Part II:Bases for Trade

The No-Trade Model

1. Identical production functions in all countries

2. Same relative factor endowments in all countries

3. Constant returns to scale

4. Identical, Homogeneous preferences in all countries

5. No Distortions (imperfect competition, externalities, taxes).

In this world, there would be no trade and no gains from trade.

Lecture 5: Ricardian Models - Technology as a basis for Trade

1. A one-factor model of technology differences

2. Comparative versus absolute advantage

   Existence of trading opportunities depends only on comparative Advantage.

3. Production frontier, closed-economy equilibrium

4. Comparative advantage and autarky price ratios

   Pattern of comparative advantage reflected in autarky prices

6. Excess demand and international equilibrium

   Constructing the excess demand curve
   Specialization

8. The distribution of gains between countries

   Big versus small countries
   More productive versus less productive countries

7. Real wage comparisons across countries

   The role of equilibrium prices
   The role of absolute advantage

The following is sometimes referred to as the "Ricardian model" of trade, where the basis for trade is differences in technology across countries. It is generally assumed that:

1. There is only one factor of production so as to separate technology from relative factor-endowment effects.

2. There are constant returns to scale and perfect competition in production so as to separate technology from industrial-organization effects.

This is essentially the model we looked at before in talking about gains from specialization and comparative and absolute advantage.

$$X = F_x(L_x)$$

$$Y = F_y(L_y)$$

$$\bar{L} = L_x + L_y$$

Assume constant returns to scale

$$X = \alpha L_x$$

$$Y = \beta L_y$$

where α and β are some positive constants.

Absolute versus comparative advantage

Country *F* has an *absolute advantage* in the production of *X*: $\alpha_h < \alpha_f$.

Country *H* has an *absolute advantage* in the production of *Y*: $\beta_h > \beta_f$.

Marginal Products of Labor

	Home	Foreign
X	$\alpha_h = 20$	$\alpha_f = 30$
Y	$\beta_h = 20$	$\beta_f = 10$

Country *F* has a *comparative advantage* in the production of *X*:

$$\alpha_h/\beta_h < \alpha_f/\beta_f.$$

Country *H* has a *comparative advantage* in the production of *Y*:

Changes in Outputs due to Labor Reallocation

Move 1 Worker from X to Y in Country h, and 1from Y to X in Country F

	Home	Foreign	Total
X	-20	+30	+10
Y	+20	-10	+10

There exist gains from specialization

But what if one country has an absolute advantage in all goods?

Marginal Products of Labor

	Home	Foreign
X	$\alpha_h = 5$	$\alpha_f = 30$
Y	$\beta_h = 5$	$\beta_f = 10$

Move 4 workers from *X* to *Y* in Country H and 1 from *Y* to *X* in Country F.

Changes in Outputs due to Labor Reallocation
Move 4 Workers from X to Y in Country H, and 1 Worker from Y to X in Country F

	Home	Foreign	Total
X	-20	+30	+10
Y	+20	-10	+10

Gains from specialization and trade are still possible even if one country has an absolute advantage in the production of all goods.

What is needed for the existence of gains from specialization is a pattern of *comparative advantage*.

The α's and β's show up as the slopes of their "production possibilities" curves.

$$\Delta X = \alpha \Delta L_x \qquad \Delta Y = \beta \Delta L_y = -\beta \Delta L_x$$

$$\frac{\Delta Y}{\Delta X} = -\frac{\beta}{\alpha}$$

For two countries, h and f, the slopes of their production frontiers are then

$$\frac{\Delta Y_h}{\Delta X_h} = -\frac{\beta_h}{\alpha_h} \qquad \frac{\Delta Y_f}{\Delta X_f} = -\frac{\beta_f}{\alpha_f}$$

These ratios are the slopes of production frontier, but are also measures of <u>comparative advantage.</u> County h is said to have a comparative advantage in Y and country f a comparative advantage in X if

$$\frac{\beta_h}{\alpha_h} \geq \frac{\beta_f}{\alpha_f}$$

Assertion: in competitive equilibrium, each country will specialize in the good in which it has a comparative advantage (although one country might produce both goods).

This is saying that specialization goes "the right way" in a competitive, distortion-free economy.

