

Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model

ECON 243 – International Trade

Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model

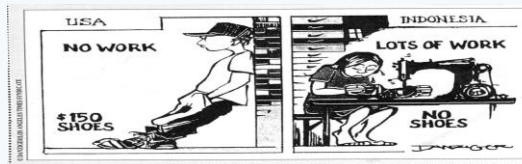


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Questions to Consider

1. Do you personally gain from inexpensive imported goods?
2. Besides you, who gains and who loses from trade?
3. What government policies can help firms and workers that lose from trade?



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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.
- A key lesson from this chapter is that in most cases, opening a country to trade generates winners and losers.

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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.

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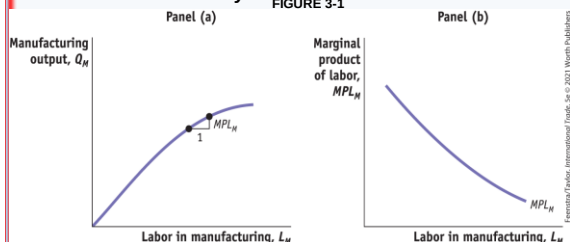
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Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model

Specific-Factors Model

The Home Country

FIGURE 3-1



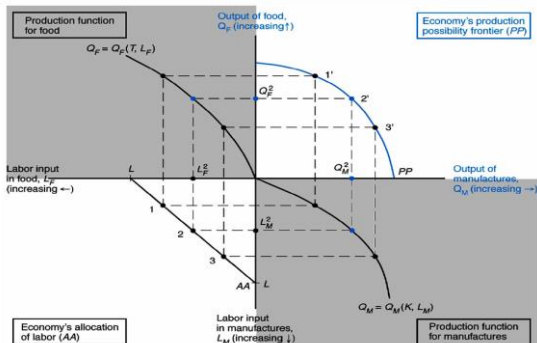
Panel (a) Manufacturing Output As more labor is used, manufacturing output increases, but it does so at a diminishing rate.

Panel (b) Diminishing Marginal Product of Labor An increase in the amount of labor used in manufacturing lowers the marginal product of labor.

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Deriving the Production Possibilities Frontier (Food is considered Agriculture {A})



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Slope of the PPF

We can formally derive an expression for the slope of the PPF. Consider moving down the PPF by reallocating one unit of labor from agriculture to manufacturing.

The slope of the PPF is approximated by small changes $\Delta Q_A / \Delta Q_M$ and the reallocation yields $\Delta Q_A = \Delta L_A MPL_A$ it also yields

$\Delta Q_M = \Delta L_M MPL_M$... but $\Delta L_A = -\Delta L_M$ so it is easy to establish the slope of the PPF is

$$\frac{\Delta Q_A}{\Delta Q_M} = -\frac{MPL_A}{MPL_M}$$

Putting these two together we get that

$$OC_M (\text{opportunity cost of manufacturing}) = \frac{MPL_A}{MPL_M} = -\text{Slope PPF}$$

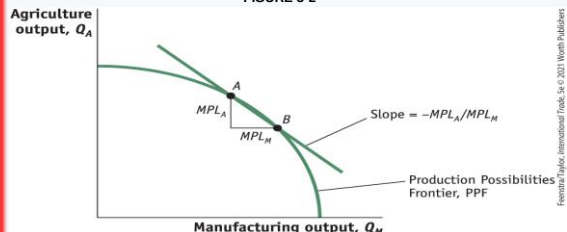
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Specific-Factors Model

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.

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Specific-Factors Model

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.

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

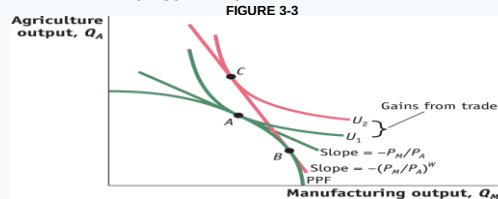
$$p_M \times MPL_M = p_A \times MPL_A \quad \text{or} \quad \frac{p_M}{p_A} = \frac{MPL_A}{MPL_M} = OC_M$$

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Specific-Factors Model

The Home Country Opportunity Cost and Prices



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.

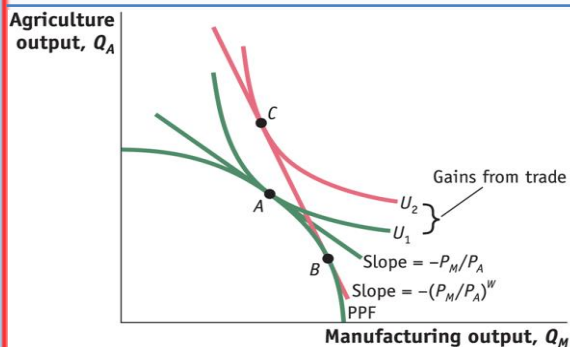
The world relative price of manufactures, $(P_M/P_A)^W$, is the slope of the line BC.

