Lecture 2

Production, Opportunity Cost and Relative Price

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Principles of Microeconomics

The Economic Problem

- **What will be produced?**
  - **Basic needs:** food, clothing, shelter, etc.
  - **Non-essentials:** fish tanks, televisions, etc.
  - **Capital goods:** machinery, tools, human skills, etc. to produce more in the future
- **How will it be produced?**
  - What resources are available?
  - How should labor and capital be allocated the production of each of the various products?
- **Who will get what is produced?**
  - How should the products be allocated to the members of society – individuals, businesses, government, etc.?

Comparative Advantage

This is one of the very few economic principles which is undeniably true, but is not obvious to intelligent people.

- The US has a **comparative advantage** in the production of a good, if the opportunity cost of producing that good is lower in the US than it is in other countries.
  - **Opportunity cost** – how much of one good you have to give up in order to gain more of another.
  - **Unit labor requirement** – amount of labor needed to produce one unit of a good. Ex. If I type 2 pages of notes per hour, then my unit labor requirement (to type one page) is half an hour per page.

$$\frac{1\text{ hour}}{2\text{ pages}} = 0.5\ \frac{\text{hour}}{\text{page}}$$

- Countries **gain from trade**,
- if they **specialize** in producing the goods
- in which they have a **comparative advantage**,
- although there may be **distributional effects** to consider.

Comparative Advantage

- **Colleen can cut 12 logs a day or gather 10 bushels of food a day**
- **Bill can only cut 5 logs a day or gather 8 bushels a day**

Colleen's opportunity cost

- **of cutting logs:**

$$\frac{\frac{1\text{ day}}{12\text{ logs}}}{\frac{1\text{ day}}{10\text{ bushels}}} = \frac{10\text{ bushels}}{12\text{ logs}} = 0.83\ \frac{\text{bushels}}{\text{log}}$$

- **of gathering food:**

$$\frac{\frac{1\text{ day}}{10\text{ bushels}}}{\frac{1\text{ day}}{12\text{ logs}}} = \frac{12\text{ logs}}{10\text{ bushels}} = 1.2\ \frac{\text{logs}}{\text{bushel}}$$

Bill's opportunity cost

- **of cutting logs:**

$$\frac{\frac{1\text{ day}}{5\text{ logs}}}{\frac{1\text{ day}}{8\text{ bushels}}} = \frac{8\text{ bushels}}{5\text{ logs}} = 1.6\ \frac{\text{bushels}}{\text{log}}$$

- **of gathering food:**

$$\frac{\frac{1\text{ day}}{8\text{ bushels}}}{\frac{1\text{ day}}{5\text{ logs}}} = \frac{5\text{ logs}}{8\text{ bushels}} = 0.625\ \frac{\text{logs}}{\text{bushel}}$$

- **Colleen has a comparative advantage in cutting logs** because her opportunity cost of cutting logs is less than Bill's.
- **Bill has a comparative advantage in gathering food** because his opportunity cost of gathering food is less than Colleen's.

- Colleen has a comparative advantage in cutting logs.
- Bill has a comparative advantage in gathering food.
- **Colleen has an ABSOLUTE advantage in the production of BOTH goods, but she has a COMPARATIVE advantage in the production of only ONE good** (cut logs)**.**

Relative Price

- If Colleen and Bill valued logs and food equally, then they would trade logs for food at a one-to-one ratio.
- If you prefer to think in terms of dollar values:
  - let the price of logs be one dollar per log: **$1/log**
  - let the price of food be one dollar per bushel: **$1/bushel**
- so that:
  - the relative price of logs is one bushel per log: $\frac{\$1/\text{log}}{\$1/\text{bushel}} = 1\ \frac{\text{bushel}}{\text{log}}$
  - the relative price of food is one log per bushel: $\frac{\$1/\text{bushel}}{\$1/\text{log}} = 1\ \frac{\text{log}}{\text{bushel}}$

Colleen's Specialization → Cutting Logs

- **A person** (country) ***should*** **specialize in producing a good if its opportunity cost is less than the relative price of that good.**
  - Colleen *should* specialize in logs because her opportunity cost of cutting logs is less than the relative price of logs.
  - By contrast, Bill *should not* cut logs because his opportunity cost of cutting logs is greater than the relative price of logs.

$$\underset{0.83\ \frac{\text{bushels}}{\text{log}}}{\text{Colleen's opp. cost of logs}} < \underset{1\ \frac{\text{bushel}}{\text{log}}}{\text{rel. price of logs}} < \underset{1.6\ \frac{\text{bushels}}{\text{log}}}{\text{Bill's opp. cost of logs}}$$

