Gains and Losses from Trade in the Specific-Factors Model
ECON 6280 - Survey of International Economics

Week 2 / Lecture 3 / Note 1 (F & T Chapter 3)

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Introduction

- The argument from the Ricardian model that trade generates gains for *all* workers is too simple because labor is the only factor of production in that model.

- We relax that assumption with the **specific-factors model**, where land can be used only in the agriculture sector and capital can be used only in the manufacturing sector; labor is used in both sectors.

- From the Ricardian model, we learned that free trade affects relative prices, and this in turn affects the earnings of factors of production.

- The question addressed by the specific-factors model is how trade, through changes in *relative prices,* affects the earnings of labor, land, and capital.

1 Specific-Factors Model

The specific-factors model we will develop has the following features:

- Once again there are two countries: Home and Foreign.

- Manufacturing uses labor and capital, and agriculture uses labor and land.

- In each industry, increases in the amount of labor used are subject to **diminishing returns**, that is, the marginal product of labor declines as the amount of labor used in the industry increases.

For now let's focus on the Home country.

1 Specific-Factors Model

The Home Country

FIGURE 3-1
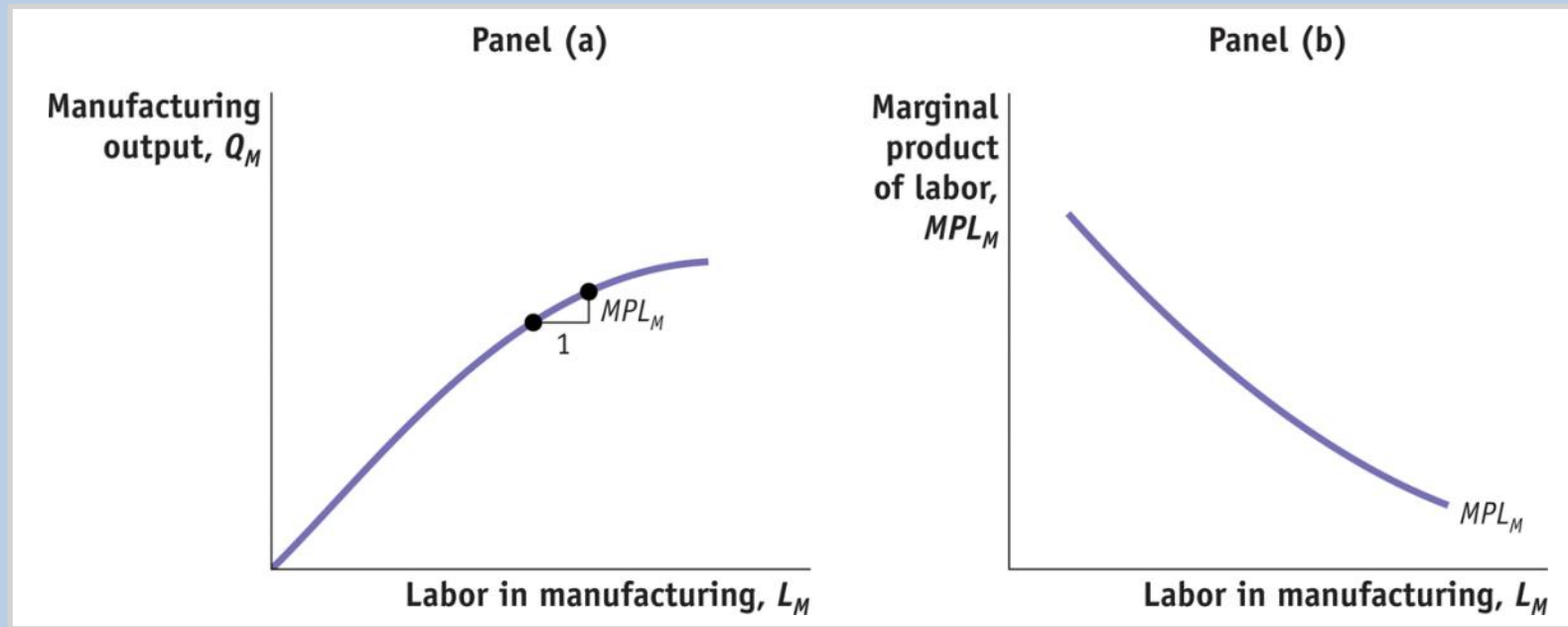
Panel (a) Manufacturing Output As more labor is used, manufacturing output increases, but it does so at a diminishing rate.
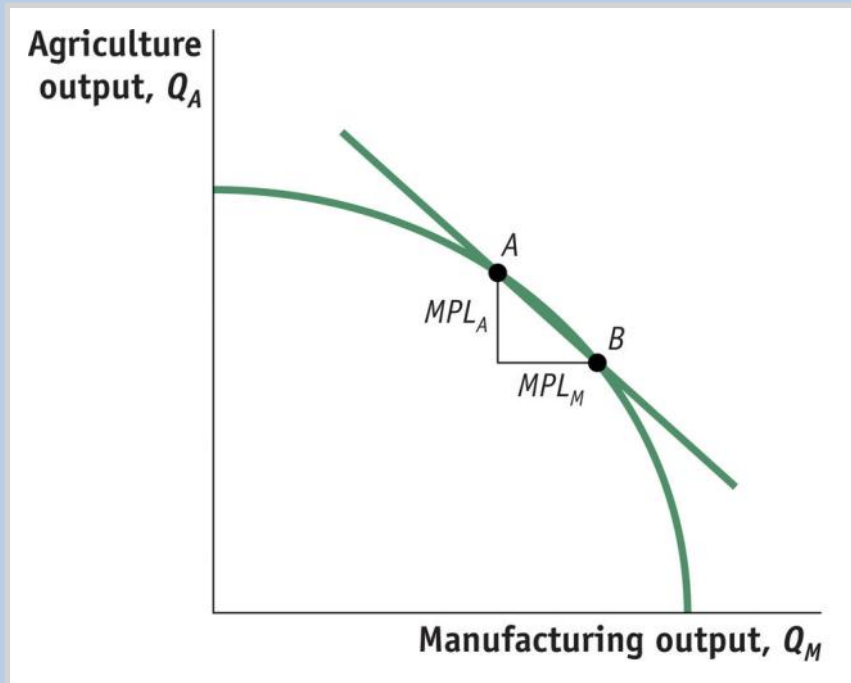
Panel (b) Diminishing Marginal Product of Labor An increase in the amount of labor used in manufacturing lowers the marginal product of labor.

The Home Country

Production Possibilities Frontier

FIGURE 3-2

Production Possibilities Frontier

The production possibilities frontier shows the amount of agricultural and manufacturing outputs that can be produced in the economy with labor.

The Home Country

Opportunity Cost and Prices

- As in the Ricardian model, the slope of the PPF equals the opportunity cost or relative price of the good on the horizontal axis; here it is manufacturing.

