International Trade: Lecture 9

Specific Factors Model (ii)

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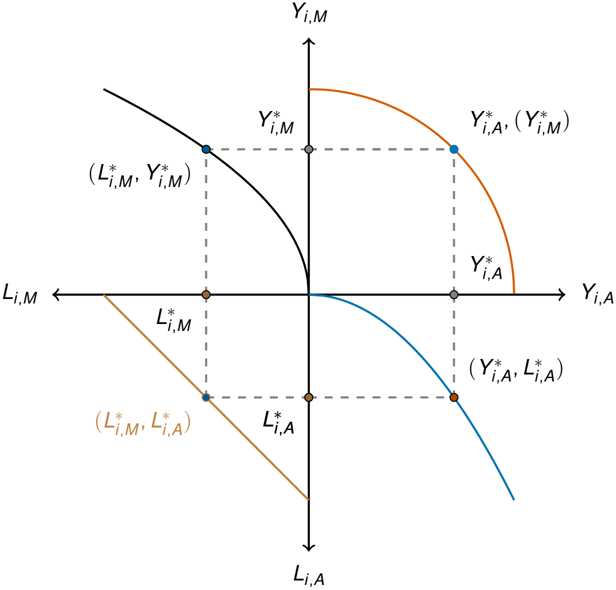
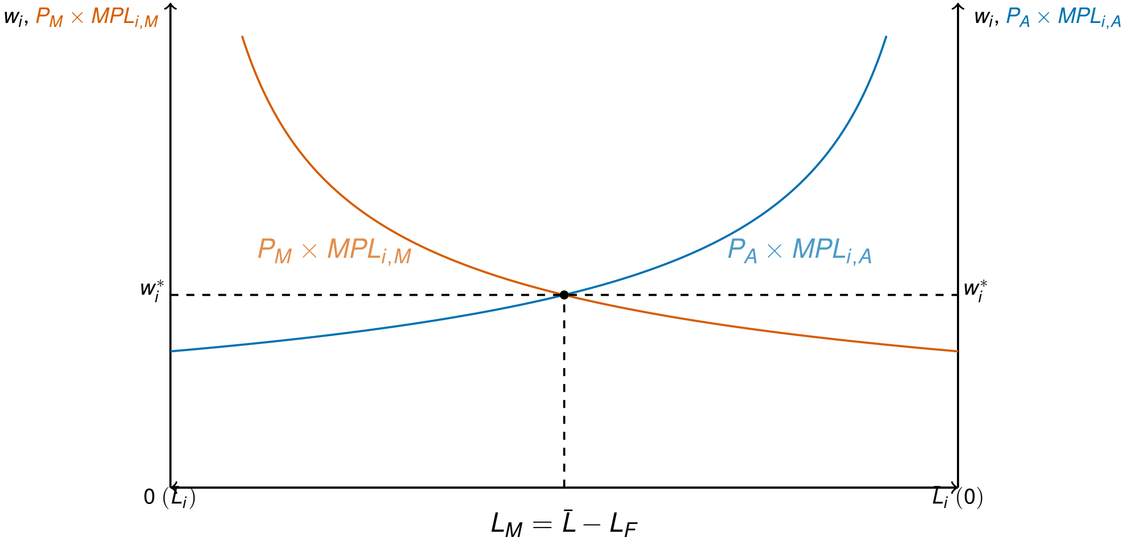
Last class

- Introduction to the Specific Factors Model
- Two mobile factors: land + capital
- One mobile factor: labor
- Induces decreasing returns to scale

The economy in one diagram



Labor Market Equilibrium: Diagram



Today

- How to solve for the equilibrium prices in autarky
- What does the trade equilibrium look like
- What changes when prices change
- Distribution of income and the political economy of trade

Labor Market Equilibrium

- We have seen that the equilibrium wage and labor allocation equalizes marginal products

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- What is the marginal product of labor?

