

International Trade

3. Gains and losses from trade in the specific-factors model

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1. Introduction

- Opening a country to trade generates winners *and* losers.
- Determining who gains and who loses answers many questions about trade politics.
- **Specific-factors** model helps explain who gains and who loses.
- Short-run specific-factors model offers new insights beyond the Ricardian model.
- Three factors of production: capital, land, and labor.
- Two sectors (manufacturing, agriculture), two countries

1. Introduction

- How does trade affect the earnings of capital, labor, and land?
- From the Ricardian model, free trade leads to:
 - Rising relative prices in the export sector;
 - Falling relative prices in the import sector.
- How do changes in **relative prices** affect the earnings of factors?
 - Earnings of specific or fixed factors (such as capital and land) go up or down the most with changes in relative prices because they are immobile.
 - Mobile factors (such as labor) can offset losses from changes in relative prices by seeking employment in other sectors.

2. Specific-factors model

- Two countries: Home and Foreign.
- Two sectors: manufacturing and agriculture.
- Three production factors: capital and land (fixed), labor (mobile).
- Home Country
 - Manufacturing uses labor and capital.
 - Agriculture uses labor and land.
 - Diminishing returns to labor—decreasing MPL_M and MPL_A (see Figure 3.2).

2. Specific-factors model

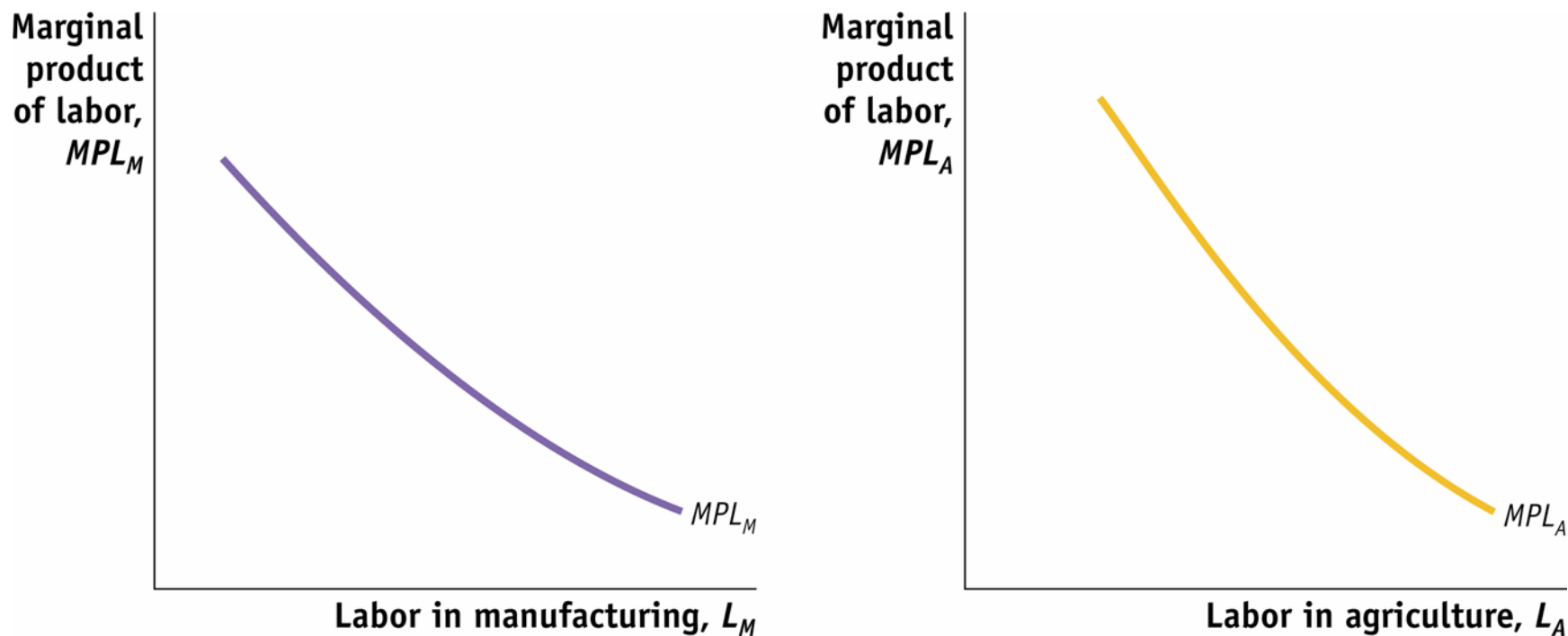
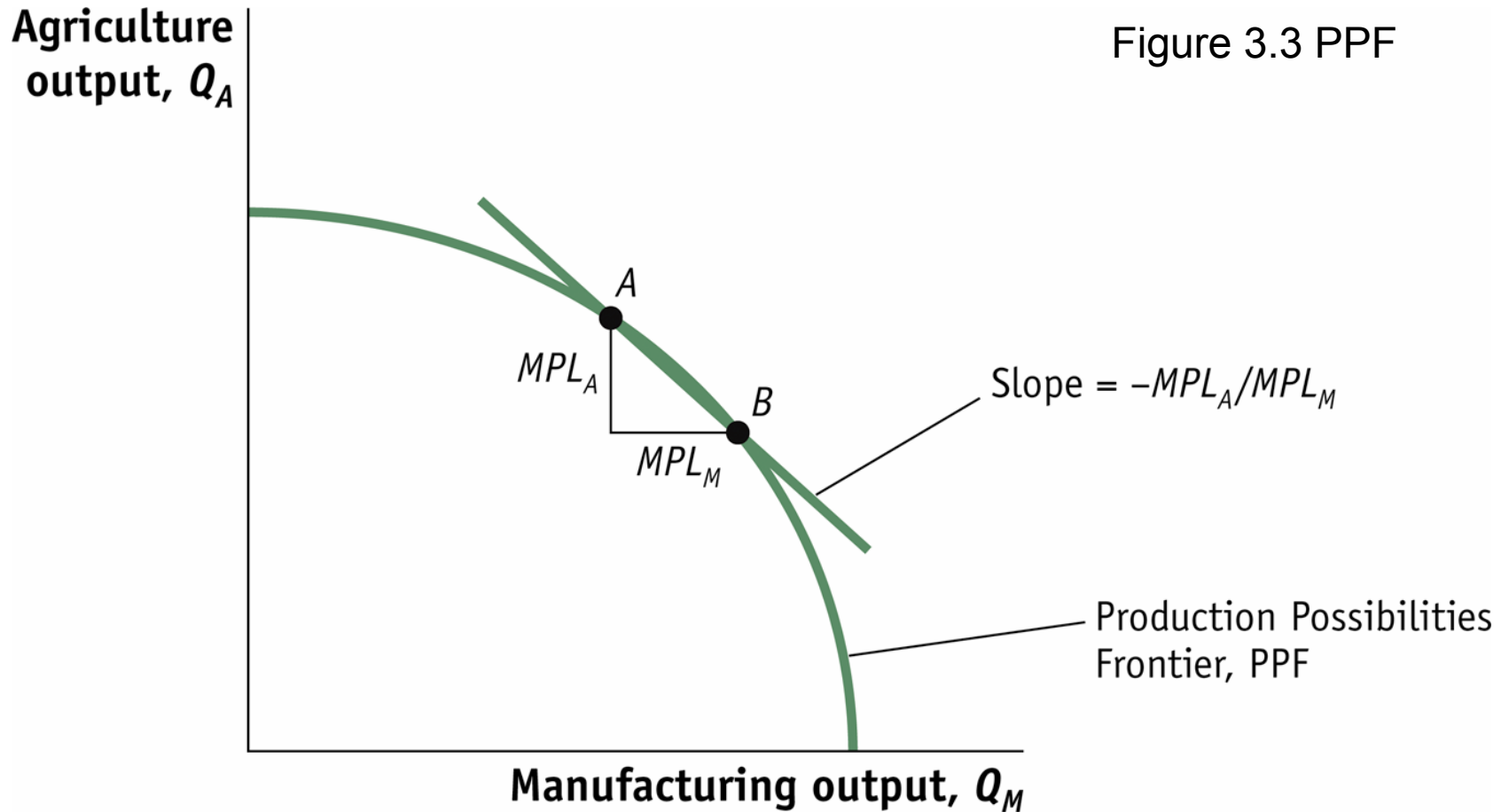


