Chapter 3
Specific Factors and Income Distribution

Prepared by **Iordanis Petsas**

To Accompany

International Economics: Theory and Policy, Sixth Edition

by **Paul R. Krugman and Maurice Obstfeld**

Chapter Organization

- Introduction
- The Specific Factors Model
- International Trade in the Specific Factors Model
- Income Distribution and the Gains from Trade
- The Political Economy of Trade: A Preliminary View
- Summary
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Introduction

- Trade has substantial effects on the income distribution within each trading nation.
- There are two main reasons why international trade has strong effects on the distribution of income:
  - Resources cannot move immediately or costlessly from one industry to another.
  - Industries differ in the factors of production they demand.
- The **specific factors model** allows trade to affect income distribution.

The Specific Factors Model

- Assumptions of the Model
  - Assume that we are dealing with one economy that can produce two goods, manufactures and food.
  - There are three factors of production; labor (*L*), capital (*K*) and land (*T* for terrain).
  - Manufactures are produced using capital and labor (but not land).
  - Food is produced using land and labor (but not capital).
    - Labor is therefore a mobile factor that can be used in either sector.
    - Land and capital are both specific factors that can be used only in the production of one good.
  - Perfect Competition prevails in all markets.

The Specific Factors Model

- How much of each good does the economy produce?
  - The economy's output of manufactures depends on how much capital and labor are used in that sector.
- This relationship is summarized by a production function.
- The production function for good *X* gives the maximum quantities of good *X* that a firm can produce with various amounts of factor inputs.
  - For instance, the production function for manufactures (food) tells us the quantity of manufactures (food) that can be produced given any input of labor and capital (land).

The Specific Factors Model

- The production function for manufactures is given by

$$Q_M = Q_M(K, L_M) \qquad (3\text{-}1)$$

where:

– Q_M is the economy's output of manufactures

– K is the economy's capital stock

– L_M is the labor force employed in manufactures

- The production function for food is given by

$$Q_F = Q_F(T, L_F) \qquad (3\text{-}2)$$

where:

– Q_F is the economy's output of food

– T is the economy's supply of land

– L_F is the labor force employed in food

The Specific Factors Model

- The full employment of labor condition requires that the economy-wide supply of labor must equal the labor employed in food plus the labor employed in manufactures:

$$L_M + L_F = L \qquad (3\text{-}3)$$

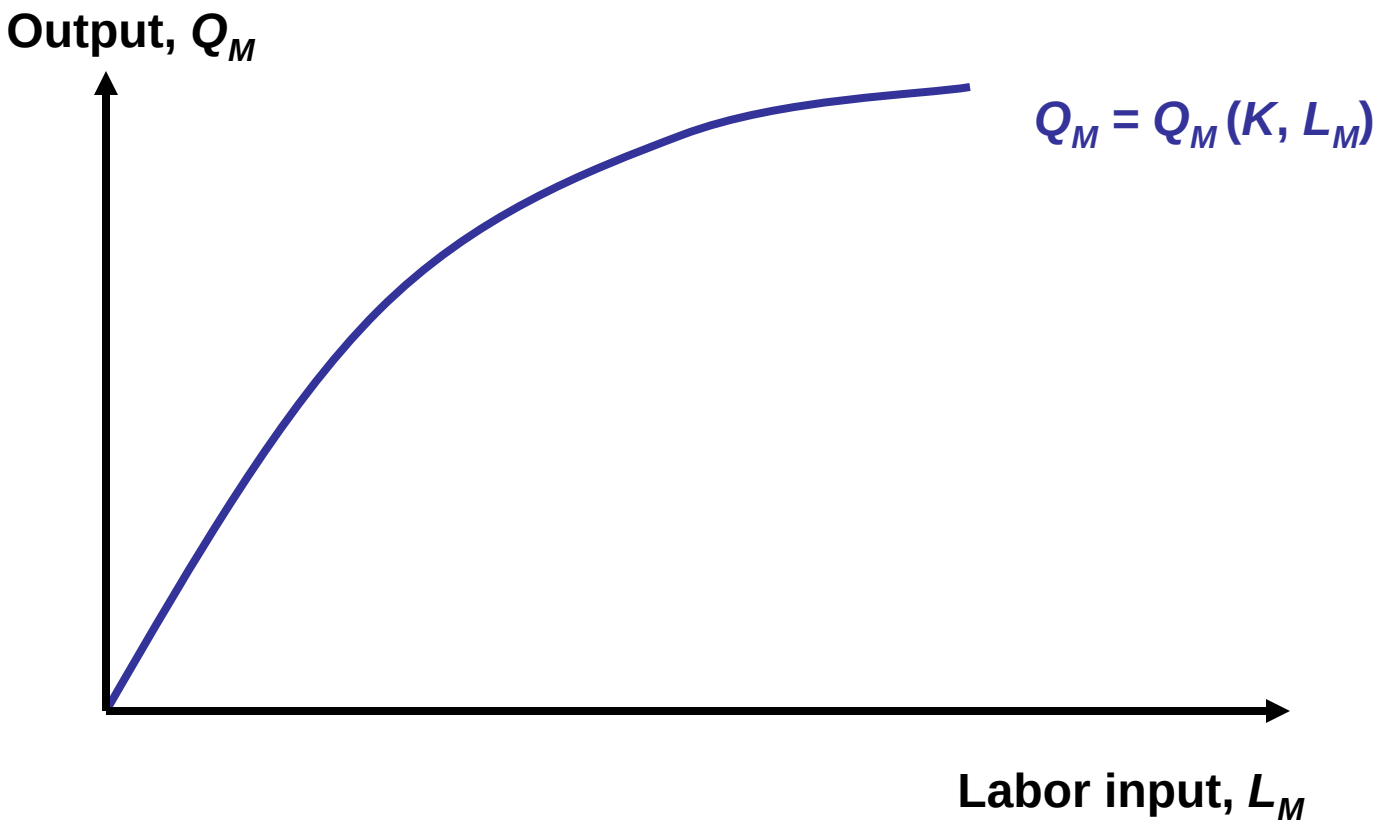
- We can use these equations and derive the **production possibilities frontier** of the economy.

The Specific Factors Model

- Production Possibilities
  - To analyze the economy's production possibilities, we need only to ask how the economy's mix of output changes as labor is shifted from one sector to the other.
  - Figure 3-1 illustrates the production function for manufactures.

The Specific Factors Model

Figure 3-1: The Production Function for Manufactures



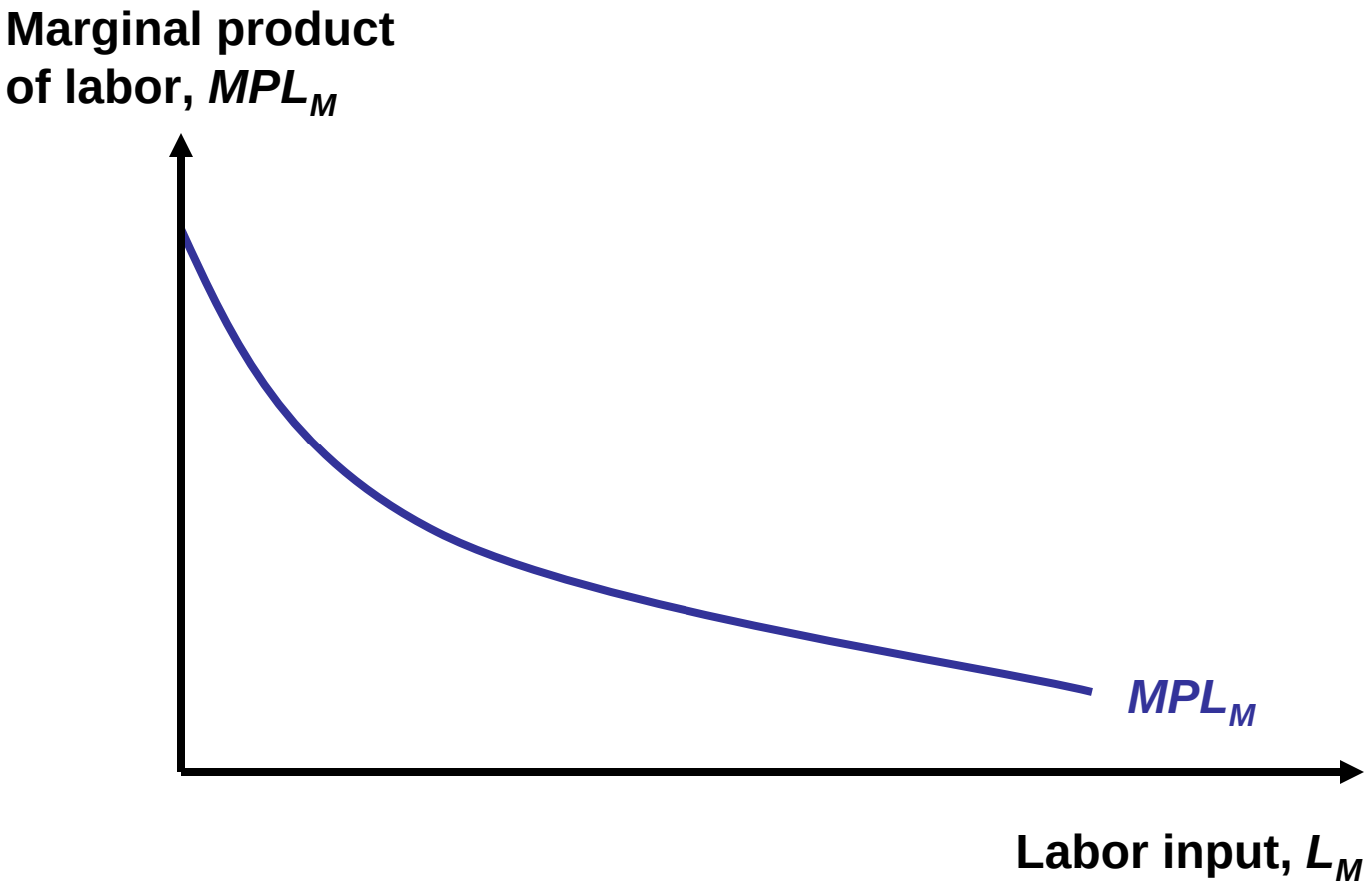
The Specific Factors Model

- The shape of the production function reflects the law of **diminishing marginal returns**.
  - Adding one worker to the production process (without increasing the amount of capital) means that each worker has less capital to work with.
  - Therefore, each additional unit of labor will add less to the production of output than the last.