  (additional output generated by one extra unit of labor)

$$\begin{aligned} MPL_{i,M} &\equiv \frac{\partial Y_{i,M}}{\partial L_{i,M}} = (1-\beta_i) \times Z_{i,M} \times \left(\frac{K_i}{L_{i,M}}\right)^{\beta_i}, \\ MPL_{i,A} &\equiv \frac{\partial Y_{i,A}}{\partial L_{i,A}} = (1-\beta_i) \times Z_{i,A} \times \left(\frac{T_i}{L_{i,A}}\right)^{\beta_i} \end{aligned}$$

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- What is the labor endowment constraint?

  (sum of labor in both sectors must be equal to total labor supply)

$$L_{i,A} + L_{i,M} = \bar{L}_i \iff L_{i,A} = \bar{L}_i - L_{i,M}$$

Labor Market Equilibrium

- Combining the three equations above:

$$P_M \times Z_{i,M} \times (1-\beta_i) \times \left(\frac{K_i}{L_{i,M}}\right)^{\beta_i} = P_A \times Z_{i,A} \times (1-\beta_i) \times \left(\frac{T_i}{\bar{L}_i - L_{i,M}}\right)^{\beta_i}$$

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- Rearrange terms:

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- Raise both sides to β_i:

$$\left(\frac{P_M \times Z_{i,M}}{P_A \times Z_{i,A}}\right)^{\frac{1}{\beta_i}} \times \frac{K_i}{T_i} \times (\bar{L}_i - L_{i,M}) = L_{i,M}$$

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- Define $\Omega_i = \left(\frac{P_M \times Z_{i,M}}{P_A \times Z_{i,A}}\right)^{\frac{1}{\beta_i}} \times \frac{K_i}{T_i}$.

Labor Market Equilibrium

- What is $\Omega_i = \left(\frac{P_M \times Z_{i,M}}{P_A \times Z_{i,A}}\right)^{\frac{1}{\beta_i}} \times \frac{K_i}{T_i}$? This term reflects:
  - relative profitability and tech, scaled by how responsive production is to labor (via β_i); and
  - relative capacity of the two sectors to employ labor, given the specific factors (K_i, T_i).

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- Note: $L_{i,M} / L_{i,A} = \Omega_i$ (parameters in Ω_i pin down relative labor allocation)

Labor Market Equilibrium: Numerical Example

- Suppose $Z_{i,A} = 1$, $T_i = 4$, $Z_{i,M} = 4$, $K_i = 1$, $P_M = 1$, $P_A = 2$, $\beta_i = 1/2$, $\bar{L}_i = 1$. Solve for $\{L_M, L_A, w_i^*\}$

$$P_M \times MPL_{i,M} = P_M \times Z_{i,M} \times (1-\beta_i) \times \left(\frac{K_i}{L_{i,M}}\right)^{\beta_i} = 1 \times 4 \times \frac{1}{2} \times \left(\frac{1}{L_{i,M}}\right)^{1/2} = \frac{2}{\sqrt{L_{i,M}}}$$

$$P_A \times MPL_{i,A} = P_A \times Z_{i,A} \times (1-\beta_i) \times \left(\frac{T_i}{\bar{L}_i - L_{i,M}}\right)^{\beta_i} = 2 \times 1 \times \frac{1}{2} \times \left(\frac{4}{1 - L_{i,M}}\right)^{1/2} = \frac{\sqrt{4}}{\sqrt{1-L_{i,M}}} = \frac{2}{\sqrt{1-L_{i,M}}}$$

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- To find wage:

$$w_i = P_{i,M} \times MPL_{i,M} = \frac{2}{\sqrt{L_{i,M}}} = \frac{2}{\sqrt{\frac{1}{2}}} = 2\sqrt{2}$$

Solving for prices

- For now, we have taken prices P_M and P_A as given
- But as we have mentioned before, trade models are general equilibrium models
- We have just seen that the equilibrium wage adjusts to clear the labor market
- Similarly, equilibrium prices will adjust to make sure supply equals demand