Figure 3.2 Diminishing Marginal Product of Labor

2. Specific-factors model

- Standard Production Possibilities Frontier (PPF).
 - Concave to the origin because of diminishing returns to labor in both industries.
 - If one unit of L moves from agriculture to manufacturing: agricultural output falls by MPL_A and manufacturing output rises by MPL_M .
 - Slope of the PPF is negative of ratio of marginal products (see figure 3.3) and gives opportunity cost of producing one unit of manufacturing.
 - If L continues to move to manufacturing, MPL_A rises and MPL_M falls so the slope of the PPF gets steeper.

2. Specific-factors model



2. Specific-factors model

- Opportunity Cost and Prices
 - As in Ricardian model, the slope of the PPF equals the opportunity cost or relative price of the good on the horizontal axis (manufacturing).
 - Firms hire labor up to point where cost of one more hour of labor (wage) equals value of one more hour of labor in production.

$$W = P_M \cdot MPL_M$$

2. Specific-factors model

- Opportunity Cost and Prices (cont'd)
 - Value of additional output can be measured by multiplying the price of the good times the additional output, or the MPL.
 - Equality holds for both industries:

$$W = P_M \cdot MPL_M$$

$$W = P_A \cdot MPL_A$$

2. Specific-factors model

- Labor is mobile, so wages in the two industries must be equal.
- Relative price of manufacturing equals the opportunity cost of manufacturing (slope of PPF).

$$P_M \cdot MPL_M = P_A \cdot MPL_A$$

$$\frac{P_M}{P_A} = \frac{MPL_A}{MPL_M}$$

2. Specific-factors model

- The no-trade position for Home is shown in figure 3.4 at point A.
- The Foreign Country
 - Assume the no-trade price in the foreign country (P_M^*/P_A^*) is higher than that in the Home country

$$P_M^*/P_A^* > P_M/P_A$$

- Home country has comparative advantage in manufacturing (can produce at lower opportunity cost than Foreign country).

2. Specific-factors model

- Overall Gains from Trade (figure 3.4)
 - When trade opens the world price will end up between no-trade prices of Home and Foreign.
 - After trade
 - Relative Home price of manufacturing will rise
 - Relative Foreign price of manufacturing will fall
 - Total gains from trade can be measured by the increased utility of the higher indifference curve.

2. Specific-factors model

- Overall Gains from Trade – detailed mechanism
 - Relatively higher price in manufacturing attracts more workers to that industry—production now at point B.
 - Manufactured goods exported and agricultural goods imported.
 - Consumption changes to point C, moving individuals to higher indifference curve.