The fact that specialization and trade go the "right way" is another Smithian "invisible hand" result.

The proof is by contradiction. Suppose that country h (comparative advantage in Y) specializes in X.

The price ratio is either

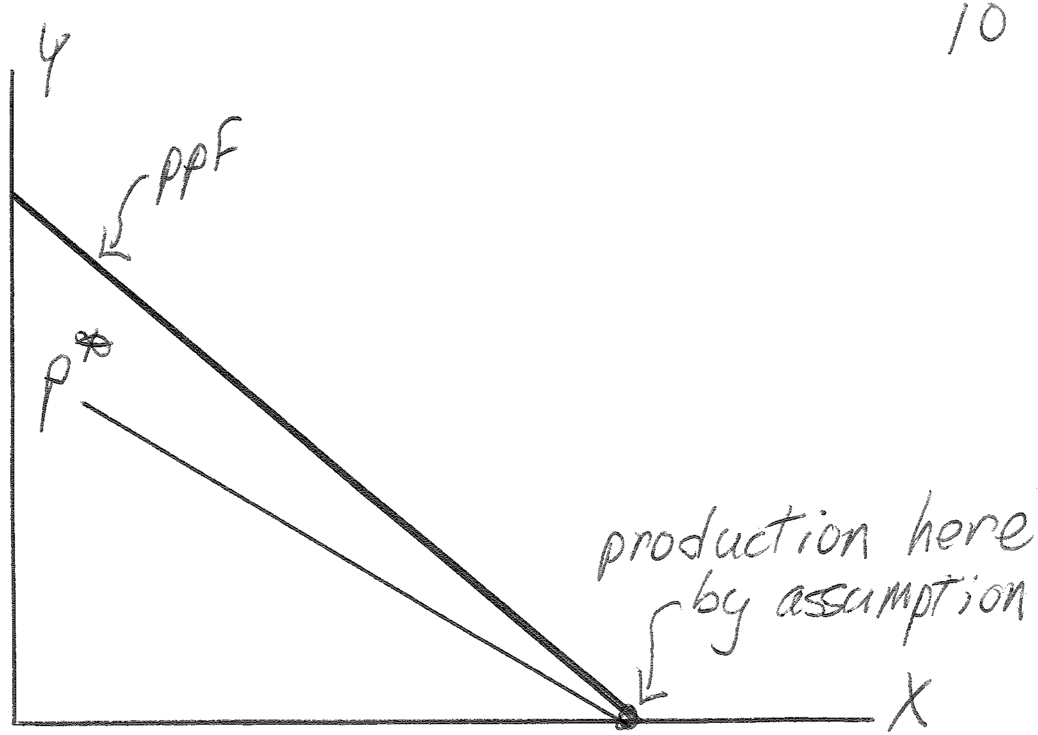
(a) steeper than h's production frontier or

(b) flatter than h's production frontier.

Suppose that case (b) is true. Then

$$\frac{\beta_h}{\alpha_h} > \frac{p_x}{p_y}$$

$$p_y\beta_h > p_x\alpha_h = w_h$$



where the last equation is the condition for competitive equilibrium: the value of the marginal product of labor in X (the good that is produced) is equal to the wage rate.

But that in turn implies that the value of the marginal production of labor in Y (the good that is not produced) is greater than the wage rates.

Therefore, there are profits to be earned in Y production and entry will occur. Thus (b) cannot be an equilibrium.

Thus presumably case (a) is true. That is consistent with equilibrium for country h.

$$\frac{\beta_h}{\alpha_h} < \frac{p_x}{p_y} \qquad p_y\beta_h < p_x\alpha_h = w_h$$

The value of the marginal production of labor in the good that is produced (X) equals the wage rate and this is greater than the marginal product of labor in the good that is not produced (Y) so there are no profits to be earned in Y and no entry occurs.

