Topic 3: the Ricardian (Classical) trade model

Ricardian model: introduction

This will be our first theoretical model that explains our basic questions:

What do countries trade? (comparative advantage)

What are the gains from trade (GFT)?

Do both (all) countries GFT?

Before starting the model, let's consider three (false) common propositions you may hear about international trade. The first two:

(1) "Wealthy, high-wage countries cannot afford to trade with low-wage developing countries because their low wage costs would allow them to produce most goods more cheaply and drive firms in richer countries out of business." We need protection from low-wage imports to avoid seeing our wages brought down to their level.

(2) "Low-wage developing countries cannot afford to trade with high-wage countries because labor in those countries is so much more productive because of skills, capital, and technological superiority that they would produce most goods more cheaply and drive LDC firms out of business."

Ricardian model: introduction

Which is it? They can't both be true, even though both are commonly heard in the media and policy circles.

The fallacy with both is that they look at only one component of production costs: wages on the one hand and productivity on the other. But productivity and wages (also exchange rates, capital costs, and many other factors) combine to determine unit costs.

The US can trade with Mexico or Vietnam to our mutual advantage, because we're much better at producing some goods (better enough to pay for the high wages) and only a little better at others, so low wages matter there.

Another fallacy is to believe that wages, productivity, exchange rates, etc. won't adjust as the economy changes. But trade with poor countries could very well raise their wages, as is happening in China and Mexico.

Ricardian model: introduction

The classical theory of CA is well suited to showing the simple proposition that wealthy and poor countries can trade with each other to their mutual advantage. So can rich countries among themselves and poor countries among themselves. All that's required is some *efficiency differences (cost differences) between them that allows them to specialize in production.*

It's no different from the idea that a lawyer and a plumber can profitably specialize and trade. The lawyer may be better at both the law and fixing sinks but she's probably much better at the law and a little better at sinks. It follows that if she specializes in the law, and leaves the plumber to deal with the sinks, both can have higher incomes.

This is the essence of comparative advantage and trade for countries.

Ricardian model: introduction

Now the third false proposition: **Mercantilism, or the idea that exports are "good" and imports are "bad".**

(3) 18th & 19th-century "Mercantilism" argued that power and wealth are associated with domestic production and exports. Trade is welfare-increasing only if you export (i.e., produce) and welfare-decreasing if you import (production is elsewhere). The policy Idea was to maximize the trade surplus through restrictive import barriers (e.g., English Corn Laws of 18th and 19th centuries).

Why? A trade surplus gives a claim on foreign assets (gold then, physical or financial assets now), so it was seen as a means of *appropriating wealth from abroad in a zero-sum way*.

Mercantilism was (and is again) the belief that trade among countries could not be beneficial for all but was instead a competition to accumulate the world's wealth by increasing exports and decreasing imports.

Ricardian model: introduction

But consider this idea carefully. We don't usually think of production as a goal, but as a means to increasing national utility or well-being. And *utility is a function of how much people can consume*, or what is in their consumption baskets and in how much variety.

That is, economists see consumption as the true objective, not exports. This implies imports are a "good" thing (we consume them, we don't produce them).   Exports are a means of generating income for consumption. Taken to the extreme, we could argue that you'd like to maximize the trade deficit because you get to consume a lot of imports and sacrifice few exports. (In an important way the US is in a unique position to do this: we get cars and food and clothing from imports in exchange for financial claims on dollars as the reserve currency. Seems a pretty good way to have a party.)

Yet there is no question that the idea that exports are good and imports are bad remains popular and drives trade policy in some countries, including the current US administration. Note that if all countries are mercantilist there would be high barriers to trade, harming them all. Getting countries not to do this is mainly why there is a WTO.

To economists, mercantilism is a flawed idea, as are (1) and (2). The first economist to examine these problems clearly was David Ricardo (early 1800s England). He pointed out that all countries can specialize and trade beneficially and the trade balance will take care of itself.

Ricardian model: introduction

The basic notion is comparative advantage: the fact that one country may be more productive at producing most or even all goods compared to another is not important for trade; what matters is the *relative cost advantages* or disadvantages.

If the US produces all goods more efficiently than Mexico they can still trade with each other so long as the US has *greater advantages in some goods than others*, as it always will. For then there are lesser disadvantages for Mexico in other goods and both countries will be better off if they specialize and trade.

You may still be skeptical. This theory will convince you otherwise.

Ricardian model: assumptions

Assumptions of the model:

- Perfect competition;
- 2 goods and 1 factor (labor);
- Labor is mobile between sectors within a country => a single wage w;
- Full employment of the fixed labor force.
- Simple production technologies: $X = L_x/a$ and $Y = L_y/b$ where a and b are laborers per unit of output (or, as in the text, hours of work per unit of output).
  - Note that 1/a and 1/b then give outputs per labor unit.   They are both the constant average products of labor and the constant marginal products of labor. Also note that there is CRS in both goods.
  - And important: all laborers are identical, meaning if you shifted 1 from X to Y she would immediately be as productive as anyone already working in Y. This means there can be only 1 wage in the economy, paid to all workers.
- Consumer utility and welfare is represented by indifference curves.