2. Specific-factors model

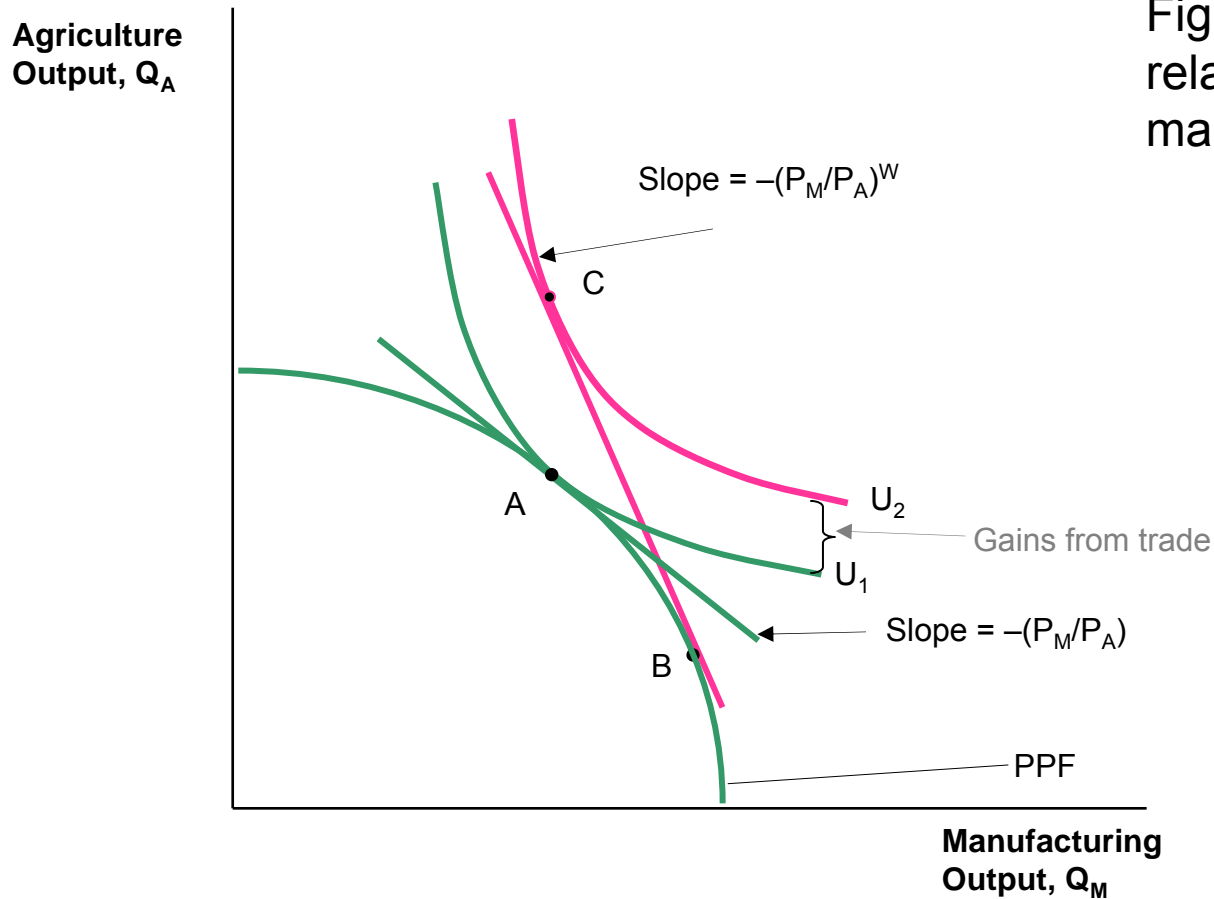


Figure 3.4 Increase in relative price of manufactures

2. Specific-factors model

- Conclusions
 - The good whose relative price increases becomes the exported good.
 - The good whose relative price decreases is the imported good.
 - A country can never be made worse off from trade.

3. Earnings of labor

- Country as a whole is better off from trade, but not necessarily every individual.
- Determination of Wages (figure 3.5)
 - Amount of labor used in each industry on one graph.

$$L_M + L_A = \bar{L}$$

- Firms hire up to the point where wages equal the value of the marginal product $W = P_M \cdot MPL_M = P_A \cdot MPL_A$
- Equilibrium wage at point A.

3. Earnings of labor

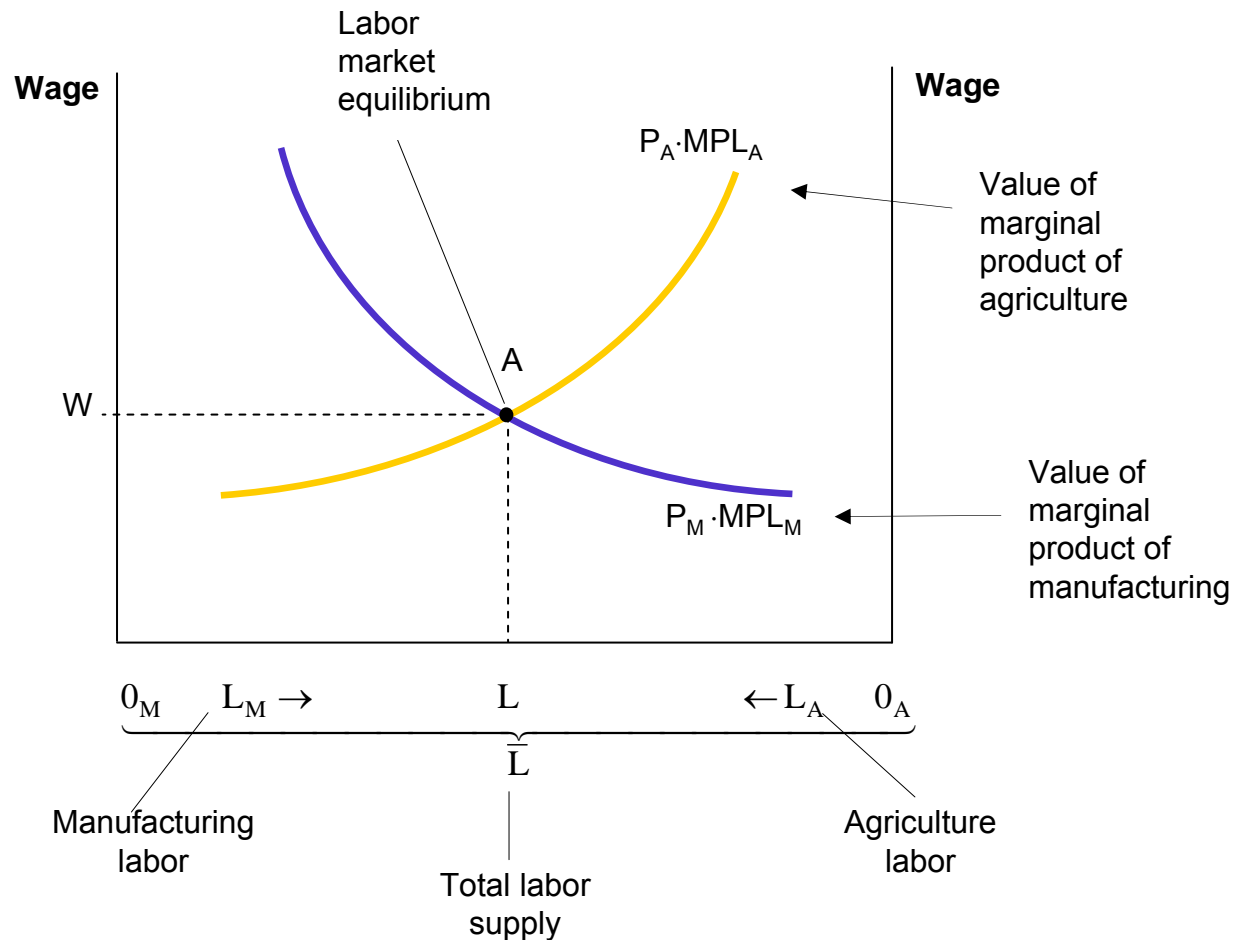


Figure 3.5
Allocation of labor
between
manufacturing and
agriculture

3. Earnings of labor

- With equal wages in two sectors, labor does not move.
- Equilibrium can change as other factors in market change.
- Change in Relative Price of Manufactures (figure 3.6)
 - Relative price of manufactures rises (e.g. because of foreign demand) – increase in P_M or decrease in P_A (same effect on wage).
 - Assume P_M rises
 - $P_M \cdot MPL_M$ curve shifts up by $\Delta P_M \cdot MPL_M$ to $P'_M \cdot MPL_M$
 - New equilibrium at higher wage
 - L_M has increased and L_A has decreased.