- Figure 3-2 shows the **marginal product of labor,** which is the increase in output that corresponds to an extra unit of labor.

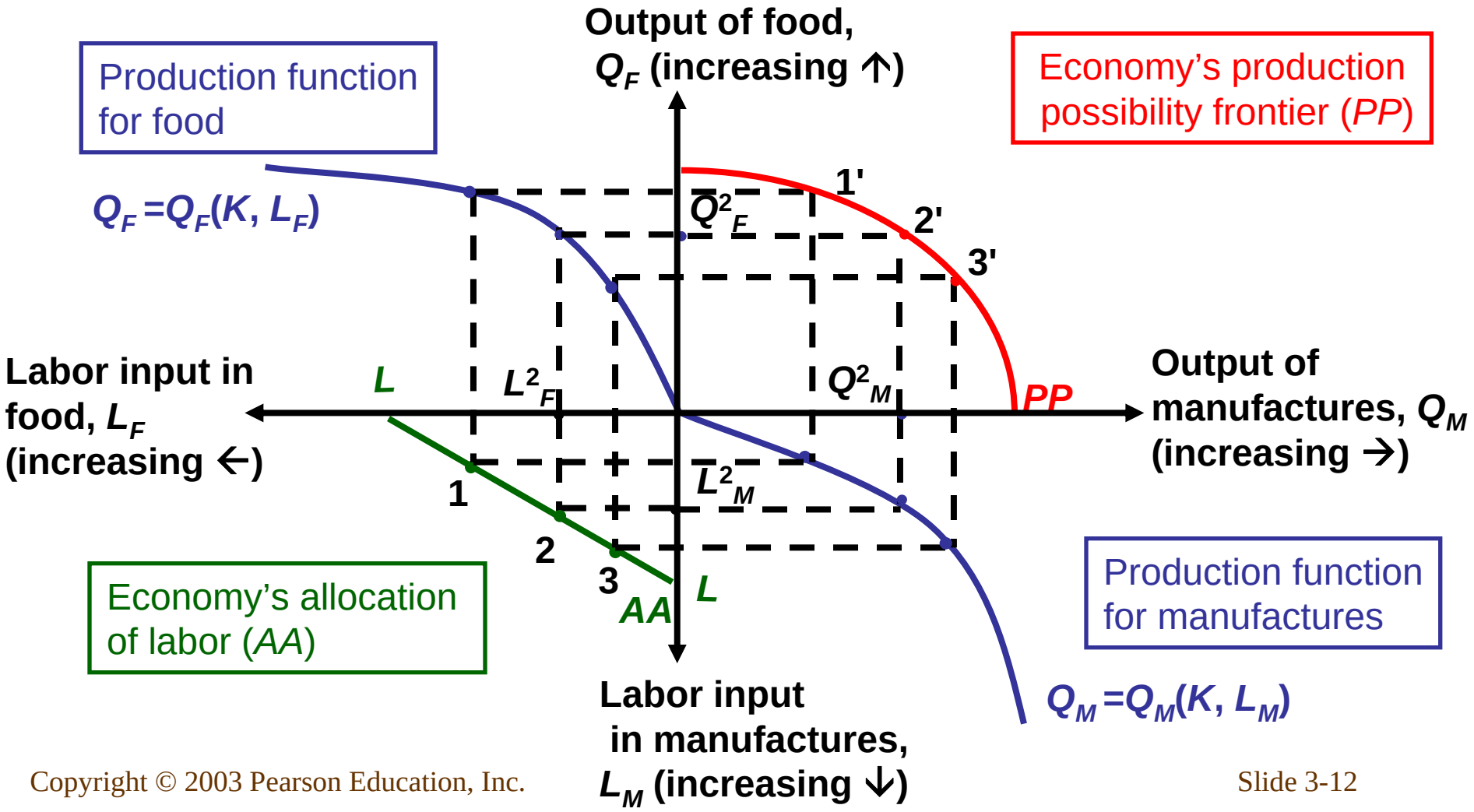
The Specific Factors Model

Figure 3-2: The Marginal Product of Labor



The Specific Factors Model

Figure 3-3: The Production Possibility Frontier in the Specific Factors Model



The Specific Factors Model

- Prices, Wages, and Labor Allocation
  - How much labor will be employed in each sector?
    - To answer the above question we need to look at supply and demand in the labor market.
  - Demand for labor:
    - In each sector, profit-maximizing employers will demand labor up to the point where the value produced by an additional person-hour equals the cost of employing that hour.

The Specific Factors Model

- The demand curve for labor in the manufacturing sector can be written:

$$MPL_M \times P_M = w \qquad (3\text{-}4)$$

  – The wage equals the value of the marginal product of labor in manufacturing.

- The demand curve for labor in the food sector can be written:

$$MPL_F \times P_F = w \qquad (3\text{-}5)$$

  – The wage rate equals the value of the marginal product of labor in food.

The Specific Factors Model

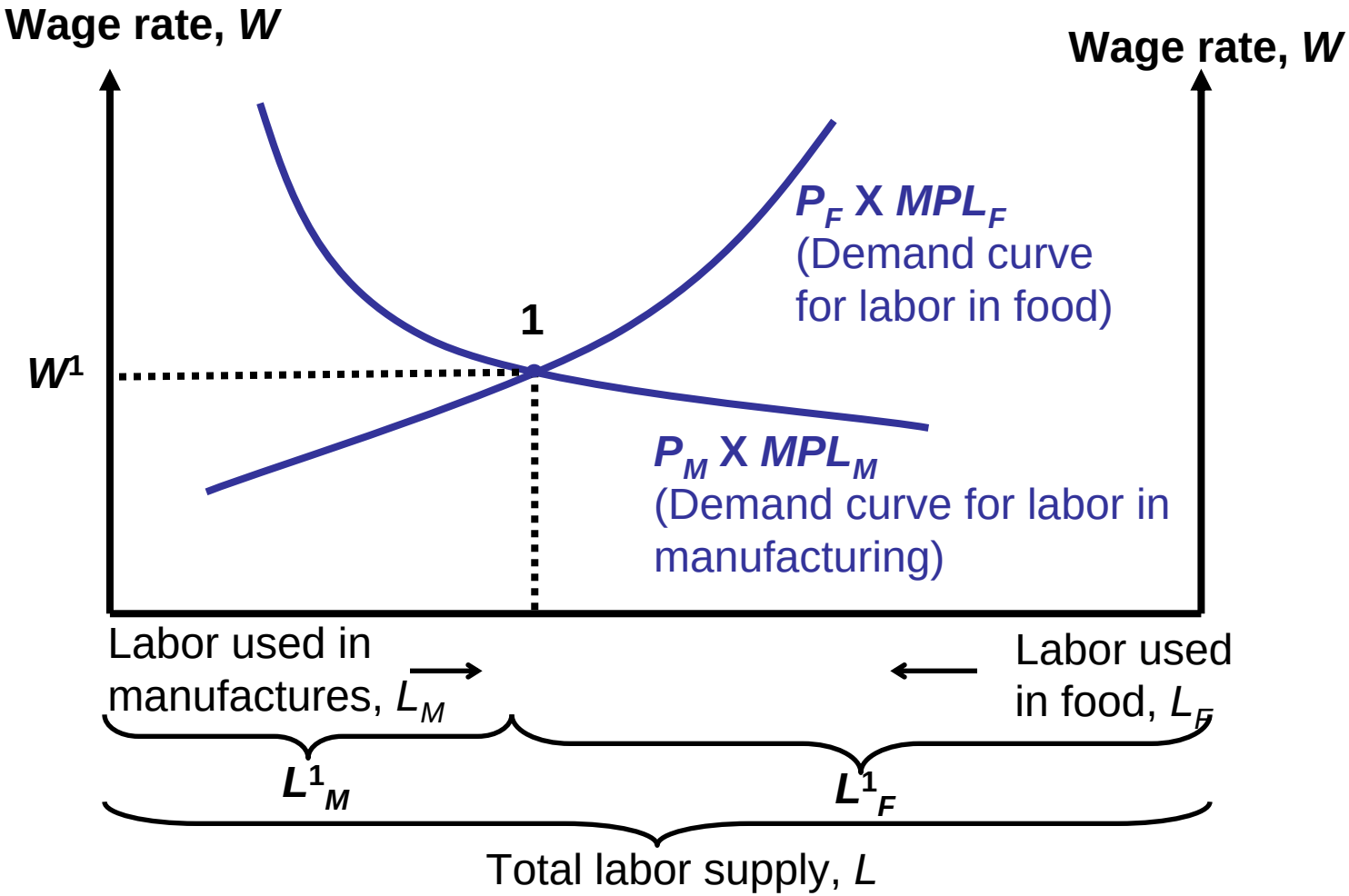
- The wage rate must be the same in both sectors, because of the assumption that labor is freely mobile between sectors.