Colleen's Gains from Trade

- **By specializing in cutting logs and trading her logs for food, Colleen gains more food** (per day of work) **than if she gathered food herself.**

$$\frac{12\ \text{logs}}{1\ \text{day}} * \frac{1\ \text{bushel}}{1\ \text{log}} = \frac{12\ \text{bushels}}{1\ \text{day}} > \frac{10\ \text{bushels}}{1\ \text{day}}$$

Bill's Specialization → Gathering Food

- **A person** (country) ***should*** **specialize in producing a good if its opportunity cost is less than the relative price of that good.**
  - Colleen *should not* gather food because her opportunity cost of gathering food is greater than the relative price of food.
  - By contrast, Bill *should* gather food because his opportunity cost of gathering food is greater than the relative price of food.

$$\underset{\text{Colleen's opp. cost of food}}{1.2\ \frac{\text{logs}}{\text{bushel}}} > \underset{\text{rel. price of food}}{1\ \frac{\text{log}}{\text{bushel}}} > \underset{\text{Bill's opp. cost of food}}{0.625\ \frac{\text{logs}}{\text{bushel}}}$$

Bill's Gains from Trade

- **By specializing in gathering and trading his food for logs, Bill gains more logs** (per day of work) **than if he cut logs himself.**

$$\frac{8\ \text{bushels}}{1\ \text{day}} * \frac{1\ \text{log}}{1\ \text{bushel}} = \frac{8\ \text{logs}}{1\ \text{day}} > \frac{5\ \text{logs}}{1\ \text{day}}$$

Moral of the Story

- Even though Colleen can produce both goods more efficiently, she gains by specializing in logs (the good in which she has a comparative advantage) and trading her logs for food with Bill.
- **Moral: America gains by trading with less developed countries.**
- Even though Bill is less efficient at producing both goods, he gains by specializing in food (the good in which he has a comparative advantage) and trading his food for logs with Colleen.
- **Moral: less developed countries gain by trading with America.**

Lower Productivity → Lower Wage

- **Recall the dollar prices of each good: $1/bushel and $1/log**
  - Colleen produces 12 logs per day, so her wage is $12 per day.
  - Bill produces 8 bushels per day, so his wage is $8 per day.
- **This is why the Malaysians who made your sneakers, receive a much lower wage than you do. They're less productive.**

econ. data for 15 of the largest underdeveloped countries, 2001				
country	GDP per cap. at PPP	Human Dev. Index	Exports as % of GDP	Imports as % of GDP
Mexico	$ 8,430	80.0 %	27.5 %	29.8 %
Brazil	$ 7,360	77.7 %	13.2 %	14.2 %
Thailand	$ 6,400	76.8 %	66.0 %	59.4 %
Philippines	$ 3,840	75.1 %	48.6 %	51.7 %
Turkey	$ 5,890	73.4 %	33.7 %	31.3 %
China	$ 4,020	72.1 %	25.5 %	23.1 %
Iran	$ 6,000	71.9 %	20.7 %	18.5 %
Vietnam	$ 2,070	68.8 %	54.6 %	57.0 %
Indonesia	$ 2,940	68.2 %	42.3 %	34.9 %
Egypt	$ 3,520	64.8 %	17.4 %	22.1 %
India	$ 2,840	59.0 %	13.5 %	14.1 %
Bangladesh	$ 1,610	50.2 %	15.4 %	21.5 %
Pakistan	$ 1,890	49.9 %	18.0 %	19.3 %
Nigeria	$ 850	46.3 %	43.3 %	34.4 %
Ethiopia	$ 810	35.9 %	15.1 %	29.8 %
correlation matrix	GDP per cap. at PPP	Human Dev. Index	Exports as % of GDP	Imports as % of GDP
GDP per cap. at PPP	1.000			
Human Dev. Index	0.847	1.000		
Exports as % of GDP	0.062	0.353	1.000	
Imports as % of GDP	–0.024	0.245	0.939	1.000
sources: World Development Indicators (2005); Human Development Report (2003)				

Trading Up

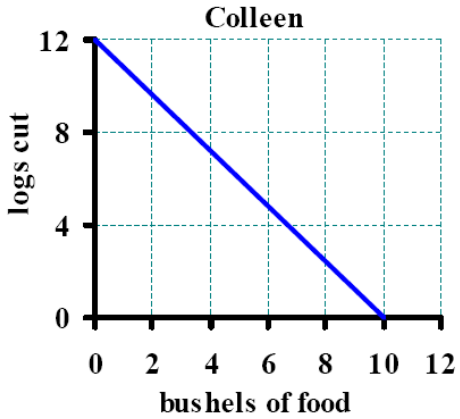
- **Of the countries in the table above, the ones which have the highest levels of human development, are generally the ones that engage in more international trade.**
- **the Human Development Index is positively correlated with:**
  - **a country's share of exports in GDP**
  - **a country's share of imports in GDP**
- the correlations are not perfect, but they are significant