3. Earnings of labor

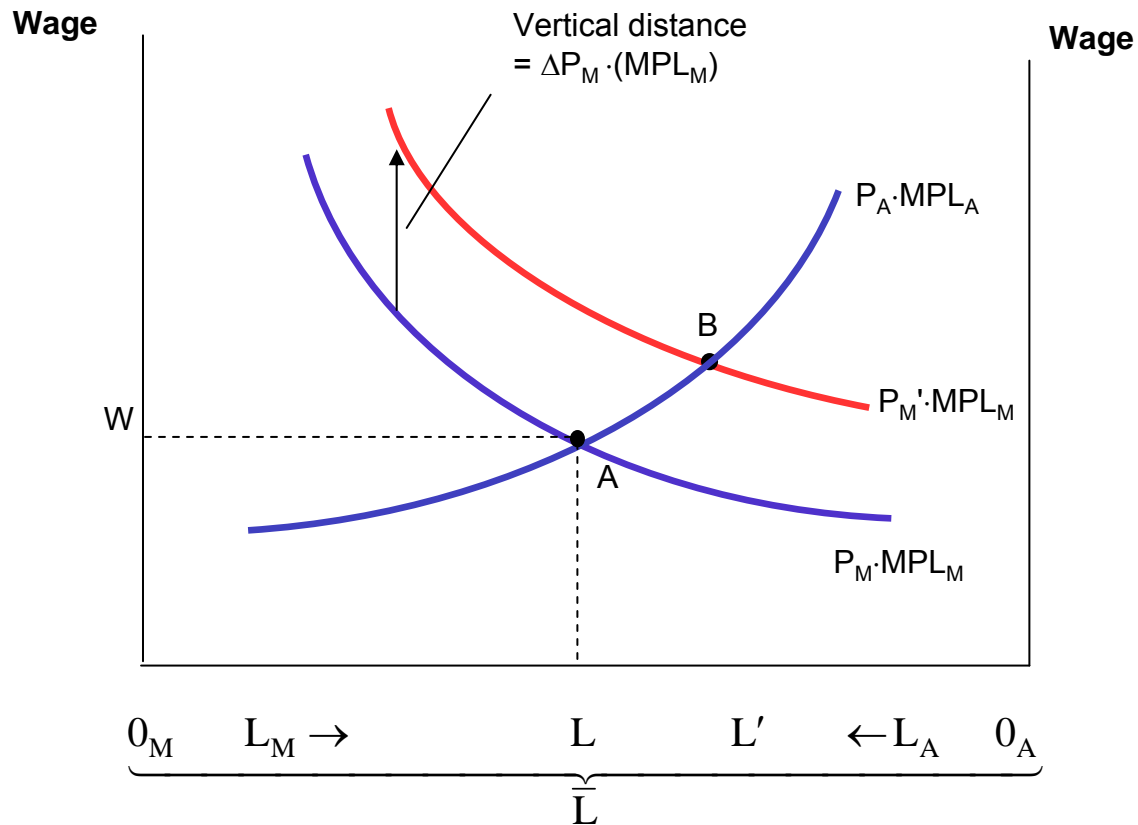


Figure 3.6 Increase in the price of manufactured goods

3. Earnings of labor

- Effect on Real Wages
 - Do higher (nominal) wages translate into higher *real* wages? Depends on changes in prices.
 - We assumed P_A did not change so W/P_A has increased—workers can buy more food.
 - We assume that P_M increased, as did W ; what is the net effect on W/P_M ?

3. Earnings of labor

- Effect on Real Wages (cont'd)

- We showed in figure 3.6 that

$$\Delta W < \Delta P_M \cdot MPL_M$$

- If we divide both sides by W (equal to $P_M \cdot MPL_M$) we get:

$$\frac{\Delta W}{W} < \frac{\Delta P_M \cdot MPL_M}{P_M \cdot MPL_M} = \frac{\Delta P_M}{P_M}$$

- $\Delta W / W$ is the percentage change in wages.

3. Earnings of labor

- Effects on Real Wages (cont'd)
 - $\Delta P_M/P_M$ is the percentage change in the price of manufactured goods.
 - Since $\Delta W/W$ is a smaller increase, the amount of manufactured goods that can be purchased with the money wage has fallen.
 - *The real wage in terms of manufactured goods has decreased.*

3. Earnings of labor

- Overall Impact on Labor
 - Is labor better off or worse off after the price increase?
 - A person who spends more of his or her income on agricultural goods is better off.
 - A person who spends more of his or her income on manufactured goods is worse off.
 - In the specific-factors model, the overall effect on the well-being of workers is ambiguous.

3. Earnings of labor

- Overall Impact on Labor (cont'd)
 - The result differs from Ricardian model, where labor unambiguously earned a higher real wage.
 - One cannot make unqualified statements about the effects of trade on workers.
 - The effect of trade on real wages can be complex.

3. Earnings of labor

- Unemployment in Specific Factors Model
 - Total labor is always $L_M + L_A$ so no unemployment.
 - Why no unemployment?
 - Unemployment is usually considered a macro phenomenon affected by business cycles.
 - Many people laid off due to trade often soon find new jobs, even with higher wages – many in expanding exporting industry.
 - Even after we take into account that workers eventually find new jobs, we still cannot conclude whether trade is necessarily good or bad for workers.

3.1 Trade and labor in specific-factors model - empirics

- Manufacturing and Services in the U.S.: Employment and Wages Across Sectors.
- Figure 3.7 shows employment in U.S. manufacturing industry over time.
- Figure 3.8 shows real wages earned by production workers in manufacturing, all private services, and in information services.
- Table 3.1 shows job loss and reemployment data for workers in U.S. manufacturing and service industries.