- The wage rate is determined by the requirement that total labor demand equal total labor supply:

$$L_M + L_F = L \qquad (3\text{-}6)$$

The Specific Factors Model

Figure 3-4: The Allocation of Labor



The Specific Factors Model

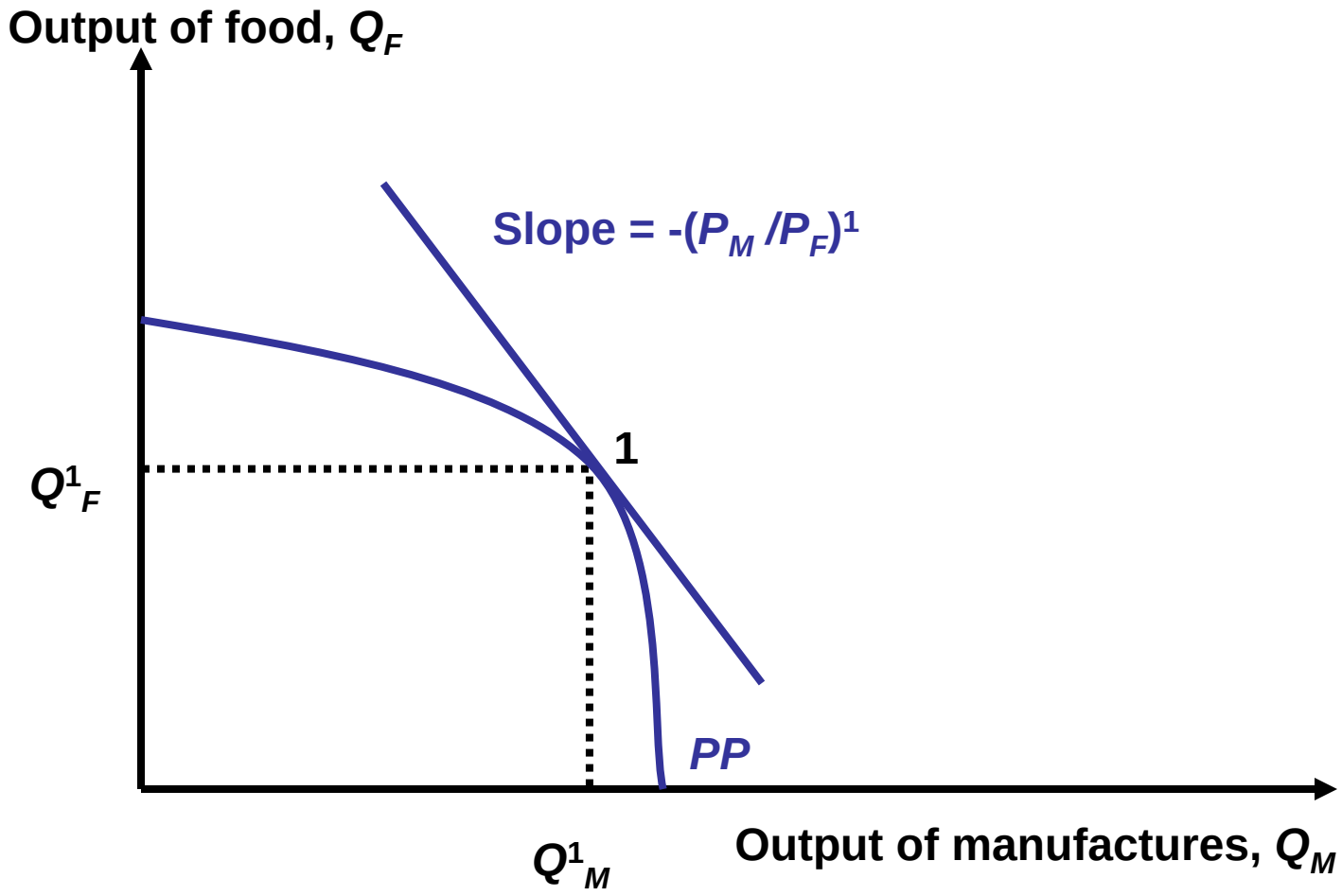
- At the production point the production possibility frontier must be tangent to a line whose slope is minus the price of manufactures divided by that of food.

- Relationship between relative prices and output:

$$-MPL_F/MPL_M = -P_M/P_F \qquad (3\text{-}7)$$

The Specific Factors Model

Figure 3-5: Production in the Specific Factors Model



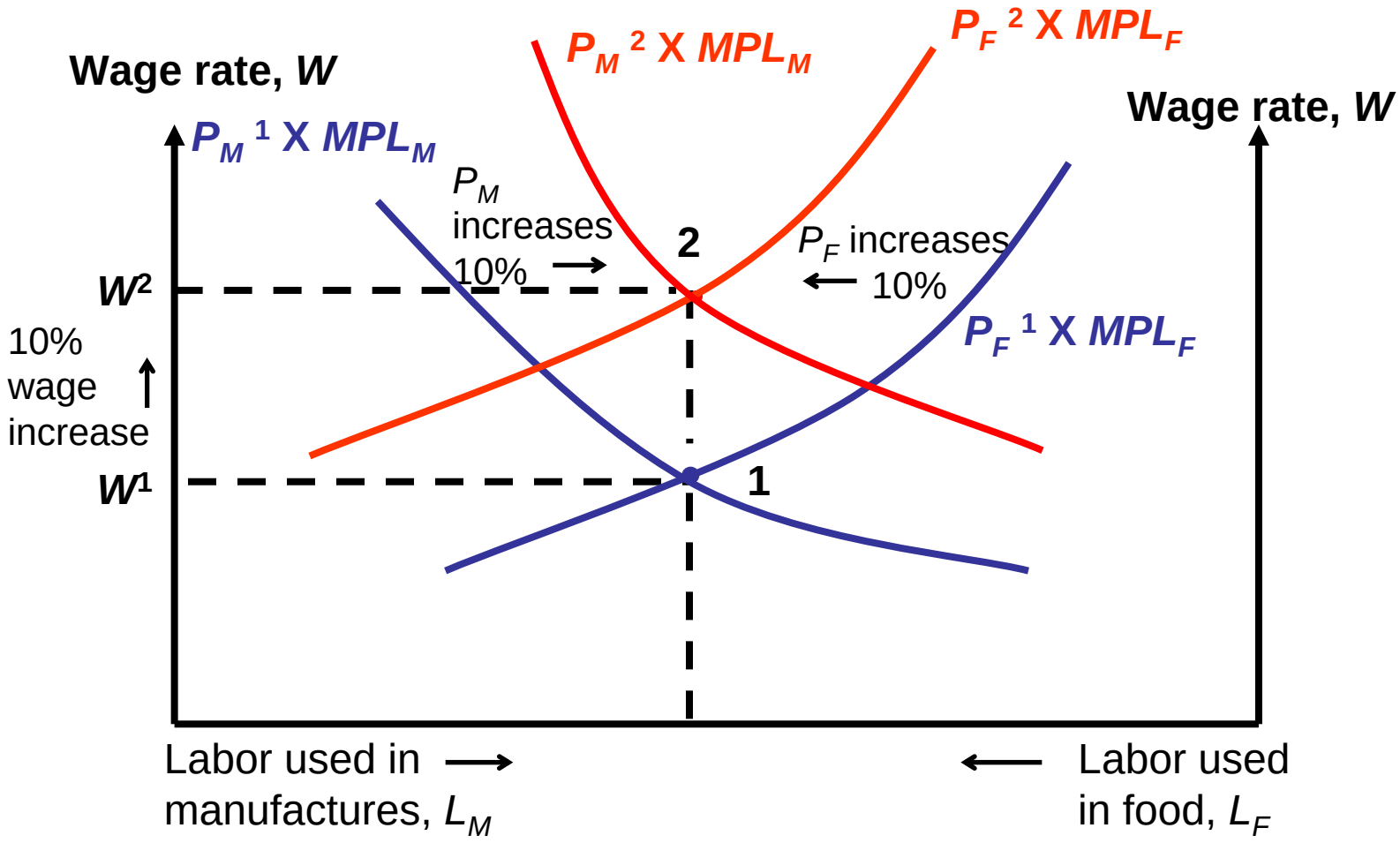
The Specific Factors Model

- What happens to the allocation of labor and the distribution of income when the prices of food and manufactures change?

- Two cases:
  - An equal proportional change in prices
  - A change in relative prices

The Specific Factors Model

Figure 3-6: An Equal Proportional Increase in the Prices of Manufactures and Food



The Specific Factors Model

- When both prices change in the same proportion, no real changes occur.
  - The wage rate (w) rises in the same proportion as the prices, so real wages (i.e. the ratios of the wage rate to the prices of goods) are unaffected.
  - The real incomes of capital owners and landowners also remain the same.