These labor productivities 1/a and 1/b vary between countries. *This is the only meaningful difference between countries and it drives trade.*

Ricardian model: example 1

Here is an example, with these numbers being the labor-per-output ratios:

	US	Mexico
Chemicals (C)	1	10
Radios (R)	3	5

 The US has an *absolute advantage* in both C and R (more productive in both).

Now in US (perfect competition): $p_C = w_{US} * 1$ $p_R = w_{US} * 3$ then $p^{US} = (^{p_C}/_{p_R}) = 1/3.$

Important point: WAGES DO NOT MATTER FOR RELATIVE COSTS OR RELATIVE PRICES.

We can state this as 1C = 1/3 R   and   1R = 3C   These are the opportunity costs of C, R.

For Mexico, $p^M = (^{p_C}/_{p_R}) = 10/5 = 2.$ 1C = 2R   and   1R = 1/2 C

So C is relatively cheap in the US and R is cheap in Mexico. We can immediately state about CA:

$\frac{1}{3} \leq p^* = \left(^{p_C^*}/_{p_R^*}\right) \leq 2$ is the range of free-trade prices where there would be 2-way trade. Why? See below.

Example 1

Let's look at this graphically with PPFs. Let labor endowments be L^{US} = 600 and L^M = 2000.

Then for US max C = 600, max R = 200. For M max C = 200, max R = 400. Also the relative autarky prices are fixed: $p^{US} = \left({}^{p_C}/p_R\right) = 1/3$ and $p^M = \left({}^{p_C}/p_R\right) = 2$.
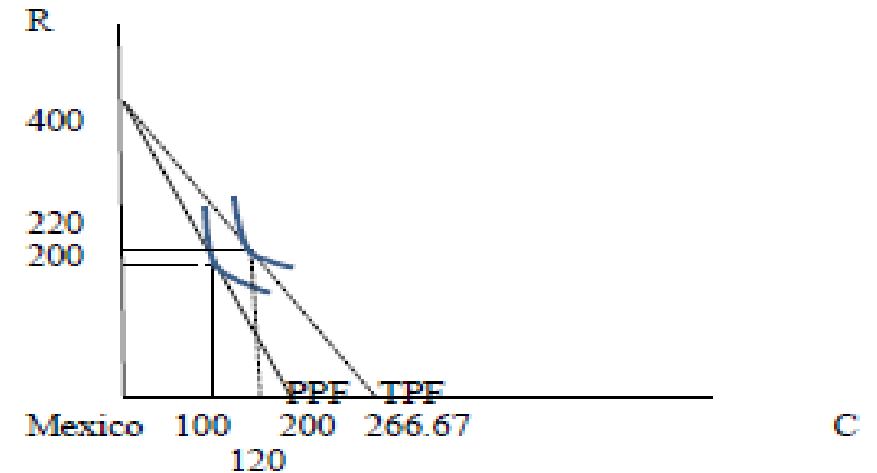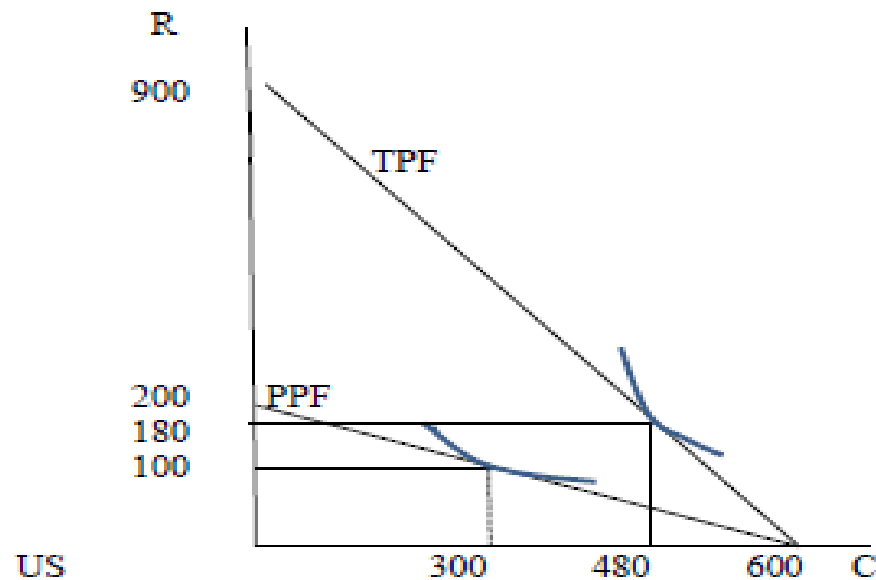
Example 1

Note that these PPFs feature *constant opportunity costs* in production: because of the unchanging marginal productivities of labor the PPFs are just straight lines. (Example: to get one more C in the US always costs 1/3 R, no matter where the economy is on the PPF.)

Now let's think about an equilibrium and economic welfare in autarky. We can draw in CICs for both countries; note they could be tangent to PPFs at any points, depending on preferences. Let's just suppose that CICs split labor force in half in both US and M.

