

Economics 102

Spring 2010

Home Assignment #1 (ANSWER KEY)

Due 2/3/10 at lecture

Directions: The homework will be collected in a box **before** the lecture. Please place your name, TA name and section number on top of the homework (legibly). Make sure you write your name as it appears on your ID so that you can receive the correct grade. Please remember the section number for the section **you are registered**, because you will need that number when you submit exams and homework. Late homework will not be accepted so make plans ahead of time. **Please show your work**. Good luck!

Problem 1.

Find the intersection of the two lines, described by the following equations:

$$x + y = 10$$

$$y = 2x - 5$$

Solution.

We solve for y in both equations:

$$y = 10 - x$$

$$y = 2x - 5,$$

then equate the right sides to solve for x:

$$10 - x = 2x - 5$$

$$15 = 3x$$

$$x = 5,$$

which implies $y = 10 - x = 5$.

The answer is (5,5).

Problem 2.

(a) Find the equation of the line which goes through the origin and the point (2,8).

(b) Find the equation of a line that has a y-intercept of -5 and is parallel to the line you found in part (a).

Solution.

(a) The slope of the line is $\frac{\Delta y}{\Delta x} = \frac{8-0}{2-0} = \frac{8}{2} = 4$, hence the equation of the line is $y = 4x + b$. Since it goes through the origin, $b = 0$, so the answer is $y = 4x$.

(b) Parallel lines have the same slope, so the equation we're looking for has the same form of $y = 4x + b$. The y-intercept of -5 means at $x = 0$ $y = -5$, but $y(0) = b$, hence $b = -5$ and the equation is $y = 4x - 5$.

Problem 3.

A farm in Madison produces two goods, milk and corn. The farm's production possibilities frontier can be represented as a linear line where corn is measured on the X axis and milk is measured on the Y axis. The points (2, 10) and (4, 6) are on the farm's linear PPF.

(a) What is the slope-intercept form of the straight line that expresses the farm's PPF?

(b) Assume this farm is producing on its PPF. How many units of milk will the farm produce if it produces 3 units of corn?

(c) Assume this farm is producing on its PPF. How many units of corn will the farm produce if it produces 0 units of milk?

Solution.

(a) (2, 10) and (4, 6) are on the PPF, so the slope of the PPF is $(6-10) / (4-2) = -2$, so the straight line should be $Y = -2X + a$, where a is unknown.

Now we plug in point (4, 6), we can get $6 = -2 * 4 + a$, and solving for a , we find that $a = 14$.

So the Straight line should be $Y = -2X + 14$.

(b) If this farm produces 3 units of corn, then $X = 3$, so $Y = -2 * 3 + 14 = 8$, so the farm would produce 8 units of milk.

(c) If the farm produces 0 units of milk, $Y = 0$, so $0 = -2X + 14$. $X = 7$. 7 units of corn will be produced.

Problem 4.

Two waitresses, Mary and Lucy, can either serve tables or clean windows. Their abilities are illustrated in the following table. Assume both of them can work up to 10 hours a day. If they work less than 10 hours assume the unused time has no value. Assume Mary and Lucy do not trade with each other.

	Tables/hour	Windows/hour
Mary	6	3
Lucy	6	1

(a) Graph separately the PPFs for Mary and Lucy respectively (for one day with 10 hours of work). Measure tables (T) on the X axis and windows (W) on the Y axis. Assume the PPFs are linear between the points listed in the table. Label your PPFs carefully and completely.

Now assume both Mary and Lucy are producing on their PPFs.

(b) What is the opportunity cost of serving one more table for Mary?

(c) What is the opportunity cost of cleaning one more window for Lucy?

(d) Who has the absolute advantage in cleaning windows?

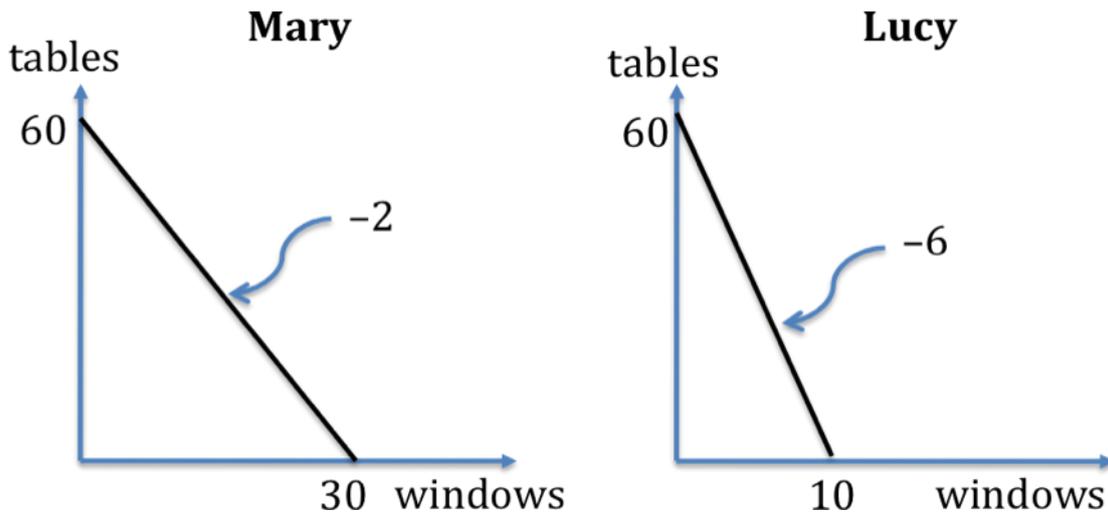
(e) Who has the comparative advantage in cleaning windows? Who has the comparative advantage in serving tables?