- Firms hire labor up to the point where the cost of one more hour of labor (the wage) equals the value of one more hour of labor in production.
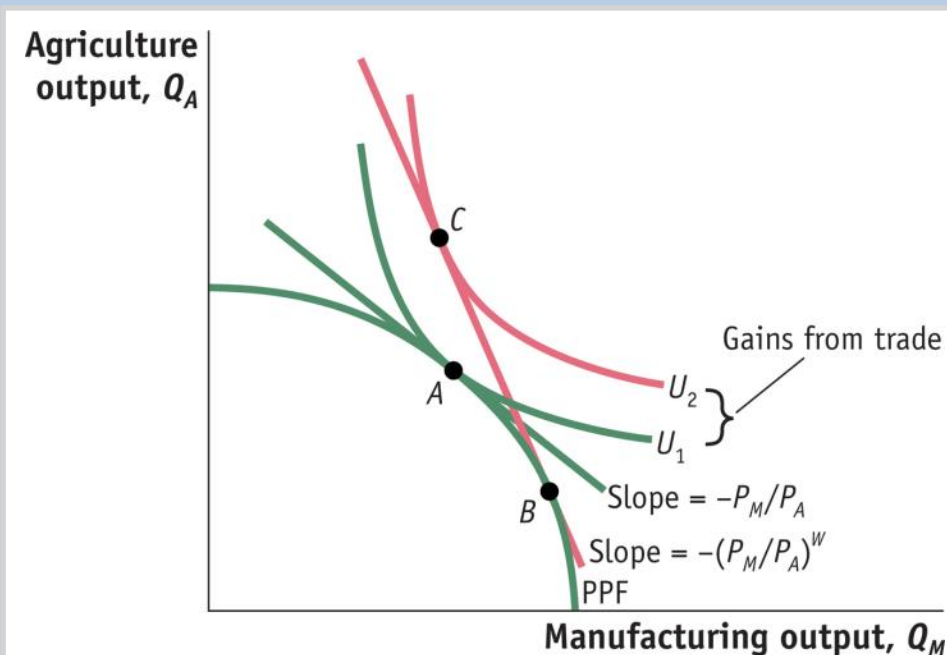
$$W = P_M \cdot MPL_M$$
$$W = P_A \cdot MPL_A$$

1 Specific-Factors Model

The Home Country

Opportunity Cost and Prices

FIGURE 3-3	Increase in the Relative Price of Manufactures

In the absence of international trade, the economy produces and consumes at point A.

The relative price of manufactures, P_M/P_A, is the slope of the line tangent to the PPF and indifference curve U_1, at point A.

With international trade, the economy is able to produce at point B and consume at point C.

The world relative price of manufactures, $(P_M/P_A)^W$, is the slope of the line BC.

The rise in utility from U_1 to U_2 is a measure of the gains from trade for the economy.

1 Specific-Factors Model

The Foreign Country

- Let us assume that the Home no-trade relative price of manufacturing is *lower* than the Foreign relative price.

$$(P_M/P_A) < (P^*_M/P^*_A)$$

- This means that Home can produce manufactured goods relatively cheaper than Foreign.

- Put another way, Home has a comparative advantage in manufacturing.

Overall Gains from Trade

- The good whose relative price goes up (manufacturing, for Home) is exported.

- The good whose relative price goes down (agriculture, for Home) is imported.

- By exporting manufactured goods at a higher price and importing food at a lower price, Home is better off than it was in the absence of trade.

APPLICATION

How Large Are the Gains from Trade?

There are a few historical examples of countries that have moved from **autarky** (i.e., no trade) to free trade, or vice versa, quickly enough to estimate the gains from trade.

- One episode occurred in the United States between December 1807 and March 1809.

- The U.S. Congress imposed a nearly complete halt on international trade at the request of President Thomas Jefferson.

- A complete stop of all trade is called an **embargo.** As you might expect, U.S. trade fell dramatically during this period. It is estimated that U.S. GDP was 5% lower than it would have been without the trade embargo.

How Large Are the Gains from Trade?

There are a few historical examples of countries that have moved from autarky (i.e., no trade) to free trade, or vice versa, quickly enough to estimate the gains from trade.

- Another historical case was Japan's rapid opening to the world economy in 1854, after 200 years of self-imposed autarky.

- The gains were not one-sided, however; Japan's trading partners—such as the United States—also gained from being able to trade in the newly opened markets.

2 Earnings of Labor

Determination of Wages

**FIGURE 3-4 (1 of 2)** Allocation of Labor Between Manufacturing and Agriculture
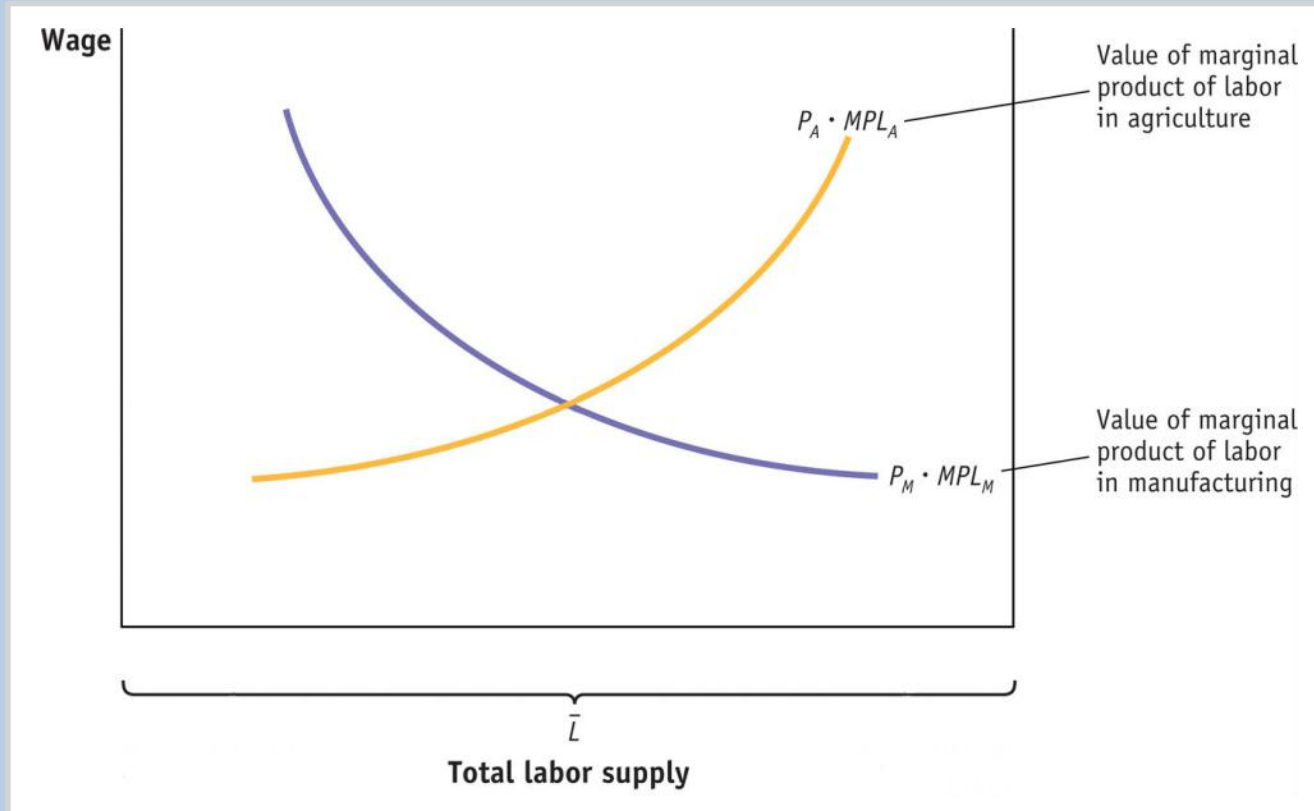
The amount of labor used in manufacturing is measured from left to right along the horizontal axis, and the amount of labor used in agriculture is measured from right to left.