		Outputs	Consumption	Trade
Autarky	US	300C, 100R	300C, 100R	NA
	Mexico	100C, 200R	100C, 200R	NA

Now let them trade and suppose the world price settles at p* = 1.5 (1C = 1.5R in trade; this implies 1R = 1/1.5 C or 1R = 2/3 C).

Then the US gets 1.5R in imports for each 1C in exports, better than in autarky (where 1C was worth 1/3 R).

And Mexico can export 1R and get back 1/1.5C = 2/3 C, better than in of autarky (where 1R was worth ½ C).

Example 1

BOTH COUNTRIES WOULD GAIN FROM TRADE.

That is, US gains because 1C buys 1.5R (> 1/3 R in autarky).

Mexico gains because 1C costs 1.5R (< 2R in autarky). Or we can state that 1R buys 2/3 C (> ½ R in autarky).

Next translate this outcome into trade possibility frontiers, or TPFs. Note that *each country would choose to specialize completely*. This is because as you produce more of either good the productivity figures never change. So it makes sense to take full advantage of your productivity advantage by completely specializing.

Suppose in free trade that US exports 120C for 180R (which is consistent with p* = 1.5). What do our figures look like now?

	Outputs	Consumption	Trade	GFT
US	600C, 0R	480C, 180R	120C for 180R	+180C, +80R
Mexico	0C, 400R	120C, 220R	180R for 120C	+20C, +20R
World	600C, 400R	600C, 400R	as noted	+200C, +100R

Trade possibility frontiers (TPFs) are the national budget constraints in free trade. They start at complete specialization (US in C, Mexico in R) and extend to the max of the other good if you export all of your production.
So US *could* (it won't in equilibrium) export 600 C and get back 900 R at p* = 1.5; and Mexico *could* export 400 R and get back 400/1.5 = 266.67 C in imports. Equilibrium will depend on how much the countries want or demand of these goods (preferences).

Note the "trade triangles": US exports 120 C and imports 180 R; M exports 180 R and imports 120 C.
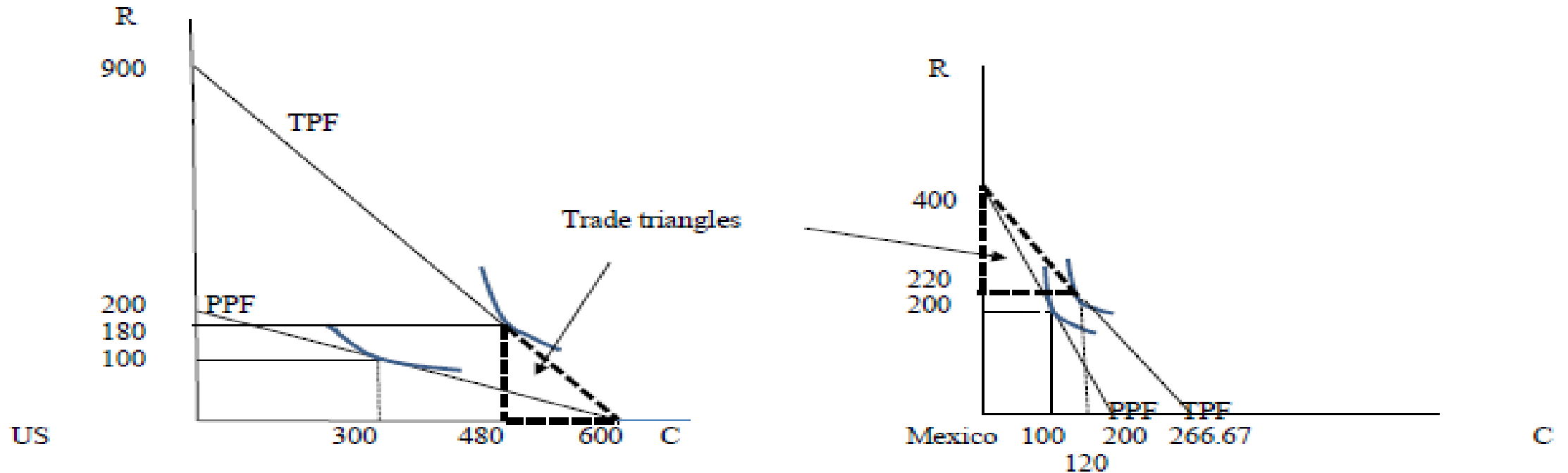
Example 1: notes on the equilibrium

Important points:

◦ Both US and M gain from trade, whether you look at higher CICs or the higher consumption bundles.

◦ Trade is balanced. This means 2 things:

◦ 1. Physical terms: US exports of C = Mexico imports of C; Mexico exports of R = US imports of R.

◦ 2. Value terms (trade is balanced in dollar or peso terms).