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

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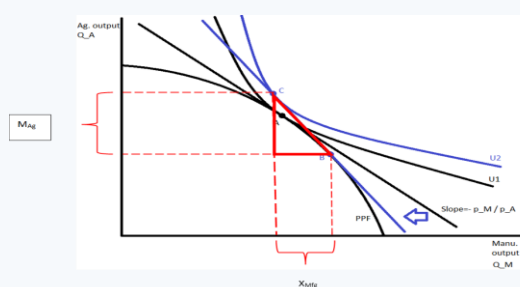
A Closer Look



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An Even Closer Look



B is the production bundle and C is the consumption bundle under free trade. In contrast to the Ricardian model, specialization is incomplete.

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Specific-Factors Model

- The Home and The Foreign Country
 - Let us assume that the Home no-trade relative price of manufacturing is lower than the Foreign relative price.
- $$(P_M/P_A) < (P_M^*/P_A^*) \text{ or } (P_A^*/P_M^*) < (P_A/P_M)$$
- This means that Home can produce manufactured goods relatively cheaper than Foreign.
 - Put another way, Home has a comparative advantage in manufacturing.
 - Foreign has a comparative advantage in agriculture

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Specific-Factors Model

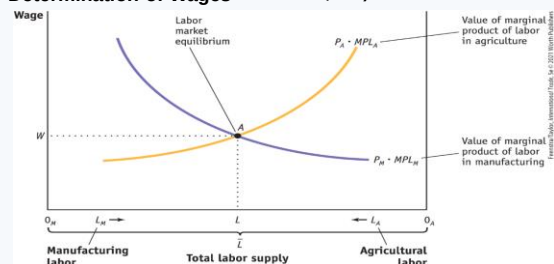
- Overall Gains from Trade
 - The good whose relative price goes up (manufacturing, for Home) is exported.
 - The good whose relative price goes down (agriculture, for Home) is imported.
 - By exporting manufactured goods at a higher price and importing food at a lower price, Home is better off than it was in the absence of trade.

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Earnings of Labor

Determination of Wages FIGURE 3-4 (1 of 2)



- 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.
- Labor market equilibrium is at point A. At the equilibrium wage of W , manufacturing uses $O_M L$ units of labor and agriculture uses $O_A L$ units

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Earnings of Labor

- 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 $\Delta P_M \cdot MPL_M$

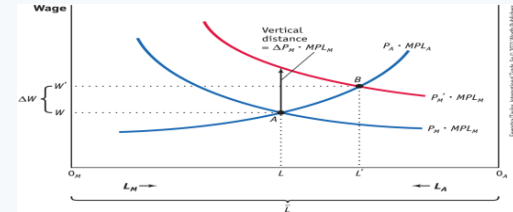
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Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model

Earnings of Labor

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.

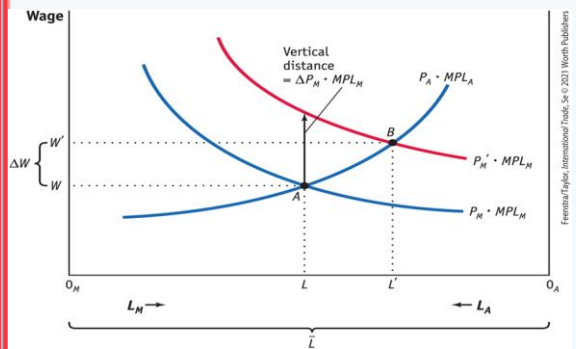
The labor used in manufacturing rises from $O_M L$ to $O_M L'$, and labor used in agriculture falls from $O_A L$ to $O_A L'$.

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

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A Closer Look - Figure 3-5



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Earnings of Labor

- 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.

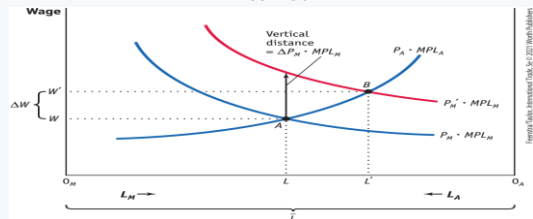
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Earnings of Labor

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/P_M has decreased.