However, for country f we then have:

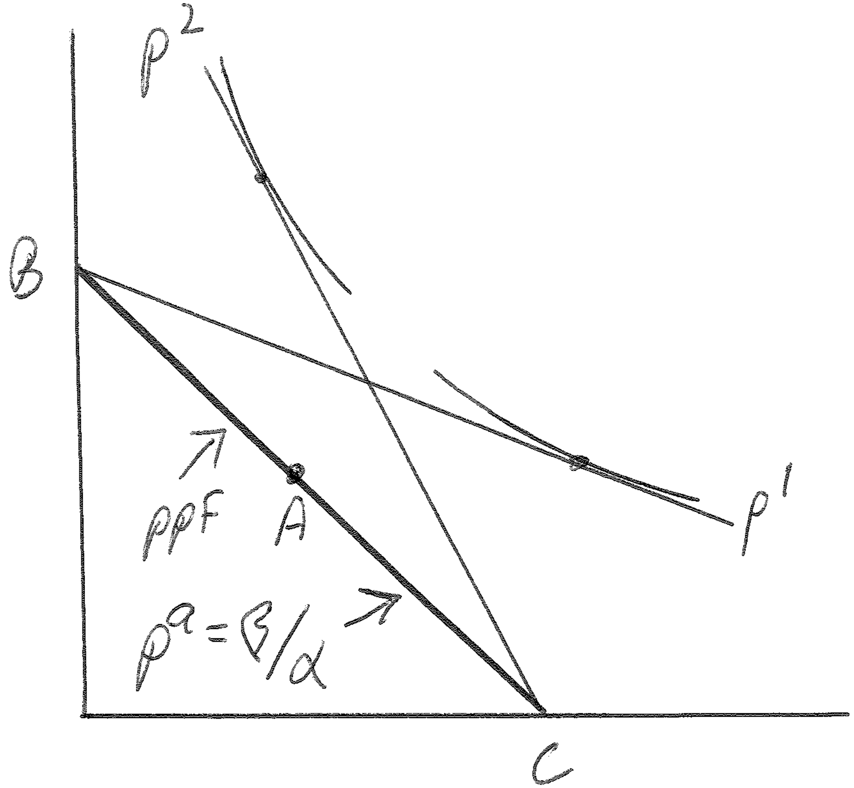
$$\frac{\beta_f}{\alpha_f} < \frac{\beta_h}{\alpha_h} < \frac{p_x}{p_y} \qquad p_y\beta_f = w < p_x\alpha_f$$

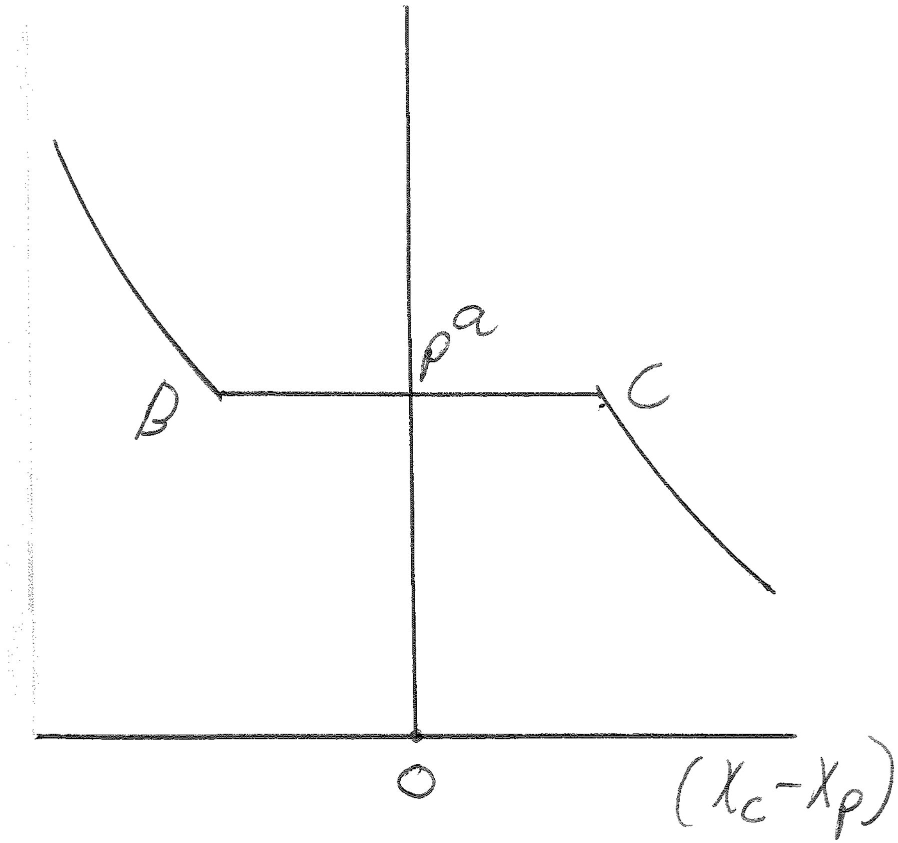
Country f cannot be specialized in producing good Y, because then there would be excess profits to be earned in good X.