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- The condition $RD_i = RS_i$ will solve for equilibrium prices $(P_M / P_A)^*$

Autarky Equilibrium: Intuition

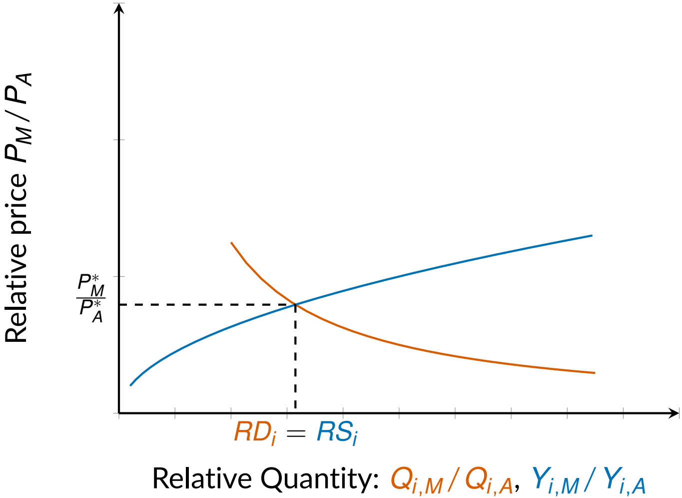

Figure: Relative Supply and Relative Demand as functions of relative prices

Solving for prices

- First, let us simplify the expression for RS_i:

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- Which shows RS_i is increasing in P_M / P_A

Solving for prices

- Now using the market clearing condition $RD_i = RS_i$:

$$RD_i = \frac{1-\alpha_i}{\alpha_i} / \frac{P_M}{P_A} = \left(\frac{Z_{i,M}}{Z_{i,A}}\right)^{\frac{1}{\beta_i}} \frac{K_i}{T_i} \left(\frac{P_M}{P_A}\right)^{\frac{1-\beta_i}{\beta_i}} = RS_i$$

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- Solving for relative prices P_M / P_A

$$\frac{P_M^*}{P_A^*} = \frac{Z_{i,A}}{Z_{i,M}} \left(\frac{1-\alpha_i}{\alpha_i} \times \frac{T_i}{K_i}\right)^{\beta_i}$$

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- $\uparrow$ agricultural productivity $Z_{i,A}$; $\uparrow$ land-to-capital ratio (T_i / K_i) = relative abundance of A (increases P_M / P_A)

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- $\uparrow$ agricultural productivity $Z_{i,A}$; $\uparrow$ land-to-capital ratio (T_i / K_i) = relative abundance of A (increases P_M / P_A)

- larger expenditure share on food ($\uparrow \alpha_i$) expands food demand (decreases P_M / P_A)

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- We solved for:
  - prices: $\{w_i^*, P_M^*/P_A^*\}$
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  - firms production choices: $\{K_i, L_{i,M}, T_i, L_{i,A}\}$

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- Such that:
  - consumers maximize utility (behave optimally)
  - firms maximize profits (behave optimally)
  - factor markets clear: $K_i = \bar{K}_i$, $T_i = \bar{T}_i$, $L_{i,A} + L_{i,M} = \bar{L}_i$
  - goods markets clear: $RS_i = RD_i$

Trade Equilibrium

- Once we open up to trade, things get complicated
- $\frac{P_M}{P_A}$ must simultaneously clear *four* markets: two goods and two labor markets
- No longer a system of linear equations that we can solve with pen and paper
- We could use a computer algorithm to solve for prices...
- ... and can still use charts to understand the qualitative aspects of the new equilibrium