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Proof

It can be shown that the percentage change in wages is less than the percentage change in p_M . To see why this is the case, from the graph we can see that $\Delta w < \Delta p_M \times MPL_M$. If we divide by w on both sides we get

$$\frac{\Delta w}{w} < \frac{\Delta p_M \times M \cdot P L_M}{w}$$

$$\frac{\Delta w}{w} < \frac{\Delta p_M \times M \cdot P L_M}{p_M \times M \cdot P L_M} \text{ or } \frac{\Delta w}{w} < \frac{\Delta p_M}{p_M}$$

$$\frac{w' - w}{w} < \frac{p'_M - p_M}{p_M} \text{ or } \frac{w'}{w} - 1 < \frac{p'_M}{p_M} - 1$$

$$\frac{w'}{p'_M} < \frac{w}{p_M}$$

Thus, we see that the real wage in terms of manufactures (w/p_M) declines.

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Effect on Real Wages

- The fact that the wage has risen does not really tell us whether workers are better off or worse off in terms of the amount of food and manufactured goods they can buy.
- To answer this question, we have to take into account any change in the prices of these goods.
- For instance, the amount of food that a worker can afford to buy with his or her hourly wage is W/P_A .
- Because W has increased from W to W' and we have assumed that P_A has not changed, workers can afford to buy more food.
- In other words, the real wage has increased in terms of food.

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Earnings of Labor

- 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 from 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.

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Earnings of Labor

- 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—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; we also look 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.

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Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model

APPLICATION: The “China Shock” and Employment in the United States

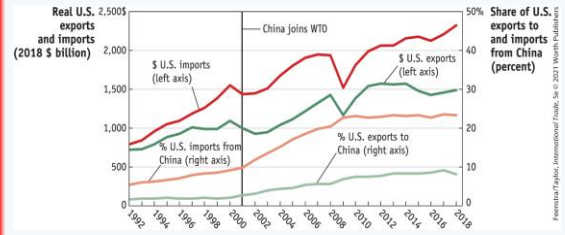
- In the specific-factors model we assumed that workers leaving one industry could be absorbed freely into the other.
- After China joined the WTO in 2001, U.S. imports from China grew rapidly, from 10% of total imports in 2001 to 23% in 2009.
- The large increase in the share of U.S. imports coming from China and its impact on employment in manufacturing are called the “China shock.”
- Studies have found that 2 million jobs or more were lost in U.S. manufacturing industries.
- In reality, we see that with a very large change in prices (as occurred with the “China shock”), it takes more than one decade for enough jobs to be created in export industries to balance the losses in import industries.

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APPLICATION: The “China Shock” and Employment in the United States

FIGURE 3-8 Real U.S. Imports and Exports and the China Share, 1992–2018



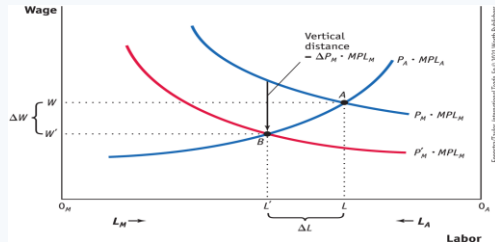
Real values (in 2018 dollars) of U.S. nonpetroleum imports (the red line) and exports (the green line) to the world are shown on the left axis. The share of U.S. imports coming from China (the orange line) and the share of U.S. exports going to China (the light green line) are shown on the right axis.

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APPLICATION: The “China Shock” and Employment in the United States

FIGURE 3-9 Decrease in the Price of Manufactured Goods



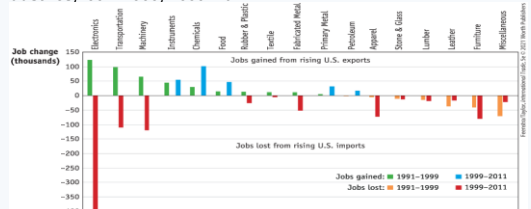
With a decrease in the price of manufactured goods, the curve $P_M \cdot MPL_M$ shifts down to $P'_M \cdot MPL_M$ and the equilibrium shifts from point A to point B. The amount of labor in manufacturing falls to $O_M L'$ and the amount of labor in agriculture rises to $O_A L'$. The wage falls to W' .

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APPLICATION: The “China Shock” and Employment in the United States

FIGURE 3-10 Job Gains and Job Losses in U.S. Manufacturing Industries, 1991–1999, 1999–2011



For the period 1991–1999, estimated job gains due to rising U.S. exports are shown in green, and the estimated job losses due to rising U.S. imports are shown in orange. For the period 1999–2011, estimated job gains due to rising U.S. exports are shown in blue, and the estimated job losses due to rising U.S. imports are shown in red.