Solution.

(a) **Step 1.** By using all the resources available (10 hours), how many goods can each person produce?

Mary		Lucy	
Tables	Windows	Tables	Windows
60	0	60	0
0	30	0	10

Step 2. Graph the PPFs:



- (b) The opportunity cost of serving one more table for Mary is $\frac{1}{2}$ fewer windows cleaned.
 (The slope of Mary's PPF is -2 and that means that a decrease of 1 window will result in an increase of 2 tables. Therefore, to serve one more table, it requires a reduction of her production of $\frac{1}{2}$ window. Thus, the opportunity cost of one more table served for Mary is $\frac{1}{2}$ window not being cleaned.)
- (c) The opportunity cost of one more window cleaned for Lucy is 6 fewer tables served.
 (The slope of Lucy's PPF is -6 and that means that an increase of 1 window cleaned is only possible if Lucy serves 6 fewer tables. Therefore, the opportunity cost of one more window cleaned for Lucy is 6 fewer tables served.)
- (d) Mary has the absolute advantage in cleaning windows.
 (Mary can do 30 windows per hour, while Lucy can only clean 10 windows in an hour.)
- (e) Mary has the comparative advantage in cleaning windows.
 (Comparative advantage is determined by the comparison of opportunity costs. The opportunity cost of producing one more cleaned window is 2 fewer tables served for Mary, while it is 6 fewer tables served for Lucy. Thus, the opportunity cost for Mary to produce one additional clean window is cheaper since we only lose the production of 2 tables by asking Mary to produce one more clean window. On the other hand, if we ask Lucy to produce one more clean window, we will lose her serving of 6 tables. As a consequence, Mary has the comparative advantage in producing clean windows.)

Lucy has the comparative advantage in serving tables.

Using the similar argument as in the first part of (e), we know that the O.C. of one table is $\frac{1}{2}$ clean window for Mary, but it's only $\frac{1}{6}$ clean window for Lucy. Thus Lucy has the comparative advantage in serving tables.

Problem 5.

In one day in the US, it takes 40 workers to produce a car and 15 workers to produce a computer. In one day in Japan, it takes 20 workers to produce a car and 10 workers to produce a computer. Both countries have 60 workers available each day. Assume that both PPFs are linear with respect to these two goods.

- (a) Draw the PPF of each country (for one day's worth of production). Measure computers on the Y axis and cars on the X axis. Label your PPFs carefully and completely.
- (b) Which country has an absolute advantage in car production? Which country has an absolute advantage in producing computers?
- (c) What is the opportunity cost of producing a car in the US? What is the opportunity cost of producing a computer in the US?
- (d) What is the opportunity cost of producing a car in Japan? What is the opportunity cost of producing a computer in Japan?
- (e) Which country has a comparative advantage in car production? Which country has a comparative advantage in producing computers?
- (f) Suppose the countries trade with each other. What is the range of possible car prices (in terms of computers)?

Solution.

