

L2 – Efficiency, Opportunity Cost, PPF

Pareto Efficiency: A state in which it is impossible to make at least one individual better off without hurting the others.

The action that makes at least one individual better off without hurting others is called a **Pareto Improvement**. So being Pareto efficient is equivalent to that there is no Pareto improvement existing.

In a context where there is one producer who produces more than one goods, Pareto efficiency refers to a state in which it is impossible to increase the production of one good without decreasing the production of at least one of the other goods.

Opportunity Cost is equal to the maximum value of forgone alternatives.

e.g.1 The accounting cost of a computer is \$1000. Its opportunity cost is at least $\$1000(1+r)$, where r is the interest rate.

e.g.2 Your wage is \$10/hour. You can take one day off (without wage) to hang out with your friend. What's the price of one hour of your leisure time?

Question: You quit your \$60,000 job and started a new business, and hired a computer programmer who developed a website using your old computer that is worth \$1,000. You worked for free for your own startup, but paid the programmer a wage of \$40,000. At the end of the year, the revenue was \$50,000. Is your profit positive? Should you continue your business?

Question: Why do we care about opportunity cost rather than accounting cost?

Production Possibilities Frontier (“PPF”)

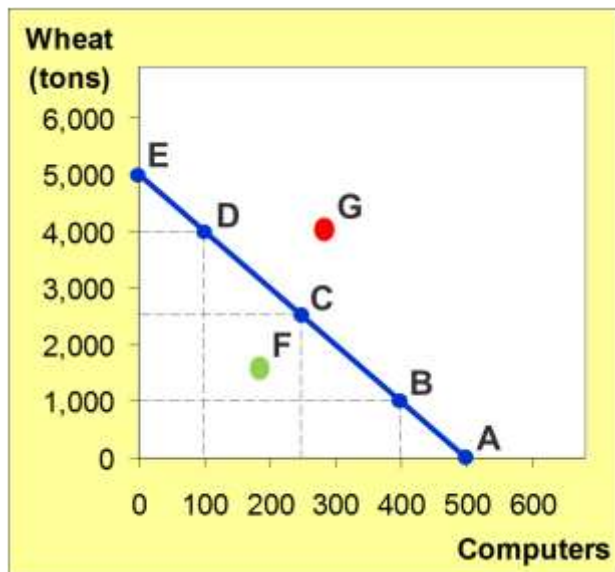
PPF is a graph that shows the combinations of output that the economy can possibly produce given the available factors of production and the available production technology.

1) PPF Example 1 – Wheat and Computer:

The economy has:

- Two goods: computers and wheat
- One resource: labor (measured in hours)
- 50,000 labor hours per month available for production
- Producing one computer requires 100 hours labor
- Producing one ton of wheat requires 10 hours labor

	Employment of Labor Hours		Production	
	Computer	Wheat	Computer	Wheat
A	50,000	-	500	-
B	40,000	10,000	400	1,000
C	25,000	25,000	250	2,500
D	10,000	40,000	100	4,000
E	-	50,000	-	5,000



- Points on the PPF (like A – E):
 - Possible
 - Efficient: all resources are fully utilized
- Points under the PPF (like F)
 - Possible
 - Not efficient: some resources underutilized (e.g., workers unemployed, factories idle)
- Points above the PPF (like G)
 - Not possible (society has limited resources)

Note: In this course we assume all goods are splittable and the quantities are positive real numbers (can be decimal numbers.)

2) PPF: Trade-off and Opportunity Cost

- ❖ Moving along a PPF involves shifting resources (e.g., labor) from the production of one good to the other (i.e. Trade-off).
- ❖ The slope of the PPF tells you the **opportunity cost** of one good in terms of the other.

Example 1:

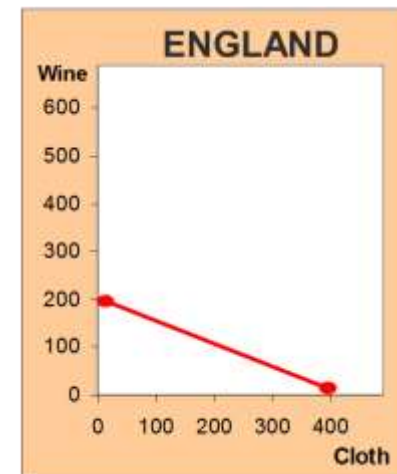
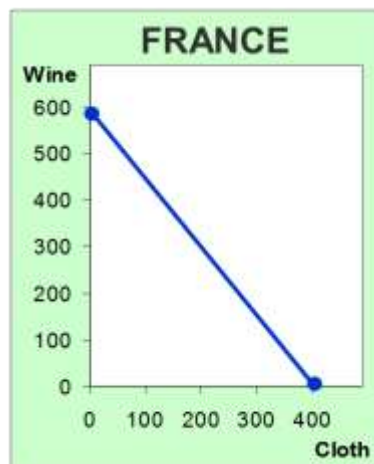
Refer to the previous PPF example.

$$\text{Slope} = 1000/100 = -10$$

i.e. the opportunity cost of a computer is 10 tons of wheat.

