (Q1' - Q2') = 10 * (70 - 30) = 400$$

- iii. Deadweight loss from the intervention.

Deadweight Loss: area 5 and 7 combined

$$\text{Area 5} = \frac{1}{2} * (Q2' - Q2) * 10 = \frac{1}{2} * (30 - 20) * 10 = 50$$

$$\text{Area 7} = \frac{1}{2} * (Q1 - Q1') * 10 = \frac{1}{2} * (80 - 70) * 10 = 50$$

$$\text{Therefore, deadweight loss is } 50 + 50 = 100.$$

## Consumer Preferences and Choice

1. What is the difference between diminishing MU and diminishing MRS? Give real-world examples to support the answer.

Diminishing marginal utility means that extra satisfaction from extra unit of the good consumed is diminishing. For example, the second plate of food is not as delicious as the first plate.

Diminishing marginal rate of substitution means, as more X is consumed, the consumer is less willing to give Y for another X. For example, if one has already ordered fried chicken for his/her first plate, it is more likely that the next plate will be hamburger.

2. Suppose Michael purchases only two goods, fish (F) and chips (C).

- a. What is the relationship between  $MRS_{FC}$  and the marginal utilities  $MU_F$  and  $MU_C$ ?

MRS is the ratio of MU:  $MU_F/MU_C = MRS_{FC}$ .

- b. Suppose the marginal utility of fish is always zero. Draw a typical indifference curve. What type of goods is the fish?

Fish is a neutral good. The IC is horizontal when Fish on the X-axis, or is vertical when Fish is on the Y-axis.

- c. Suppose the marginal rate of substitution of fish for chips is constant. Draw a typical indifference curve. In this case, are fish and chips perfect substitutes or perfect complements?

Perfect substitutes. The IC is a straight line with a negative slope.

- d. Suppose that Michael always wants two orders of fish along with every sachet of chips. Draw a typical indifference curve. In this case, are fish and chips perfect substitutes or perfect complements?

Perfect complements. The IC has an L shape.

3. Suppose a consumer's preferences for two goods can be represented by the Cobb–Douglas utility function  $U = Ax^\alpha y^\beta$ , where A,  $\alpha$ , and  $\beta$  are positive constants. The marginal utilities are  $MU_x = \alpha Ax^{\alpha-1} y^\beta$  and  $MU_y = \beta Ax^\alpha y^{\beta-1}$ .

- a. Is the assumption that more is better satisfied for both goods?

Yes.  $MU_x$  and  $MU_y$  are positive.

- b. Does the marginal utility of x diminish, remain constant, or increase with more x?

You need to calculate  $dMU_x/dx$  to see how  $MU_x$  changes as X increases.

$dMU_x/dx$  is positive (meaning that  $MU_x$  is increasing) when  $\alpha > 1$ .

$dMU_x/dx$  is zero (meaning that  $MU_x$  is constant) when  $\alpha = 1$ .

$dMU_x/dx$  is negative (meaning that  $MU_x$  is decreasing) when  $\alpha < 1$ .

- c. What is  $MRS_{XY}$ ? Interpret the value.

$$MRS = \frac{MU_x}{MU_y} = \frac{\alpha A x^{\alpha-1} y^\beta}{\beta A x^\alpha y^{\beta-1}} = \frac{\alpha y}{\beta x} \rightarrow \text{This means this consumer is willing to give up } \frac{\alpha y}{\beta x} \text{ units of } y \text{ to consume one more unit of } x, \text{ holding utility constant.}$$

- d. Is  $MRS_{XY}$  diminishing, constant, or increasing as the consumer substitutes  $x$  for  $y$  (buy more  $x$  and less  $y$ ) along an indifference curve?

$$\frac{dMRS_{XY}}{dx} = -\alpha\beta^{-1}x^{-2}y \rightarrow \text{negative} \rightarrow MRS_{XY} \text{ is diminishing.}$$

4. Assume the interior solution for the consumer optimum. At the current non-optimal bundle,  $MU_x = 6$ ,  $MU_y = 6$ ,  $P_x = 2$ , and  $P_y = 1$ . Answer the following questions.

