# "Ricardian Model: I and II"

(1 Factor, 2 Goods, constant unit labor requirements)

FREE-TRADE EQUILIBRIUM

Pretrade equilibrium at home is shown by point A in the upper diagram, (a); abroad it is shown by A* in the lower diagram (b). Equilibrium terms of trade are illustrated by the slope of the dashed line for each country. The home country produces at E and consumes at B; the foreign country produces at E* and consumes at B*. Each country gains from trade.
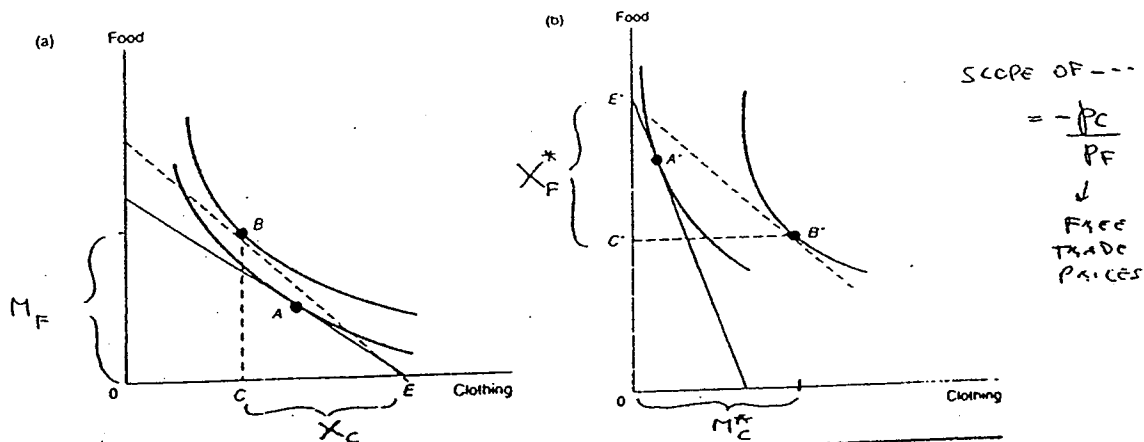
Notice that:

(1) $X_F^* = M_F$ (Exports of Food by Foreign = Imports of Food by Home)

(2) $X_C = M_C^*$ (Exports of Clothing by Home = Imports of Clothing by Foreign)

and since the consumption points in each country are on the free trade price line that also includes their production point we have:

For Home:

$$P_C \cdot q_C + P_F \cdot q_F = P_C \cdot D_C + P_F \cdot D_F$$

or

$$P_C \cdot (q_C - D_C) = P_F (D_F - q_F)$$

or

$$\boxed{P_C \cdot X_C = P_F \cdot M_F}$$ Balanced Trade: Value of X = Value of M

For Foreign:

$$P_C \cdot q_C^* + P_F \cdot q_F^* = P_C \cdot D_C^* + P_F \cdot D_F^*$$

or

$$P_F \cdot (q_F^* - D_F^*) = P_C \cdot (D_C^* - q_C^*)$$

or

$$\boxed{P_F \cdot X_F^* = P_C \cdot M_C^*}$$ Balanced Trade

Here p_F / p_C are the free trade prices.

19

(1 Factor, 2 Goods, constant unit labor requirements)

Comparative Advantage

- start with an example from scratch and lets walk our way through it trying to pick up stuff at every step

- Suppose our information looks like the following

	Argentina (*)	Ecuador
Wheat (hours of labor per unit)	2	5
Tile (hours of labor per unit)	5	4

The total labor endowment in each country is 20 hours.

- The first thing we want to do is to draw the production possibilities frontiers for each country

- the easiest way to do that is by taking the equation for a linear PPF from both countries it has the form:

(Ecuador)		(Argentina)
$a_{LT} \cdot Q_T + a_{LW} \cdot Q_W = L$	and	$a^*_{LT} \cdot Q^*_T + a^*_{LW} \cdot Q^*_W = L^*$

- if we just rearrange these equations, into slope intercept form we get the following equation for Ecuador (put Tile on the Y-axis)

Step 1: Write down the equation for the PPF in slope-intercept form (for both countries)
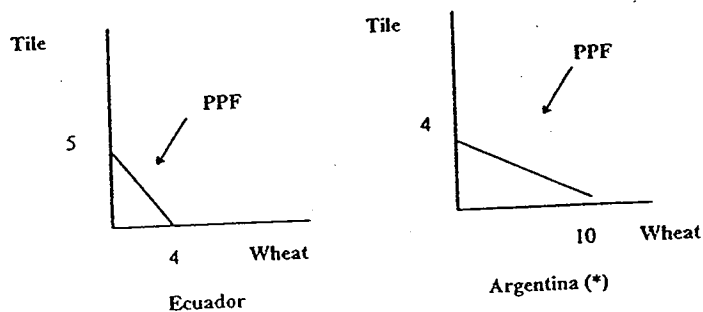
$$Q_T = - (a_{LW} / a_{LT}) Q_W + L / a_{LT} \qquad \text{and} \qquad Q^*_T = - (a^*_{LW} / a^*_{LT}) Q^*_W + L^* / a^*_{LT}$$