Conclusion: specialization must be consistent with comparative advantage in a competitive, distortion free environment.

Finally, note that one country, but only one country, may produce both goods; that is, one country may be non-specialized.

Construction of excess demand function.

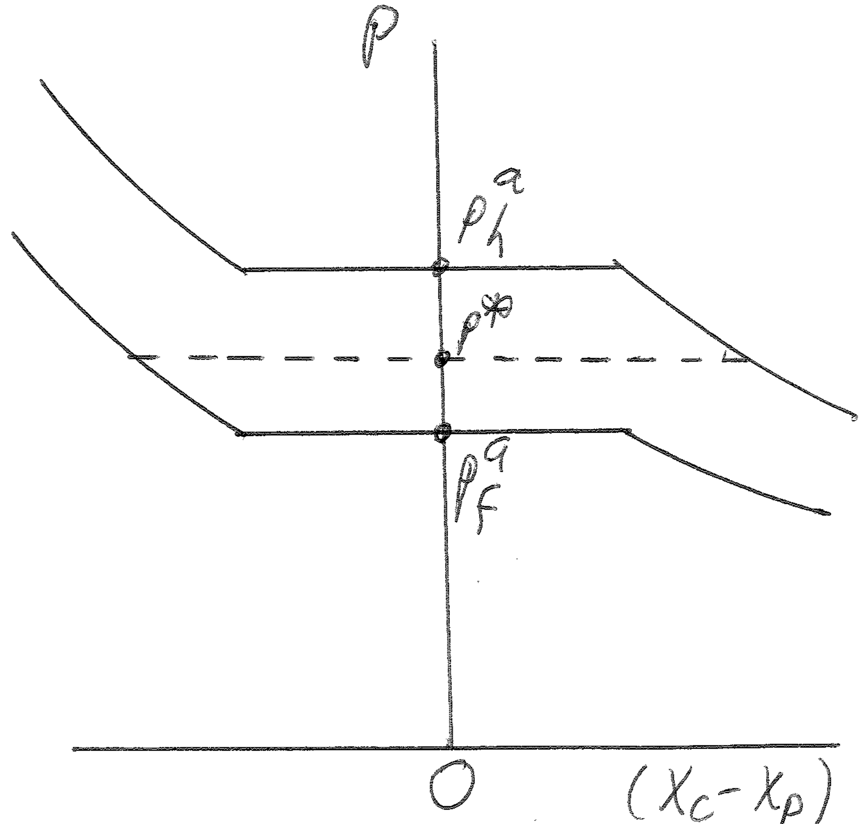


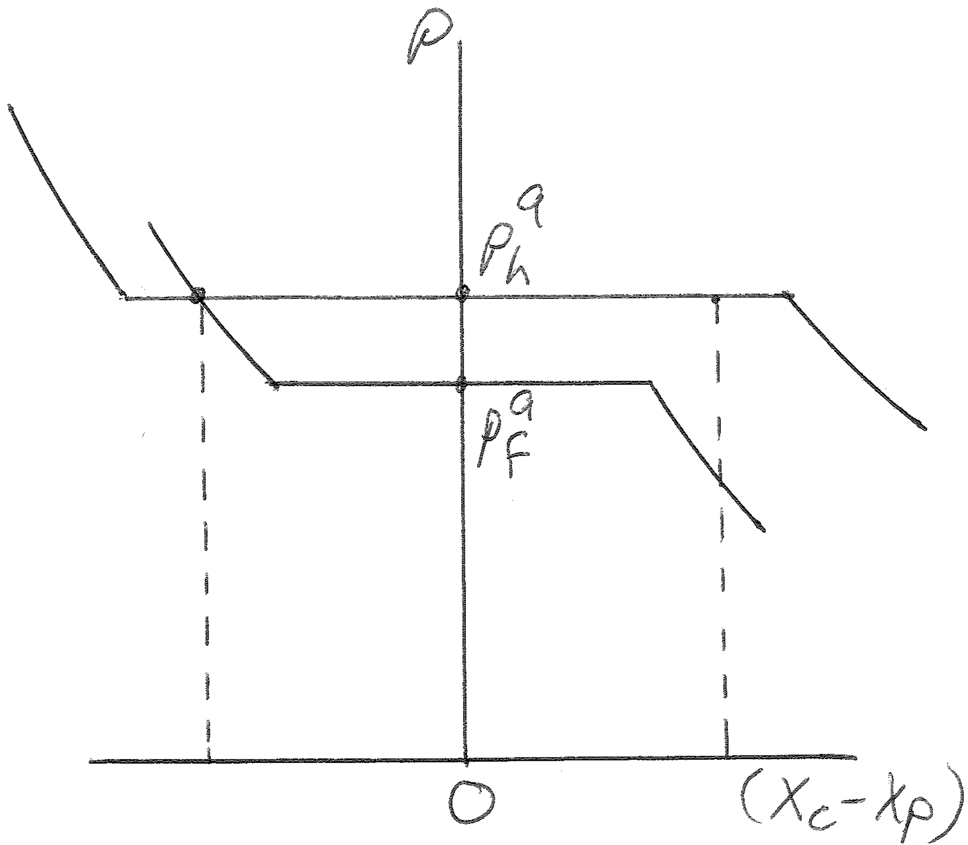


"World" equilibrium