2 Earnings of Labor

Determination of Wages

| FIGURE 3-4 (2 of 2) | Allocation of Labor Between Manufacturing and Agriculture (continued) |
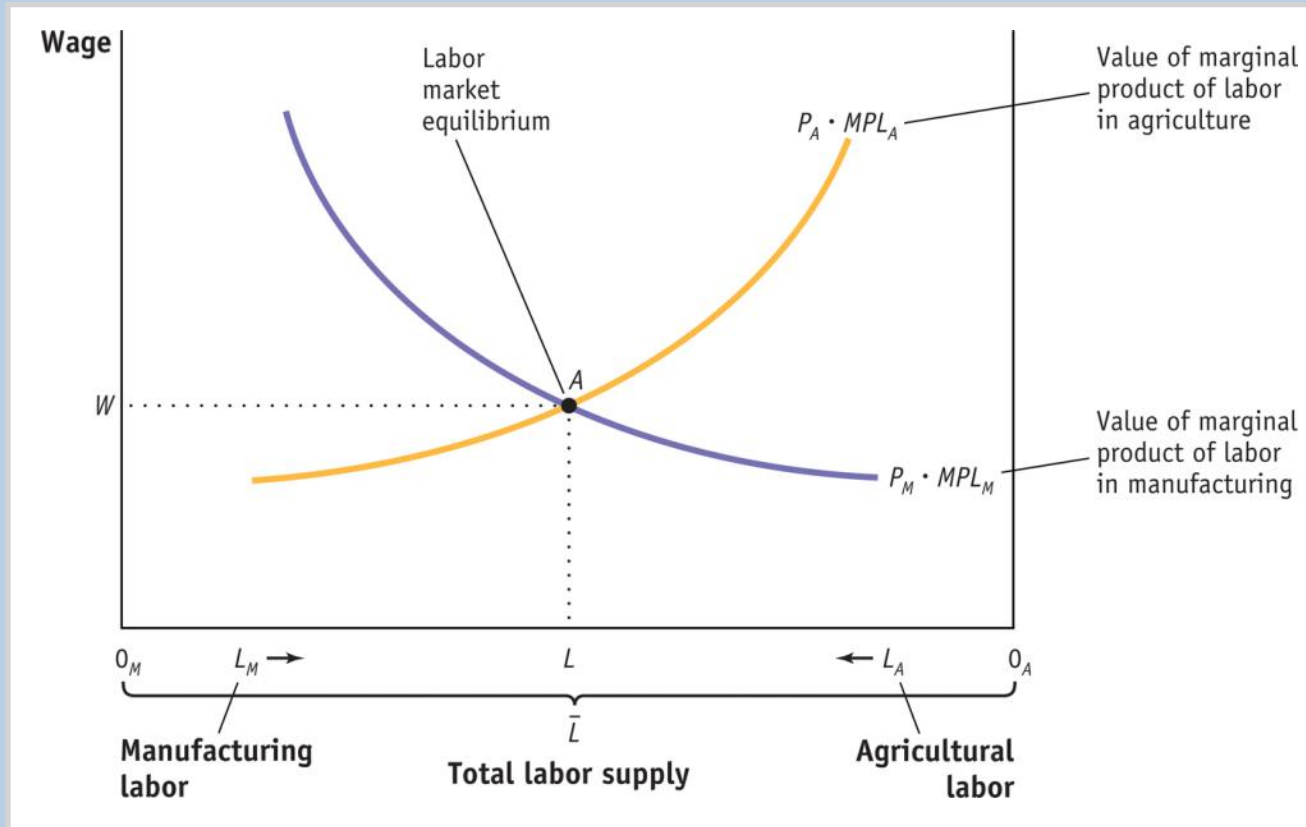
Labor market equilibrium is at point A. At the equilibrium wage of W, manufacturing uses $0_M L$ units of labor and agriculture uses $0_A L$ units.
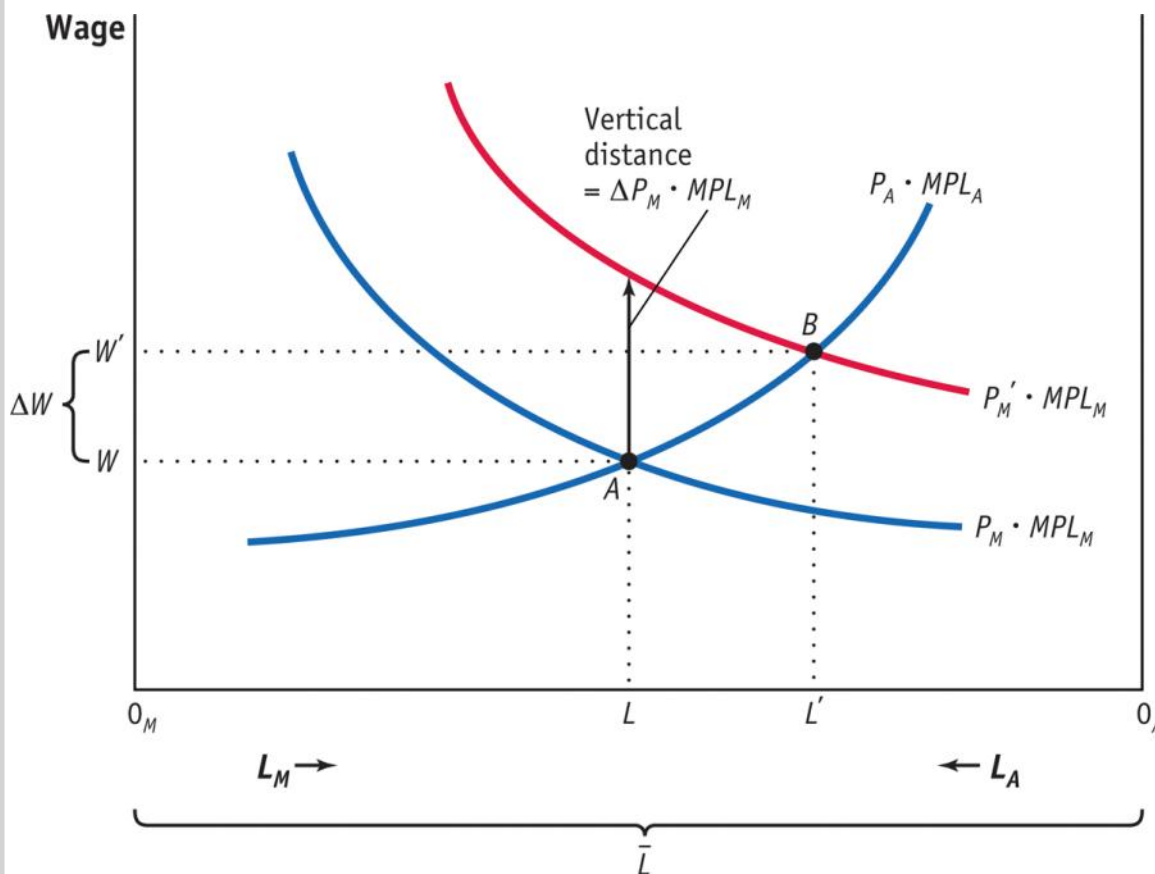
Change in Relative Price of Manufactures