Trade Equilibrium: Preliminaries

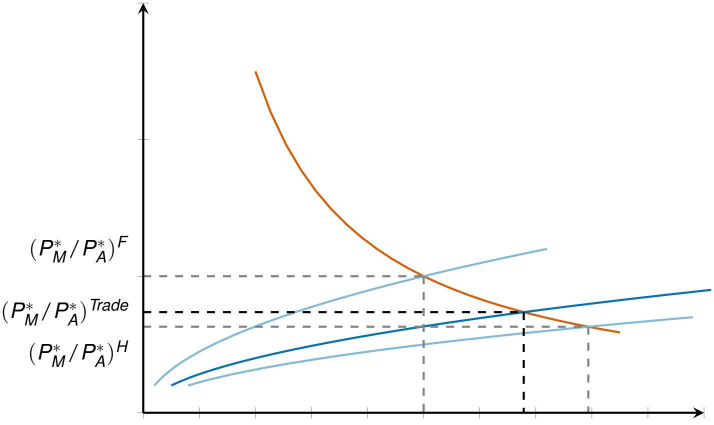
- Suppose H, F are identical; except home is more capital intensive: $K_H / T_H > K_F / T_F$.
- Recall equilibrium prices in autarky:

$$\frac{P_M^*}{P_A^*} = \frac{Z_{i,A}}{Z_{i,M}} \left(\frac{1-\alpha_i}{\alpha_i} \times \frac{T_i}{K_i} \right)^{\beta_i}$$

- Implication: (for same tfp and preferences) $(P_M / P_A)^H < (P_M / P_A)^F$
- Suppose there prices under free trade satisfy:

$$(P_M / P_A)^H < (P_M / P_A)^{Trade} < (P_M / P_A)^F$$

Trade Equilibrium: Global Demand and Supply



Relative Quantity: $\frac{Q_{H,M}+Q_{F,M}}{Q_{H,A}+Q_{F,A}}$, $\frac{Y_{H,M}+Y_{F,M}}{Y_{H,A}+Y_{F,A}}$

Figure: World Trade Equilibrium

Trade Equilibrium: Implications for Production

- Capital is more abundant at home, so in autarky prices of manufacturing are low
- After trade, relative price of manufacturing increases

$$(P_M/P_A)^H < (P_M/P_A)^{Trade} < (P_M/P_A)^F$$

- Home shifts production towards manufacturing (comparative advantage)
- Home uses higher price to expand consumption (gains from trade)