- so the slope of the PPF is just given by $- (a_{LW} / a_{LT})$ or $- (a^*_{LW} / a^*_{LT})$
- if we plus the values into this equation we get

$$Q_T = - (5/4) Q_V + 20/4 \qquad \text{and} \qquad Q^*_T = - (2/5) Q_V + 20/5$$

Ecuador		Argentina
$Q_{LT} = - 5/4 \, Q_V + 5$	and	$Q^*_{LT} = - (2/5) Q_V + 4$

**Step 2:** Graph The PPFs

Ecuador

Argentina (*)

Step 3: Opportunity Costs

- what is the slope of the PPF? What does it represent?
- so the slope of the PPF is just given by $- (a_{LW} / a_{LT}) = -5/4$ or $- (a^*_{LW} / a^*_{LT}) = -2/5$

- What is the opportunity cost of wheat?

Step 4: Determine comparative advantage
- specifically, since we have the opportunity costs, we can determine which country has the comparative advantage in Wheat (Argentina)

20

Tile ? (Ecuador)

Step 5: Community Indifference Curves
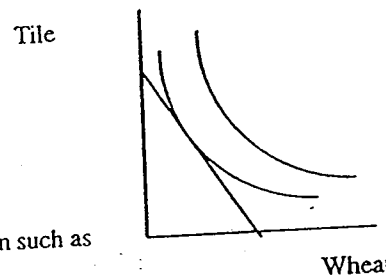
- How do we find the point of maximum utility in a problem such as this? (find the tangency to a budget line)

- We're going to do the same thing in the context of international trade. Except, instead of making the community indifference curve tangent to a budget line, first we put the community indifference curves together with the PPF.

Step 5: Autarky relative price ratio and Equilibrium
- we know that in autarky if (say) Ecuador is consuming both Tile and Wheat that the relative price line (the GNP line) that it is facing is the same line as the PPF
- that is to say that the GNP line of the PPF is also $-P_w / P_T$.
- So in Ecuador, $-P_w / P_T = -5/4$
- So in Argentina, $-P^*_w / P^*_T = -2/5$

Step 6: Introduce Free Trade: Determine production points &CPF
- given a new world price ratio such as $P_w / P_T = 1$, which country will produce each good?

- Since Argentina has a comparative advantage in Wheat they will produce only Wheat
- Since Ecuador has a comparative advantage in Tile they will produce only Tile
- They will trade to a point on the world price ratio (the Consumption Possibilities Frontier)

Ecuador

Argentina (*)
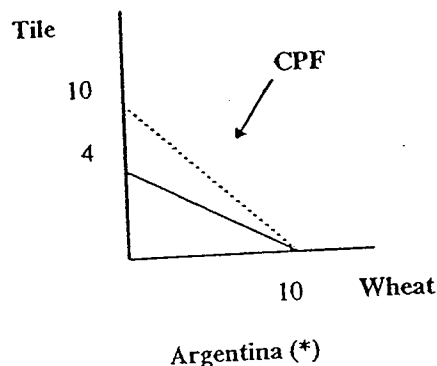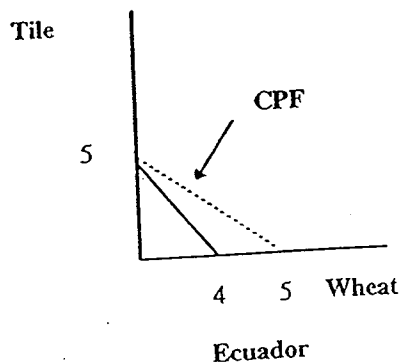
- What is the CPF? What does it represent?

- What is the CPF when we have **autarky**? (CPF=PPF)
- What is the CPF when we have free trade?

<u>Step 8:</u> **Determine export flows and welfare changes**
- if Ecuador wants to consume both goods, it must trade some (exports) Tile for (imports) Wheat
- if Argentina wants to consume both goods, it must trade some (exports) Wheat for (imports) Tile

- Are the countries better off? Since they can be on a higher indifference curve (more stuff) we say yes

<u>Real Wages:</u>
- there are four real wages in each state of the world (autarky and free trade) that we need to worry about
- Remember the profit maximization rule $MPL \cdot P = w$, so $w/p = MPL$

<p align="center">Autarky</p>

<u>Ecuador</u>

$W/P_W = MPL_W = 1/5$

$W/P_T = MPL_T = 1/4$

<u>Argentina</u>

$W^*/P^*_W = MPL^*_W = 1/2$

$W^*/P^*_T = MPL^*_T = 1/5$

- Remember the profit maximization rule $MPL \cdot P = w$, so $w/p = MPL$ but this is only for the sector that actually produces in free trade (Ecuador: Tile, Argentina: Wheat)

<p align="center">Free Trade</p>

<u>Ecuador</u>

$W/P_W = \cancel{MPL_W} = W/P_W (P_T/P_T)$
$= W/P_T (P_T/P_W) = (1/4)(1) = 1/4$

$W/P_T = MPL_T = 1/4$

<u>Argentina</u>

$W^*/P_W = MPL^*_W = 1/2$

$W^*/P_T = \cancel{MPL^*_T} = W^*/P_T (P_W/P_W) = W^*/P_W (P_W/P_W)$
$= (1/2)(1) = 1/2$

Remark:

$W/P_W = \cancel{MPL_W}$ means that because wheat is not produced in Ecuador under free trade , the real wage in terms of wheat in Ecuador (i.e. W/P_W) is not equal to the Marginal Productivity of labor in the Wheat sector (i.e., MPL_W).