3.1 Trade and labor in specific-factors model - empirics

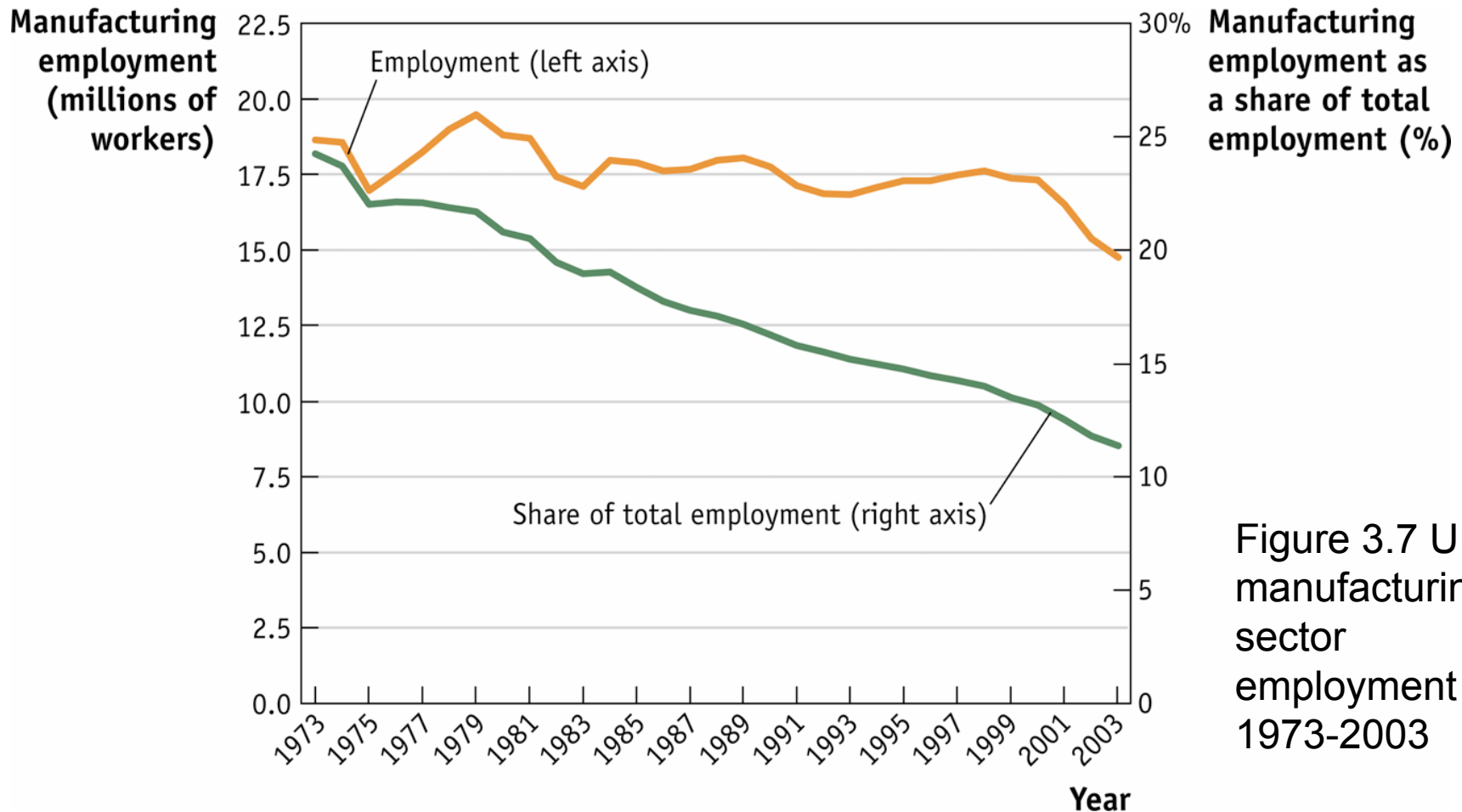


Figure 3.7 U.S. manufacturing sector employment 1973-2003

3.1 Trade and labor in specific-factors model - empirics

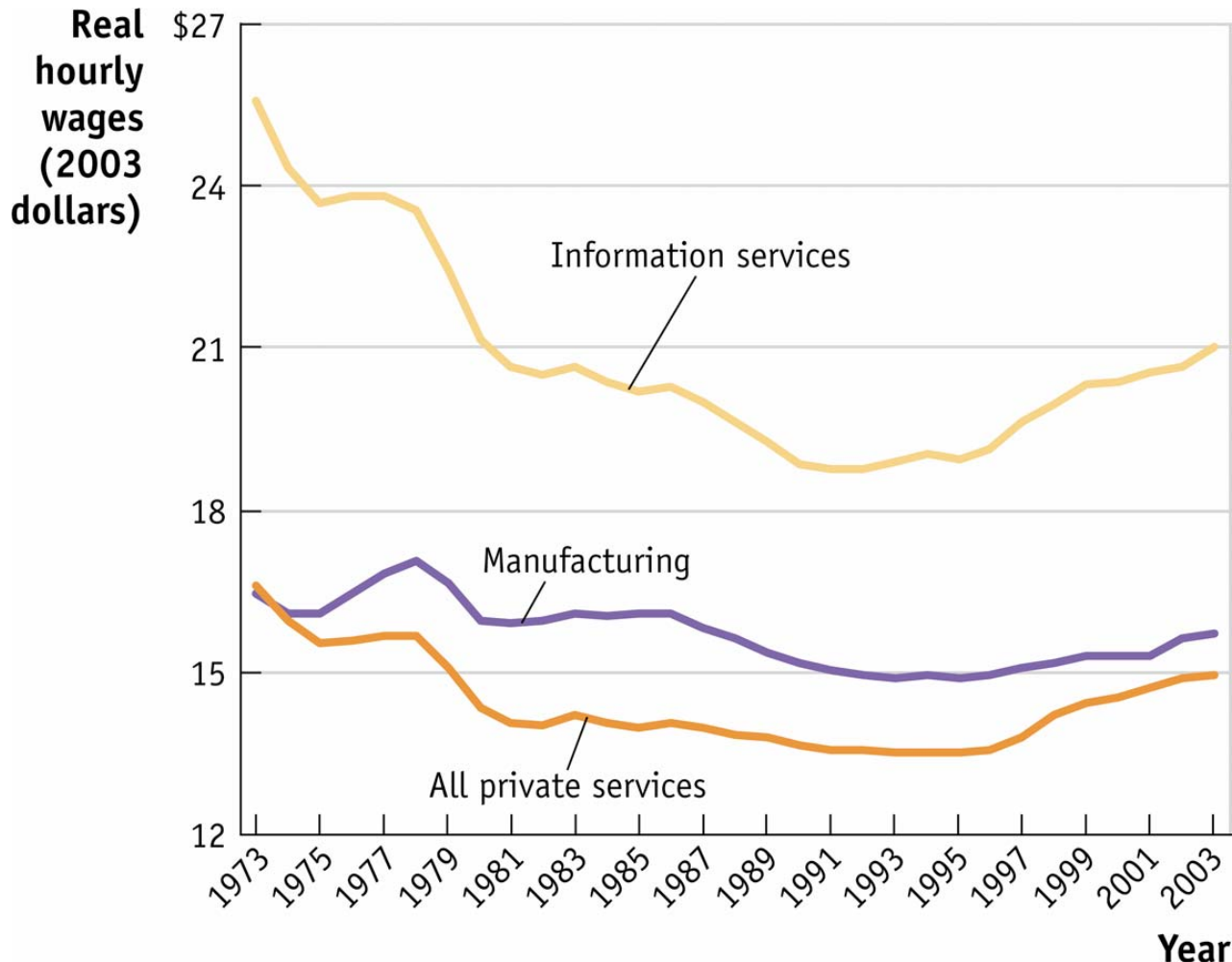


Figure 3.8 Real hourly earnings of production workers

3.1 Trade and labor in specific-factors model - empirics

Table 3.1 Job losses in manufacturing and service industries 2003-2005

Industry	Total Displaced Workers (thousands)	Workers Reemployed by January 2006	PERCENTAGES	
			Of the Workers Reemployed:	
			Earn Less in New Job	Earn Same or More in New Job
Manufacturing industries	1,085	65%	54%	46%
Service industries	2,381	70%	48%	52%

Source: U.S. Bureau of Labor Statistics, <http://www.bls.gov/news.release/disp.nr0.htm>

3.1 Trade and labor in specific-factors model - empirics

- Conclusions
 - Wages differ across different sectors in the economy, so assumption that wages are the same in both industries is simplification.
 - Many workers that are displaced every year for various reasons must find jobs elsewhere.
 - Some are laid off because of import competition, but there are many other reasons
 - The majority of workers find new jobs within 2–3 years, but not necessarily at same wage.
 - Real wages for all production workers fell in most years between 1972–95, but have since risen.

4. Earnings of capital and land

- Overall gains from trade for the country, but labor, the mobile factor, does not necessarily gain.
- What happens to earnings of immobile factors capital and land?
- Determining the Payment to Capital and Land
 - Capital and Land earn what is left over from sales revenue after labor is paid.
 - Total revenue is price times the quantity sold, and payments to labor are wages times quantity hired.

4. Earnings of capital and land

- Determining the Payment to Capital and Land (cont'd)
 - Payments to capital = $P_M \cdot Q_M - W \cdot L_M$
 - Payments to land = $P_A \cdot Q_A - W \cdot L_A$
 - Quantity of land used in agriculture is T acres.
 - Quantity of capital used in manufacturing is K .
 - Earnings of capital, R_K , and land, R_T :

$$R_K = \frac{\text{Payments to capital}}{K} = \frac{P_M \cdot Q_M - W \cdot L_M}{K}$$

$$R_T = \frac{\text{Payments to land}}{T} = \frac{P_A \cdot Q_A - W \cdot L_A}{T}$$

4. Earnings of capital and land

- Determining the Payment to Capital and Land (cont'd)
 - R_K and R_T are rental on capital and land, respectively.
 - Alternative method to calculate the rental on capital and land: consider the value of the additional output we get from hiring those factors.

$$R_K = P_M \cdot MPK_M$$

$$R_T = P_A \cdot MPT_A$$

4. Earnings of capital and land

- Change in the Real Rental on Capital
 - Assume P_M increases as before, P_A constant.