Now consider an increase in the price of the manufactured good (P_M).

- With an increase in the price of the manufactured good the curve $P_M \cdot MPL_M$ shifts up.

- Therefore, the labor used in manufacturing rises, and labor used in agriculture falls.

- The wages also increase, but this increase is less than the upward shift $\Delta P_M \cdot MPL_M$

Change in Relative Price of Manufactures

FIGURE 3-5

Increase in the Price of Manufactured Goods

With an increase in the price of the manufactured good, the curve $P_M \cdot MPL_M$ shifts up to $P_M' \cdot MPL_M$ and the equilibrium shifts from point A to B.

The labor used in manufacturing rises from $0_M L$ to $0_M L'$, and labor used in agriculture falls from $0_A L$ to $0_A L'$.

The wage increases from W to W', but this increase is less than the upward shift $\Delta P_M \cdot MPL_M$.

**Change in Relative Price of Manufactures**

Effect on Real Wages

*   As we can see from Figure 3-5, the increase in the wage from W to W' is *less than* the vertical increase $\Delta P_M \cdot MPL_M$

*   Since $\Delta W/W < \Delta P_M/P_M$, the percentage increase in the wage is *less than* the percentage increase in the price of the manufactured good.

*   This inequality means that the amount of the manufactured good that can be purchased with the wage has fallen.

*   Therefore, the **real wage** *in terms of the manufactured good* W/P_M has decreased.

2 Earnings of Labor

Change in Relative Price of Manufactures

Effect on Real Wages

FIGURE 3-5
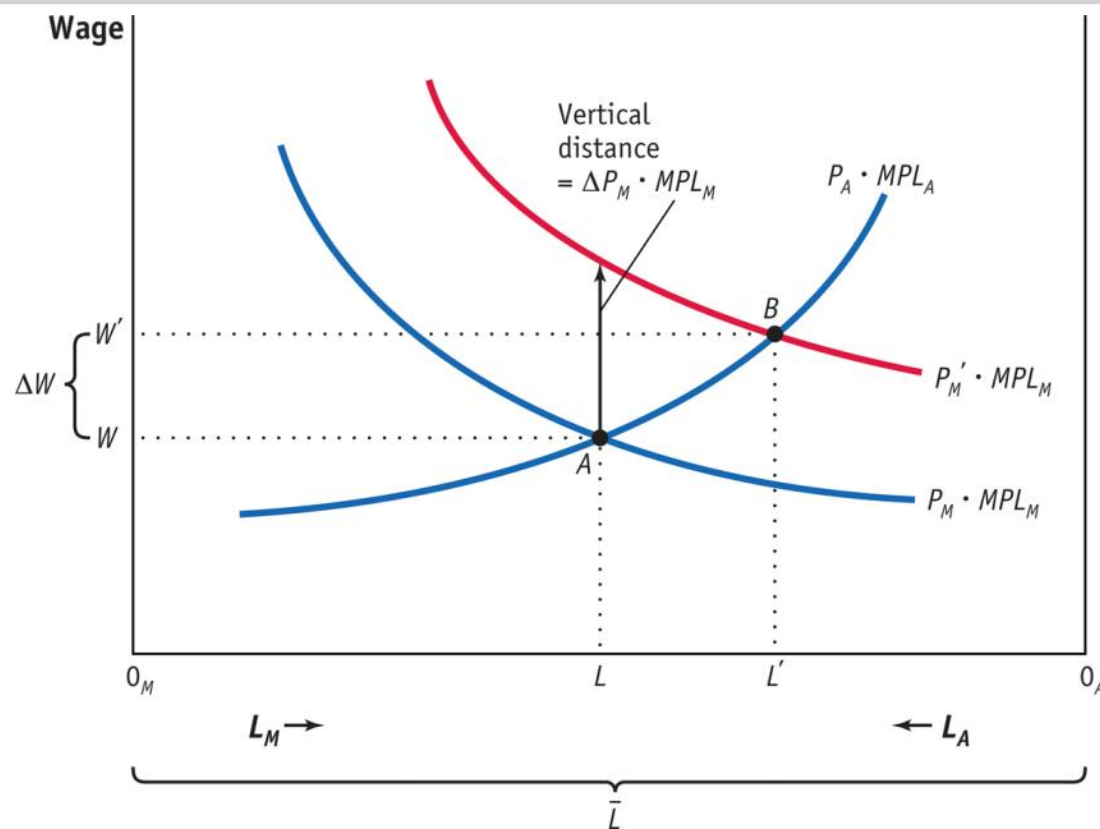
Once again, since $\Delta W/W < \Delta P_M/P_M$, the percentage increase in the wage is *less than* the percentage increase in the price of the manufactured good.

The manufactured good that can be purchased with the wage has fallen.

Therefore, the *real wage in terms of the manufactured good W/PM* has decreased.

Change in Relative Price of Manufactures

Overall Impact on Labor

- In the specific-factors model, the increase in the price of the manufactured good has an ambiguous effect on the real wage and therefore an *ambiguous* effect on the well-being of workers. Although ambiguous, this conclusion is important.

- The result is different than what was found in the Ricardian model, where labor unambiguously earned a higher real wage.

- This warns us that one cannot make unqualified statements about the effects of trade on workers.

- The effect of trade on real wages can be complex.

Change in Relative Price of Manufactures

Unemployment in the Specific-Factors Model

- It is hard to combine business cycle models with international trade models to isolate the effects of trade on workers.

- Once we recognize that workers can find new jobs—possibly in export industries that are expanding—so we still cannot conclude that trade is necessarily good or bad for workers.

- Next we look at some evidence from the United States on the amount of time it takes to find new jobs and on the wages earned, and at attempts by governments to compensate workers who lose their jobs because of import competition. This type of compensation is called **Trade Adjustment Assistance (TAA)** in the United States.