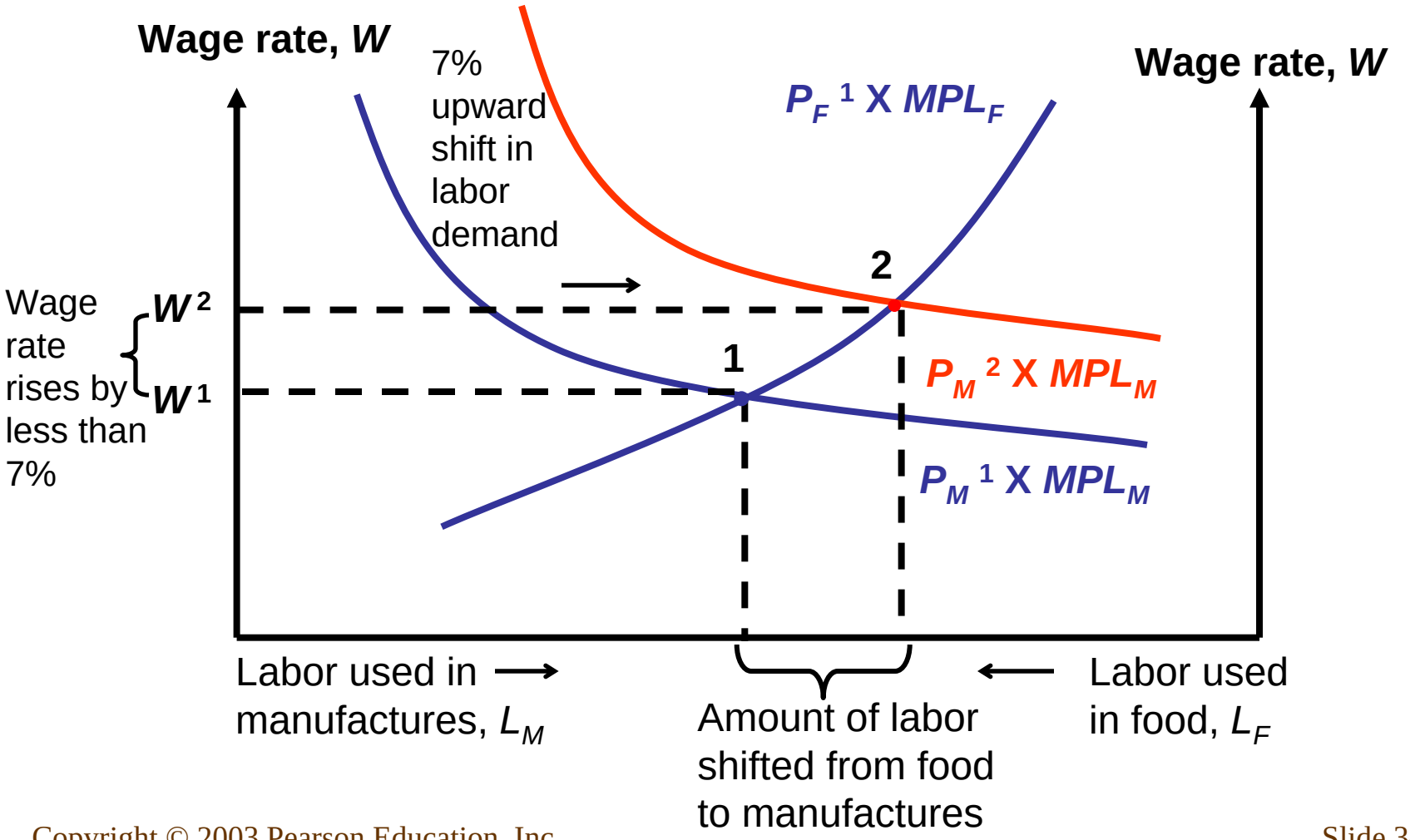
The Specific Factors Model

- When only P_M rises, labor shifts from the food sector to the manufacturing sector and the output of manufactures rises while that of food falls.

- The wage rate (w) does not rise as much as P_M since manufacturing employment increases and thus the marginal product of labor in that sector falls.