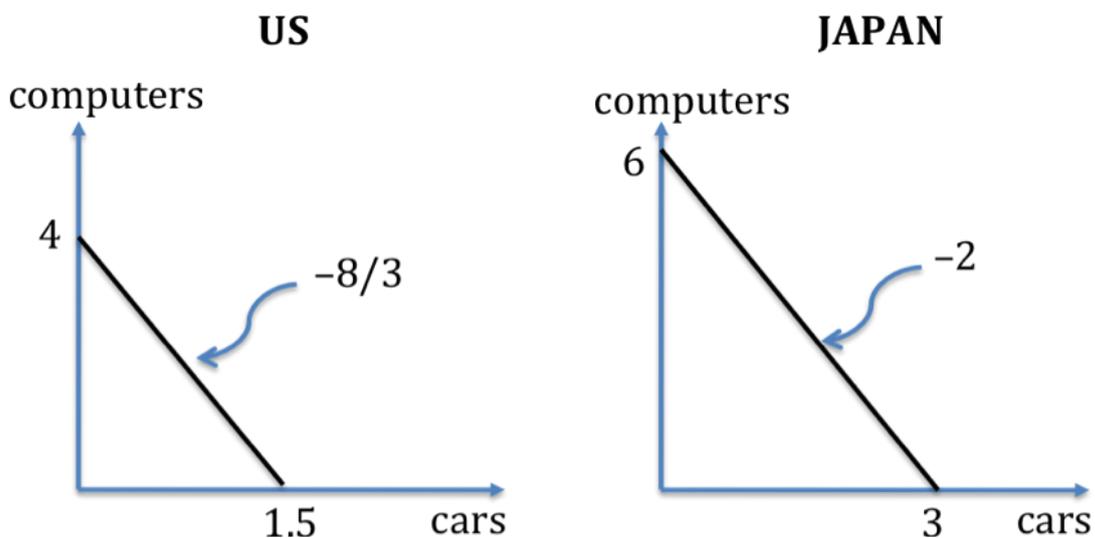
(a) In the US, 1 worker can produce either $\frac{1}{40}$ of a car or $\frac{1}{15}$ of a computer.

US has 60 workers so it can produce: $\frac{60}{40} = 1.5$ cars and 0 computers or $\frac{60}{15} = 4$ computers and 0 cars or some combination that lies on the line between these two possibilities.

In Japan, 1 worker can produce either $\frac{1}{20}$ of a car or $\frac{1}{10}$ of a computer.

Japan has 60 workers so it can produce: $\frac{60}{20} = 3$ cars and 0 computers or $\frac{60}{10} = 6$ computers and 0 cars or some combination that lies on the line between these two possibilities.

Use this information to draw the PPFs.



(b) Japan can produce up to 3 cars per day while the US can only produce a maximum of 1.5. Therefore Japan has the absolute advantage in car production.

Japan can produce up to 6 computers per day while US can only produce a maximum of 4. Therefore Japan has the absolute advantage in computer production.

(c) Recall: the opportunity cost of the good on the horizontal axis is = $-(\text{slope of PPF})$.

The slope is of the PPF in the US is: $\frac{\Delta \text{computers}}{\Delta \text{cars}} = \frac{-4}{3/2} = \frac{-4 \times 2}{3} = \frac{-8}{3}$.

So the opportunity cost of producing a car in US is: $\frac{8}{3}$ computers.

Recall: the opp. cost of the good on the vertical axis is the reciprocal of the opp. cost of other good.

The opp. cost of a car in US was $\frac{8}{3}$ computers, so the opp. cost of a computer is: $\frac{3}{8}$ cars.

(d) The slope is of the PPF in Japan is: $\frac{\Delta \text{computers}}{\Delta \text{cars}} = \frac{-6}{3} = -2$.

So the opportunity cost of producing a car in Japan is: 2 computers.

Recall: the opp. cost of the good on the vertical axis is the reciprocal of the opp. cost of other good.

The opp. cost of a car in Japan was 2 computers so the opp. cost of a computer is: $\frac{1}{2}$ cars.

(e) In US it costs $\frac{8}{3}$ computers to produce a car.

In Japan it costs 2 computers to produce a car.

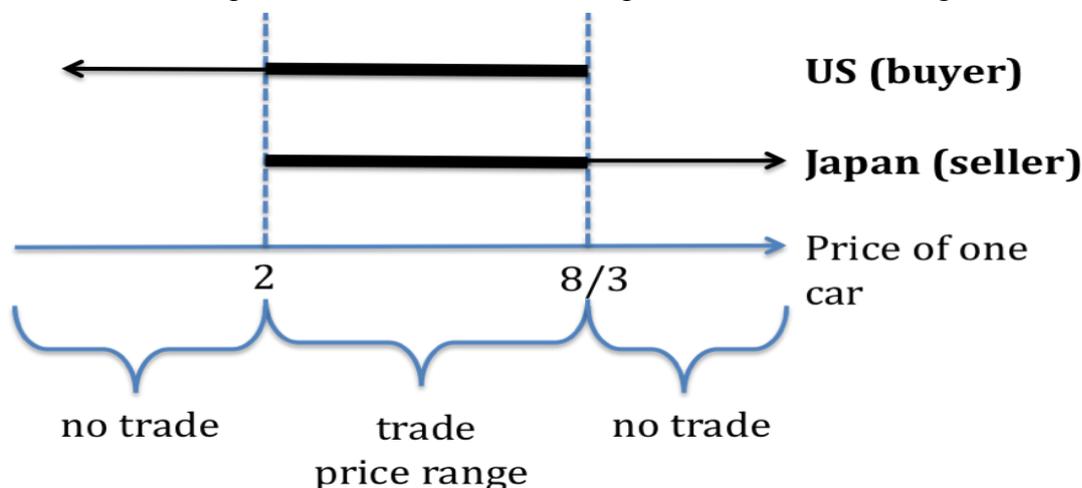
Therefore Japan has the comparative advantage in producing cars.