Manufacturing and Services in the United States: Employment and Wages Across Sectors

| FIGURE 3-6	U.S. Manufacturing Sector Employment, 1973–2014
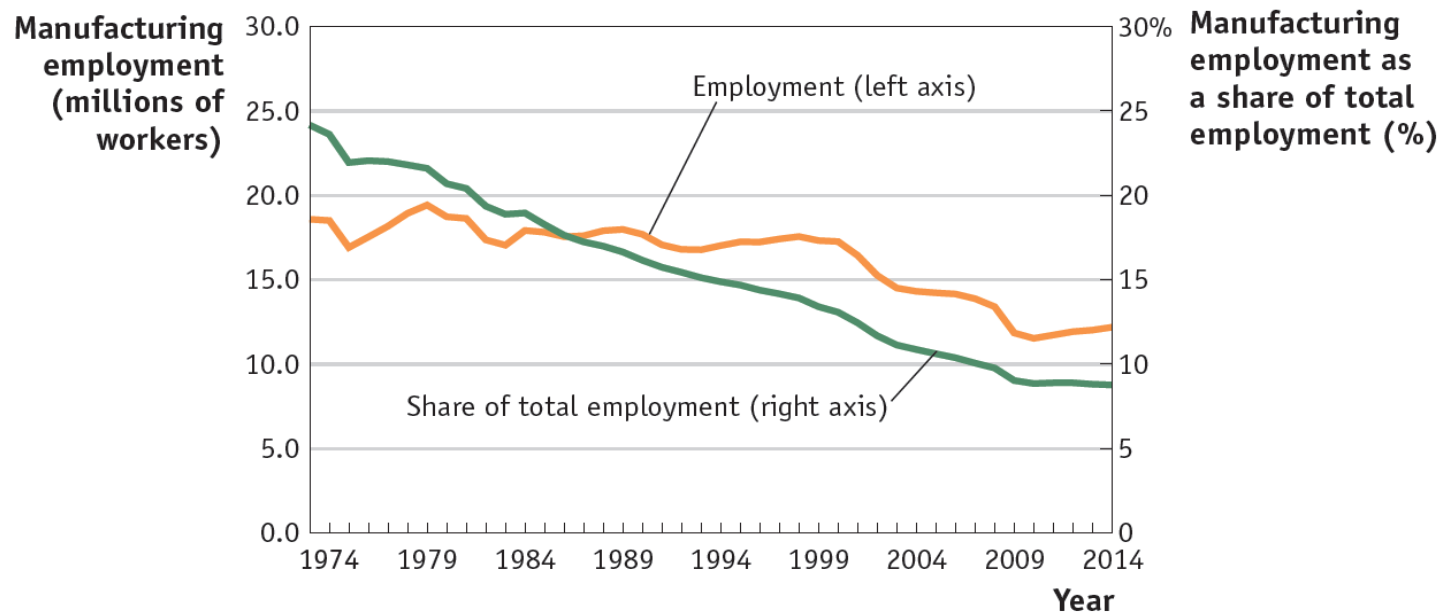
Employment in the U.S. manufacturing sector is shown on the left axis, and the share of manufacturing employment in total U.S. employment is shown on the right axis. Both manufacturing employment and its share in total employment have been falling over time, indicating that the service sector has been growing.

Manufacturing and Services in the United States: Employment and Wages Across Sectors

FIGURE 3-7 (1 of 2) | Real Hourly Earnings of Production Workers
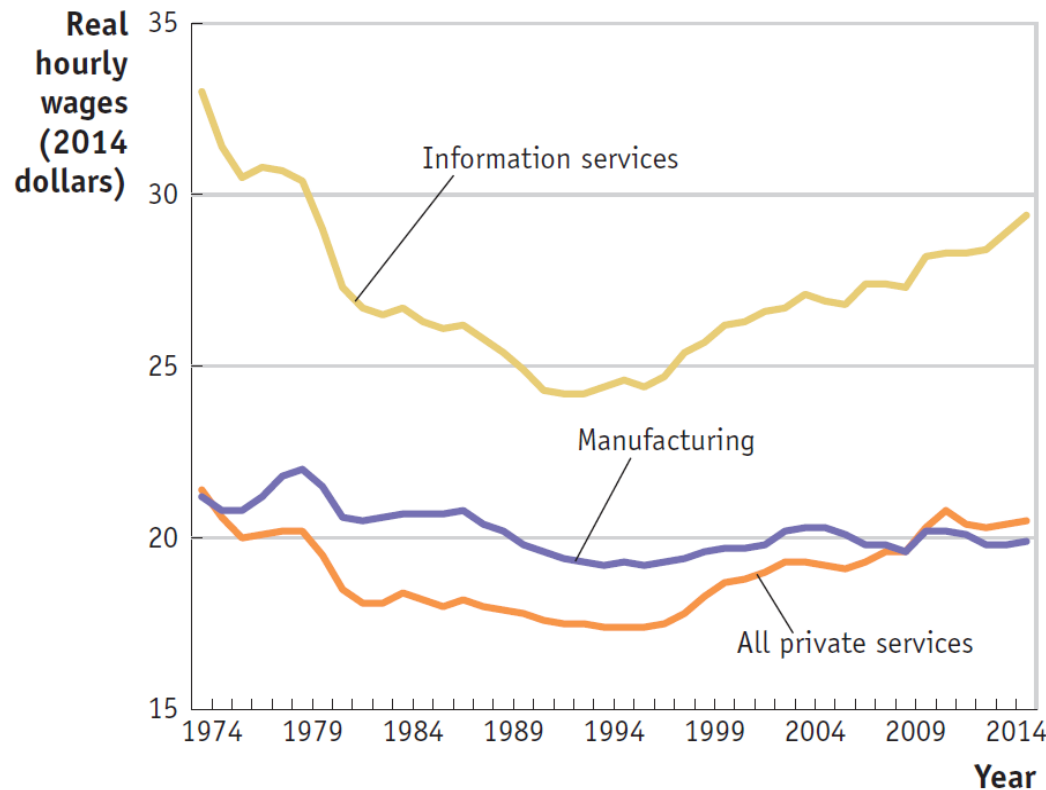
This chart shows the real wages (in constant 2014 dollars) earned by production workers in U.S. manufacturing, in all private services, and in information services (a subset of all private services).
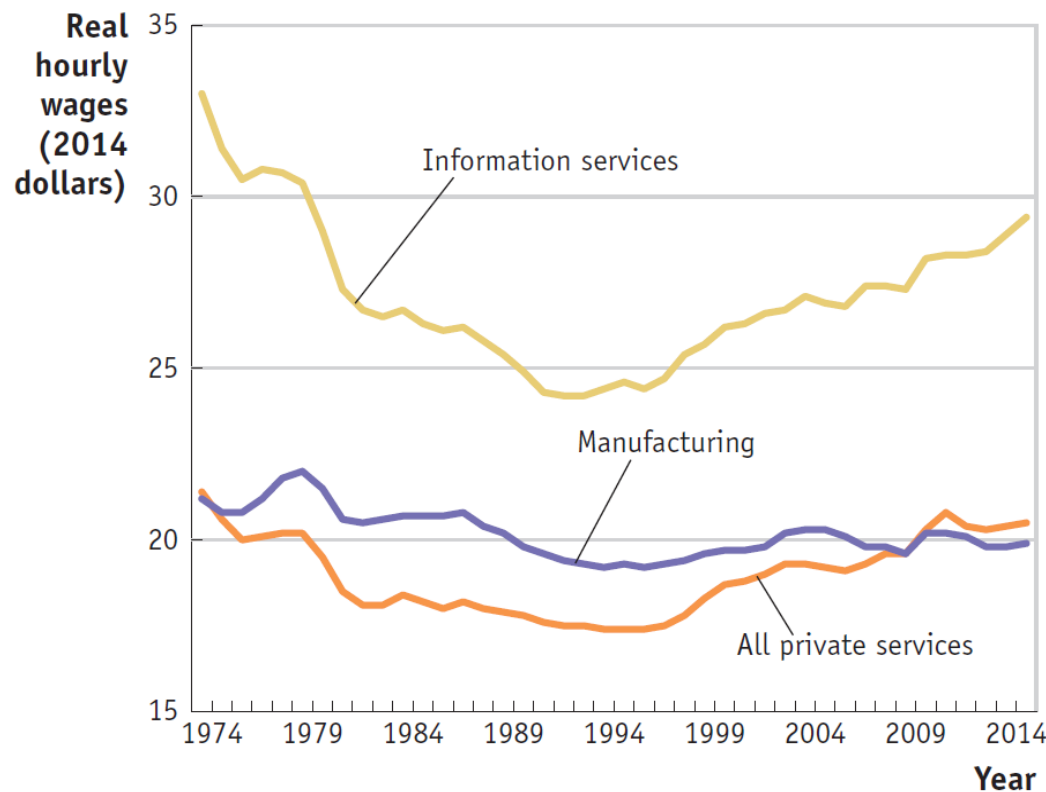
Services includes wholesale and retail trade, finance, law, education, information technology, software engineering, consulting, and medical and government services.