For US: $\frac{p_C^*}{p_R^*} = \frac{IM_R}{EX_C} => p_C^* EX_C = p_R^* IM_R$ Example: (in dollars: let p_C^* = \$200 and p_R^* = \$133.3.
Then the value of exports = \$200x120C =\$24,000 and the value of imports = \$133.33x180R = \$24,000). You show that Mexico also has balanced trade in dollars at these prices.

Example 1: Gains from Trade

Note something here: without any change in labor supplies, there is more consumption and production in the world. How? Think of the GFT.

Where do these gains from trade come from? There are really 2 sources.

- *Specialization of labor in each country into its most productive use* ("gain from specialization"). This is like a technological improvement.
- *Consumers and producers in both countries get to exchange goods at better price ratios* ("gain from exchange"). Exporters receive higher prices and consumers face lower import prices.

This isn't magic. It's the result of specialization according to comparative advantage.

This is one of the most important global processes of all. Don't forget it.

Distribution of the GFT

Internal (within countries): all workers within a country gain the same amount because they are all identical and have the same wage.

That is, in US each worker (person) gets 1/600 of the higher consumption basket; in Mexico each gets 1/2000). *Because workers in each country are identical in productivity and income changes, all share equally in the gains from trade.*

External (between countries): the amount by which each country gains depends on the change in the terms of trade (how much the relative price in free trade differs from the relative price in autarky).

General definition: A country's **terms of trade** is the ratio of its export-good price to its import-good price: $T \ of \ T = \frac{p_{EX}}{p_{IM}}$.   VERY IMPORTANT CONCEPT.

(More general concept: the T of T is an index of export prices divided by an index of import prices.)

Distribution of the GFT

In our example, for the US, T of T $= \frac{p_C}{p_R}$. This price ratio went from 1/3 in autarky to 1.5 in free trade (a relative price increase of +350%). GREAT NEWS!!!!!

For M, T of T $= \frac{p_R}{p_C}$. This price ratio went from ½ in autarky to 0.667 in free trade (+33%). GOOD NEWS BUT NOT AS GREAT AS THE US BENEFIT.

Clearly, in free trade the US would like the highest possible price for C and M the lowest possible price for C. US would prefer the lowest possible price for R and M would prefer the highest possible price for R.

So the ***between-country distribution of GFT depends on world demand for and supply of C and R***. In our example, the demand for C is quite high in equilibrium so $\frac{p_C}{p_R^*}$ is near the high endpoint of its possible range.

This means that the US gets the larger share of the GFT though both countries are better off in trade than in autarky.

Distribution of the GFT

Important implications:
- *Free trade raises both countries well-being compared to no trade (fundamental concept).*
- *Once countries are in free trade, a worsening of a country's T of T makes it worse off (but still better than autarky) but a rise in its T of T makes it better off.*

Obvious examples: (1) oil-exporting countries want the highest possible international prices for oil but Japan and Korea (major importers) are better off with low oil prices. (2) Commodity exporters like Australia, Canada, and Brazil benefit when world agricultural prices go up.

What could change a nation's T of T? Many things, here are examples.
- A rise in the country's labor force would expand exports and reduce its T of T by driving down the world price of its exports. Then each person in that country is worse off on a "per capita" basis.
- A decline (rise) in world demand for a country's export good worsens (improves) its T of T.
- A technological improvement in producing the export good has 2 effects:
  - A rise in the productivity of labor, which should raise the wage (+)
  - A fall in the T of T, which should reduce income (-)
  - Not clear which will dominate in this case; depends on the circumstances.

Distribution of the GFT

Special case: consider a small economy (Costa Rica) trading with a large economy (US) and let them trade hats (H) and cars (C). Suppose Costa Rica has a comparative advantage in H.

Now let them go into free trade. It is reasonable to suppose that Costa Rica is so small that even if it specializes in H it cannot sell all of the demand for H in both CR and the US, which means that US must produce both H and C in free trade, just as in autarky.

In this case, the US does not specialize and the free trade relative price is the same as in autarky. US gets NO gains from trade (but it doesn't lose anything either). CR gets ALL the GFT in this case as it gets to trade at the US relative price rather than the CR autarky price.

Result: in the Ricardian model small countries get all the GFT because they can specialize and trade at different prices established in the large countries (or the world). Large countries do not gain from trade with small countries.

Clicker question

In the Ricardian model, both countries are better off in moving from autarky to free trade if:

A. The free-trade price ratio of goods is strictly between the autarky price ratios.

B. Each country fully specializes in its good of comparative advantage and exports that good.

C. One country specializes and the other produces both goods in free trade.

D. Both countries export the same good to each other.

E. Both A. and B.

Prices and wages: a closer look

So far our theory has mostly ignored nominal prices, wages, and exchange rates, arguing that only relative prices (real terms) matter. Yet policymakers argue about low wages abroad all the time. Why are these factors not central to the basic analysis?

Assert: nominal prices, nominal wages, and exchange rates adjust to establish balanced trade according to comparative advantage. It is important to remember that these variables are *endogenous*, which means they adjust to achieve an equilibrium, they DO NOT CAUSE an equilibrium.

Start with an important definition.