- a. Use the “bang for the buck” interpretation to explain what the consumer will do to maximize his utility.

$$\frac{MU_x}{P_x} = 6/2 = 3. \quad \frac{MU_y}{P_y} = 6/1 = 6.$$

One \$ spent on Y gives more MU than one \$ spent on X. More Y should be consumed

- b. Use the “two rates of exchanges” interpretation to explain what the consumer will do to maximize his utility.

$$\frac{MU_x}{MU_y} = 6/6 = 1. \quad \frac{P_x}{P_y} = 2/1 = 2.$$

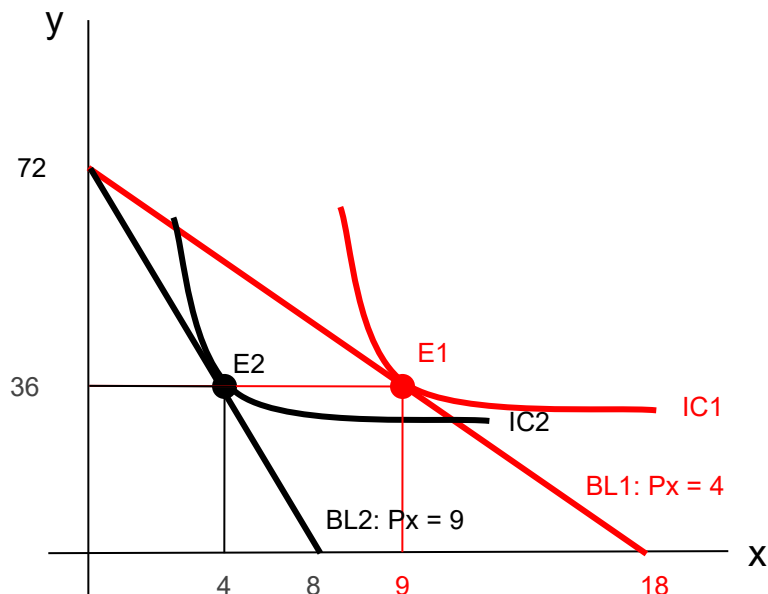
The consumer is willing to trade 1Y for 1X. The market is willing to trade 2Y for 1X.

The consumer can give 1X to the market and get 2Y in return (which is more than 1Y that he/she requires when giving up 1X). Hence, the consumer will be better off.

5. At a corner point solution, state the condition where the consumer will only buy good Y. Explain why the consumer will choose to do so (i.e., interpret the condition).

When  $\frac{MU_y}{P_y} > \frac{MU_x}{P_x}$  for every combination of goods, the consumer will always buy only good Y. This is because one \$ spent on Y always gives higher MU than one \$ spent on X.

6. (Interior Solution) Consider the case of two goods, X and Y. Let  $U(X, Y) = XY$ .  $P_y = \$1$ ,  $P_x = \$4$ , and  $I = \$72$ . Find the optimal choice. Now, suppose  $P_x$  increases to  $\$9$ . Find the new optimal choice. Draw the consumer choice diagram to show the effect of the price change.



From Optimality Condition,

$$\frac{MU_x}{MU_y} = \frac{P_x}{P_y} \rightarrow \frac{Y}{X} = \frac{P_x}{P_y} \rightarrow P_x X = P_y Y \rightarrow \text{Spend budget on } x \text{ and } y \text{ equally.}$$

When  $P_x = 4$

Optimality Cond.:  $4x = y$

Budget Line:  $4x + y = 72$

Solving them:  $8x = 72 \rightarrow X = 9, Y = 36$

When  $P_x = 9$

Optimality Cond.:  $9x = y$

Budget Line:  $9x + y = 72$

Solving them:  $18x = 72 \rightarrow X = 4, Y = 36$

7. (Corner Solution) Consider two goods: X and Y. Let  $U(X, Y) = X - Y$ .  $P_x = \$1$ ,  $P_y = \$1$ , and  $I = \$10$ .