If Japan has the comparative advantage in producing cars then US must have the comparative advantage in producing computers.

(f) Note: each country will produce the good for which it has the comparative advantage. Japan will specialize in the production of cars since that is its comparative advantage. It costs Japan 2 computers to produce a car so it won't trade for anything less than 2 computers.

US could produce its own cars at a cost of $\frac{8}{3}$ computers so it won't pay any more than that.

Therefore the price won't be less than 2 computers and it won't be higher than $\frac{8}{3}$ computers.



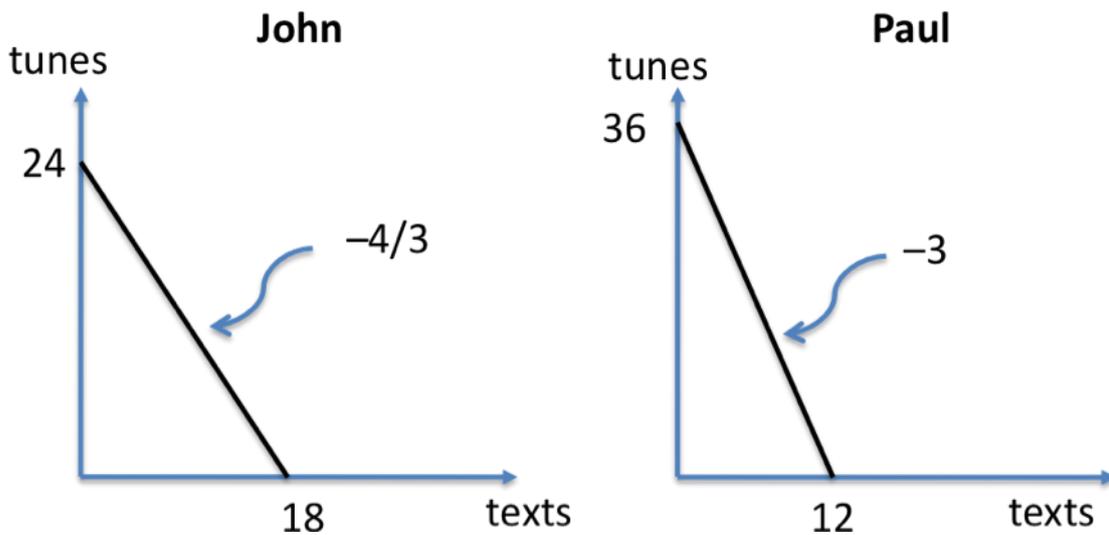
Problem 6.

John Lennon and Paul McCartney both write songs. Each spends 72 hours a week on this business. It takes John 4 hours to write a text or 3 hours to compose a tune, whereas Paul needs 6 hours to write a text or 2 hours for a tune.

- (a) Find the equations of the PPFs of both songwriters and depict them with tunes on the y-axis and texts on the x-axis.
- (b) What is the opportunity cost of writing a text for John (in terms of tunes)? What is the opportunity cost of writing a text for Paul?
- (c) Who has an absolute advantage in writing texts? Who has an absolute advantage in composing tunes?
- (d) Would John and Paul benefit from specialization? Explain your answer fully.
- (e) If Mick Jagger needs 12 hours to write a text and 4 hours to compose a tune, will he benefit from cooperation with Paul? Explain your answer fully.

Solution.

(a) The time it takes John to produce x texts is $4x$ and to produce y tunes is $3y$. Given that all in all he spends 72 hours, the equation of his PPF is $4x + 3y = 72$. In the same way, Paul's PPF is $6x + 2y = 72$.



- (b) It takes John 4 hours to write a text, at the same time he could compose $4/3$ tunes. Paul could have composed 3 tunes at the same time it takes him to write a text.
- (c) It takes John less time to write a text, and Paul less time to compose a tune, hence John has an absolute advantage in text writing, and Paul has an absolute advantage in composing tunes.
- (d) If John writes texts and Paul composes tunes, together they would be able to produce more songs as compared to the number of songs they could produce working separately.
- (e) Mick has the same opportunity costs of writing a text as Paul ($12/4 = 3$). Hence cooperation with Paul would not be beneficial, as they would not be able to increase their total output.