APPLICATION

Manufacturing and Services in the United States: Employment and Wages Across Sectors

FIGURE 3-7 (2 of 2)	Real Hourly Earnings of Production Workers (continued)

While wages were slightly higher in manufacturing than in all private services from 1974 through 2007, all private service wages have been higher since 2008.

This change is due in part to the effect of wages in the information service industry, which are substantially higher than those in manufacturing.

Manufacturing and Services in the United States: Employment and Wages Across Sectors

| TABLE 3-1 | | |

Job Losses in Manufacturing and Service Industries, 2011–2013

This table shows the number of displaced (or laid-off) workers in manufacturing and service industries from 2011 to 2013.

Industry	Total Displaced Workers (thousands) Jan 2011–Dec 2013	Workers Reemployed by Jan 2014	PERCENTAGES Of the Workers Reemployed:	
			Earn Less in New Job	Earn Same or More in New Job
Total	4,292	61%	48%	52%
Manufacturing industries	765	59%	57%	43%
Service industries	3,146	62%	72%	28%

In the three years from January 2011 to December 2013, about 0.77 million workers were displaced in manufacturing and 3.2 million in all service industries. Roughly 62% of the workers displaced from 2011 to 2013 were reemployed by January 2014. In manufacturing more than one-half (57%) were earning less in their new jobs, while nearly three-quarters (72%) of the workers reemployed in service industries were earning more at their new job.

Trade Adjustment Assistance Programs: Financing the Adjustment Costs of Trade

- The unemployment insurance program in the United States provides some compensation, regardless of the reason for the layoff.

- In addition, the Trade Adjustment Assistance (TAA) program offers additional unemployment insurance payments and health insurance to workers who are laid off because of import competition and who are enrolled in a retraining program.

- Other countries also have programs like TAA to compensate those harmed by trade.

- A recent development, which was part of the jobs stimulus bill signed by President Obama on February 17, 2009, allows workers in the service sector (as well as farmers) who lose their jobs due to trade to also apply for TAA benefits.

3 Earnings of Capital and Land

Determining the Payments to Capital and Land

If Q_M is the output in manufacturing and Q_A is the output in agriculture, the revenue earned in each industry is $P_M \cdot Q_M$ and $P_A \cdot Q_A$, and the payments to capital and to land are:

$$\text{Payment to capital} = P_M \cdot Q_M - W \cdot L_M$$
$$\text{Payments to land} = P_A \cdot Q_A - W \cdot L_A$$

Determining the Payments to Capital and Land

The earnings of one unit of capital (a machine, for instance), which we call R_K, and the earnings of an acre of land, which we call R_T, are calculated as:

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

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

Economists call R_K the **rental on capital** and R_T the **rental on land**.

Determining the Payments to Capital and Land

Change in the Real Rental on Capital

- As more labor is used in manufacturing, the marginal product of capital will rise because each machine has more labor to work it.

- In addition, as labor leaves agriculture, the marginal product of land will fall because each acre of land has fewer laborers to work it.

- The general conclusion is that *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.*

Determining the Payments to Capital and Land

- With labor leaving agriculture, the marginal product of each acre falls, so R_T/P_A also falls.

- The fact that R_T/P_A falls means that the real rental on land in terms of food has gone down, so landowners cannot afford to buy as much food.

- Thus, landowners are clearly worse off from the rise in the price of the manufactured good because they can afford to buy less of both goods.

Determining the Payments to Capital and Land

Summary

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 conclusion means that:

- The specific factors used in export industries will generally gain as trade is opened.

- The relative price of exports rises.

- The specific factors used in import industries will generally lose as trade is opened and the relative price of imports falls.

Numerical Example

$$Manufacturing: \text{Sales revenue} = P_M \cdot Q_M = \$100$$
$$\text{Payments to labor} = W \cdot L_M = \$60$$
$$\text{Payments to capital} = R_K \cdot K = \$40$$

$$Agriculture: \text{Sales revenue} = P_A \cdot Q_A = \$100$$
$$\text{Payments to labor} = W \cdot L_A = \$50$$
$$\text{Payments to land} = R_T \cdot T = \$50$$

$$Manufacturing: \text{Percentage increase in price} = \Delta P_M/P_M = 10\%$$
$$Agriculture: \text{Percentage increase in price} = \Delta P_A/P_A = 0\%$$
$$Both\ industries: \text{Percentage increase in the wage} = \Delta W/W = 5\%$$

Change in the Rental on Capital

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

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

$$\frac{\Delta R_K}{R_K} = \frac{(10\% \cdot 100 - 5\% \cdot 60)}{40} = 17.5\%$$

Change in the Rental on Land

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

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

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

Determining the Payments to Capital and Land

General Equation for the Change in Factor Prices

These equations summarize the response of all three factor prices in the short run, when capital and land are specific to each sector but labor is mobile.