A country's real wages = $\frac{w}{p_R}$ and $\frac{w}{p_C}$. These figures (nominal wages divided by prices) show the amount of each good the wage can purchase. Recall in this model that each worker in a country has the same nominal wage, so these ratios indicate how much purchasing power every worker has.

Prices and wages: a closer look

Let's compare real wages in our example between autarky and real trade. If we are right that everyone is better off in trade it must be that real wages go up.

Recall our example, labor (days) per unit of output.

	US	M
C	1	10
R	3	5

 From this we get opportunity costs: US   1C = 1/3R (1R = 3C)
                                    Mexico   1C = 2R (1R =1/2C)

What are real wages in autarky in US and M? Recall that price = average cost (and price = marginal cost, which is the same here) because of perfect competition. But average cost is just the wage times the amount of labor needed per unit of output.

So in the US in autarky, $p_C = w^{US}x1 \; and \; p_R = w^{US}x3$. Then $\frac{w^{US}}{p_C} = 1 \; and \; \frac{w^{US}}{p_R} = \;^1/_3$ are the real wages in terms of C and R in autarky in the US. (Again, this is how many C and R the wage can purchase.)

Prices and wages

Note that these real wages are equal to average productivity (and marginal productivity) of labor, 1/a and 1/b in the US.

Important point: A workers' real wages are equal to the marginal products of labor in each good.

Be clear what this means: *all workers* (because they have the same wage) have the same *real wages* in terms of buying C and R.

The same theory will show us that real wages in Mexico are 1/10 in C and 1/5 in R.

NOTE: clearly *real wages in autarky are higher in the US than in Mexico because labor is more productive in both goods in the US*.

Prices and wages

Now let's see just how it is that wages must adjust in free trade if they are excessively high or low. We do this by figuring out limits to the ratio of market wages in US versus Mexico in free trade.

Note that the US labor is 10 times more productive than M labor in C, which is the biggest productivity advantage for the US. It follows that if US wage > 10 x Mexican wage then Mexico would produce both C and R more cheaply.

How can we see this? First, note the Mexican wage is in pesos, which we need to convert to $.

The Mexican wage in $ would be $w^{M\$} = w^{MPeso} x E$, where E is the $/peso exchange rate. (Example: let $1 be worth 15 pesos (pesos/$), so E = 1/15 ($/peso). Suppose w^{MPeso} = 150 pesos per day then $w^{M\$}$ = 150 pesos x 1/15 ($/peso), = $10 per day). For now let's leave the exchange rate aside by setting E = 1/15 and keeping it fixed.

Suppose also that the US wage is w_{US} = $180 per day. (Note that this is more than 10 times higher than the M wage so it should be a problem.) What are unit costs (and therefore prices) if US and M traded with each other?

Prices and wages

	US	M
C	1x$180 = $180	10x$10 = $100
R	3x$180 = $540	5x$10 = $50

Then M would export both goods to the US. This cannot be an equilibrium because M would have a trade surplus and US a trade deficit. (It would actually mean M produces both goods and US produces none, which is inconsistent with full employment.) So wages would rise in M and fall in the US. How far? Until $w^{US} \leq 10x w^{M\$}$.

(Alternative: suppose nominal wages are "sticky" in peso and $ terms. Then what would adjust? Here the peso would *appreciate* and the $ would *depreciate*.)

So suppose new w^{US} = $100 and new $w^{M\$}$ = $20 (which would be 300 pesos per day at $1 = 15P). Now what are costs?

	US	M
C	$100	$200
R	$300	$100

Prices and wages

These unit costs are consistent with CA and the US will specialize in C and export C and M will specialize in R and export R. (*Note this is despite the US having an absolute advantage in both goods*.) And note that the US wage is now 5 times the M wage so this is below the maximum ratio (of 10) noted above.

Let's try the other extreme. The US is 5/3 times as productive in R => if $w^{US} < \frac{5}{3} w^{M\$}$ the US would produce both goods more cheaply and export both. This is not possible so the US wage would rise and Mexican wage would fall until they are established within the allowable range.

Show this at home: let w^{US} = $15 and $w^{M\$}$ = $10 and show that US produces both goods more cheaply.

Limits on relative wages across countries

What we have are limits on the *relative wage* rate between countries in free trade:

$5/3 \leq (w^{US}/w^{P\$}) \leq 10$. This would be the expression where both wages are expressed in dollars, which is what we will do in this model (That is, we will ignore the exchange rate E.)

These are the limits that are consistent with balanced trade and nominal wages must adjust to be inside these limits.

Again, where do these limits come from? 10 is the maximum US absolute advantage in productivity (C). Any higher wage ratio makes US costs higher in both goods, which can't happen. And 5/3 is the minimum US absolute advantage (R). Any lower relative wage makes US costs lower in both goods, which can't happen.

Relative wages must lie between these limits given by labor productivity.

Summary: because trade must be balanced nominal wages will adjust to within limits determined by labor productivities. This adjustment could be in exchange rates, wages or both.