Example 2:

The opportunity cost of cloth is lower in England because the slope of its PPF is not as steep as France's.



3) The Shape of the PPF

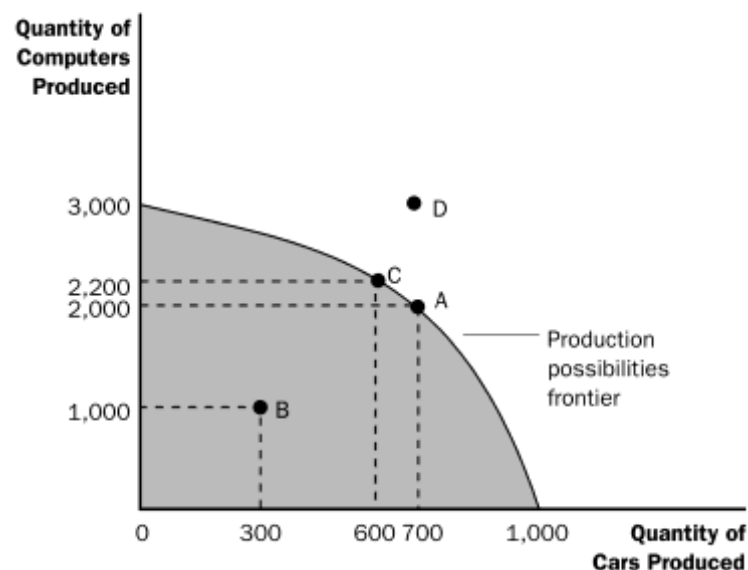
❖ The shape of the PPF depends on opportunity cost

- If opp. cost remains **constant**, PPF is a straight line.

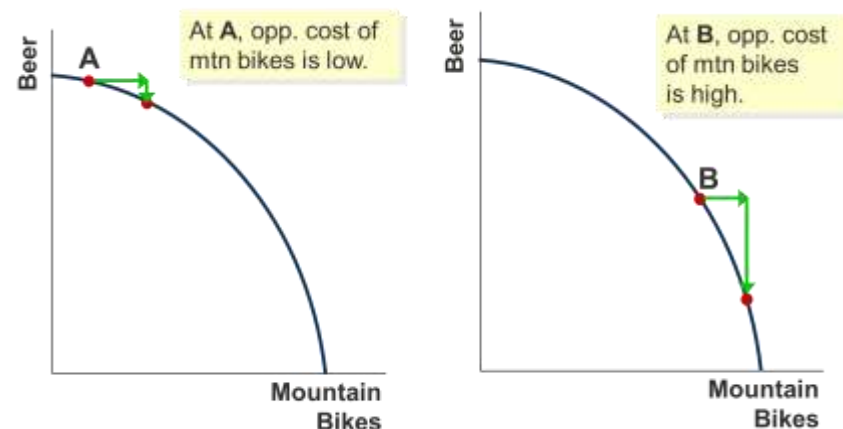
Example: the wheat and computer example

- If opp. cost of a good **rises** as the economy produces more of the good, PPF is bow-shaped

Example: The opp. cost of cars in terms of computers increases as the country produces more cars and fewer computers. This occurs because some resources are better suited to the production of cars than computers (and vice versa).



❖ Why the PPF Curve Might Be Bowed Shape?

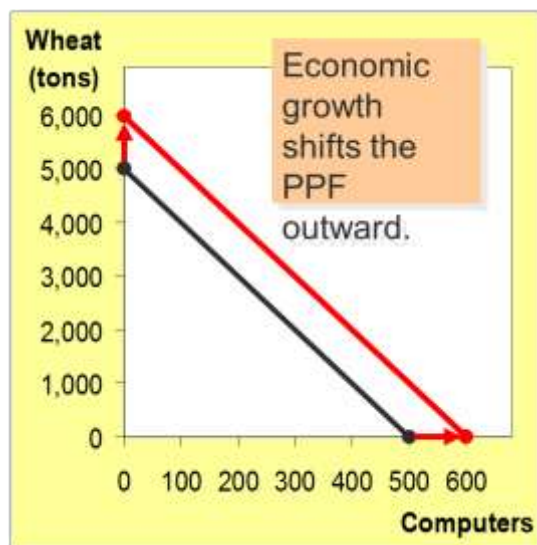


- At point A, most workers are producing beer, even those that are better suited to building bikes. So, do not have to give up much beer to get more bikes.
- At B, most workers are producing bikes. The few left in beer are the best brewers. Producing more bikes would require shifting some of the best brewers away from beer production, would cause a big drop in beer output.