$$\underbrace{\Delta R_T/R_T < 0}_{\substack{Real\ rental \\ on\ land\ falls}} < \underbrace{\Delta W/W < \Delta P_M/}_{\substack{Change\ in\ the\ real \\ wage\ is\ ambiguous}} \underbrace{P_M < \Delta R_K/R_K}_{\substack{Real\ rental \\ on\ capital\ rises}}, \text{ for an increase in } P_M$$

$$\underbrace{\Delta R_K/R_K < \Delta P_M/P_M}_{\substack{Real\ rental \\ on\ capital\ falls}} < \underbrace{\Delta W/W < 0}_{\substack{Change\ in\ the\ real \\ wage\ is\ ambiguous}} < \underbrace{\Delta R_T/R_T}_{\substack{Real\ rental \\ on\ land\ rises}}, \text{ for a decrease in } P_M$$

$$\underbrace{\Delta R_K/R_K < 0}_{\substack{Real\ rental \\ on\ capital\ falls}} < \underbrace{\Delta W/W < \Delta P_A/}_{\substack{Change\ in\ the\ real \\ wage\ is\ ambiguous}} \underbrace{P_A < \Delta R_T/R_T}_{\substack{Real\ rental \\ on\ land\ rises}}, \text{ for an increase in } P_A$$
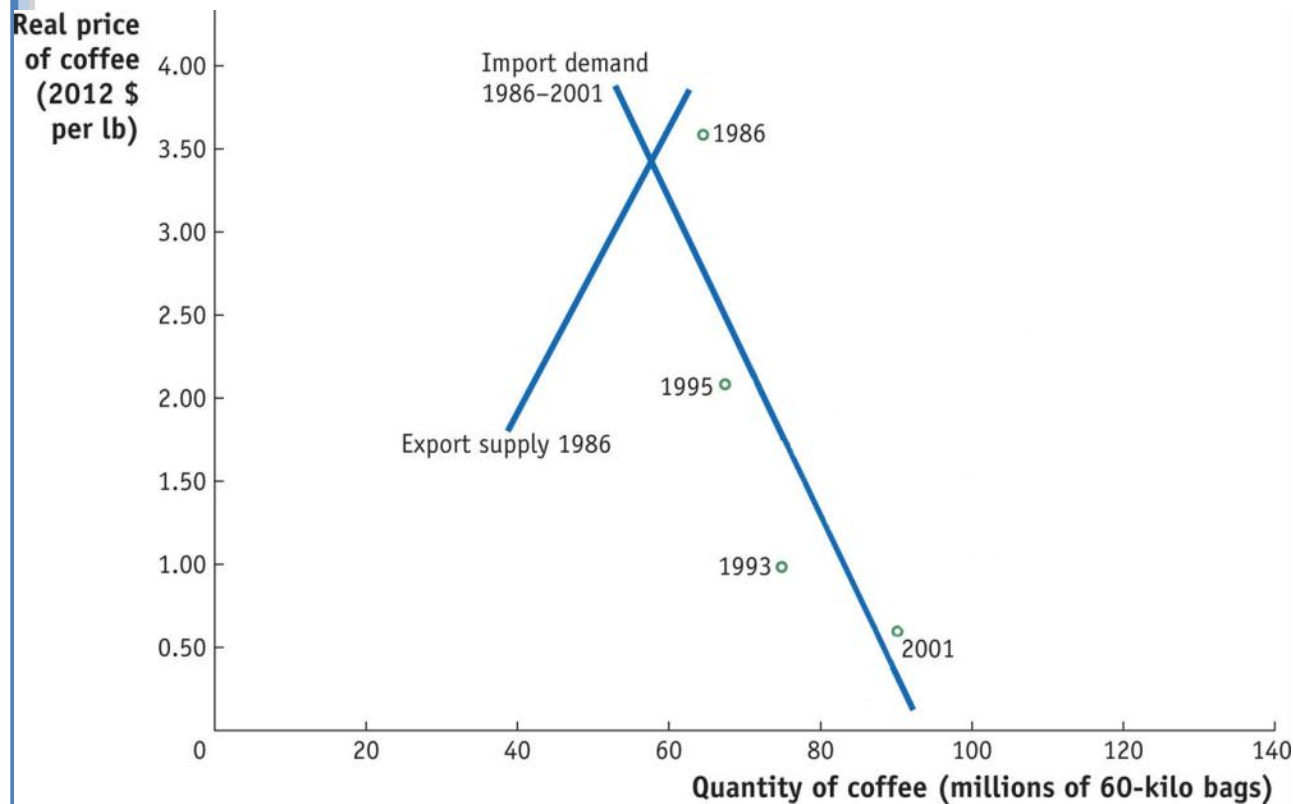
- The specific factor in the sector whose relative price has increased gains.
- The specific factor in the other sector loses.
- Labor is "caught in the middle," with its real wage increasing in terms of one good, but falling in terms of the other.

Prices in Agriculture

Coffee Prices

FIGURE 3-8 (1 of 3)   World Coffee Market, 1984–2014

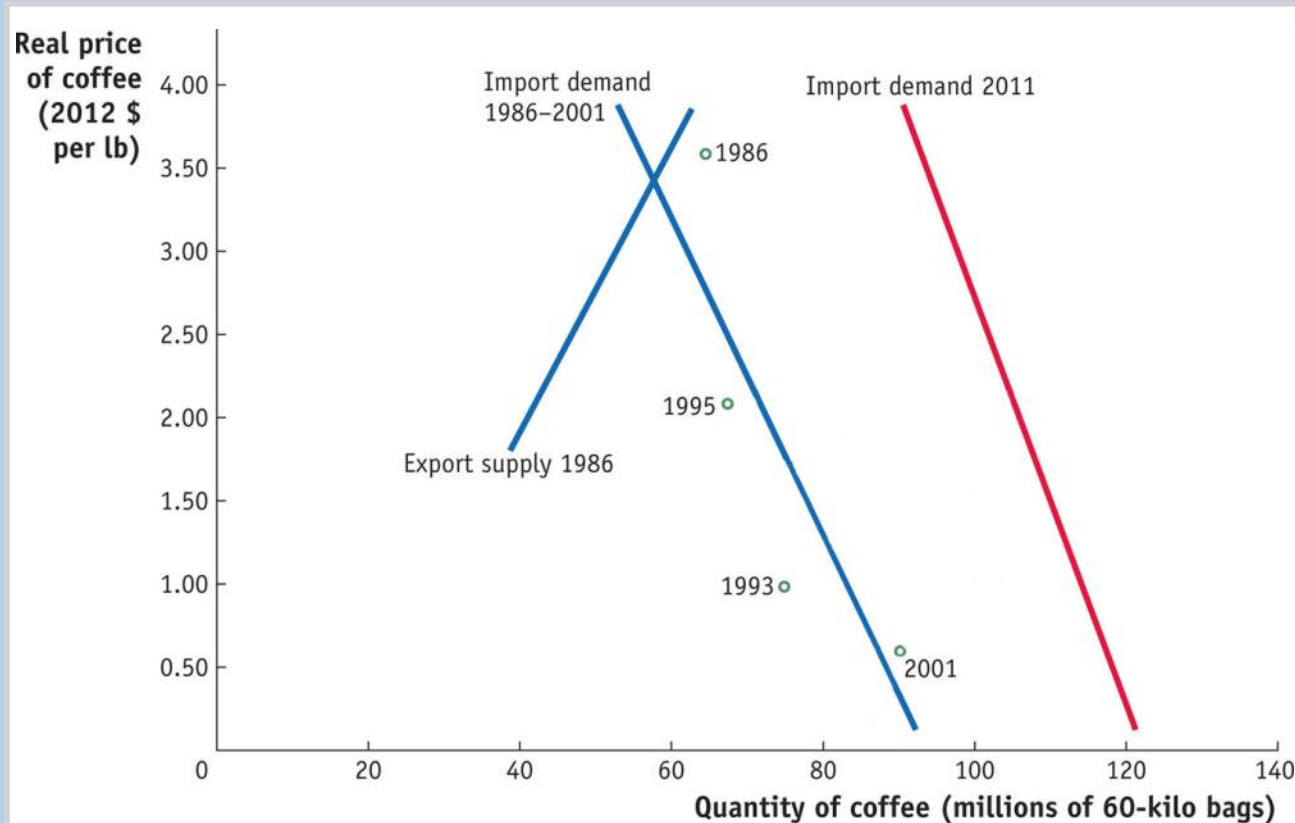Real wholesale prices for coffee have fluctuated greatly on world markets.