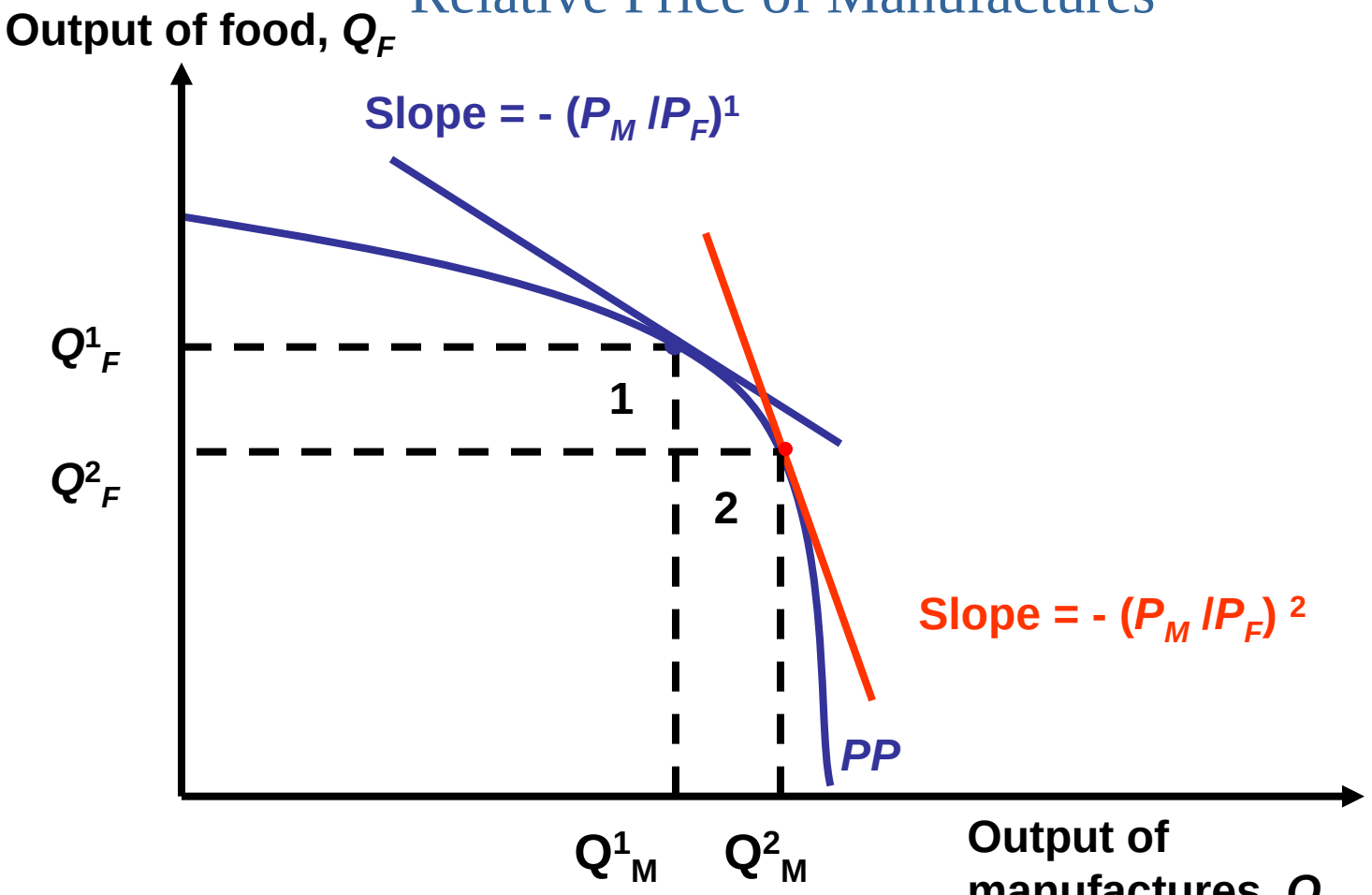
The Specific Factors Model

Figure 3-7: A Rise in the Price of Manufactures



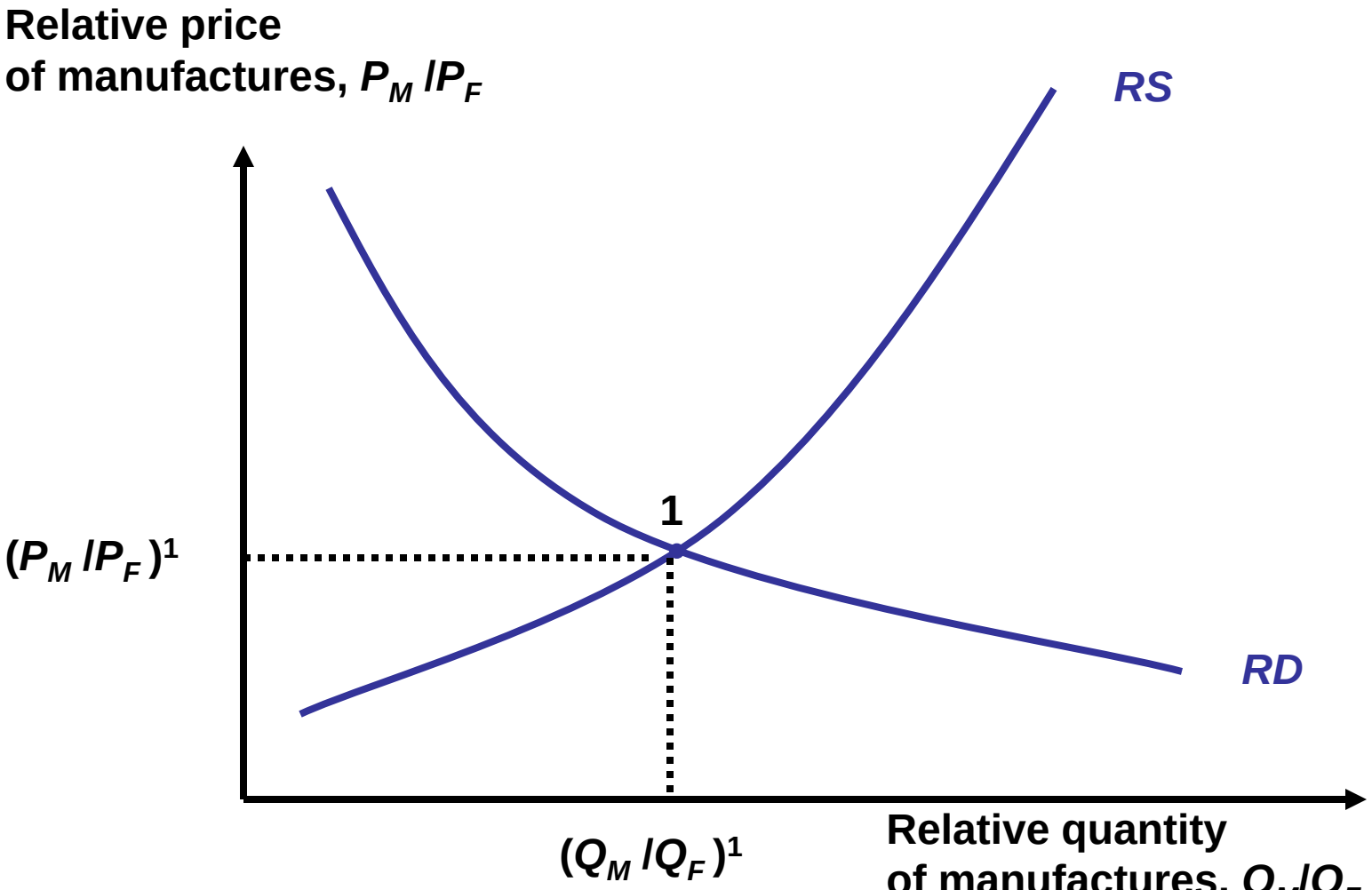
The Specific Factors Model

Figure 3-8: The Response of Output to a Change in the Relative Price of Manufactures



The Specific Factors Model

Figure 3-9: Determination of Relative Prices



The Specific Factors Model

- Relative Prices and the Distribution of Income
  - Suppose that P_M increases by 10%. 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
    - Owners of capital
    - Owners of land

The Specific Factors Model

- 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.

International Trade in the Specific Factors Model

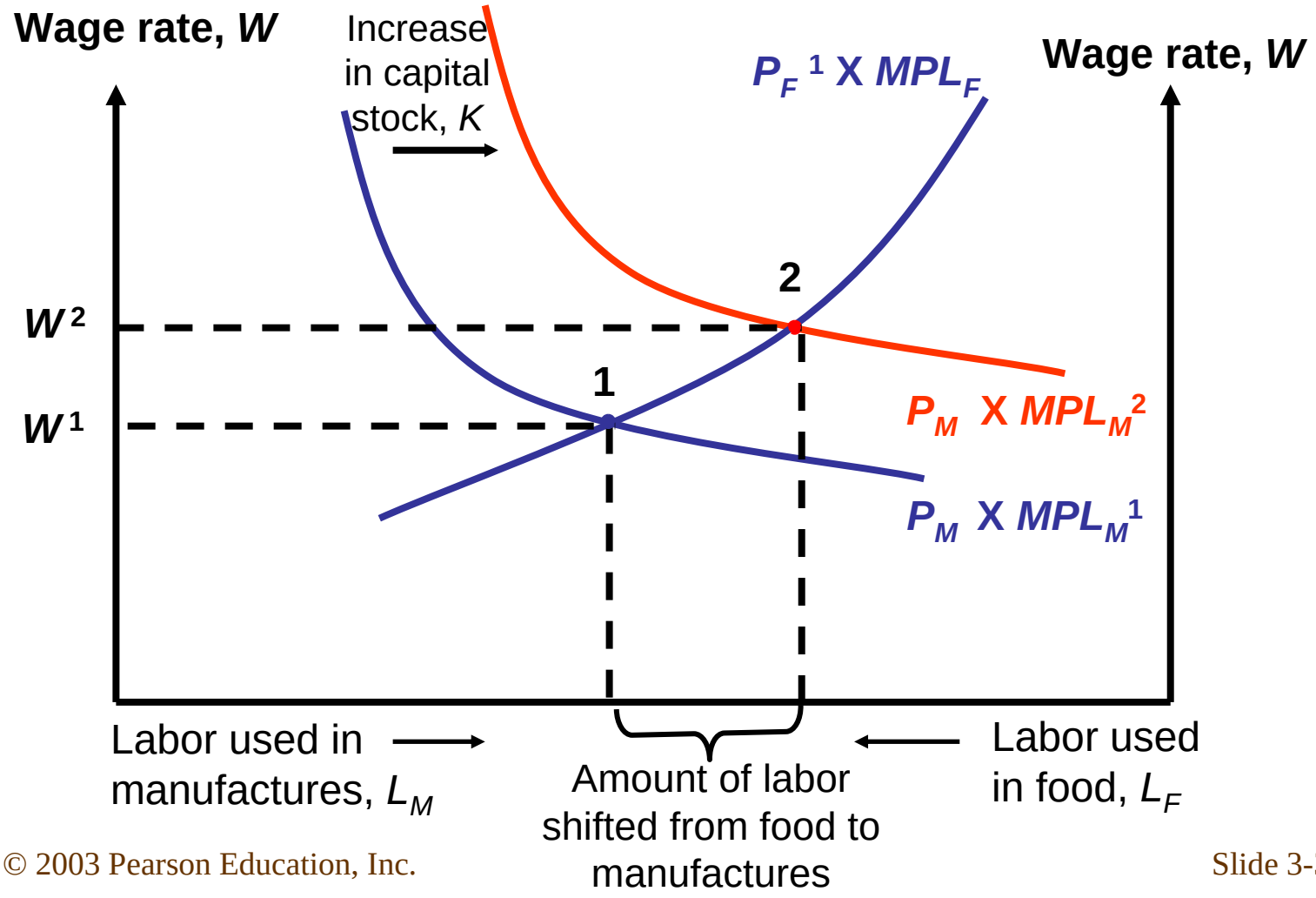
- Assumptions of the model
  - Assume that both countries (Japan and America) have the same relative demand curve.
  - Therefore, the only source of international trade is the differences in relative supply. The relative supply might differ because the countries could differ in:
    - Technology
    - Factors of production (capital, land, labor)

International Trade in the Specific Factors Model

- Resources and Relative Supply
  - What are the effects of an increase in the supply of capital stock on the outputs of manufactures and food?
    - A country with a lot of capital and not much land will tend to produce a high ratio of manufactures to food at any given prices.

International Trade in the Specific Factors Model

Figure 3-10: Changing the Capital Stock



International Trade in the Specific Factors Model

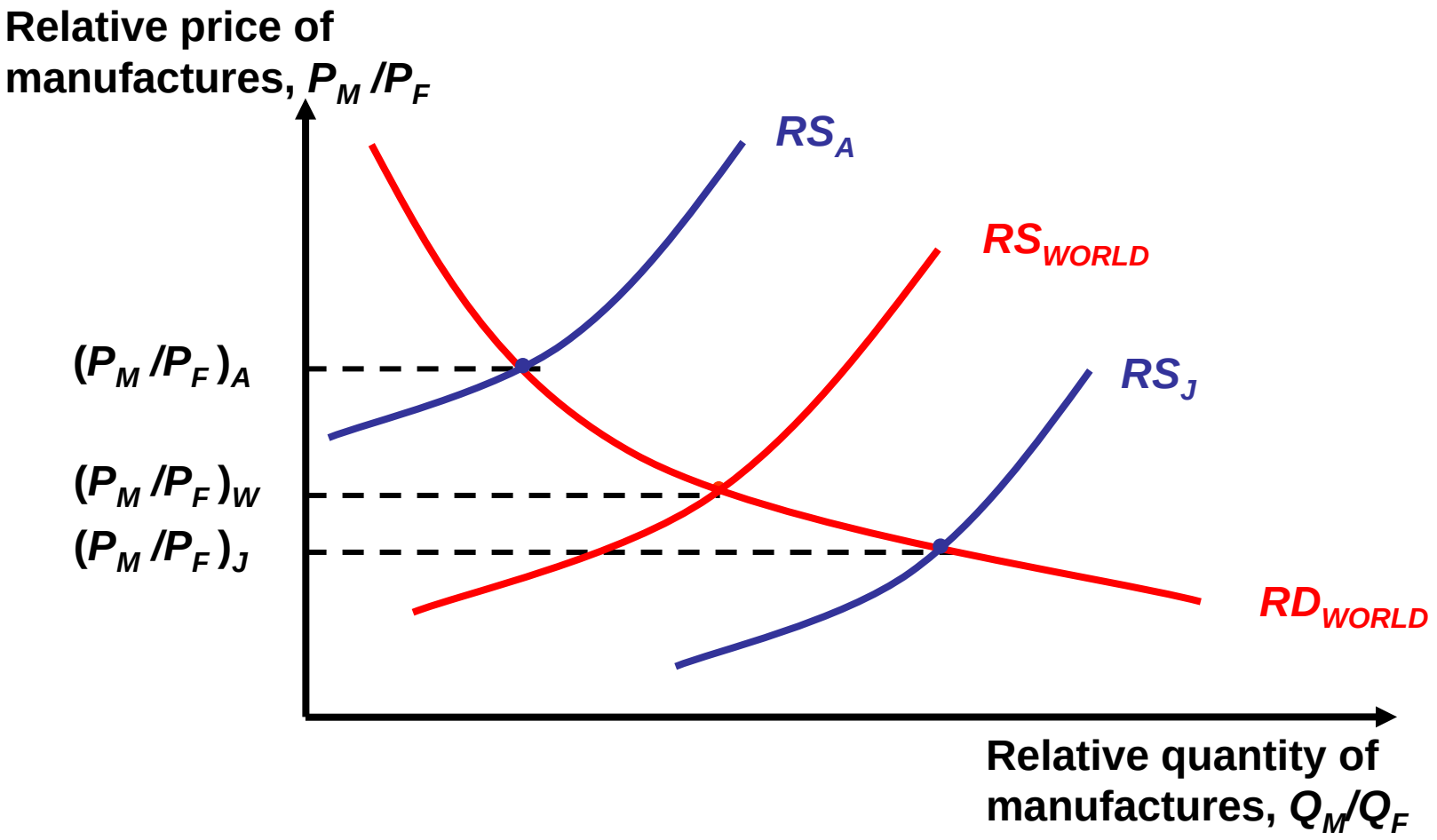
- An increase in the supply of capital would shift the relative supply curve to the right.
- An increase in the supply of land would shift the relative supply curve to the left.
- What about the effect of an increase in the labor force?
  - The effect on relative output is ambiguous, although both outputs increase.