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Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model

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:

$$\text{Payment to capital} = P_M \cdot Q_M - W \cdot L_M$$

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

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Earnings of Capital and Land

- 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.

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Earnings of Capital and 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.*

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Earnings of Capital and Land

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.

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Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model

Changes in the Real Rental on Capital

We will see how the real rental on capital changes when P_M rises and P_A stays constant.

We know that

$$P_M \times MPK_M = R_K$$

$$MPK_M = \frac{R_K}{P_M}$$

We know that when we open to trade, labor will shift from agriculture to manufacturing. MPK_M rises because each machine has more labor to work it.

In general, an increase in the quantity of labor used in an industry will raise the marginal product of the factor specific to that industry.

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Changes in the Real Rental on Capital

Thus, we know that MPK_M increases which means that R_K/P_M increases as well. Real rental on capital in terms of manufactured goods has increased.

The real rental on capital in terms of agricultural good is R_K/P_A . R_K has increased since we know that it must increase more than P_M . And we know that P_A has remained the same. Thus, R_K/P_A also increases, which means that the real rental on capital in terms of foods has also gone up.

Capital owners are better off since they can consume more of both goods.

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Changes in the Real Rental on Land

The real rental on land in terms of agricultural good is R_T/P_A .

We know that $P_A \times MPT_A = R_T$

$$MPT_A = R_T/P_A$$

As labor leaves agriculture, MPT_A falls because each acre has fewer laborers to work on it.

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

What happens to R_T/P_M ? First, we know that R_T declines. This is because MPT_A declines and P_A remains unchanged.

Second, we know that P_M increases as well. Thus, R_T/P_M declines.

Landowners are left worse off.

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Earnings of Capital and Land

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.

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Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model

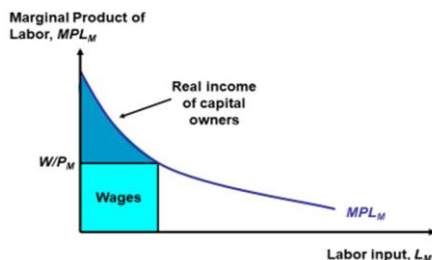
Examining the Distribution of Income

- Suppose that P_M increases by 10% (assuming P_A remains constant). Then, we would expect the wage to rise by less than 10%, say by 5%.
- What is the economic effect of this price increase on the incomes of the following three groups?
 - Workers: We cannot say whether workers are better or worse off; this depends on the relative importance of manufactures and food in workers' consumption.
- Owners of capital: They are definitely better off.
- Landowners: They are definitely worse off.

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The Distribution of Income Within the Manufacturing Sector

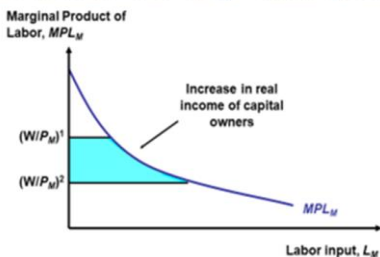


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The Distribution of Income Within the Manufacturing Sector

A Rise in P_M Benefits the Owners of Capital ((Remember that if P_M rises, W also rises, but $\% \Delta W < \% \Delta P_M$). We assume P_A is constant.

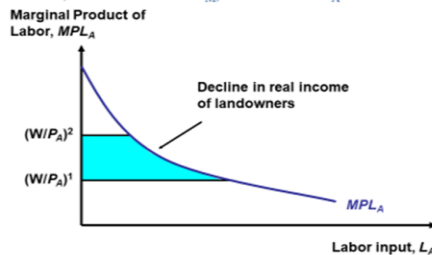


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Distribution of Income Within the Agricultural Sector

A Rise in P_M Hurts Landowners (Remember that if P_M rises, W also rises, but $\% \Delta W < \% \Delta P_M$). We assume P_A is constant.



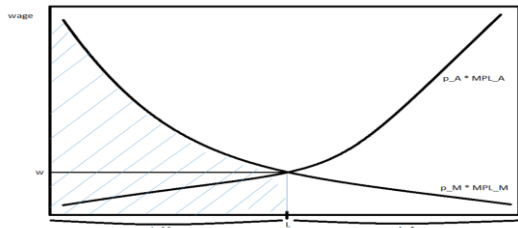
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Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model

GDP Distribution

We can also show graphically how Total Product (GDP) is divided among earnings of capital owners, earnings of land owners, and the wage bill ... the shaded area is the Total Product in Manufacturing. The "triangle" above the equilibrium wage is the capital owners' earnings; the rectangle below the equilibrium wage to the left of L is the wage bill in manufacturing. Similarly for the agriculture sector



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

A Simple Problem

2a. Begin by stating the assumptions of the specific factors model.