$W^*/P_T = \cancel{MPL^*_T}$ means that because tiles are not produced in Argentina under free trade , the real wage in terms of tile in Argentina (i.e. W^*/P_T) is not equal to the Marginal Productivity of labor in the Tile sector (i.e., MPL^*_T).

MARK'S RECIPE FOR RICARDO

1ˢᵗ INFO: unit labor coefficients for home and foreign country (a_x, a_y, a^*_x, a^*_y)
labor supply (L, L^*)

1) Using this info you can calculate the full-employment conditions for each country. These are the equations that say that labor supply=labor demand. Labor supply is L, and total labor demand is how much labor is used in each sector. This equation looks like: $L = a_x*X + a_y*Y$

2) From this equation we can draw the PPF. The Y-intercept will be L/a_y and the X-intercept will be L/a_x. The slope will be $-a_x/a_y$, which will determine comparative advantage (CA). How?

   a) a_x/a_y is the opportunity cost of producing good X (it equals the number of units of good Y you give up to produce a unit of X).
   b) a_x/a_y is also equal to p_x/p_y (recall that $p_x=AC=wa_x$ when a good is produced in equilibrium). So CA in a good gives that country the lowest relative price of that good in autarky.

3) Comparative advantage determines the pattern of trade. In free trade, countries will export the good in which they have a CA, and import the other one. What price ratio will they trade? Some price that is between the autarky relative prices, determined by the total world demand and total world supply of each good. Since we can't know what that price is exactly without looking at preferences (which is complicated!) we in Econ 364 usually assume it is some nice number that lets us solve the problem easily.

2ⁿᵈ INFO: Free Trade Price $(p_x/p_y)^{FT}$

4) Suppose we want to calculate by how much a country gains from trade? Then we need to know how its real wages change. In autarky, we know that real wages, (W/P, or the amount of real "stuff" we can buy, in terms of either good X or good Y) are determined by productivity. In particular, *whenever a good is produced, W/P=MPL*, so:

$$\left. \begin{array}{l} \dfrac{w}{p_x} = MPL_x \\[2mm] \dfrac{w}{p_y} = MPL_y \end{array} \right\} \text{ because both goods are produced in autarky}$$

Notice that here all prices are the autarky prices.

23

However, in free trade, the import good is no longer produced. So we can't use this condition. We need a new condition for the real wage in terms of the import good. But we can use the real wage for the export good and the free trade price equation and cross-multiply (assume we export X and import Y):

$$\frac{w}{p_x} = MPL_x \quad \} \text{ because X is still produced under free trade}$$

(Notice that here all the prices are the Free Trade prices, although they are not explicitl written as FT prices everywhere.)

$$\frac{w}{p_y} = \frac{w}{p_x}\left(\frac{p_x}{p_y}\right)^{FT} \quad \} \text{ because Y is NOT produced in this country}$$

the first equation is the usual condition that says workers can buy back exactly what they produced. What does this second equation say? That the amount workers can buy of good Y is equal to the amount of good X they get as income (w/p_x) times the amount that they can get for good X in terms of good Y on the world market, $(p_x/p_y)^{FT}$.

5) Finally, suppose we want to show that, through the mysterious workings of comparative advantage, countries that trade will always produce one good more cheaply than the other (that is, even if your technology totally sucks, there will always be something that you can produce more cheaply than everyone else—pretty cool huh?). Anyway, we know that $AC=wa$, and we know all the a's, so all we will need to know is what w is in each country.

Unfortunately, w is a nominal value, and we have no scale on which to judge nominal values. All prices are ratios—rates at which goods trade, just as if we had a barter system with no money—so there is no such thing as an independent price. But if we set one price (the *numeraire*), we can figure out all the others through the ratios. So we need some new info:

3rd INFO: Numeraire: $p_x=1$

This means that $w/p_x=w/1=w$.
But we know w/p_x from the step above. So the nominal wage w is equal to whatever we found that w/p_x was equal to before. Now we can plug this wage in for <u>both</u> sectors, to find average cost. When a country produces a good, since we know that $w=pMPL$, will see that

$$AC=wa =p(MPL)a = p(1/a)a = p.$$

That is, *price equals average cost*. When a country does not produce a good, we will see that it is because $AC>p$, so the country can import the good more cheaply than it can produce it itself.

24