 - Wages rise and labor shifts from agriculture to manufacturing.
 - As more labor is used in manufacturing, the marginal product of capital will rise.
 - As more labor leaves agriculture, the marginal product of land will fall.
 - *An increase in the quantity of labor used in an industry will raise the marginal product of the factor specific to that industry, and a decrease in labor will lower the marginal product of the specific factor.*

4. Earnings of capital and land

- We can get more from this conclusion:
 - Remember $MPK_M = R_K/P_M$
 - P_M is rising; MPK_M is rising.
 - R_K must be increasing by more than P_M , in percentage terms.
 - Remember R_K/P_A is amount of food that can be purchased by capital owners.
 - R_K increased, P_A fixed, so R_K/P_A increases.
 - Real rental on capital in terms of food has increased.

4. Earnings of capital and land

- Change in the Real Rental on Capital (cont'd)
 - Since capital owners can afford more of both goods, they are better off when P_M rises.
 - This is unlike the case of labor, which could buy more of one good but less of the other.
 - Capital owners are better off with trade.

4. Earnings of capital and land

- Change in the Real Rental on Land
 - Labor leaves agriculture, causing MPT_A to fall.
 - Since $MPT_A = R_T/P_A$, R_T/P_A must fall, meaning R_T itself must fall (P_A remains constant).
 - The real rental on land in terms of food has decreased—landowners cannot buy as much food.
 - P_M has increased, so landowners cannot buy as much of the manufactured good.
 - Landowners are clearly worse off with trade than in the no-trade case.

4. Earnings of capital and land

- Summary
 - Real earnings of capital owners and landowners move in opposite directions.
 - *An increase in the relative price of an industry's output will increase the real rental earned by the factor specific to that industry, but will decrease the real rental of factors specific to other industries.*
 - This means that, generally, specific factors in export industries gain, and specific factors in importing industries lose.

4. Earnings of capital and land – numerical example

- Manufacturing:
 - Sales Revenue = $P_M \cdot Q_M = \$100$
 - Payments to Labor = $W \cdot L_M = \$60$
 - Payments of Capital = $R_K \cdot K = \$40$
- Agriculture
 - Sales Revenue = $P_A \cdot Q_A = \$100$
 - Payments to Labor = $W \cdot L_A = \$50$
 - Payments to Land = $R_T \cdot T = \$50$

4. Earnings of capital and land – numerical example

- Assume P_M increases by 10% and P_A remains constant. Percentage change in labor is 5%
 - $\Delta P_M/P_M = 10\%$
 - $\Delta P_A/P_A = 0\%$
 - $\Delta W/W = 5\%$
 - Percent change in wages will be between the percent change in the two industry price changes.

