

Contents

The Specific Factors Model	1
Core Principles	1
Model Setup	2
Production Possibilities Frontier (PPF)	2
Autarky Equilibrium	3
Factor Prices and Returns	3
Effects of Price Changes: Stolper-Samuelson (Specific Factors Version)	3
Summary of Price Increase Effects	4
Numerical Example: Price Change Effects	5
Trade and Income Distribution	5
Production and Trade Pattern	6
Welfare Analysis	6
Key Differences from Ricardian Model	7
Mathematical Deep Dive	7
Applications	7
Empirical Relevance	8
Problem-Solving Framework	8
Key Takeaways	8

The Specific Factors Model

Big Idea: In the short run, some factors are stuck in particular industries (specific factors). Trade creates winners and losers based on which industry you're in, not just which factor type you own. This explains why some industries lobby for protection while others support free trade.

Core Principles

Foundation

- **Multiple Factors:** Three factors of production: Labor (L), Capital (K), and Land (T)
 - Unlike Ricardian (one factor) but simpler than HO (factor mobility)
- **Factor Specificity:** Capital and land are specific to sectors; labor is mobile
 - Capital (K) can only be used in manufacturing
 - Land (T) can only be used in agriculture
 - Labor (L) can move between sectors
- **Short-Run Model:** Reflects short-run where some factors cannot move between sectors
 - Factories can't instantly become farms
 - But workers can switch jobs (with some friction)
- **Diminishing Returns:** Each sector exhibits diminishing marginal product of mobile factor
 - Adding more workers to fixed capital/land → declining productivity
 - Implies concave PPF
- **Perfect Competition:** All markets are perfectly competitive
 - Price-taking firms
 - Factors paid their marginal products

Why This Model Matters

- Introduces **distributional conflict** from trade (winners and losers)
 - Not everyone gains like in Ricardian model
- More realistic short-run analysis than Ricardian model
 - Captures adjustment costs and industry-specific interests
- Explains political economy of trade policy
 - Why steel workers oppose imports but tech workers don't
- Bridge between Ricardian and Heckscher-Ohlin models
 - Combines technology with factor ownership

Model Setup

Two Sectors

1. **Manufacturing (M)**: Uses labor (L) and capital (K)
2. **Agriculture (A)**: uses labor (L) and land (T)

Production Functions

Manufacturing: $Q = F(K, L)$ - K is fixed (specific to manufacturing) - Exhibits diminishing marginal product: $Q / L = MPL > 0, \frac{\partial Q}{\partial L} < 0$

Agriculture: $Q = G(T, L)$ - T is fixed (specific to agriculture) - Exhibits diminishing marginal product: $Q / L = MPL > 0, \frac{\partial Q}{\partial L} < 0$

Resource Constraints

Labor market clearing: $L_M + L_A = L$ (total labor endowment)

Specific factors: K and T are fixed in their respective sectors

Production Possibilities Frontier (PPF)

Shape

- **Concave** (bowed out from origin)
- Reflects increasing opportunity cost due to diminishing returns

Slope

At any point on PPF: $\text{Slope} = -MPL / MPL = -(Marginal\ cost\ of\ agriculture)/(Marginal\ cost\ of\ manufacturing)$

Derivation

As labor moves from M to A: $-\Delta Q = MPL_M \cdot \Delta L - \Delta Q = -MPL_A \cdot \Delta L = -MPL_A \cdot \Delta L$ (since $\Delta L = -\Delta L$)

Opportunity cost: $|\Delta Q / \Delta L| = MPL_A / MPL_M$

This increases as more labor moves to agriculture (diminishing returns).

Autarky Equilibrium

Profit Maximization

Each sector hires labor until: - **Manufacturing:** $P \cdot MPL = w$ - **Agriculture:** $P \cdot MPL = w$

where w is the wage rate.

Labor Market Equilibrium

Setting wages equal across sectors:

$$P \cdot MPL = P \cdot MPL = w$$

This determines the allocation of labor (L_1, L_2).