International Trade in the Specific Factors Model

- Trade and Relative Prices
  - Suppose that Japan has more capital per worker than America, while America has more land per worker than Japan.
    - As a result, the pretrade relative price of manufactures in Japan is lower than the pretrade relative price in America.
  - International trade leads to a convergence of relative prices.

International Trade in the Specific Factors Model

Figure 3-11: Trade and Relative Prices

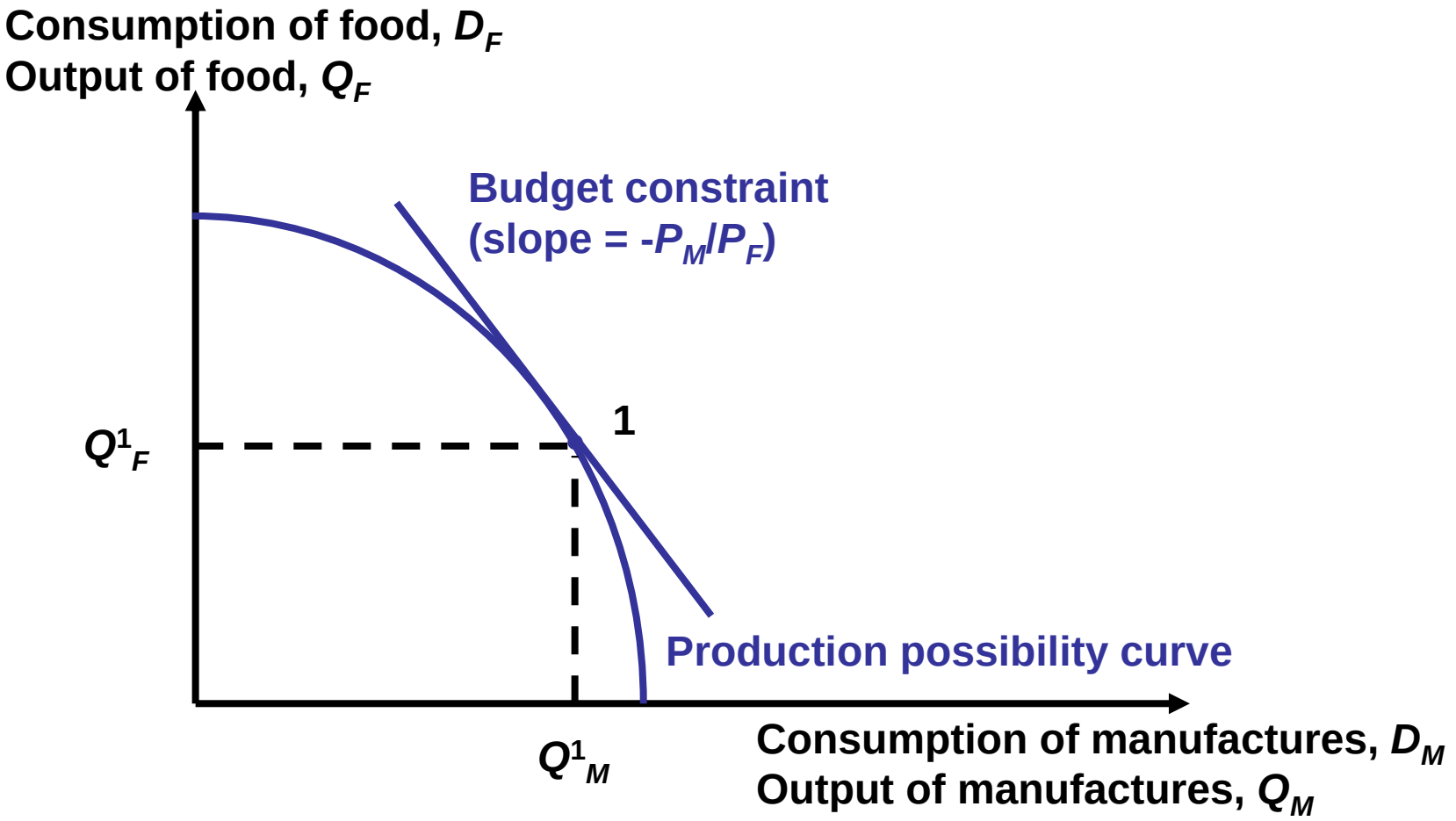


International Trade in the Specific Factors Model

- The Pattern of Trade
  - In a country that cannot trade, the output of a good must equal its consumption.
  - International trade makes it possible for the mix of manufactures and food consumed to differ from the mix produced.
  - A country cannot spend more than it earns.

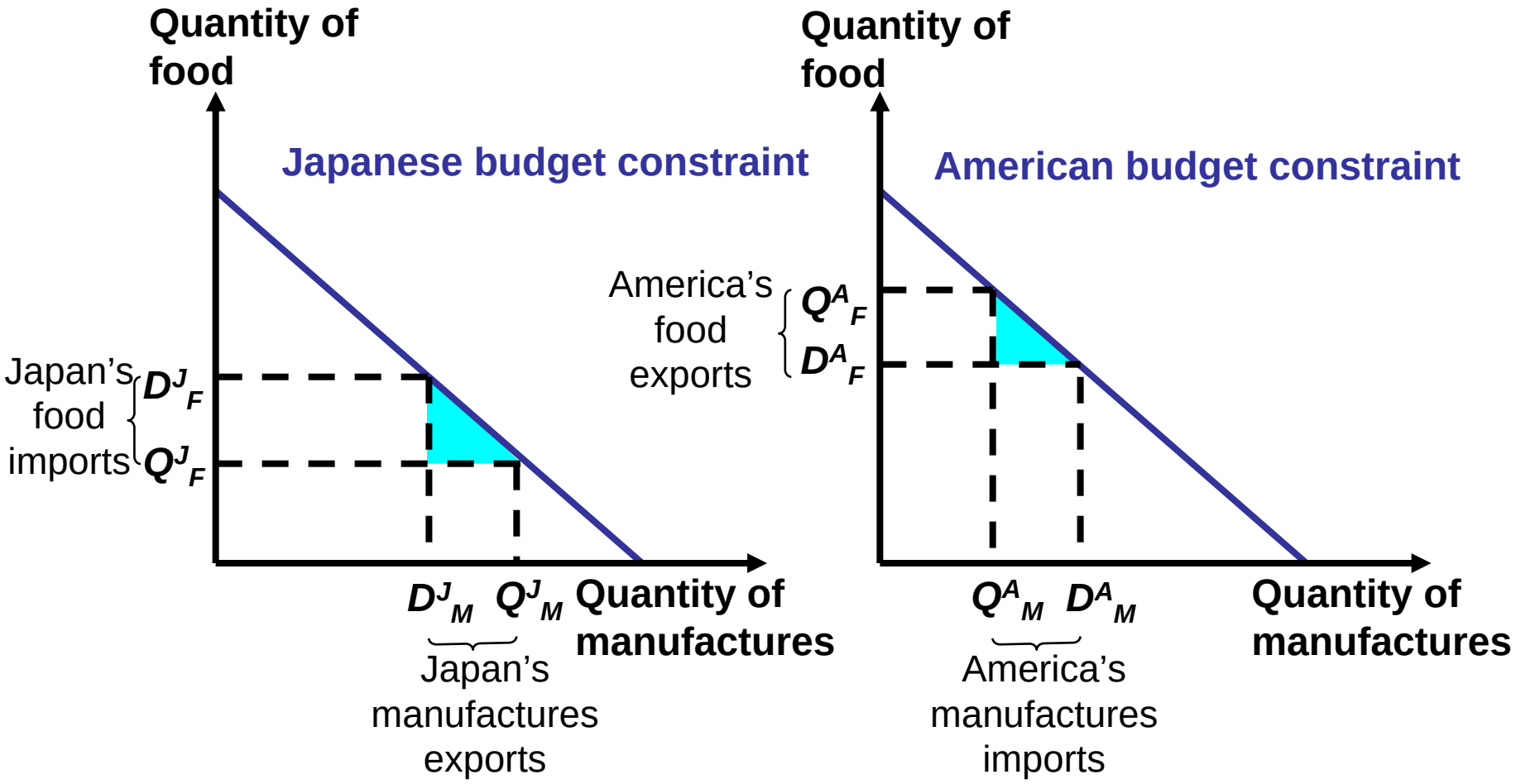
International Trade in the Specific Factors Model

Figure 3-12: The Budget Constraint for a Trading Economy



International Trade in the Specific Factors Model

Figure 3-13: Trading Equilibrium



Income Distribution and the Gains from Trade

- To assess the effects of trade on particular groups, the key point is that international trade shifts the relative price of manufactures and food.