4. Earnings of capital and land – numerical example

- Change in the Rental on Capital

$$R_K = \frac{\text{Payments to Capital}}{K} = \frac{P_M \cdot Q_M - W \cdot L_M}{K}$$

$$\Delta R_K = \frac{\Delta P_M \cdot Q_M - \Delta W \cdot L_M}{K}$$

Rewriting using percentage changes gives:

$$\frac{\Delta R_K}{R_K} = \frac{(\Delta P_M / P_M) \cdot P_M \cdot Q_M - (\Delta W / W) \cdot W \cdot L_M}{R_K \cdot K}$$

4. Earnings of capital and land – numerical example

- Change in Rental on Capital
 - $\Delta R_K/R = (10\% \cdot 100 - 5\% \cdot 60)/40 = 17.5\%$
 - The percentage increase in rental on capital is greater than percentage increase in the relative price of manufacturing, 10%
 - This holds no matter what, given that the percentage increase in the wage is less than the percentage increase in the price of the manufactured good.

4. Earnings of capital and land – numerical example

- Change in Rental on Land
 - Change in rental rates due to increase in P_M

$$\Delta R_T = \frac{0 \cdot (Q_A) - \Delta W \cdot L_A}{T}$$

- Wages are increasing, which means the rental on land is falling. We can calculate how much.

4. Earnings of capital and land – numerical example

- Change in Rental on Land (cont'd)
 - Land rent falls by same percentage as wage increases (because labor and land receive same share of sales revenue)

$$\frac{\Delta R_T}{R_T} = -\frac{\Delta W}{W} \left(\frac{W \cdot L_A}{R_T \cdot T} \right)$$

$$\frac{\Delta R_T}{R_T} = -5\% \left(\frac{50}{50} \right) = -5\%$$

4. Earnings of capital and land

- General Equation for the Change in Factor Prices
 - All changes in factor and industry prices are related.
 - Assume P_M increases and P_A does not change (or P_A falls and P_M remains the same) then:

$$\underbrace{\frac{\Delta R_T}{R_T}}_{\text{real rental on land falls}} < 0 < \underbrace{\frac{\Delta W}{W}}_{\text{change in real wage is ambiguous}} < \frac{\Delta P_M}{P_M} < \underbrace{\frac{\Delta R_K}{R_K}}_{\text{real rental on capital rises}}$$

4. Earnings of capital and land

- General Equation for the Change in Factor Prices (cont'd)
 - The opposite is true if P_M falls or, alternatively, if P_A increases (while the price of the other good remains constant).
 - Wages fall by less than percent change in the manufactured good, rental on capital falls by more than the manufacturing price, and rental on land rises.

$$\underbrace{\frac{\Delta R_K}{R_K}}_{\text{real rental on capital falls}} < 0 < \underbrace{\frac{\Delta W}{W}}_{\text{change in real wage is ambiguous}} < \frac{\Delta P_A}{P_A} < \underbrace{\frac{\Delta R_T}{R_T}}_{\text{real rental on land rises}}$$

4. Earnings of capital and land

- Summary:
 - The earnings of specific factors change the most from relative price changes due to international trade.
 - This is because these factors (land and capital) cannot move between industries.
 - The earnings changes are in opposite directions and so the interests of T and K are opposed to each other.
 - Changes in wages paid to labor are less extreme.

5. Prices in agriculture - empirics

- Prebisch-Singer Hypothesis from previous chapter states that (relative) prices of primary commodities will fall.
 - Did not hold for all commodities, but true for cotton, palm oil, rice, sugar, rubber, wheat and wool – declined for more than half the years 1900-1998.
 - Generally, prices fall as efficiency rises and country begins exporting.
- Specific-factors model predicts landowners will lose in real terms from decline in relative prices, while capital owners gain (changes in wages are ambiguous).

5. Prices in agriculture - empirics

- Governments often protect agricultural sector from negative effects of trade.
 - Industrial countries often restrict imports and encourage exports.
 - Protection from trade tends to raise domestic prices of “protected” goods, with the aim of raising real incomes of farmers, in line with specific-factors model’s prediction.
- Measure of protection given by nominal protection coefficient (NPC):

$$\text{Nominal protection coefficient} = \frac{\text{Domestic price of a good}}{\text{World price of that good}}$$

5. Prices in agriculture - empirics

- Figure 3.9 shows that average NPCs for agricultural goods in OECD are greater than one, meaning consumers are paying higher domestic prices due to protection.
 - Note however that prices have been falling for some goods because of reduced protection.
- Figure 3.10 shows price fluctuations of coffee, grown primarily in developing countries.
 - Large price fluctuations have meant large fluctuations in real incomes of coffee farmers, primarily in Central America and Asia – in line with model.
 - Fair-trade cooperatives insure against large price fluctuations by offering fixed (fair-trade) price.

