# Discussion 2

# Important Topics

- Comparative Advantage, Opportunity Cost
- Global Production Possibility Frontiers (PPF)
- Technological Change and PPFs

# Exercises

## Opportunity Costs and Trade

Erika can chop 10 logs in 8 hours and gather 5 coconuts in 8 hours. Jon can chop 4 logs per hour and gather 8 coconuts per hour. Both work a standard 8 hour work day. How should they specialize, given their respective advantages?

1. Assuming that Erika and Jon both want to consume twice as many logs as coconuts, what is the total log and total coconut consumption if they do not specialize and trade?
2. Now assume that Erika and Jon specialize. Who specializes in gathering coconuts? Assuming that they each perfectly specialize, what is the total consumption of coconuts? Of logs?
3. Comment on the result from question 2. If Jon and Erika choose to trade and still want to consume twice as many logs as coconuts, will they perfectly specialize? Why or why not?

*Solutions:*

1. *Erika and Jon both have only 8 hours total to dedicate to either chopping wood or gathering coconuts. They each want to allocate their working hours such that they produce twice as many logs as cocounuts. We can represent the problem as a system of equations:*

$$\frac{1}{2}[\text{logs per hour}] \times [\text{logging hours}] = [\text{coconuts per hour}] \times [\text{gethering hours}]$$
$$[\text{hours spent chopping}] + [\text{hours spent gethering}] = 8$$

*Solving this system for Erika and Jon separately yields:*

$$\begin{aligned}
\text{Erika: } & 4 \text{ hours spent on each activity} \\
& 40 \text{ logs and } 20 \text{ coconuts consumed} \\
\text{Jon: } & \frac{32}{5} = 6.4 \text{ hours spent chopping wood} \\
& \frac{8}{5} = 1.6 \text{ hours spent gathering coconuts} \\
& \frac{128}{5} = 25.6 \text{ logs and } \frac{64}{5} = 12.8 \text{ coconuts consumed}
\end{aligned}$$

*Thus, if Jon and Erika do not trade, 65.6 logs and 32.8 coconuts are consumed.*

2. *We can construct the production and opportunity cost tables as follows:*

| | Logs | Coconuts | OC Logs | OC Coconuts |
|---|---|---|---|---|
| Erika | 10 | 5 | $\frac{1}{2}$ | 2 |
| Jon | 4 | 8 | 2 | $\frac{1}{2}$ |

*Erika has a comparative advantage in chopping logs and Jon has a comparative advantage in gathering coconuts. Thus, Jon will specialize in gathering coconuts, and Erika will specialize in chopping logs. We can then solve:*

$$\text{Logs produced/consumed} = 10 * 8 = 80. \text{Coconuts produced/consumed} \quad = 8 * 8 = 64$$

3. *Erika and Jon will not perfectly specialize because there would be no rate of logs traded from Erika to Jon per coconut traded from Jon to Erika that would allow them both to consume twice as many logs as coconuts. Instead, Jon will dedicate some of his time to cutting logs in addition to gathering coconuts, while Erika fully specializes in chopping logs.*

## Opportunity Costs and Global PPFs

Alice builds 2 tables in 6 hours and 3 chairs in 2 hours. Bob builds 1 table in 2 hours and builds 2 chairs in 3 hours. Fill in the table below in terms of the amount of time it takes to build each unit:

| | Tables | Chairs | OC tables | OC chairs |
|---|---|---|---|---|
| Alice | | | | |
| Bob | | | | |

1. Who has comparative advantage in tables? In chairs?
2. Suppose Alice and Bob must make exactly nine chairs during a twelve hour work day. How many tables will they be able to finish in addition to the nine chairs?
3. Now suppose they each have six hours. Draw the PPFs for both Alice and Bob (chairs on the horizontal axis). What is the marginal rate of transformation (MRT) for Alice and Bob?

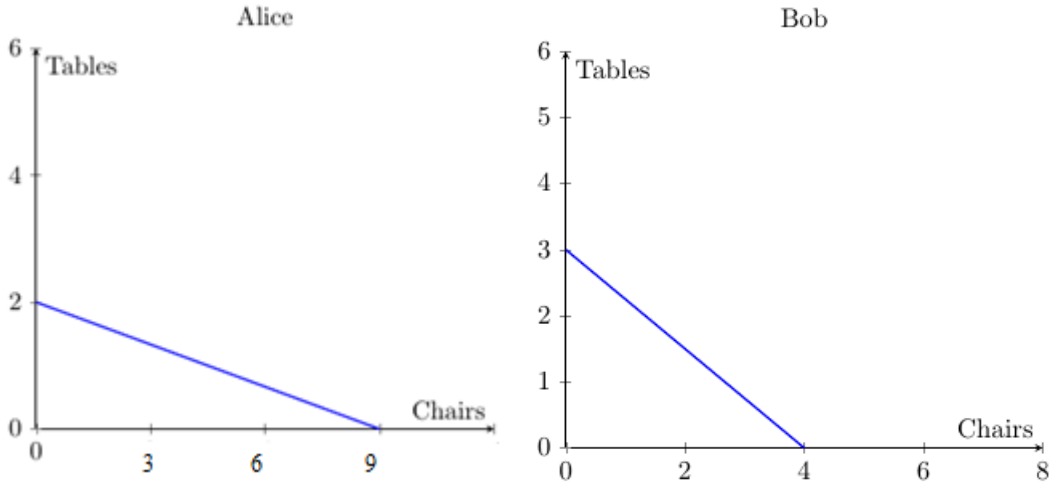
4. Now combine the two PPFs to construct the global PPF.
5. What happens if we have more than 2 people? How do you think the global PPF changes?