Goods Market Equilibrium

Relative price P/P adjusts so that: - Production equals consumption in both goods - Economy operates on the PPF

Factor Prices and Returns

Labor (Mobile Factor)

$$\text{Nominal wage: } w = P \cdot MPL = P \cdot MPL$$

$$\text{Real wage in terms of manufactures: } w/P = MPL$$

$$\text{Real wage in terms of agriculture: } w/P = MPL$$

Capital (Specific to Manufacturing)

$$\text{Nominal return: } r = (P \cdot Q - w \cdot L)/K$$

$$\text{Real return: } r/P \text{ or } r/P$$

Land (Specific to Agriculture)

$$\text{Nominal return: } r = (P \cdot Q - w \cdot L)/T$$

$$\text{Real return: } r/P \text{ or } r/P$$

Effects of Price Changes: Stolper-Samuelson (Specific Factors Version)

Scenario: P increases (P held constant)

Step 1: Labor Reallocation

- Initially: $P \cdot MPL = w$ (old equilibrium)
- After price increase: $P \uparrow \cdot MPL > w$
- Manufacturing sector wants to hire more labor
- Labor flows from agriculture to manufacturing: $L_1 \rightarrow L_2$

Step 2: Marginal Products Adjust

- MPL falls (diminishing returns as L rises)
- MPL rises (diminishing returns as L falls)

Step 3: New Wage Equilibrium **New wage:** $w' = P \uparrow \cdot MPL \downarrow = P \downarrow \cdot MPL \uparrow$

Key insight: w rises, but by less than the proportional increase in P

Effects on Real Wages

Real Wage in Terms of Manufactures $w'/P \uparrow = MPL \downarrow < w/P$ (original)

Real wage falls measured in manufactures.

Real Wage in Terms of Agriculture $w'/P = MPL \uparrow > w/P$ (original)

Real wage rises measured in agriculture.

Overall Effect on Labor Ambiguous: Workers can buy:
- Less manufactures - More agriculture

Net welfare depends on consumption preferences.

Effects on Specific Factors

Capital (Specific to Manufacturing) Return: $r' = (P \uparrow \cdot Q \uparrow - w' \uparrow \cdot L \uparrow)/K$

- Revenue increases: $P \uparrow \cdot Q \uparrow$
- Wage bill increases: $w' \uparrow \cdot L \uparrow$ (but w rises less than P)
- **Nominal return r increases**

Real returns: $-r'/P \uparrow$: Increases (since r rises more than proportionally to P)
 $-r'/P$: Increases even more

Capital owners unambiguously gain.

Land (Specific to Agriculture) Return: $r' = (P \downarrow \cdot Q \downarrow - w' \uparrow \cdot L \downarrow)/T$

- Revenue decreases: $P \downarrow \cdot Q \downarrow$ (output falls as L falls)
- Wage bill changes: $w' \uparrow \cdot L \downarrow$ (ambiguous)
- **Nominal return r decreases**

Real returns: $-r'/P \uparrow$: Decreases significantly
 $-r'/P$: Decreases

Landowners unambiguously lose.

Summary of Price Increase Effects

When P rises (P constant):

Factor	Nominal Return	Real Return (P)	Real Return (P)	Overall
Capital (K)	↑↑	↑	↑↑	Gains
Labor (L)	↑	↓	↑	Ambiguous
Land (T)	↓	↓↓	↓	Loses

General Principle

Factor specific to expanding sector gains Factor specific to contracting sector loses
Mobile factor has ambiguous effect

Numerical Example: Price Change Effects

Initial Setup: - K = 100 (capital in manufacturing) - T = 100 (land in agriculture) - L = 200 (total labor) - Production functions: $Q = \sqrt{K \cdot L}$, $Q = \sqrt{T \cdot L}$ - Initial prices: $P = P = \$1$ - Initial equilibrium: $L = L = 100$