(1) The world price ratio must lie between the autarky price ratios of the two countries (but could equal the autarky price ratio of one country), otherwise both countries would want to export the same good, and this cannot be an equilibrium.

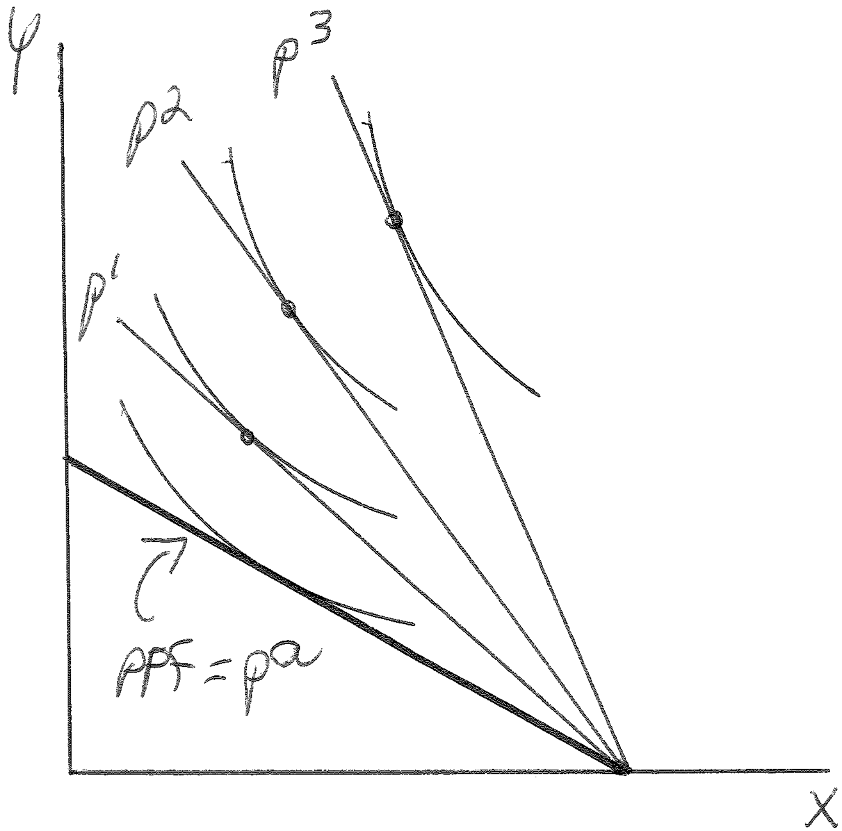
(2) Thus each country will export the good for which it has a relatively low export price, its comparative-advantage good.

