

N. Gregory Mankiw – Principles of Economics

Chapter 3. INTERDEPENDENCE AND THE GAINS FROM TRADE

Solutions to Problems and Applications

1. In the text example of the farmer and the rancher, the farmer's opportunity cost of producing one ounce of meat is 4 ounces of potatoes because for every 8 hours of work, he can produce 8 ounces of meat or 32 ounces of potatoes. With limited time at his disposal, producing an ounce of meat means he gives up the opportunity to produce 4 ounces of potatoes. Similarly, the rancher's opportunity cost of producing one ounce of meat is 2 ounces of potatoes because for every 8 hours of work, she can produce 24 ounces of meat or 48 ounces of potatoes. With limited time at her disposal, producing an ounce of meat means she gives up the opportunity to produce 2 ounces of potatoes.
2. a. See Figure 2. If Maria spends all five hours studying economics, she can read 100 pages, so that is the vertical intercept of the production possibilities frontier. If she spends all five hours studying sociology, she can read 250 pages, so that is the horizontal intercept. The time costs are constant, so the production possibilities frontier is a straight line.

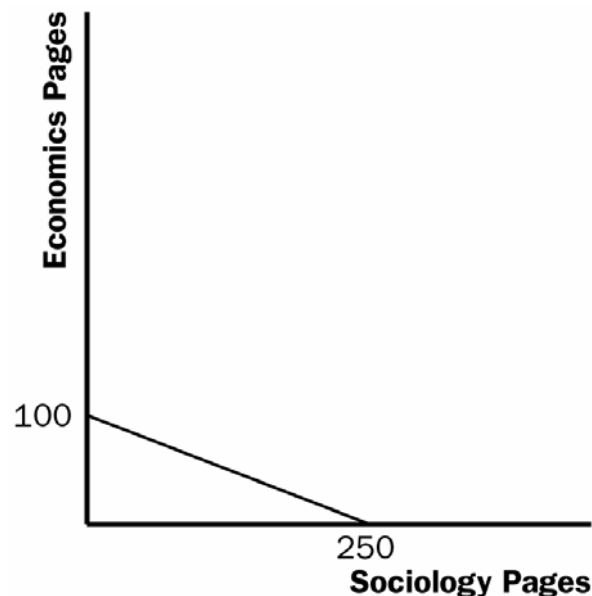


Figure 2

- b. It takes Maria two hours to read 100 pages of sociology. In that time, she could read 40 pages of economics. So the opportunity cost of 100 pages of sociology is 40 pages of economics.

3. a.

	Workers needed to make:	
	One Car	One Ton of Grain
U.S.	1/4	1/10
Japan	1/4	1/5

- b. See Figure 3. With 100 million workers and four cars per worker, if either economy were devoted completely to cars, it could make 400 million cars. Since a U.S. worker can produce 10 tons of grain, if the United States produced only grain it would produce 1,000 million tons. Since a Japanese worker can produce 5 tons of grain, if Japan produced only grain it would produce 500 million tons. These are the intercepts of the production possibilities frontiers shown in the figure. Note that since the tradeoff between cars and grain is constant, the production possibilities frontier is a straight line.

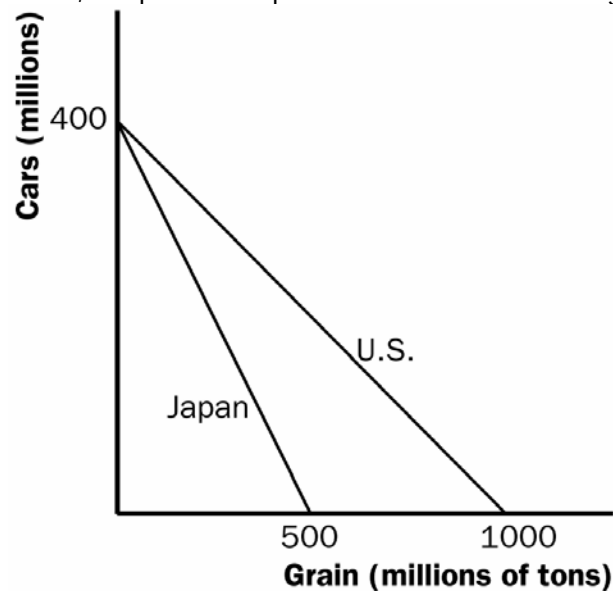


Figure 3

- c. Since a U.S. worker produces either 4 cars or 10 tons of grain, the opportunity cost of 1 car is $2\frac{1}{2}$ tons of grain, which is 10 divided by 4. Since a Japanese worker produces either 4 cars or 5 tons of grain, the opportunity cost of 1 car is $1\frac{1}{4}$ tons of grain, which is 5 divided by 4. Similarly, the U.S. opportunity cost of 1 ton of grain is $\frac{2}{5}$ car (4 divided by 10) and the Japanese opportunity cost of 1 ton of grain is $\frac{4}{5}$ car (4 divided by 5). This gives the following table:

	Opportunity Cost of:	
	1 Car (in terms of tons of grain given up)	1 Ton of Grain (in terms of cars given up)
U.S.	$2\frac{1}{2}$	$\frac{2}{5}$
Japan	$1\frac{1}{4}$	$\frac{4}{5}$

- d. Neither country has an absolute advantage in producing cars, since they're equally productive (the same output per worker); the United States has an absolute advantage in producing grain, since it is more productive (greater output per worker).