*Solution*

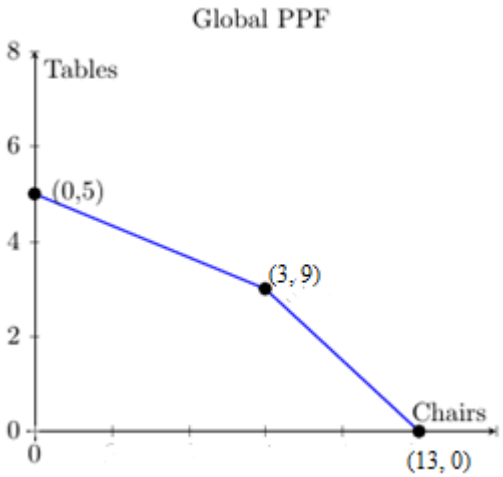
## Opportunity Costs and Global PPFs

| | Tables | Chairs | OC tables | OC chairs |
|---|---|---|---|---|
| Alice | 3 | 2/3 | 9/2 | 2/9 |
| Bob | 2 | 3/2 | 4/3 | 3/4 |

1. Who has comparative advantage in tables? In chairs?
   *Bob has the lower opportunity cost for tables, so he has comparative advantage in tables. Alice has the comparative advantage in chairs*
2. Suppose Alice and Bob must make exactly nine chairs during a twelve hour work day. How many tables will they be able to finish in addition to the nine chairs?
   *Since Alice has comparative advantage in chairs, she will specialize in chairs: it will take her six hours to complete the nine chairs needed. She then has six hours left, in which she can build 2 tables. Bob has comparative advantage in tables and will spend the whole 12 hours on tables, producing 6 tables. In total, they will produce 8 tables*
3. Now suppose they each have six hours. Draw the PPFs for both Alice and Bob (chairs on the horizontal axis). What is the marginal rate of transformation (MRT) for Alice and Bob?




4. Combine the two PPFs (global PPF).
   *The Global PPF has a kink which is due to the ability to specialize and extends the PPF outward. Note that if Alice's opportunity cost of making chairs was equal to that of Bob's opportunity cost of making chairs, then the global PPF would not have a kink.*




5. What happens if we have more than 2 persons? How does the global PPF change?
   *As we add more people to our world, we will see more and more kinks. Eventually, the kinks will become so numerous and so small that the joint PPF becomes a smooth curve.*

# Multiple Choice Practice

## Exercise 1:

Consider a curved PPF which plots the tradeoff between corn production (y-axis) and wheat production (x-axis). At any particular point at the edge of the frontier, where maximum production capacity is reached, how would you measure the opportunity cost of producing corn?

(a) The absolute value of the slope

(b) 1

(c) The reciprocal of the absolute value of the slope

(d) Cannot determine without more information

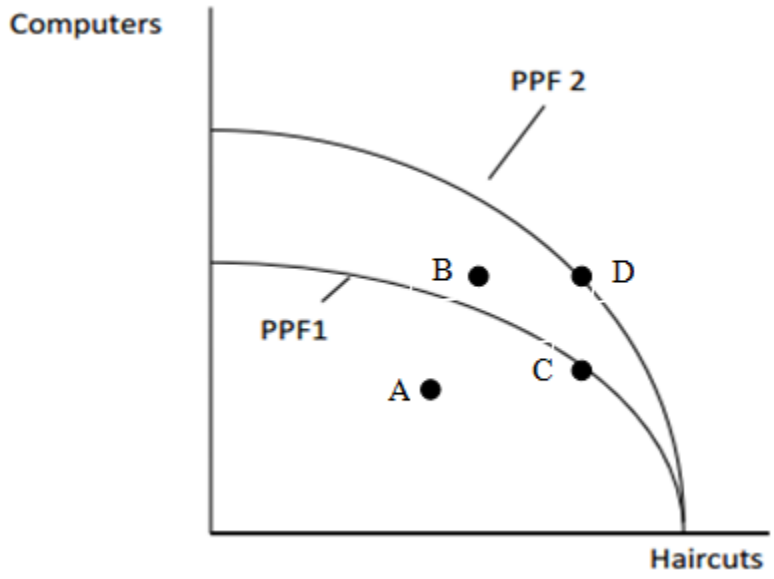
*Solution*

*The correct answer is (c); we are looking for the opportunity cost of corn, or how much wheat per corn is traded off. The absolute value of the slope would give the opportunity cost of wheat; 1 is a possible value of the absolute value of the slope at a specific point on the PPF, but given we don't know where the PPF intercepts either axis and that we are looking for a general solution, this is not correct; we also have enough information to conceptualize what this equation is. Therefore, the answer is (c).*