4) PPF and Economic Growth

- ❖ With additional resources or an improvement in technology, the economy can produce more computers, more wheat, or any combination in between.

Example:



5) PPF Summary

- ❖ The PPF illustrates the concepts of: tradeoff and opportunity cost, efficiency and inefficiency, unemployment, and economic growth.

Positive Versus Normative Analysis

- ❖ Positive statements attempt to describe the world as it is.

- ❖ Normative statements attempt to prescribe how the world should be.

Examples:

- a) Prices rise when the government increases the quantity of money -- Positive statement
- b) The government should raise minimum wage -- Normative statement

Gains from Trade and Division of Labor

There are two basic ways that people can satisfy their wants:

- ❖ Self-sufficient
- ❖ Specialize in the production of one thing and then trade with others

With rare exceptions, individuals and nations tend to rely on specialization and trade.

PPF: Production Possibilities Frontier

I. PPF With Trade vs. PPF without Trade

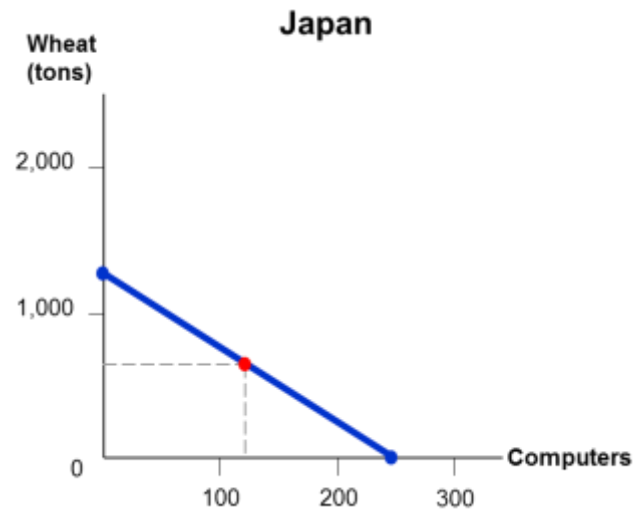
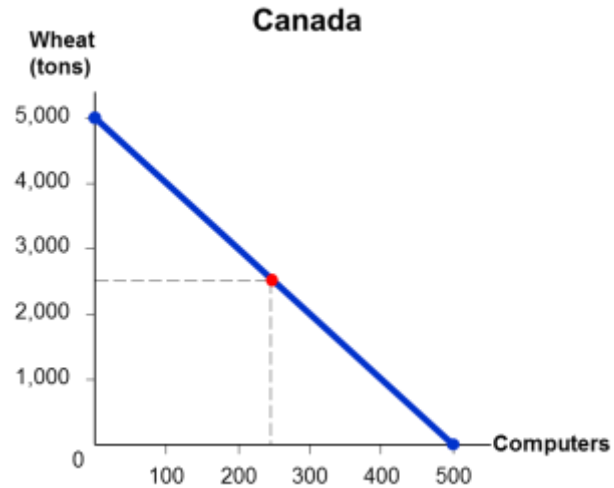
a) Model Assumptions:

- Two countries: Canada and Japan
- Two goods: wheat and computers
- One resource: labor, measured in hours
- We will look at how much of both goods each country produces and consumes
 - if the country chooses to be self-sufficient OR
 - if it trades with the other country

b) PPF Without Trade

	Canada	Japan
Hours of Labour Available	50,000	30,000
Hours required to produce 1 computer	100	125
Hours required to produce 1 ton of wheat	10	25
Maximum computer production used all available labour	500	240
Maximum wheat production used all available labour	5,000	1,200
If each country use half of its available labour to produce each goods without trade:		
	Canada	Japan
Hours of labour for computer	25,000	15,000
Hours of labour for wheat	25,000	15,000
Total computer production	250	120
Total wheat production	2,500	600