- e. Japan has a comparative advantage in producing cars, since it has a lower opportunity cost in terms of grain given up. The United States has a comparative advantage in producing grain, since it has a lower opportunity cost in terms of cars given up.
 - f. With half the workers in each country producing each of the goods, the United States would produce 200 million cars (that is 50 million workers times 4 cars each) and 500 million tons of grain (50 million workers times 10 tons each). Japan would produce 200 million cars (50 million workers times 4 cars each) and 250 million tons of grain (50 million workers times 5 tons each).
 - g. From any situation with no trade, in which each country is producing some cars and some grain, suppose the United States changed 1 worker from producing cars to producing grain. That worker would produce 4 fewer cars and 10 additional tons of grain. Then suppose the United States offers to trade 7 tons of grain to Japan for 4 cars. The United States will do this because it values 4 cars at 10 tons of grain, so it will be better off if the trade goes through. Suppose Japan changes 1 worker from producing grain to producing cars. That worker would produce 4 more cars and 5 fewer tons of grain. Japan will take the trade because it values 4 cars at 5 tons of grain, so it will be better off. With the trade and the change of 1 worker in both the United States and Japan, each country gets the same amount of cars as before and both get additional tons of grain (3 for the United States and 2 for Japan). Thus by trading and changing their production, both countries are better off.
4.
 - a. Pat's opportunity cost of making a pizza is $\frac{1}{2}$ gallon of root beer, since she could brew $\frac{1}{2}$ gallon in the time (2 hours) it takes her to make a pizza. Pat has an absolute advantage in making pizza since she can make one in two hours, while it takes Kris four hours. Kris' opportunity cost of making a pizza is $\frac{2}{3}$ gallons of root beer, since she could brew $\frac{2}{3}$ of a gallon in the time (4 hours) it takes her to make a pizza. Since Pat's opportunity cost of making pizza is less than Kris's, Pat has a comparative advantage in making pizza.
 - b. Since Pat has a comparative advantage in making pizza, she will make pizza and exchange it for root beer that Kris makes.
 - c. The highest price of pizza in terms of root beer that will make both roommates better off is $\frac{2}{3}$ of a gallon of root beer. If the price were higher than that, then Kris would prefer making her own pizza (at an opportunity cost of $\frac{2}{3}$ of a gallon of root beer) rather than trading for pizza that Pat makes. The lowest price of pizza in terms of root beer that will make both roommates better off is $\frac{1}{2}$ gallon of root beer. If the price were lower than that, then Pat would prefer making her own root beer (she can make $\frac{1}{2}$ gallon of root beer instead of making a pizza) rather than trading for root beer that Kris makes.
 5.
 - a. Since a Canadian worker can make either two cars a year or 30 bushels of wheat, the opportunity cost of a car is 15 bushels of wheat. Similarly, the opportunity cost of a bushel of wheat is $\frac{1}{15}$ of a car. The opportunity costs are the reciprocals of each other.
 - b. See Figure 4. If all 10 million workers produce two cars each, they produce a total of 20 million cars, which is the vertical intercept of the production possibilities frontier. If all 10 million workers produce 30 bushels of wheat each, they produce a total of 300 million bushels, which is the horizontal intercept of the production possibilities frontier. Since the tradeoff between cars and wheat is always the same, the production possibilities frontier is a straight line.

If Canada chooses to consume 10 million cars, it will need 5 million workers devoted to car production. That leaves 5 million workers to produce wheat, who will produce a total of 150 million bushels (5 million workers times 30 bushels per worker). This is shown as point A on Figure 4.

- c. If the United States buys 10 million cars from Canada and Canada continues to consume 10 million cars, then Canada will need to produce a total of 20 million cars. So Canada will be producing at the vertical intercept of the production possibilities frontier. But if Canada gets 20 bushels of wheat per car, it will be able to consume 200 million bushels of wheat, along with the 10 million cars. This is shown as point B in the figure. Canada should accept the deal because it gets the same number of cars and 50 million more bushels of wheat.