- 2 countries (Germany & New Zealand)
- 2 Goods (Machines & Wool)
- 3 INPUTS: Land is specific to wool
Capital is specific to machines
Labor is mobile across sectors

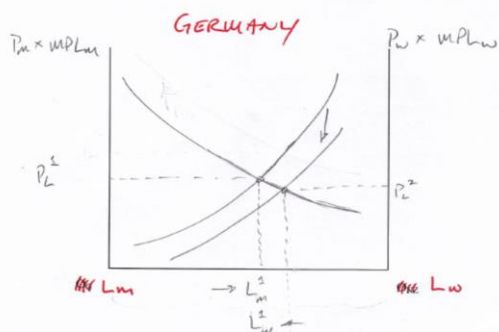
PERFECT COMPETITION $\Rightarrow$ PERFECT LABOR MOBILITY.

Suppose two countries, Germany and New Zealand, produce two goods, wool and machines. Assume that land is specific to wool production, capital is specific to machine production, and labor is mobile between the two industries within each country, but labor is not mobile across borders. When Germany and New Zealand engage in free trade, the relative price of machines rises in Germany and the relative price of machines falls in New Zealand. Tells us Germany has capital & New Zealand has land.

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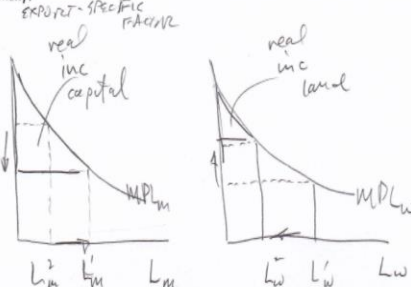
2b. Use an appropriate labor allocation graph to show how the money wage changes in Germany due to the fall in the price of wool, holding constant the price of machines. Predict the change in real wage in Germany.



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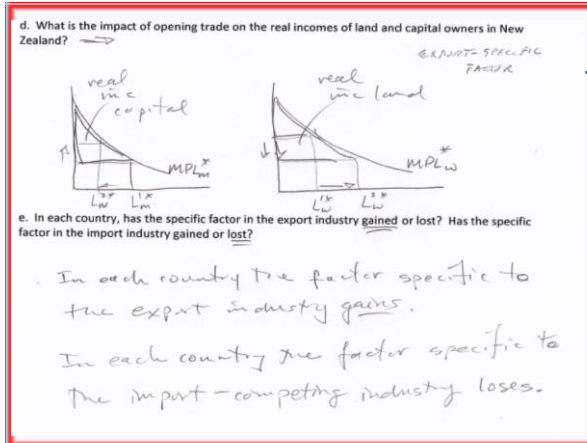
Problem 2 continues ...

c. What is the impact of opening trade on the real incomes of land and capital owners in Germany?



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Chapter 3 - Gains and Losses from Trade in the Specific-Factors Model



Conclusions

- As long as the relative price with international trade differs from the no-trade relative price, a country will gain from international trade.
- The change in relative prices due to the opening of trade creates winners and losers. Some factors of production gain in real terms, and other factors of production lose.
- The factor that is specific to the importing-competing industry will lose. That industry suffers a drop in its relative price due to international trade, which leads to a fall in the real rental on the specific factor in that industry.
- The specific factor in the export industry, whose relative price rises with the opening of trade, enjoys an increase in real rental.

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Conclusions

- Labor is mobile between the two industries, which allows it to avoid such extreme changes in wages. Real wages rise in terms of one good but fall in terms of the other good, so we cannot tell whether workers are better off or worse off after a country opens to trade.
- In theory, the gains of individuals as a result of the opening of trade exceed the losses. That means, in principle, that the government could tax the winners and compensate the losers in such a way that everyone would be better off. This has proven to be very challenging in practice.

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KEY POINTS

1. Opening a country to international trade leads to overall gains, but in a model with several factors of production, some factors of production will lose.
2. In the specific-factors model, factors of production that cannot move between industries will gain or lose the most from opening a country to trade. The factor of production that is specific to the import industry will lose in real terms, as the relative price of the import good falls. The factor of production that is specific to the export industry will gain in real terms, as the relative price of the export good rises.
3. In the specific-factors model, labor can move between the industries and earns the same wage in each. When the relative price of either good changes, then the real wage rises when measured in terms of one good but falls when measured in terms of the other good. Without knowing how much of each good workers prefer to consume, we cannot say whether workers are better off or worse off because of trade.

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