## Exercises 2 through 4 refer to the following chart:

## Non-linear Production Possibilities Frontier

Use this graph of the U.S.'s production possibility frontier (PPF) to answer the following questions:



2. If the US's production possibility starts out at PPF1,which points are feasible? Check all that apply.

   ☐ Point A

   ☐ Point B

   ☐ Point C

   ☐ Point D

3. Now the PPF shifts out to PPF2. What does this tell us about how production has changed for haircuts and computers?

   (a) There are fewer barbers in the economy

   (b) Computers require fewer resources to produce

   (c) There is more demand for computers

   (d) The U.S. started buying computers from other countries rather than producing them

4. How will the shift from PPF1 to PPF2 affect the opportunity cost for producing haircuts?

   (a) The opporunity cost of producing haircuts will increase

   (b) The opporunity cost of producing haircuts will decrease

   (c) The opporunity cost of producing haircuts will not change

   (d) The shift will only affect the opportunity cost of producing computers

*Solution*

2. If the US's production possibility starts out at PPF1,which points are feasible? Check all that apply. *Point A and point C are both feasible. Note that only point C is efficient because it lies along the PPF rather than within the PPF.*

3. Now the PPF shifts out to PPF2. What does this tell us about how production has changed for haircuts and computers? *The correct answer is (b). Since this isn't a parallel shift, this indicates that one of the goods (computers, in this case) has become easier to produce, likely due to technology changes in the production of computers. If (a) were true, then the economy would be able to provide fewer haircuts, so the PPF would shift in along the horizontal axis. If (c) were true, nothing would change about the PPF, but the economy would move from one point below or on the PPF to another one. Answer (d) would affect the global PPF, but it would not influence the U.S. PPF.*

4. How will the shift from PPF1 to PPF2 affect the opportunity cost for producing haircuts? *The correct answer is (a). The opportunity cost for haircuts will go up at any given quantity of haircuts, the slope of PPF2 is higher than the slope of PPF1, indicating that the opportunity cost of producing a haircut is higher in the model depicted by*

*PPF2. (d) is not true because anything that affects the opportunity cost of producing computers also affects the opportunity cost of providing haircuts.*

## Exercise 5 and 6:

## Exercise 5:

Wakanda is a developed nation that is skilled in producing advanced technological goods. It also benefits from a workforce with high levels of human capital. Wakanda can produce one unit of goods for every unit of services, and in a given year it can produce up to 8 million goods. Until now, Wakanda did not trade with other countries, and it produced equal levels of goods and services. Now Wakanda considers trade with the UK, which can produce 3 units of goods for every unit of services. The UK can produce at most 6 million goods; previously it produced 3 million units of goods and 1 million units of services.

If Wakanda and the UK decide to trade based on the theory of comparative advantage, which of the following is true?

I. Since Wakanda has an absolute advantage in producing both goods, it would be worse off trading with the UK.

II. The UK should specialize in services and Wakanda should specialize in goods.

III. Total production of services can increase above 5 million while maintaining the total level of goods produced before trade.

(a) I and II

(b) I and III

(c) II and III

(d) III only

*Solution*

*The correct answer is (d). I is false because despite its absolute advantge in both goods, Wakanda can still benefit from trading. II is false because the UK has a lower opportunity cost in producing a unit of goods (1/3 units of services) compared to Wakanda (1 unit of services). III is true. Before trading, the countries produce 7 million units of goods and 5 million units of services. If each country specializes in the product for which it has a lower opportunity cost and then they trade with one another, Wakanda can produce 7 mil. units of services and 1 mil. units of goods while the UK can produce 6 mil. units of goods, for a total of 7 mil. units of services and 7 mil. units of goods. This is more output than when they did not trade.*

## Exercise 6:

(Continuing from Exercise 5 setup) Now suppose that both countries benefit from a technological discovery. Now Wakanda can produce up to 9 million goods or up to 8 million services.

Meanwhile, the UK can now produce up to 6 million goods or up to 8 million services. The two countries trade based on the theory of comparative advantage. Which of the following is true?

(a) Wakanda's opportunity cost of producing services decreased.

(b) The UK should specialize in services and Wakanda should specialize in goods.

(c) The global production possibilities frontier is no longer bowed outward.

(d) All of the above.

*Solution*

*The correct answer is (b). The UK has a comparative advantage in production of services, because it only gives up 6 goods to produce 8 services whereas Wakanda gives up 9 goods to produce 8 services. Meanwhile, Wakanda has a comparative advantage in goods (can you explain why?). As Ricardo argued, two parties can benefit from trade if each specializes in the production of the good for which it has a comparative advantage. Answer (a) is false, since Wakanda's opportunity cost of one unit services previously was 1 and is now* $\frac{9}{8}$*. Answer (c) is false because if the global PPF were bowed inwards, that would mean that the law of increasing opportunity cost was violated. If you drew the PPF as bowed inwards, ask yourself if the economy is producing the maximal output possible, given the technology. Answer (d) is false since (a) and (c) are false.*