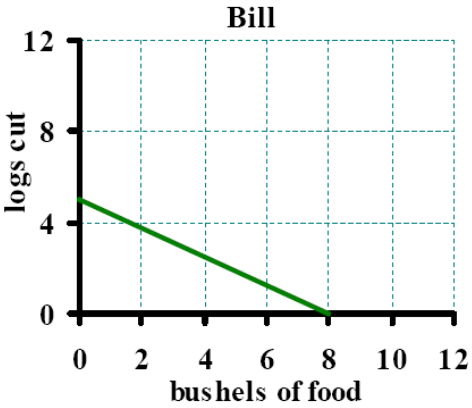
moral of the story

- Countries **gain from trade**,
- if they **specialize** in producing the goods
- in which they have a **comparative advantage**,
- although there may be **distributional effects** to consider:
  - workers who are not working in the sector where the country has a comparative advantage will be adversely affected by free trade
  - ex. in America steel workers, textile workers and farmers are adversely affected by trade

Production Possibilities Frontier

- **PPF – all combinations of goods that can be produced if resources are used efficiently.** One can produce at or below the PPF, but not above it.





In one day, **Colleen** can:

- cut 12 logs or gather 10 bushels
- or produce a **combination**, such as: 6 logs and 5 bushels.

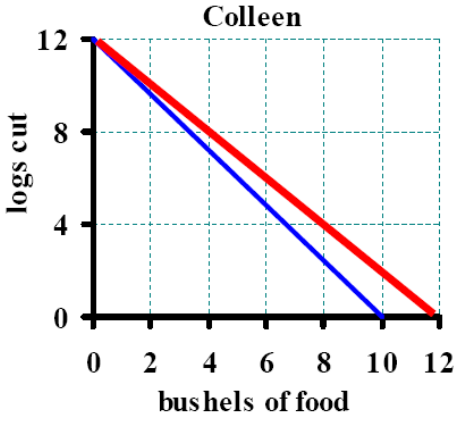
In one day, **Bill** can:

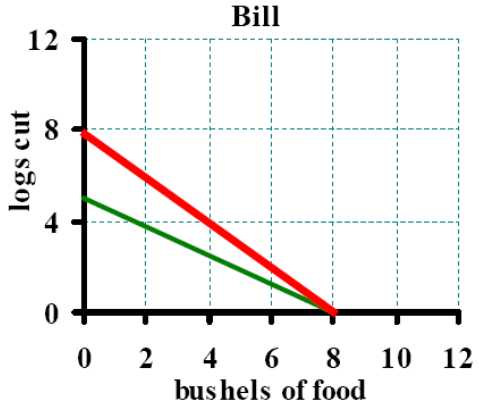
- cut 5 logs or gather 8 bushels
- or produce a **combination**, such as: 2.5 logs and 4 bushels.

Slope of the PPFs (above) **is: –1*opp. cost of gathering food**

Gains from Trade

- Add a **red line** whose **slope** represents the **relative price:** $1\frac{\log}{\text{bushel}}$





If Colleen specializes in cutting logs:

- **she can trade some of her logs for bushels of food and**
- **consume a combination that exceeds any combination that she could produce on her own.**

If Bill specializes in gathering food:

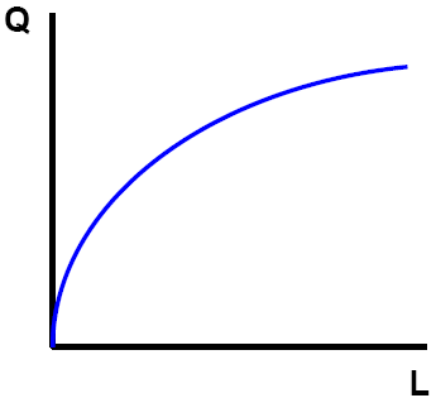
- **he can trade some of his bushels of food for logs and**
- **consume a combination that exceeds any combination that he could produce on his own.**

Production Function

Quantity produced is a function of capital and labor:

$$Q = f(K, L)$$

- **If you have one unit of kapital** (for example, one stove in a kitchen)**,**
- **and you keep increasing number of workers** (labor) **at that machine the quantity produced will increase**
- **but at a decreasing rate**
  - **because the workers start to get in each other's way**
  - **"too many cooks in the kitchen"**