Initial Equilibrium Calculations: - $Q = \sqrt{100 \times 100} = 100$ - $Q = \sqrt{100 \times 100} = 100$ - $MPL = 0.5\sqrt{K/L} = 0.5\sqrt{100/100} = 0.5$ - $MPL = 0.5\sqrt{T/L} = 0.5\sqrt{100/100} = 0.5$ - Wage: $w = P \cdot MPL = \$1 \times 0.5 = \0.50 - Capital return: $r = (P \cdot Q - w \cdot L)/K = (\$100 - \$50)/100 = \0.50 - Land return: $r = (P \cdot Q - w \cdot L)/T = (\$100 - \$50)/100 = \0.50

Shock: P increases to \$1.20 (20% increase)

New Equilibrium: - Labor reallocates: Some $L \rightarrow L$ - New equilibrium condition: $1.20 \cdot MPL = 1.00 \cdot MPL$ - After solving: $L = 120$, $L = 80$ (labor shifts to manufacturing) - New wage: $w = \$0.548$ (9.6% increase) - New $Q = 109.5$, $Q = 89.4$

Effects on Each Factor:

Capital (K): - New return: $r = (1.20 \times 109.5 - 0.548 \times 120)/100 = \0.66 - Nominal: +32% - Real (in terms of M): $r/P = 0.66/1.20 = 0.55$ (vs 0.50 before) $\rightarrow +10\%$ - Real (in terms of A): $r/P = 0.66/1.00 = 0.66$ (vs 0.50 before) $\rightarrow +32\%$ - **Unambiguously better off!**

Labor (L): - Nominal wage: +9.6% (from \$0.50 to \$0.548) - Real (in terms of M): $w/P = 0.548/1.20 = 0.457$ (vs 0.50) $\rightarrow -8.6\%$ - Real (in terms of A): $w/P = 0.548/1.00 = 0.548$ (vs 0.50) $\rightarrow +9.6\%$ - **Ambiguous:** Can buy less M, more A

Land (T): - New return: $r = (1.00 \times 89.4 - 0.548 \times 80)/100 = \0.456 - Nominal: -8.8% - Real (in terms of M): $r/P = 0.456/1.20 = 0.38$ (vs 0.50) $\rightarrow -24\%$ - Real (in terms of A): $r/P = 0.456/1.00 = 0.456$ (vs 0.50) $\rightarrow -8.8\%$ - **Unambiguously worse off!**

Key Insight: Capital owners would lobby FOR trade if manufacturing is export sector; landowners would lobby AGAINST trade!

Trade and Income Distribution

Opening to Trade

Suppose Home has comparative advantage in manufactures: - Autarky: (P/P) autarky is low - Trade: (P/P) trade > (P/P) autarky - This means P rises relative to P

Winners and Losers from Trade

Capital owners (K) gain: Specific factor in export sector **Landowners (T) lose:** Specific factor in import-competing sector **Workers (L):** Ambiguous - depends on consumption basket

Political Economy Implications

1. **Specific factors have clear interests:** Export industries support free trade; import-competing industries oppose it
2. **Short-run vs. long-run:** In long run, factors may become mobile (moves toward HO model)
3. **Coalition formation:** Workers may ally with either capital or land depending on their consumption
4. **Compensation:** Gains from trade large enough to compensate losers, but compensation may not occur

Production and Trade Pattern

Relative Supply Curve

As P/P' increases: - Labor shifts from A to M - Q increases, Q decreases - **Relative supply Q/Q' increases**

RS curve: Upward sloping (unlike Ricardian model where it's vertical)

Trade Equilibrium

Combine with relative demand: - RD curve: Downward sloping - Intersection determines (P/P') trade and trade pattern

Determining Comparative Advantage

Country with: - Relatively more capital (K/T higher) - Better technology in manufacturing - Will export manufactures