Prices, real wages and the terms of trade

Recall we also had free-trade relative price limits: $\frac{1}{3} \leq \left(\frac{p_C^*}{p_R^*}\right) \leq 2$

We have added free-trade relative wage limits: $\frac{5}{3} \leq \left(\frac{w^{US*}}{w^{M\$*}}\right) \leq 10$

Both of these must be true and both are consistent with both countries enjoying GFT.

Of course, they are related to each other. In free trade only the US produces C and only Mexico produces R because of specialization. This means we must have these free-trade prices (with wages in dollar terms):

$$p_C^* = w^{US*} x1 \text{ and } p^{R*} = w^{M\$*} x5$$

$$\left(\frac{p_C^*}{p_R^*}\right) = \left(\frac{w^{US*}x1}{w^{M\$*}x5}\right) => \left(\frac{w^{US*}}{w^{M\$*}}\right) = 5\left(\frac{p_C^*}{p_R^*}\right).$$

And so $1/3 \leq \left(\frac{p_C^*}{p_R^*}\right) \leq 2 \Leftrightarrow 5/3 \leq \left(\frac{w^{US*}}{w^{M\$*}}\right) \leq 10$.

Note this means that *a rise in the US T of T implies a rise in the US relative wage*. So the US wants both of these ratios to be as high as possible; Mexico wants them to be as low as possible. But as long as both are inside the limits, both US and M will gain from trade.

Real wages rise in free trade

But we still haven't shown that real wages are higher in free trade than in autarky, which we do now.

Recall what we already showed:

Autarky $\dfrac{w^{US}}{p_C} = 1$ This is the *real wage* in terms of C.

$\dfrac{w^{US}}{p_R}$ = 1/3. This is the *real wage* in terms of R.

And in Mexico $\dfrac{w^M}{p_C}$ = 1/10 and $\dfrac{w^M}{P_R}$ = 1/5 These are real wages in autarky in M.

Again, these real wages are equal to labor productivities.

Note that *real wages are higher in the US*. This is due to higher L productivity.

Real wages rise in free trade

Now consider free trade with w^{US*} = $100 and $w^{M\$*}$ = $20. Let's compare the costs (prices) at these wages if countries had to produce both goods (no trade) and in free trade with specialization. (But note we'd expect free trade wages to be different from autarky nominal wages).

Costs if no trade		US	M
	C	$100	$200
	R	$300	$100
Costs in free trade		US	M
	C	$100 (produced in US)	$100 (imported from US)
	R	$100 (imported from M)	$100 (produced in Mexico)

What are real wages in free trade?

$$w^{US*}/p_C^* = 1 \text{ (no change from autarky)} \qquad w^{US*}/p_R^* = 1 \text{ (> 1/3; higher than autarky)}$$

$$w^{M\$*}/p_C^* = 20/100 = 0.2 \text{ (> 1/10; higher)} \qquad w^{M\$*}/p_R^* = 1/5 \text{ (no change from autarky)}$$

Real wages rise in free trade

Note what happened.   In US the real wage remains the same in C as in autarky because US still produces it and there is no change in marginal labor productivity. But because the price of R is lower through imports (from $300 to $100) the real wage rises from 1/3 to 1.

In M the real wage remains the same in R as in autarky. But M imports C from US at a lower price ($100 instead of $200) and the real wage rises from 0.1 to 0.2.

Summary: autarky and FT real wages are the same in the export good (no change in MPL) but higher in the import good due to lower import price.

Because real wages are higher for all workers, all workers gain from trade.

But note also that even in free trade US workers have higher real wages than Mexican workers.

A note on labor migration and productivity

We found that in free trade the US still has higher real wages in both goods. This sets up an incentive for L to migrate from M to US. (In fact in the Ricardian model all L in M would move to US, which suggests the Ricardian model may not capture reality all that well.)

An interesting observation: in this model productivity depends on where you're located, not on the workers inherently. How true is that? We'll consider that in our later unit on immigration.

But the big point here is that high-wage countries in free trade are also the high-productivity countries. They can trade beneficially with low-wage countries (and vice versa) due to the combined influence of wages and productivities.

What determines the marginal productivity of labor, which is the key to CA and the reason there are trade and GFT?

In general, differences in technology, skills, education, endowments, organization, infrastructure, government policies. To raise real wages over time, countries need to improve such variables.

Clicker question 2

Which statement is false?

A. A country wants to see its terms of trade rise as much as possible in free trade.

B. The reason a country gains from trade in this model is that the price of imports is lower in free trade than the price of the same good in autarky.

C. In free trade in this model each country gains from trade because its labor becomes more productive in free trade than in autarky.

D. A country with higher labor productivity has higher real wages in free trade than the other country.

Finishing example

Let's do one more example for additional practice. Suppose there are 2 countries, Vietnam (V) and Germany (G) and 2 goods, clothing (C) and medicines (D for drugs). And we have the following figures on hours of labor per unit of output.

	C	D
V	5	15
G	3	3

I hope you can see immediately that drugs are very expensive in V but not expensive in G, in relative terms. But let's answer our basic questions.

• G is more productive in both goods so it has the absolute advantage in both. V has the absolute disadvantage in both. Note this means G will have higher real wages than V.