- Trade benefits the factor that is specific to the export sector of each country, but hurts the factor that is specific to the import-competing sectors.

- Trade has ambiguous effects on mobile factors.

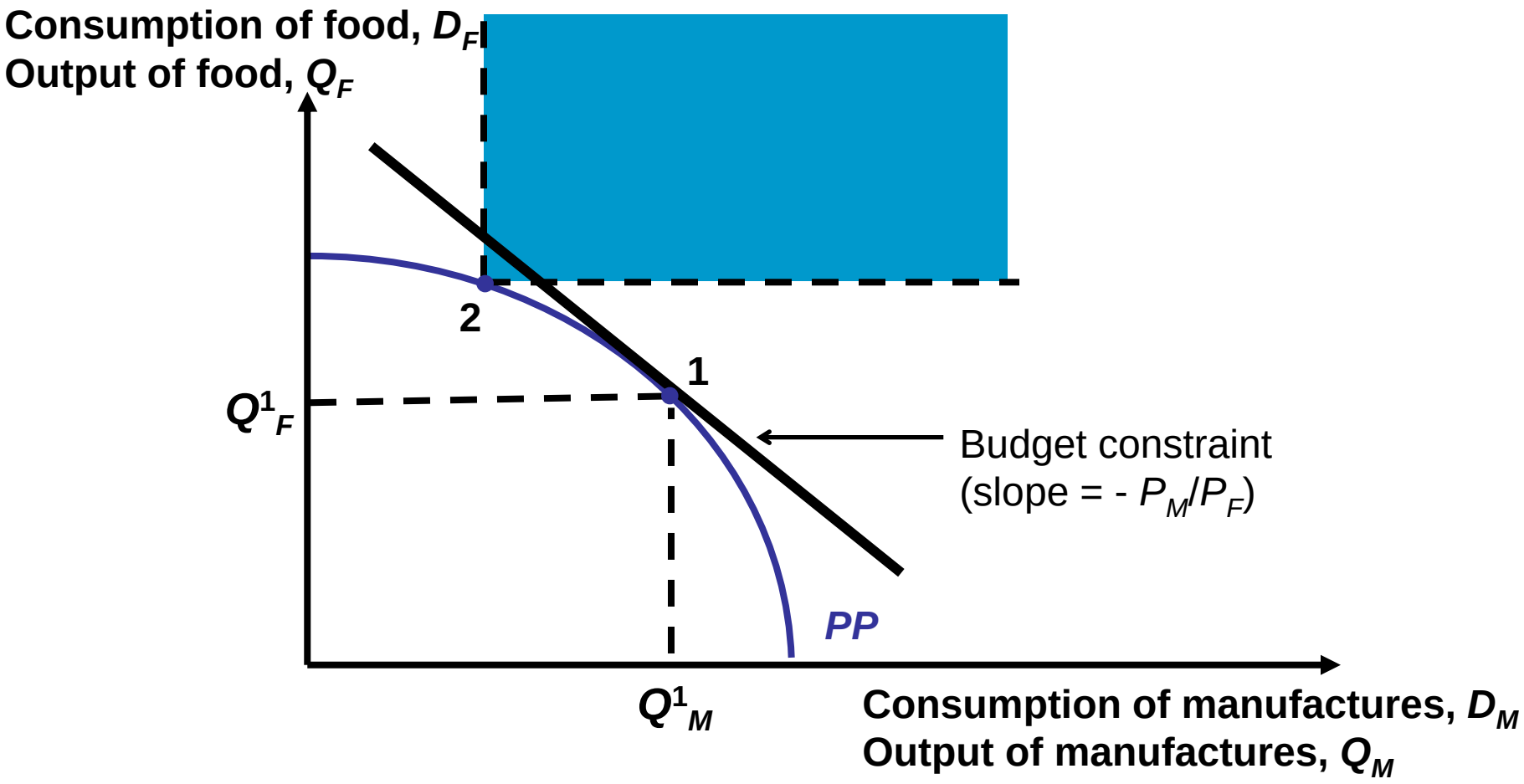
Income Distribution and the Gains from Trade

- Could those who gain from trade compensate those who lose, and still be better off themselves?
  - If so, then trade is potentially a source of gain to everyone.

- The fundamental reason why trade potentially benefits a country is that it expands the economy's choices.
  - This expansion of choice means that it is always possible to redistribute income in such a way that everyone gains from trade.

Income Distribution and the Gains from Trade

Figure 3-14: Trade Expands the Economy's Consumption Possibilities



The Political Economy of Trade: A Preliminary View

- Trade often produces losers as well as winners.
- Optimal Trade Policy
  - The government must somehow weigh one person's gain against another person's loss.
    - Some groups need special treatment because they are already relatively poor (e.g., shoe and garment workers in the United States).
    - Most economists remain strongly in favor of more or less free trade.
  - Any realistic understanding of how trade policy is determined must look at the actual motivations of policy.

The Political Economy of Trade: A Preliminary View

- Income Distribution and Trade Politics
  - Those who gain from trade are a much less concentrated, informed, and organized group than those who lose.
    - Example: Consumers and producers in the U.S. sugar industry

Summary

- International trade often has strong effects on the distribution of income within countries, so that it often produces losers as well as winners.

- Income distribution effects arise for two reasons:
  - Factors of production cannot move instantaneously and costlessly from one industry to another.
  - Changes in an economy's output mix have differential effects on the demand for different factors of production.

Summary

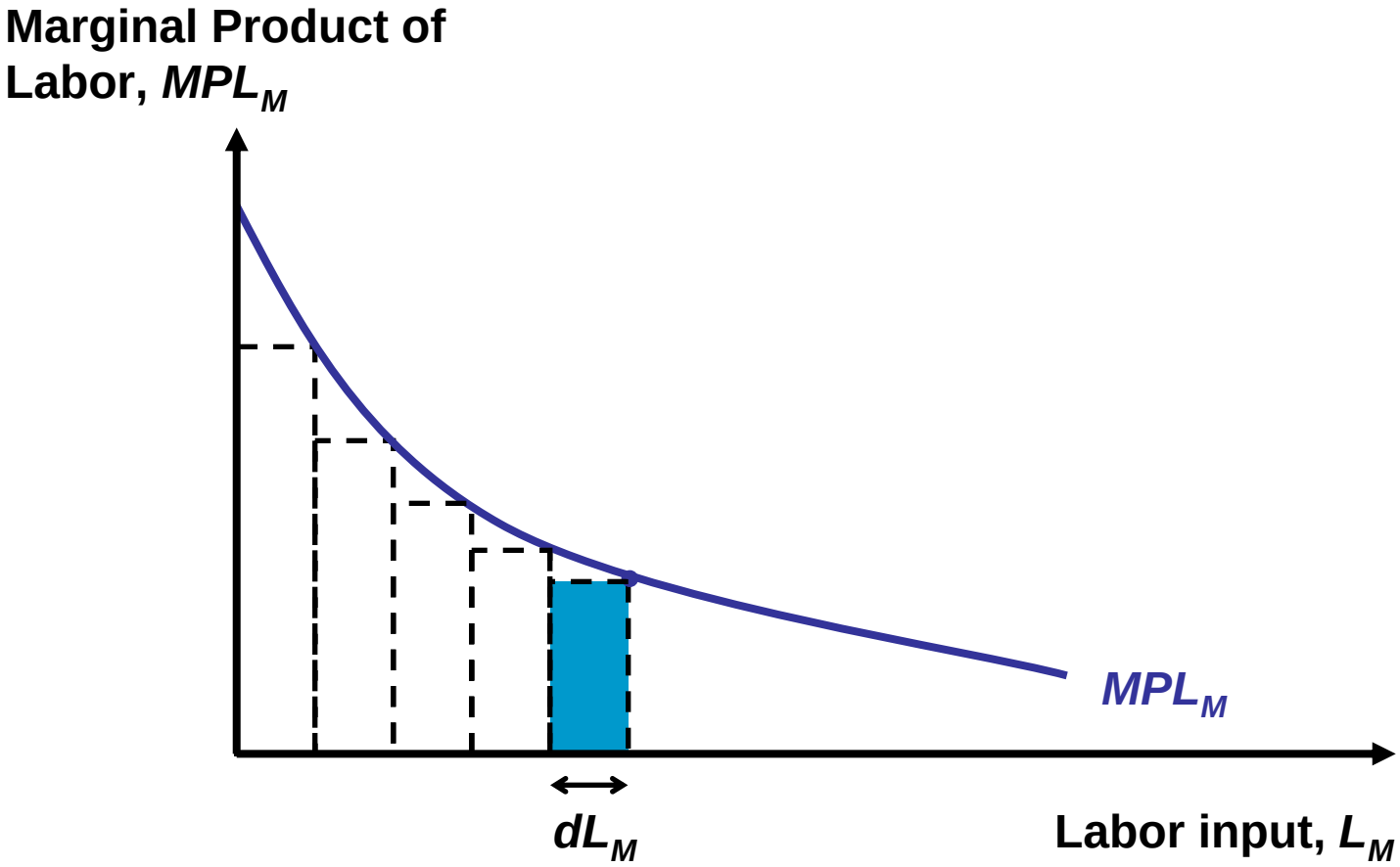
- A useful model of income distribution effects of international trade is the specific-factors model.
  - In this model, differences in resources can cause countries to have different relative supply curves, and thus cause international trade.
  - In the specific factors model, factors specific to export sectors in each country gain from trade, while factors specific to import-competing sectors lose.
  - Mobile factors that can work in either sector may either gain or lose.