Using 2012 dollars, prices were at a high of about $3.58 per pound in 1986, fell to 87¢ per pound in 1992, rose to $2.08 in 1994–1995, and then fell to 59¢ per pound in 2001.

APPLICATION

Prices in Agriculture
Coffee Prices

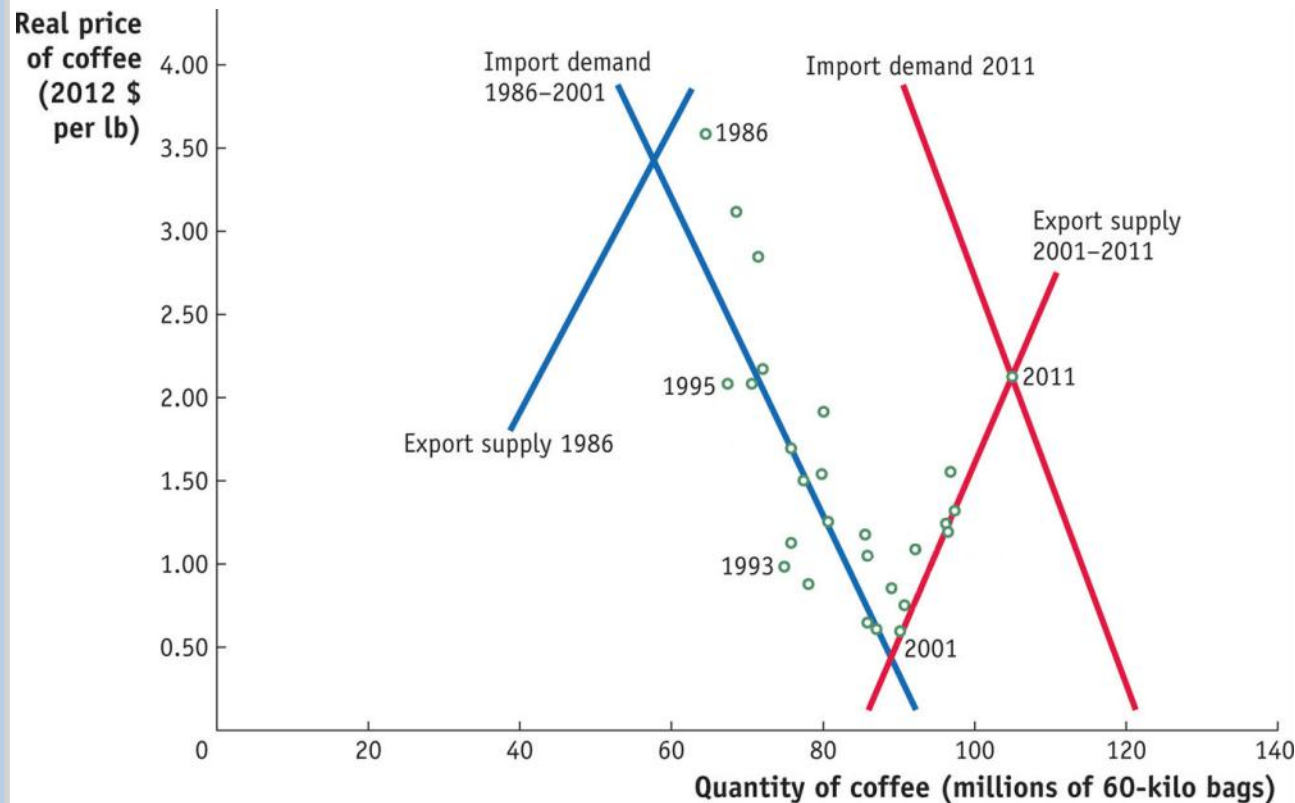FIGURE 3-8 (2 of 3) World Coffee Market, 1984–2014 (continued)

Since 2001, there has been a sustained increase in both price and quantity, implying a shift in import demand.

Prices in Agriculture
Coffee Prices

FIGURE 3-8 (3 of 3)   World Coffee Market, 1984–2014 (continued)

By 2011, prices had risen to $2.15 per pound. Correspondingly, the quantity of world coffee exports was at a low in 1986 (65 million bags) and at a high in 2014 (114 million bags) as supplies from Brazil and Vietnam increased.

Prices in Agriculture

Coffee Prices

- Dramatic fluctuations in coffee prices create equally large movements in the real incomes of farmers, making it difficult for them to sustain a living.

Fair-Trade Coffee

- TransFair USA and similar organizations purchase coffee at higher than the market price when the market is low (as in 2001), but in other years (like 2005) the fair-trade price is below the market price.

- Essentially, TransFair USA is offering farmers a form of insurance whereby the fair-trade price of coffee will not fluctuate too much, ensuring them a more stable source of income over time.

HEADLINES

Rise in Coffee Prices—Great for Farmers, Tough on Co-ops

Groups like TransFair USA ensure coffee farmers like Jesus Lopez Hernandez, pictured here, a more stable source of income over time.

- During the winter and spring of the 2005 harvest, Fairtrade cooperative managers found it increasingly difficult to get members to deliver coffee to their own organization at fair-trade prices.

- Growers were seeing some of the highest prices paid in five years, and the temptation was great for farmers to sell their coffee to the highest local bidder, instead of delivering it as promised to their own co-ops.

- "This price rise, in conjunction with the impact fair trade was already having, increased the income and living standards of coffee farmers around the world," says Christopher Himes, TransFair USA's director of certification and finance.