• In V it takes 15 hours to produce D but just 5 to produce C. So D must be more expensive than C in Vietnam. It is, for 1D = 3C in Vietnam. The OC of 1D is 3C and $p^V = (p_D/p_C)^V = \frac{15}{5} = 3$. The OC of 1C is then 1/3 D.

• In G it takes 3 hours to produce either D or C. So they would have the same cost and 1D = 1C. The OC of 1D is giving up 1C in production. And $p^G = (p_D/p_C)^G = \frac{3}{3} = 1$.

• It follows that V has a comparative advantage in C and G has a CA in D.

Example

The limits to the relative price in free trade would then be $1 \le \left({p_D^*}/{p_C^*} \right) \le 3$.

This is the relative price of drugs in free trade. Anywhere strictly between those limits both V and G gain from trade.

It also would be the terms of trade for Germany, since G would export drugs. G would like this relative price to be as high as possible but V would like it to be as low as possible (for then it imports D at a low price).

What are real wages in autarky? They are the inverses of these figures for hours of labor per output (because the inverses are the marginal products of labor). That means real wages are:

	C	D
V	1/5	1/15
G	1/3	1/3

But you can see this also by noting that real wages are nominal wages divided by prices. Prices equal average costs so for example in Vietnam, $p_C = w^V x 5$ since it takes 5 hours of labor to produce one unit of C and each hour gets wage w^V. So real wage in terms of buying C is $\left({w^V}/{p_C^V} \right) = 1/5$. Same for the other real wages.

Example

What are the limits to the relative wage, defined as $\left(w^{G*}/w^{V*}\right)$? Look back at the labor-output ratios. We see that Germany is 5 times as productive in D (15/3), so the max relative wage is 15/3 = 5. Any higher wage would permit V to produce both goods cheaper than G, which can't be. To see this, suppose in free trade we have w^{G*} = 200 euros and w^{V*} = 25 euros (forget about the Vietnamese exchange rate).

Then $\left(w^{G*}/w^{V*}\right)$ = 8, which our theory says is too high. And use these nominal wages to compute costs of production:

	C	D
V	25x5 = 125 euros	25x15 = 375 euros
G	200x3 = 600 euros	200x3 = 600 euros

So both costs (prices) would be lower in V than in G.

But Germany is just 5/3 times as productive in C, so the min relative wage is 5/3. Any lower wage ratio would permit G to produce both goods cheaper than V, which can't be.
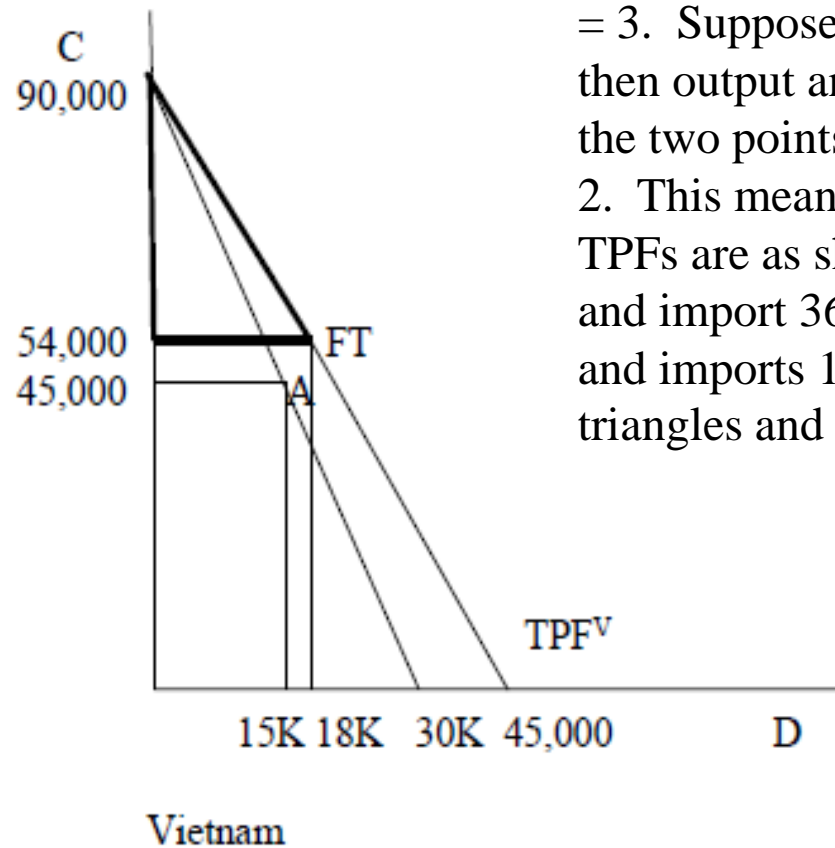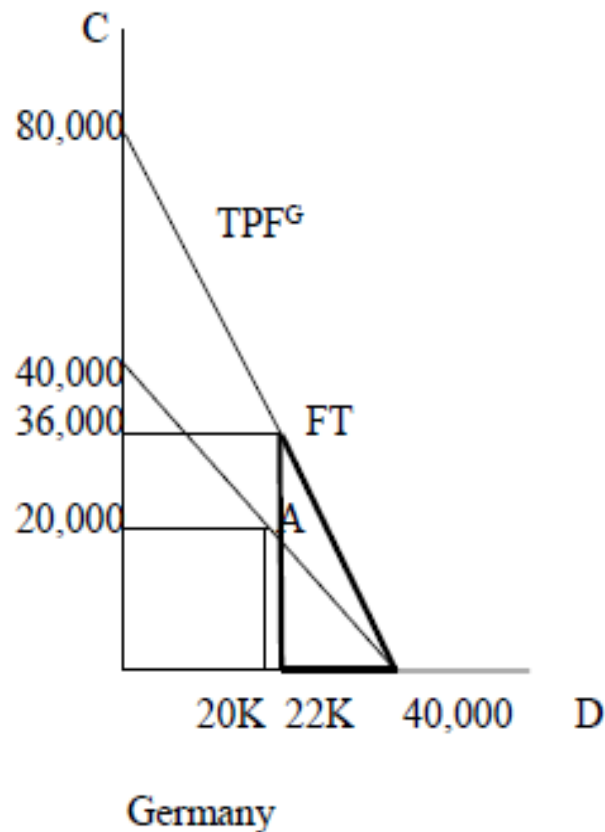
Example