c) PPF With Trade



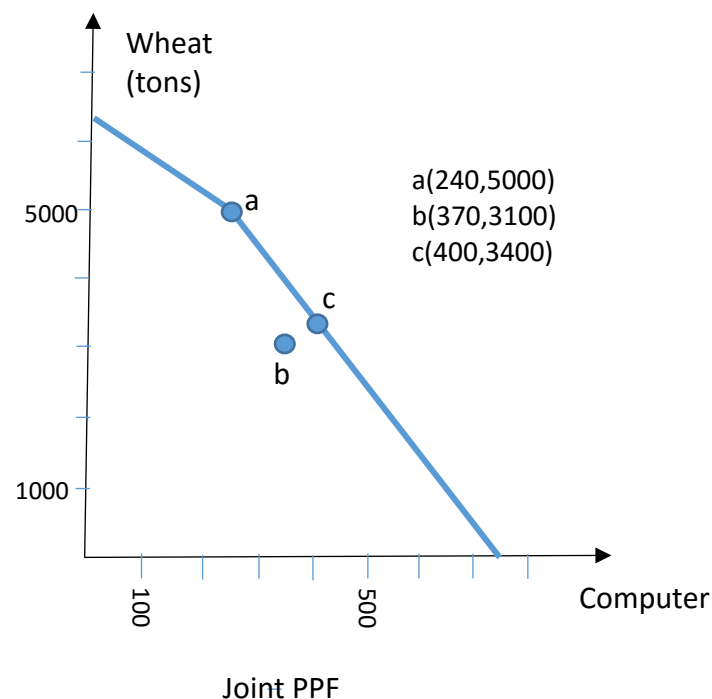
With trade		
	Canada	Japan
Hours of labour used for producing computer	16,000	30,000
Hours of labour used for producing wheat	34,000	-
Total computer production	160	240
Total wheat production	3,400	-
Trade		
Canada gives Japan 700 tons of wheat		
Japan gives Canada 110 computers		
Total Consumption		
Computers	270	130
Wheat	2,700	700

Canada			
	consumption without trade	consumption with trade	gains from trade
computers	250	270	20
wheat	2,500	2,700	200

Japan			
	consumption without trade	consumption with trade	gains from trade
computers	120	130	10
wheat	600	700	100

→ Both countries are better with gains from trade.

The above result can be shown in the following graph. The curve shows the joint PPF of Canada and Japan. The point a at the kink shows the combination of goods produced if Canada specializes in producing wheat and Japan in producing computer. Point b shows how many computers and tons of wheat are produced in total without labor division and trade. Point c shows how many computer and wheat are produced if Japan specializes in computer production but Canada spends 16,000 hours producing computers and 34,000 hours producing wheat. At point c jointly the two countries produce more computers and wheat than at point b.



II. Where Do These Gains Come From?

- ❖ Which country has an absolute advantage in wheat?

Answer: Canada

Because producing a ton of wheat uses 10 labor hours in Canada vs. 25 in Japan.

- **Absolute advantage:** the ability to produce a good using fewer inputs than another producer
- If each country has an absolute advantage in one good and specializes in that good, then both countries can gain from trade.

- ❖ Which country has an absolute advantage in computers?

Answer: Canada

Because producing 1 computer requires 100 labor hours in Canada vs. 125 in Japan

- ❖ Canada has an absolute advantage in both goods!
- ❖ So why does Japan specialize in computers? Why do both countries gain from trade?

III. Comparative Advantage vs. Absolute Advantage

- ❖ Two countries can gain from trade when each specializes in the good it produces at lowest cost.
- ❖ Absolute advantage measures the cost of a good in terms of the inputs required to produce it.
- ❖ Another measure of cost is opportunity cost.

In our example, the opportunity cost of a computer is the amount of wheat that could be produced using the labor needed to produce one computer.

- ❖ The ability to produce a good at a lower opportunity cost than another producer is called **comparative advantage**.
- ❖ Which country has the comparative advantage in computers?

To answer this, we must determine the opp. cost of a computer in each country.

Required Labor Hours for Production:		
	Canada	Japan
Computer	100	125
Wheat	10	25
Opportunity Cost:		
	Canada	Japan
Computer in terms of tons of wheat	10	5
Wheat in terms of units of computer	0.1	0.2

- ➔ Japan has a comparative advantage in computers when Canada has a comparative advantage in wheat.
- ➔ One country's opportunity costs of the two goods are inverse to each other. So no country has comparative advantage in both goods.
- ➔ ***Lesson: Gains from trade arise from comparative advantage (differences in opportunity costs), not absolute advantage.***

Question: Can you think of any other reasons why division of labor is good?

IV. Summary

- ❖ Each person consumes goods and services produced by many other people both in our country and around the world. Interdependence and trade are desirable because they allow everyone to enjoy a greater quantity and variety of goods and services.
- ❖ There are two ways to compare the ability of two people in producing a good. The person who can produce the good with a smaller quantity of inputs is said to have an absolute advantage in producing the good. The person who has the smaller opportunity cost of producing the good is said to have a comparative advantage. The gains from trade are based on comparative advantage, not absolute advantage.
- ❖ Trade makes everyone better off because it allows people to specialize in those activities in which they have a comparative advantage.