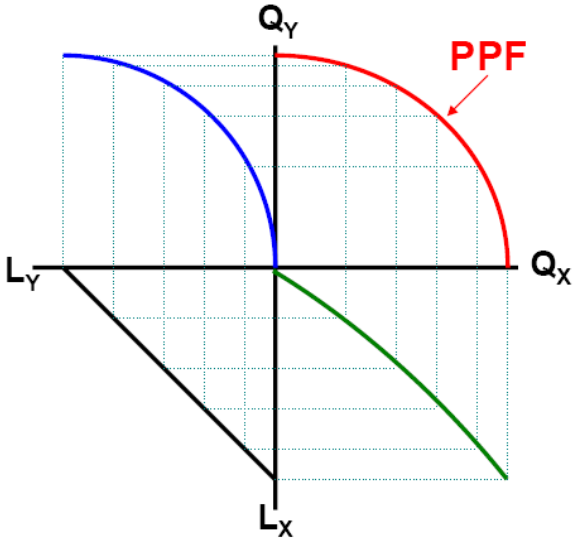


$$Q = f(K, L)$$

This production function is drawn for a fixed amount of capital.

Production Possibilities Frontier

- **PPF represents:**
  - **all the possible combinations of goods** (and services)
  - **that can be produced,**
  - **if resources are used efficiently.**
- **Production possibilities are constrained by amount of labor and capital in the economy.**
- **Cannot produce above PPF**
- **If we shift labor from production of X and into production of Y,**
  - **less X will be produced**
  - **more Y will be produced**
- **PPF summarizes opportunity cost of all such shifts.**
- **If resources are not used efficiently**
  - **labor unemployment,**
  - **inefficient management**
- **the economy is producing at a point below the PPF.**



Cuba's Ten Million Ton Sugar Harvest

- In the 1960s, Cuba produced about 6 to 7 million tons of sugar a year, which was sold primarily to countries in the Soviet bloc.
- Beginning in 1969, Cuban dictator Fidel Castro sent hundreds of thousands of urban workers into the fields in an effort to produce 10 million tons of sugar in 1970.
- Ultimately, Cuba missed its goal and only managed to produce 8.5 million tons – the largest harvest in Cuban history.

What were the effects on Cuban economy?

For simplicity, assume that before the plan:

- **Cuba produced 6 million tons of sugar and 5 million tons of "everything else"**
- **relative price of sugar was one ton of everything else per ton of sugar,**
- **at a relative price of $1 \frac{\text{everything else}}{\text{sugar}}$, Cuba traded 2 million tons of sugar for 2 million tons of everything else and**
- **consumed 4 million tons of sugar and <u>7 million tons of everything else</u>**

massive disruptions in the Cuban economy

Since Cuba allocated all of its production to sugar, it produced at the "sugar corner" of its PPF. At that corner, the opportunity cost of producing sugar exceeds the relative price of sugar.

For simplicity, let's pretend that Cuba:

- **succeeded in producing all 10 million tons of sugar, but didn't produce anything else**
- **at a relative price of $1 \frac{\text{everything else}}{\text{sugar}}$, Cuba traded 6 million tons of sugar for 6 million tons of everything else and**
- **consumed 4 million tons of sugar and <u>6 million tons of everything else</u>**

So (in this example) **Cubans consumed the same amount of sugar, but their consumption of everything else fell from 7 million tons to 6 million tons – a 15 percent decrease.**

sweet it wasn't

Q: **Would a 15 percent decrease in consumption of everything else a massive disruption in the economy?**

A: **If you could consume the same amount of sugar that you did last year, but your consumption of everything else fell 15 percent, would you be happy?**

lesson from Cuba's experiment

- **a country should produce at the point along its PPF, where the opportunity cost of producing a good** (ex. sugar) **equals the relative price of that good**
- **Cubans suffered because their country produced at a point where the opportunity cost of producing sugar exceeded the relative price of sugar**
- **Similarly, had Cuba allocated all of its resources to producing "everything else" and produced no sugar it also would have suffered**
  - **because at such a point, the opportunity cost of producing everything else would have been greater than the relative price of everything else**
  - (from the opposite perspective…) **because at such a point, the opportunity cost of sugar would have been less than the relative price of sugar**

Why did Bill and Colleen completely specialize in one good?