Welfare Analysis

Aggregate Gains from Trade

Production effect: Move to production point with higher value at world prices

Consumption effect: Access to different consumption point than production

Net effect: Country gains from trade (national income increases)

Distribution of Gains

Unlike Ricardian model, **not everyone gains:** - Owners of export-sector specific factor: Large gains - Owners of import-sector specific factor: Losses - Mobile factor: Small gains, losses, or neutral

Total gains > total losses: Potential for Pareto improvement with redistribution

Key Differences from Ricardian Model

Feature	Ricardian	Specific Factors
Factors	Labor only	Labor, capital, land
Factor mobility	Between sectors	Only labor mobile
PPF shape	Linear	Concave
Specialization	Complete	Incomplete
Income distribution	Everyone gains	Winners and losers
Time horizon	Long run	Short run

Mathematical Deep Dive

Production Functions

Assume Cobb-Douglas: $- Q = K^{\alpha} \cdot L^{\beta}$ - $Q = T^{\alpha} \cdot L^{\beta}$

Marginal Products

- $MPL = (\alpha) \cdot K^{\alpha} \cdot L^{\beta} = (\alpha) \cdot Q / L$
- $MPL = (\alpha) \cdot T^{\alpha} \cdot L^{\beta} = (\alpha) \cdot Q / L$

Equilibrium Condition

$$P \cdot MPL = P \cdot MPL$$

$$P \cdot (\alpha) \cdot Q / L = P \cdot (\alpha) \cdot Q / L$$

Labor Allocation

This equation, combined with $L + L = L$, determines L and L .

Factor Price Magnification

When P rises by 10%: - r might rise by 30% (magnified effect) - w might rise by 5% (muted effect)
- r might fall by 10%

Specific factors experience magnified price effects.

Applications

Tariff Analysis

A tariff on imported agriculture: - Raises P relative to P - Benefits landowners - Hurts capital owners - Ambiguous effect on workers

Immigration

Increase in L : - Reduces w (more labor competition) - Increases r and r (more labor to work with specific factors) - **Specific factor owners benefit from immigration**

Technological Change

Technology improvement in manufacturing (K more productive): - Shifts MPL upward - Attracts labor to manufacturing - Increases relative supply of manufactures - May change trade pattern

Empirical Relevance

Evidence Supporting the Model

1. **Short-run factor immobility:** Workers don't instantly switch sectors
2. **Industry-specific lobbying:** Trade policy coalitions form along industry lines
3. **Incomplete specialization:** Most countries produce in multiple sectors
4. **Adjustment costs:** Workers face costs when switching sectors

Limitations

1. **Long run:** Factors eventually become mobile
2. **Multiple specific factors:** Real economies have many sector-specific factors
3. **Intermediate inputs:** Model ignores intermediate goods
4. **Technology:** Assumed fixed, not endogenous

Problem-Solving Framework

Analyzing Price Changes

1. Identify which price changes
2. Determine labor reallocation direction
3. Calculate marginal product changes
4. Compute wage change
5. Determine specific factor returns
6. Assess real return changes for each factor

Welfare Analysis

1. Calculate production changes
2. Determine consumption changes
3. Identify winners (export sector specific factor)
4. Identify losers (import sector specific factor)
5. Assess mobile factor (check consumption weights)

Policy Evaluation

1. Determine which sector is protected/liberalized
2. Identify affected specific factors
3. Predict political coalitions
4. Assess efficiency costs (DWL from tariffs)
5. Consider compensation mechanisms

Key Takeaways

1. **Factor specificity creates distributional conflict** from trade

2. Export sector specific factor gains; import sector specific factor loses
3. Mobile factor has ambiguous welfare change
4. PPF is concave due to diminishing returns
5. Incomplete specialization is typical outcome
6. Short-run model: Factors become mobile in long run
7. Political economy: Explains protectionist pressures from import-competing industries
8. Aggregate gains exist: But redistribution needed for Pareto improvement