Summary

- Trade nonetheless produces overall gains in the sense that those who gain could in principle compensate those who lose while still remaining better off than before.

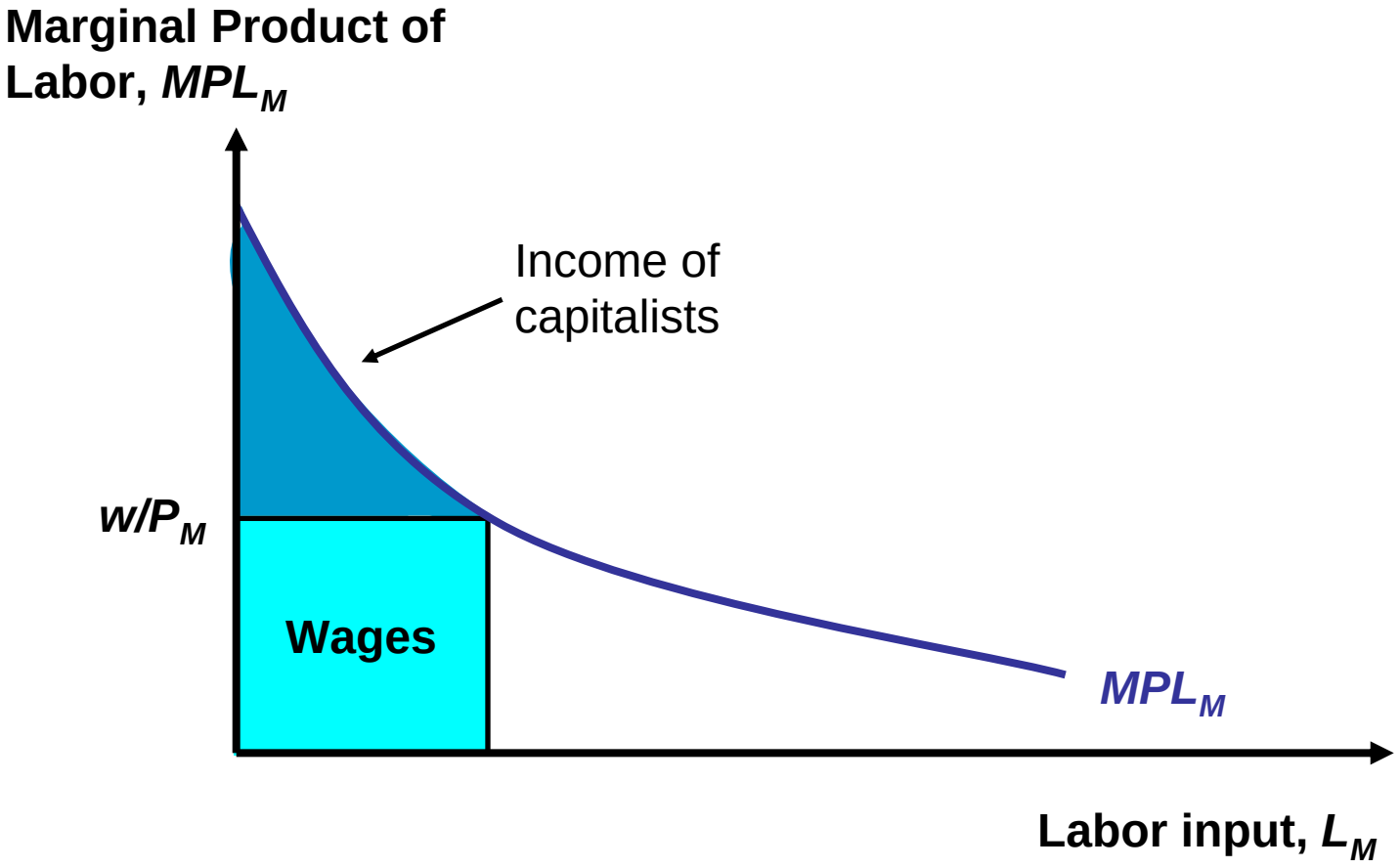
Appendix: Further Details on Specific Factors

Figure 3A-1: Showing that Output Is Equal to the Area Under the Marginal Product Curve



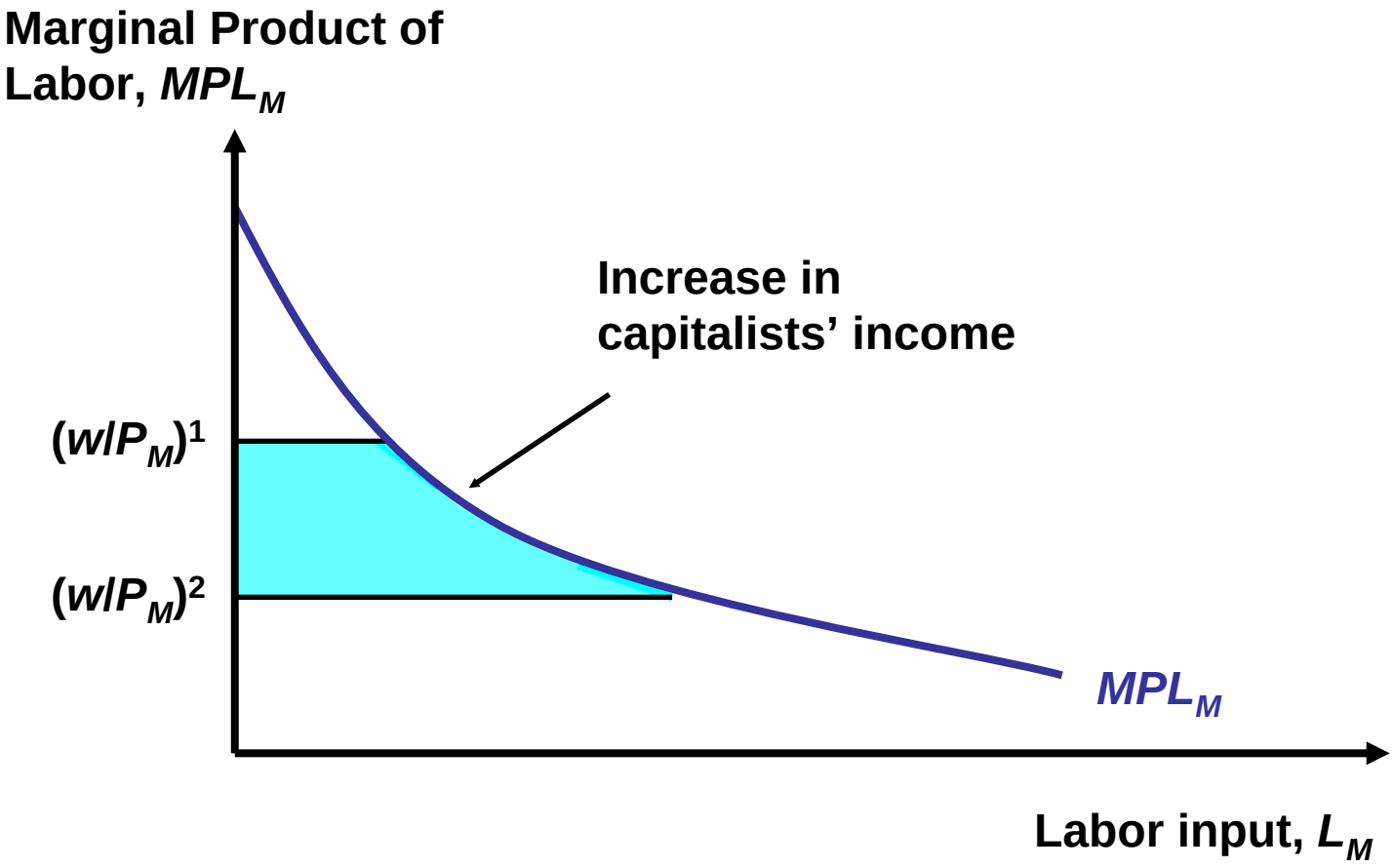
Appendix: Further Details on Specific Factors

Figure 3A-2: The Distribution of Income Within the Manufacturing Sector



Appendix: Further Details on Specific Factors

Figure 3A-3: A Rise in P_M Benefits the Owners of Capital



Appendix: Further Details on Specific Factors

Figure 3A-4: A Rise in P_M Hurts Landowners