5. Prices in agriculture - empirics

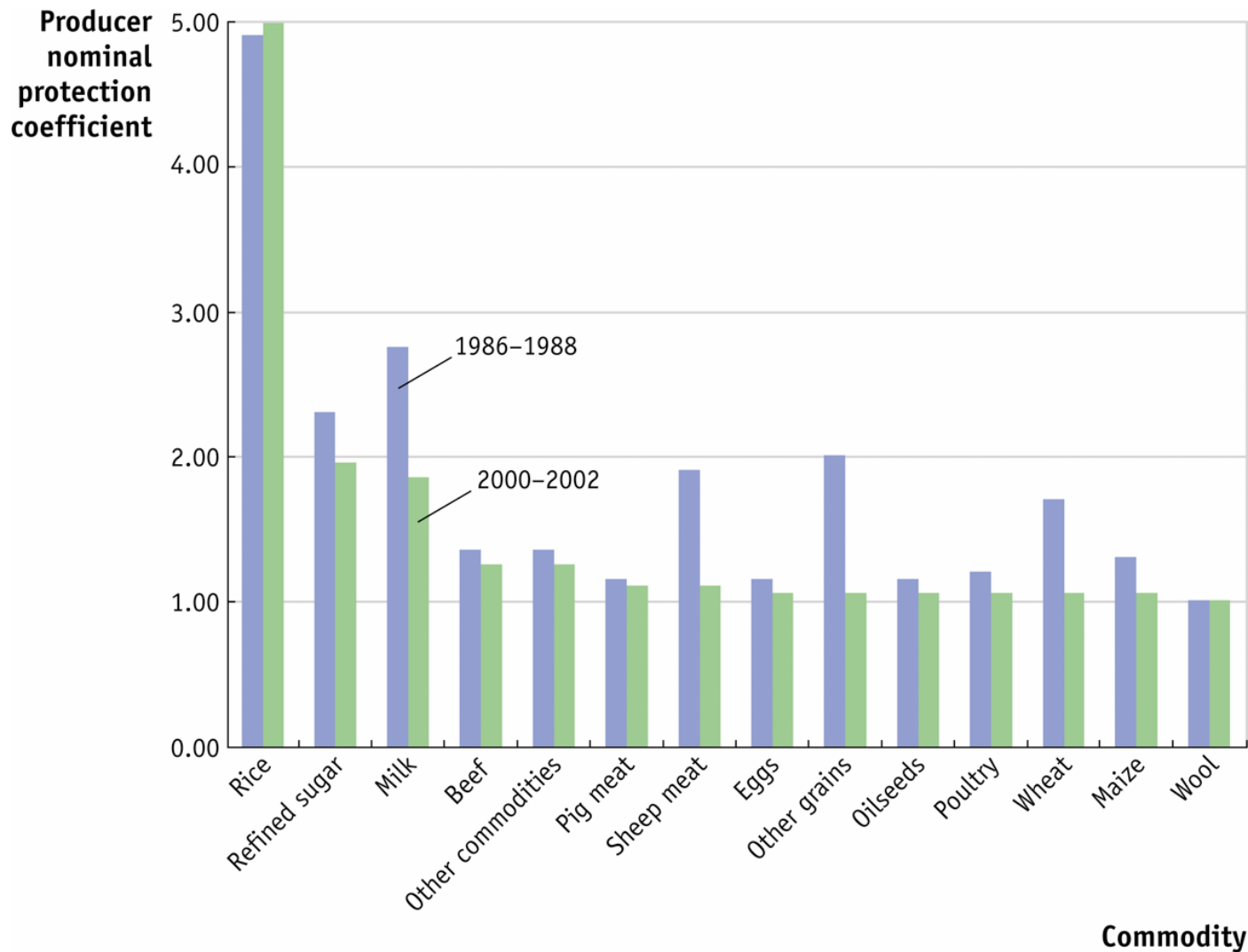


Figure 3.9
Nominal
Protection
Coefficients

5. Prices in agriculture - empirics

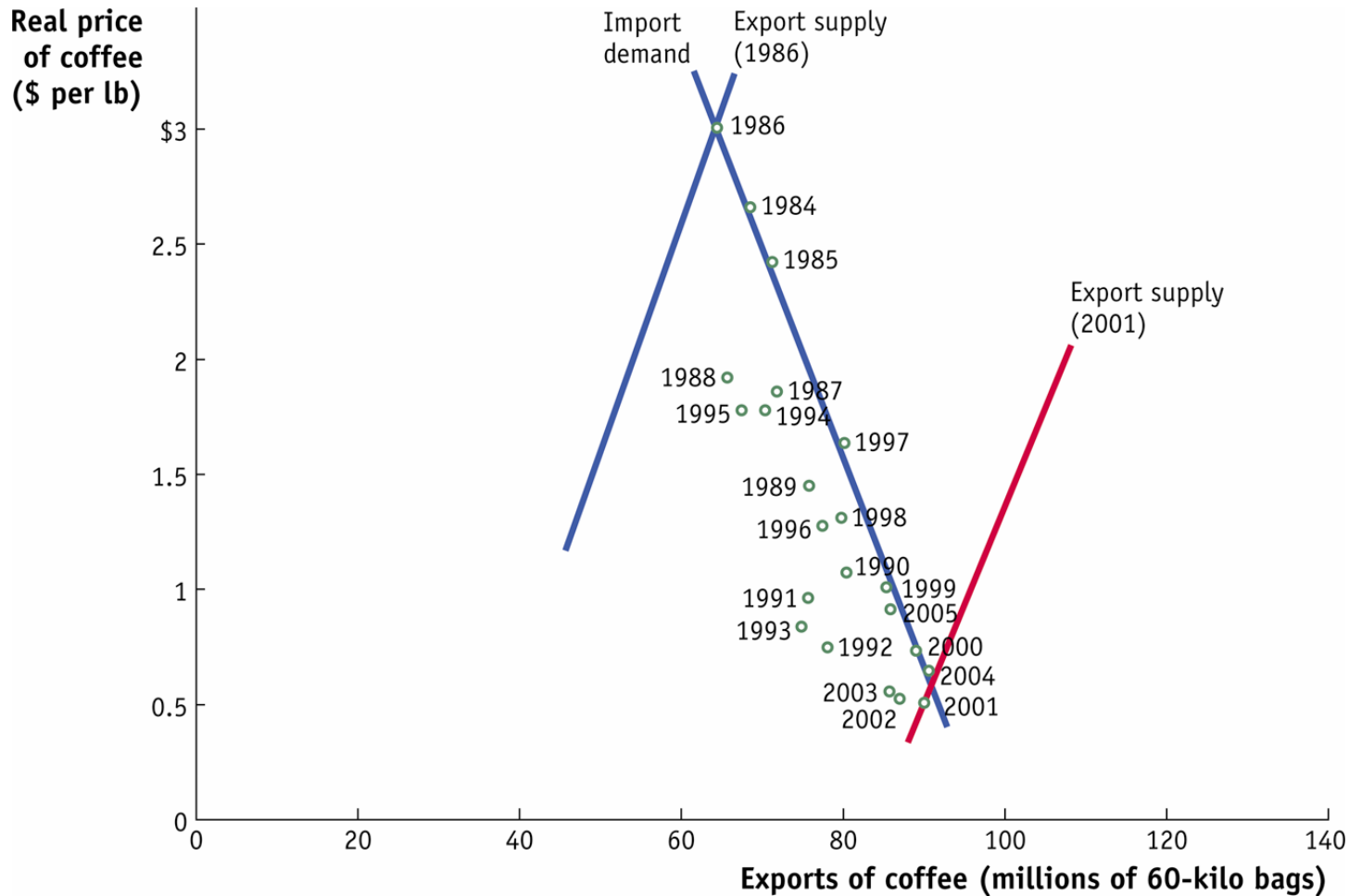


Figure 3.10
World coffee
market

6. Conclusions

- In Ricardian model, trade could never make a country worse off.
- Same for specific-factors model, but some factors of production can lose from trade.
- The factor specific to the importing industry suffers a fall in its real rental.
- The factor specific to the exporting industry enjoys an increase in its real rental.
- Since labor is mobile, it does not experience these extreme changes in wages: real wages rise in terms of one good but fall in terms of the other.