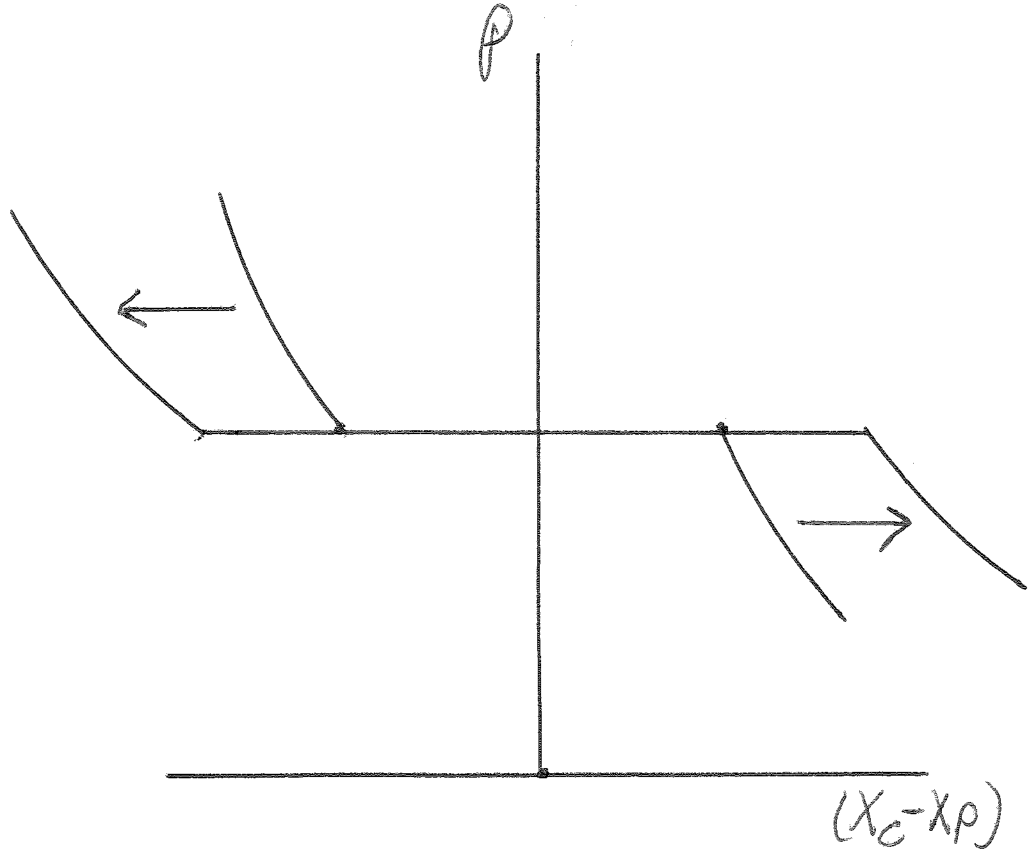




The Distribution of Gains from Trade between Countries

(1) A country's gains from trade are proportional to the difference between its autarky price ratio and the equilibrium world price ratio.





(2) The smaller and/or less productive country will trade further from its autarky price ratio than the larger and/or more productive country. Hence the former gets a larger share of the total gains.

Think of this as a comparative statics problem in which one country grows. Its excess demand at any price increases, which must force down the equilibrium price if the other country is not growing

(3) In the special case where the world price ratio is the large country's autarky price ratio, the small country gets *all* the gains.

The equilibrium price ratio is called the terms of trade. The equilibrium terms of trade is closely linked to the *distribution* of gains from trade.

What role then does absolute advantage play?

Absolute advantage does not determine the pattern of trade or the existence of gains from trade, but it does determine real income comparisons between countries.

We have established that the existence of mutual gains from trade depends only on comparative advantage, not absolute advantage.

One country may have an absolute advantage in everything, but it can still gain from specializing in what it does <u>relatively</u> well.