So we know this about relative price and relative wage limits:

$$1 \leq \left({p_D^*}/{p_C^*} \right) \leq 3$$

$$5/3 \leq \left({w^{G*}}/{w^{V*}} \right) \leq 5$$

We see that the 2d equation is just 5/3 times the first equation, so $\left({w^{G*}}/{w^{V*}} \right) = \left({5}/{3} \right) \left({p_D^*}/{p_C^*} \right)$.

Now let's do the PPFs and GFT (using hours of labor, as in the text). Suppose the labor force in G is 120,000 hours and in V is 450,000 hours. Then the PPFs are as follows.

Germany

Vietnam

Note that in autarky $(p_D/p_C)^G = 1$ and $(p_D/p_C)^V = 3$. Suppose both G and V split labor in half then output and consumption are as shown at the two points A. Now suppose $(p_D*/p_C*) = 2$. This means in trade that $1D = 2C$ and TPFs are as shown. Let G export 18,000 D and import 36,000 C. V exports 36,000 C and imports 18,000 D. We can see the trade triangles and GFT.

In fact, GFT are +2000D and +16,000C for Germany and +3000D and + 9000C for Vietnam. Both seem to get significant GFT because the world price ratio is in the middle of the possible range, so both get big improvements in the T of T. For G the percent change in price (from 1 to 2) is (2-1)/1 = 1 or +100%. For V it is (from 1/3 to ½) = +50%.

Example

How does this translate into real wages in free trade? First, if $\left(p_D^*/p_C^*\right)$ = 2 then we know that

$\left(w^{G*}/w^{V*}\right)$ = (5/3)x2 = 10/3 = 3.33. Germany's nominal wage in free trade is 3.33 x that in Vietnam.

Real wages in free trade

In Germany: real wage in buying D = $\left(w^{G*}/w^{G*}x3\right)$ = 1/3, same as in autarky

                  real wage in buying C = $\left(w^{G*}/w^{V*}x5\right)$ = (10/3)/5 = 2/3 > 1/3, higher than autarky

In Vietnam: real wage in buying D = $\left(w^{V*}/w^{G*}x3\right)$ = (3/10)/3 = 1/10 > 1/15, higher than autarky

                  real wage in buying C = $\left(w^{V*}/w^{V*}x5\right)$ = 1/5, same as in autarky

Workers in both countries have a higher real wage in the import good but same real wage in the export good, compared to autarky.

Germany has higher real wages in buying both goods because its labor is more productive.

Implication: national "competitiveness"

If nominal wages get so high that real wages are more than labor productivity, then unit labor costs get very high and an economy loses "competitiveness". (The most basic definition of competitiveness in economics is in terms of unit labor costs.)

Over time, changes will happen to reduce these costs (lower real wages, depreciated currency, employment losses where wages are "too high").

If nominal wages are excessively low compared to productivity, unit labor costs will be low and wages will rise as a result of trade.

Some examples:

The US and UK steel industries in 1970s-80s. Large declines in employment and output.

Greece in the EU during its adjustment to the financial crisis.

East Asian economies: large rises in real wages and productivity due to investment, education, technological change.

Summary: key points of Ricardian model

1. Real labor productivity determines absolute advantage and comparative advantage.

2. Comparative advantage (relative labor costs and therefore relative prices of goods in autarky) determines the trade pattern and the limits to terms of trade.

3. CA also is what permits GFT for all countries.

3. World demand for goods determines the equilibrium relative price ratio of goods in free trade and therefore the split of the GFT between countries.

4. The international price ratio (terms of trade) and relative wage ratio are related closely to each other.

5. Absolute advantage determines which country has higher real wages. Country with higher labor productivity will have the higher real wages.