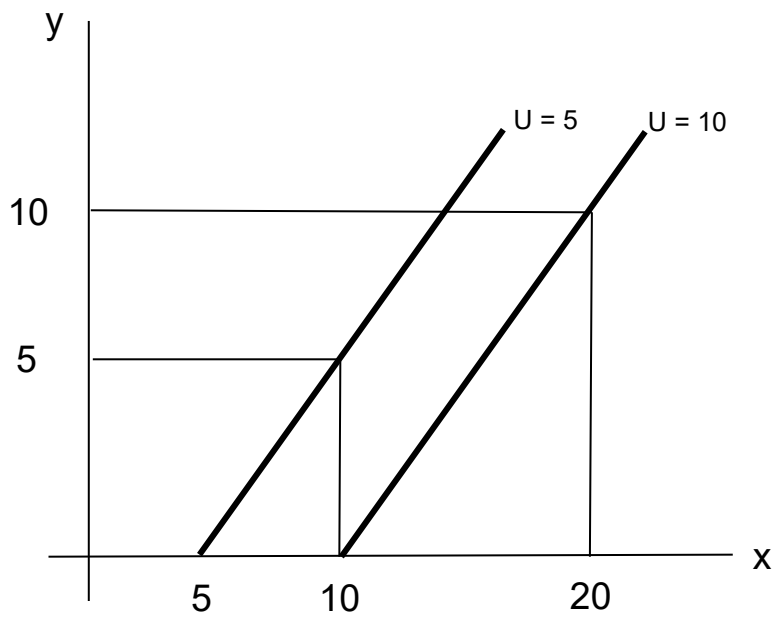
a. Based on the utility function, what is the type of Good Y?

Y is a bad good because of negative  $MU_y$ .

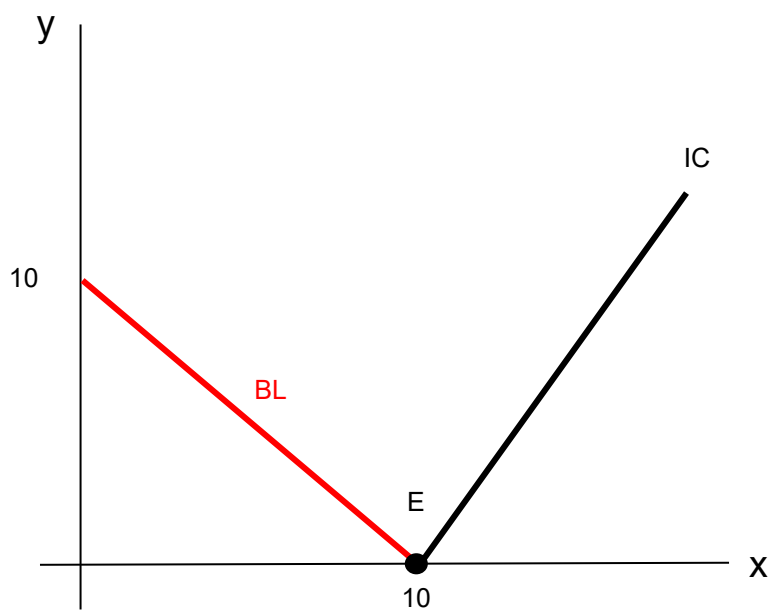
b. Find  $MU_x$ ,  $MU_y$ , and  $MRS_{xy}$ . Interpret each value.

$MU_x = 1$ ,  $MU_y = -1$ ,  $MRS_{xy} = -1$  This means the consumer will give up -1 unit of y to in exchange for 1 unit of x. That is, if x increases by 1 unit, y must increase by 1 unit as well so that leave the utility is unchanged.

c. Draw two indifference curves that show utility levels:  $U = 10$  and  $U = 5$ .



d. Find the consumer optimum and show it on the consumer choice diagram.



$\frac{MU_x}{P_x} = 1/1 = 1, \frac{MU_y}{P_y} = -1/1 = -1 \rightarrow MU_x/P_x$  is always greater than  $MU_y/P_y \rightarrow$  consume only x and no y  $\rightarrow$  optimal  $x = 10, y = 0$ .