Gains from trade at home

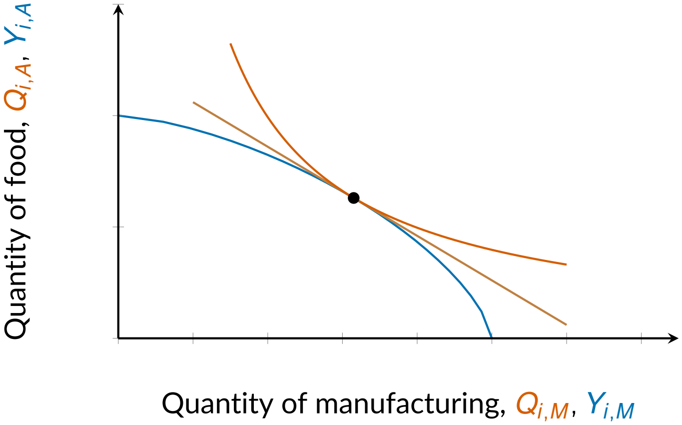


Figure: Optimal Consumption and Production Choices for Society as a Whole

Gains from trade at home

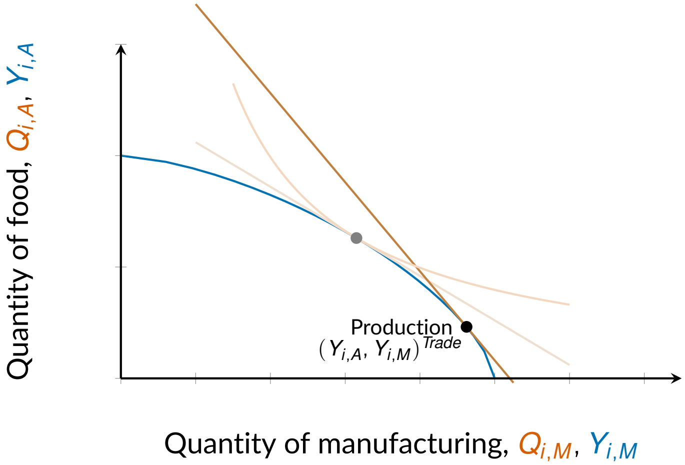


Figure: Optimal Consumption and Production Choices for Society as a Whole

Gains from trade at home

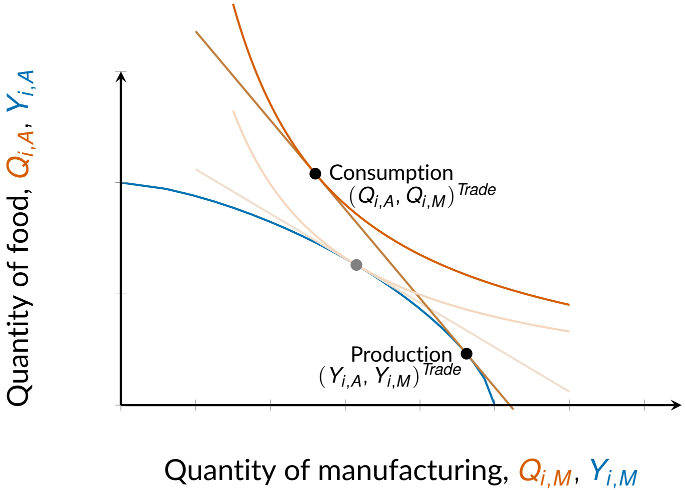
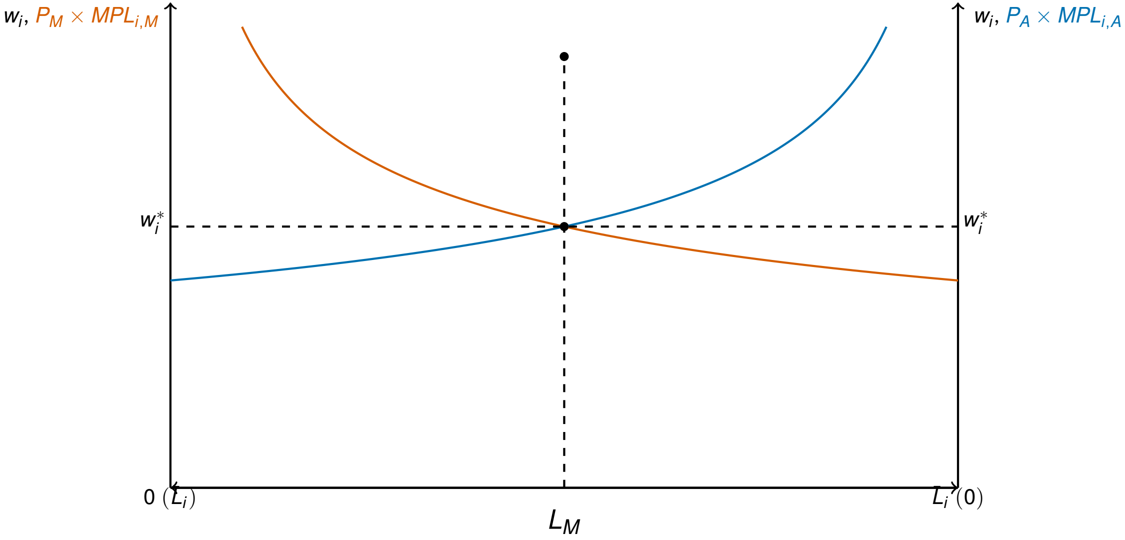


Figure: Optimal Consumption and Production Choices for Society as a Whole

Trade Equilibrium: Labor Market Shifts



Trade Equilibrium: Labor Market Shifts