Use our example in which country h has the comparative advantage in Y, so h specializes in Y and country f specializes in X and the price ratio must lie inbetween the two comparative-advantage ratios (slopes of the two production frontiers).

$$\frac{\beta_h}{\alpha_h} \geq \frac{p_x^*}{p_y^*} \geq \frac{\beta_f}{\alpha_f}$$

The wage rate in each country is equal to the value of the marginal product of labor in the good that is produced.

$$w_h = p_y^* \beta_h \qquad w_f = p_x^* \alpha_f \qquad \frac{w_h}{w_f} = \frac{p_y^* \beta_h}{p_x^* \alpha_f}$$

Assume that country h is has an absolute advantage in both goods.

$$\alpha_h > \alpha_f \qquad \frac{\beta_h}{\alpha_f} > \frac{\beta_h}{\alpha_h}$$

$$\frac{\beta_h}{\alpha_f} > \frac{\beta_h}{\alpha_h} \geq \frac{p_x^*}{p_y^*} \geq \frac{\beta_f}{\alpha_f} \quad \Rightarrow \quad \frac{\beta_h}{\alpha_f}\frac{p_y^*}{p_x^*} = \frac{w_h}{w_f} > 1$$

(the first inequality is the assumption that country h has absolute advantage in both goods, and the others are the assumed pattern of comparative advantage.)

Absolute advantage shows up in <u>real wage comparisons</u> between countries. The more productive country will have the higher real wage.

Should having a higher real wage deter the country from trading?

<u>No</u>. We have argued that gains from trade depend only on comparative advantage.

If wages are market determined, a high wage is the <u>result</u> of high productivity, and is not a deterrent to gains from trade.

Generalization to many goods: the chain of comparative advantage.

Let p_i be the *equilibrium* price of good i and γ_{ij} is country j's labor productivity coefficient in producing good i. w_j is the *equilibrium* wage in country j.

$$p_i \gamma_{ih} \leq w_h$$
$$p_i \gamma_{if} \leq w_f$$

with equality if the good is produced

Let the goods be indexed such that country h has the highest comparative advantage in good 1

$$\frac{\gamma_{1h}}{\gamma_{1f}} \geq \frac{\gamma_{2h}}{\gamma_{2f}} \ldots \geq \ldots \frac{\gamma_{nh}}{\gamma_{nf}}$$

Then there may be one good produced in common, or the equilibrium wage ratio may fall between the productivity ratios for goods i and i + 1.

Suppose that good i is produced in both countries. Then for goods j < i and k > i

$$\frac{\gamma_{jh}}{\gamma_{jf}} \geq \frac{w_h}{w_f} \ldots \geq \ldots \frac{\gamma_{kh}}{\gamma_{kf}}$$

Assume strict inequalities. Then good j can only be produced by country h, and good k can only be produced by country f.

$$\frac{\gamma_{jh}}{\gamma_{jf}} > \frac{w_h}{w_f} \quad \Rightarrow \quad p_j \gamma_{jh} = w_h \qquad p_j \gamma_{jf} < w_f$$

Summary Points

(a) With international differences in production technology, there will exist gains from trade.

(b) Countries should specialize according to comparative advantage, their relative ability to produce different goods.

(c) If prices are determined in a competitive market, then the market ensures the correct pattern of specialization. Government intervention is not needed or helpful.

(d) Theory suggest that small countries are major gainers from trade: technically, they trade further away from their autarky prices than large countries.

(e) If a country is uniformly more productive (e.g., has an absolute advantage in everything), then it must have a higher real wage. Provided that wages are market determined, having a high wage should not be a deterrent to trade, is it just reflecting high productivity.

(f) It is important to note that in a competitive market economy, the real wage is endogenous. A high wage reflects high productivity. A high wage is not a reason not to trade.

Table 1: The correlation between the first two columns is 0.94. Average annual earnings also clearly fall as workers become less productive.

Although the rankings are slightly different, the same conclusions hold for the PPP-based calculations.

The correlation between hourly productivity and hourly earnings using that set of exchange rates is 0.91.