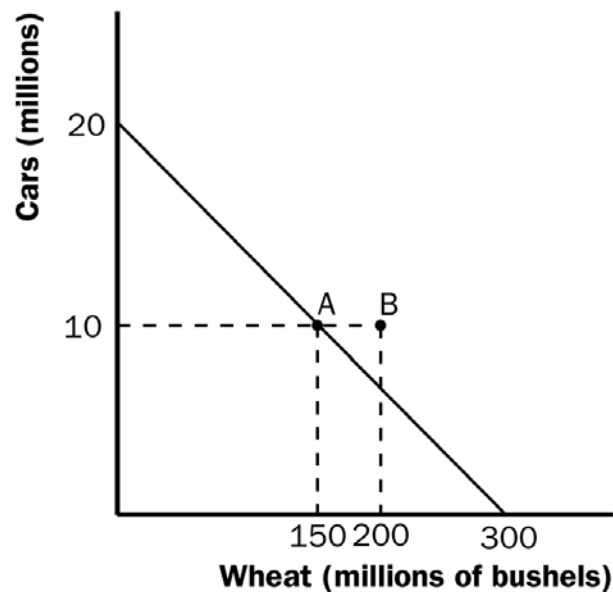


Figure 4

6. Though the professor could do both writing and data collection faster than the student (that is, he has an absolute advantage in both), his time is limited. If the professor's comparative advantage is in writing, it makes sense for him to pay a student to collect the data, since that is the student's comparative advantage.
7. a. English workers have an absolute advantage over Scottish workers in producing scones, since English workers produce more scones per hour (50 vs. 40). Scottish workers have an absolute advantage over English workers in producing sweaters, since Scottish workers produce more sweaters per hour (2 vs. 1). Comparative advantage runs the same way. English workers, who have an opportunity cost of $1/50$ sweater per scone (1 sweater per hour divided by 50 scones per hour), have a comparative advantage in scone production over Scottish workers, who have an opportunity cost of $1/20$ sweater per scone (2 sweaters per hour divided by 40 scones per hour). Scottish workers, who have an opportunity cost of 20 scones per sweater (40 scones per hour divided by 2 sweaters per hour), have a comparative advantage in sweater production over English workers, who have an opportunity cost of 50 scones per sweater (50 scones per hour divided by 1 sweater per hour).

- b. If England and Scotland decide to trade, Scotland will produce sweaters and trade them for scones produced in England. A trade with a price between 20 and 50 scones per sweater will benefit both countries, as they'll be getting the traded good at a lower price than their opportunity cost of producing the good in their own country.
 - c. Even if a Scottish worker produced just one sweater per hour, the countries would still gain from trade, because Scotland would still have a comparative advantage in producing sweaters. Its opportunity cost for sweaters would be higher than before (40 scones per sweater, instead of 20 scones per sweater before). But there are still gains from trade since England has a higher opportunity cost (50 scones per sweater).
8.
 - a. With no trade, one pair of white socks trades for one pair of red socks in Boston, since productivity is the same for the two types of socks. The price in Chicago is 2 pairs of red socks per pair of white socks.
 - b. Boston has an absolute advantage in the production of both types of socks, since a worker in Boston produces more (3 pairs of socks per hour) than a worker in Chicago (2 pairs of red socks per hour or 1 pair of white socks per hour).

 Chicago has a comparative advantage in producing red socks, since the opportunity cost of producing a pair of red socks in Chicago is 1/2 pair of white socks, while the opportunity cost of producing a pair of red socks in Boston is 1 pair of white socks. Boston has a comparative advantage in producing white socks, since the opportunity cost of producing a pair of white socks in Boston is 1 pair of red socks, while the opportunity cost of producing a pair of white socks in Chicago is 2 pairs of red socks.
 - c. If they trade socks, Boston will produce white socks for export, since it has the comparative advantage in white socks, while Chicago produces red socks for export, which is Chicago's comparative advantage.
 - d. Trade can occur at any price between 1 and 2 pairs of red socks per pair of white socks. At a price lower than 1 pair of red socks per pair of white socks, Boston will choose to produce its own red socks (at a cost of 1 pair of red socks per pair of white socks) instead of buying them from Chicago. At a price higher than 2 pairs of red socks per pair of white socks, Chicago will choose to produce its own white socks (at a cost of 2 pairs of red socks per pair of white socks) instead of buying them from Boston.
9.
 - a. The cost of all goods is lower in Germany than in France in the sense that all goods can be produced with fewer worker hours.
 - b. The cost of any good for which France has a comparative advantage is lower in France than in Germany. Though Germany produces all goods with less labor, that labor may be more valuable in the production of some goods and services. So the cost of production, in terms of opportunity cost, will be lower in France for some goods.
 - c. Trade between Germany and France will benefit both countries. For each good in which it has a comparative advantage, each country should produce more goods than it consumes, trading the rest to the other country. Total consumption will be higher in both countries as a result.
10.
 - a. True; two countries can achieve gains from trade even if one of the countries has an absolute advantage in the production of all goods. All that's necessary is that each country have a comparative advantage in some good.

- b. False; it is not true that some people have a comparative advantage in everything they do. In fact, no one can have a comparative advantage in everything. Comparative advantage reflects the opportunity cost of one good or activity in terms of another. If you have a comparative advantage in one thing, you must have a comparative disadvantage in the other thing.
- c. False; it is not true that if a trade is good for one person, it can't be good for the other one. Trades can and do benefit both sides—especially trades based on comparative advantage. If both sides didn't benefit, trades would never occur.