- **A country should completely specialize in the production of one good**
  - **ONLY if the relative price of that good is greater than the country's opportunity cost of producing it at every point along the PPF**
  - **Bill and Colleen's opportunity cost was constant all along their PPFs**
- **the PPF I drew for Cuba assumes increasing opportunity cost – i.e. Cuba's opportunity cost of producing sugar increases as it produces more sugar**

Homework #2

problems #3 and 8 from Ch. 2, p. 41–42 of Case/Fair *Principles*…(6th ed.)
and a few of my own problems

3. Kristin and Anna live in the beach town of Santa Monica. They own a small business in which they make wristbands and potholders and sell them to people on the beach. Kristen can make 15 wristbands per hour, but only 3 potholders. Anna is a bit slower and can make only 12 wristbands or 2 potholders in an hour.

	output per hour	
	Kristin	Anna
Wristbands	15	12
Potholders	3	2

- **a.** For Kristin and for Anna what is the opportunity cost of a potholder? Who has a comparative advantage in the production of potholders? Explain.
- **b.** Who has a comparative advantage in the production of wristbands? Explain.
- **c.** Assume that Kristin works 20 hours per week in the business. If Kristin were in business on her own, graph the possible combinations of potholders to wristbands that she could produce in a week. Do the same for Anna.
- **d.** If Kristin devoted half of her time (10 out of 20 hours) to wristbands and half of her time to potholders, how many of each would she produce in a week? If Anna did the same, how many of each would she produce? How many wristbands and potholders would be produced in total?
- **e.** Suppose that Anna spent all 20 hours of her time on wristbands and Kristin spent 17 hours on potholders and 3 hours on wristbands. How many of each would be produced?
- **f.** Suppose that Kristin and Anna can sell all their wristbands for \$1 each and all their potholders for \$5.50 each. If each of them worked 20 hours per week, how should they split their time between wristbands and potholders? What is their maximum joint revenue.

Do this too! Think about problem **3.f.** using different relative prices, i.e. How should Kristin and Anna optimally allocate their time if the price of potholders was \$4? if it was \$5.50? and if it was \$7? What is their maximum joint revenue in each case?

Do this too! Suppose that the simple society of Greenville can produce rice and beans. Suppose also that the Greenville's production possibilities frontier is given by the equation:

$$\text{PPF}: \quad \text{rice} = 18 - \frac{1}{2}\text{beans}^2$$

- **a.** Placing beans on the horizontal axis and rice on the vertical axis, graph Greenville's PPF.
- **b.** Suppose the relative price of beans is: $2\,\frac{\text{rice}}{\text{beans}}$. Using the Calculus Tricks you learned in the first lecture, find the quantities of rice and beans that Greenville should produce at that relative price.
- **c.** Now suppose the relative price of beans rises to: $4\,\frac{\text{rice}}{\text{beans}}$. Should Greenville produce more or less rice? Should Greenville produce more or less beans? What quantities of rice and beans should Greenville produce at that relative price?
- **d.** At what relative price of beans should Greenville specialize in the production of beans and produce no rice at all?

8. A nation with fixed quantities of resources is able to produce any of the following combinations of bread and ovens:

loaves of bread (millions)	ovens (thousands)
75	0
60	12
45	22
30	30
15	36
0	40

These figures assume that a certain number of previously produced ovens are available in the current period for baking bread.

a. Using the data in the table, graph the ppf (with ovens on the vertical axis).
b. Does the principle of "increasing opportunity cost" hold in this nation? Explain briefly. (*Hint:* What happens to the opportunity cost of bread -- measured in number of ovens -- as bread production increases?)
c. If this country chooses to produce both ovens and bread, what will happen to the ppf over time? Why? Now suppose that a new technology is discovered that allows twice as many loaves to be baked in each existing oven.
d. Illustrate (on your original graph) the effect of this new technology on the production possibilities curve.
e. Suppose that before the new technology is introduced, the nation produces 22 ovens. After the new technology is introduced, the nation produces 30 ovens. What is the effect of the new technology on the production of bread? (Give the number of loaves before and after the change).

Do this too! In the story of Colleen and Bill on p. 28–29 of Case/Fair *Principles…*, there's an **error**. The book says Bill and Colleen produce logs and bushels of food at the following rates:

	Production per day	
	Colleen	Bill
food (bushels)	10	8
fuel (logs)	10	5

The book also says that Bill and Colleen value bushels of food and logs equally, so that the price of one bushel equals the price of one log.

- Despite what is written,
  - Bill gains from trade with Colleen, but
  - Colleen doesn't gain from trade with Bill.
  - However, she doesn't lose by trading with Bill.
- Why doesn't Colleen gain from trade?
- Leaving opportunity costs unchanged, how can the story be rewritten, so that both Bill and Colleen gain from trade?

Hint: How does the assumption that Bill and Colleen value bushels of food and logs equally prevent Colleen from gaining from trade (given the production rates given above)?