Table 7.1 International Comparisons of Productivity and Wages in Manufacturing, 2004

	Market Exchange Rates			PPP Exchange Rates		
		Earnings	Average		Earnings	Average
Country	VA per hour	per hour	Earnings	VA per hour	per hour	Earnings
US	$ 47.47	$ 16.15	$34,263.84	$ 47.47	$ 16.15	$34,263.84
Sweden	$ 46.10	$ 17.16	$33,459.65	$ 38.36	$ 14.28	$27,847.19
Netherlands	$ 42.85	$ 22.66	$41,238.26	$ 42.20	$ 22.32	$40,613.83
Japan	$ 38.94	$ 14.37	$32,506.47	$ 31.46	$ 11.61	$26,263.97
Australia	$ 36.94	$ 16.78	$33,247.49	$ 40.10	$ 18.22	$36,090.21
UK	$ 34.89	$ 19.22	$40,972.09	$ 32.34	$ 17.81	$37,978.26
France	$ 34.60	$ 20.37	$38,985.14	$ 33.62	$ 19.79	$37,870.91
Canada	$ 33.38	$ 15.37	$30,281.55	$ 36.05	$ 16.59	$32,702.79
Spain	$ 30.34	$ 14.91	$27,750.56	$ 35.86	$ 17.62	$32,800.87
Rep. of Korea	$ 16.40	$ 9.39	$23,145.03	$ 23.92	$ 13.70	$33,773.86
Mexico	$ 8.76	$ 1.77	$ 4,102.92	$ 12.40	$ 2.50	$ 5,811.97
Costa Rica	$ 8.57	$ 1.75	$ 4,325.54	$ 17.49	$ 3.58	$ 8,827.07
Philippines	$ 3.78	$ 0.48	$ 1,097.95	$ 15.81	$ 1.99	$ 4,588.86
Egypt	$ 3.39	$ 0.47	$ 1,374.00	$ 10.68	$ 1.48	$ 4,321.29
India	$ 0.64	$ 0.19	$ 458.55	$ 3.18	$ 0.95	$ 2,292.76

Table 2: A considerably more rigorous test of Ricardian theory should relate figures on international trade to underlying labor-productivity coefficients that differ by industry and country.

$$\log(X_{ijk} / M_{ijk}) = \alpha_{jk} + \beta_{jk} \log(a_{ik} / a_{jk})_{-1} + \varepsilon_{ijk}$$

The variable X_{ijk} refers to exports of good *i* from country *j* to country *k*, while M_{ijk} refers to imports of the same good coming into country *j* from country *k*.

The coefficients a_{ik} and a_{jk} are measures of inverse labor productivity, in this case employment per dollar of value added in good *i*.

Note that because the coefficients of the exporting (importing) country *j* are in the numerator (denominator) of the independent variable, an increase in this ratio implies a rise in the relative productivity of the exporter.

Finally, the equations are estimated using data for 21 manufacturing industries. Note that these sectors are defined quite broadly, including such items as food, beverages and tobacco; chemicals excluding drugs; electrical machinery; and motor vehicles.

Because this is a double-log specification the coefficients may be interpreted as elasticities.

Thus, for example, in the slope column under market exchange rates the coefficient 0.46 for US-Germany suggests that a one-percent increase in the ratio of US to German labor productivity should expand US net exports with Germany by 0.46 percent.

The main question, however, is whether these coefficients are positive and significant as suggested by the Ricardian model

Coefficients in bold are significantly different from zero at the one-percent level (99-percent confidence level)

Table 7.2 Primary Results from Regressions of Bilateral Net Exports on Relative Labor Productivities

		Market Exchange Rates		PPP Exchange Rates	
Country Pair	Period	Slope (b)	R^2	Slope (b)	R^2
US-Japan	1984-91	**0.14**	0.09	**0.20**	0.10
US- Ger	1977-90	**0.46**	0.06	**0.83**	0.11
US-UK	1979-90	**-0.08**	0.03	-0.02	0.02
US-France	1978-90	**-0.21**	0.02	0.02	0.02
US-Italy	1979-89	**0.26**	0.11	**0.25**	0.01
US-Canada	1972-89	**0.41**	0.02	**0.73**	0.01
US-Aus	1981-91	**0.72**	0.05	**0.89**	0.10
US-Korea	1972-90	**-0.64**	0.02	**0.93**	0.18
US-Mexico	1980-90	**0.46**	0.14	**0.56**	0.18