

Heckscher-Ohlin Model

ECON 171 · Spring 2026 · Week 4

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Today's Agenda

1. Factor intensity in production
2. The Heckscher-Ohlin theorem
3. Equilibrium allocation and factor prices
4. Factor price equalization
5. The Stolper-Samuelson theorem
6. The Rybczynski theorem
7. Case study: Globalization and inequality in developing countries

What We Aim to Learn

- What do countries trade?
- How does trade affect
 - the production structure of the economy?
 - the distribution of incomes in the economy?
- What are the effects of changes in resource endowments?

Motivation for Heckscher-Ohlin Model

- Specific factors model predicts
 - Negative shocks to the terms of trade are mitigated through re-allocation of mobile workers
- What is insufficient about the specific factors model?
- Specific factors model cannot explain:
 - Disproportional income losses among workers hit by trade shocks

Setup and Assumptions

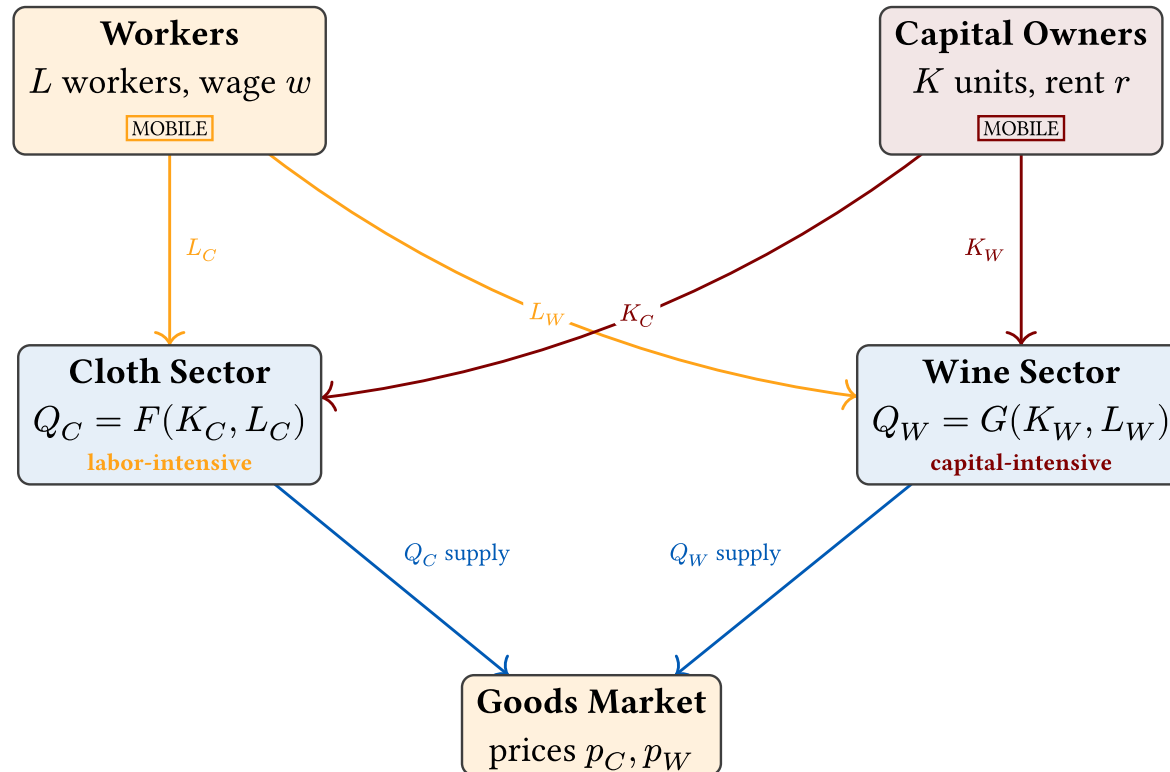
- Two countries: Home and Foreign
- Two goods: cloth (C) and wine (W)
- Two factors of production: capital (K) and labor (L)
 - Both factors are *mobile across sectors* (long run) but *immobile across countries*
- Both countries have *identical* Cobb-Douglas technology:

$$Q_C = K_C^{\alpha_C} L_C^{1-\alpha_C}, \quad Q_W = K_W^{\alpha_W} L_W^{1-\alpha_W}$$

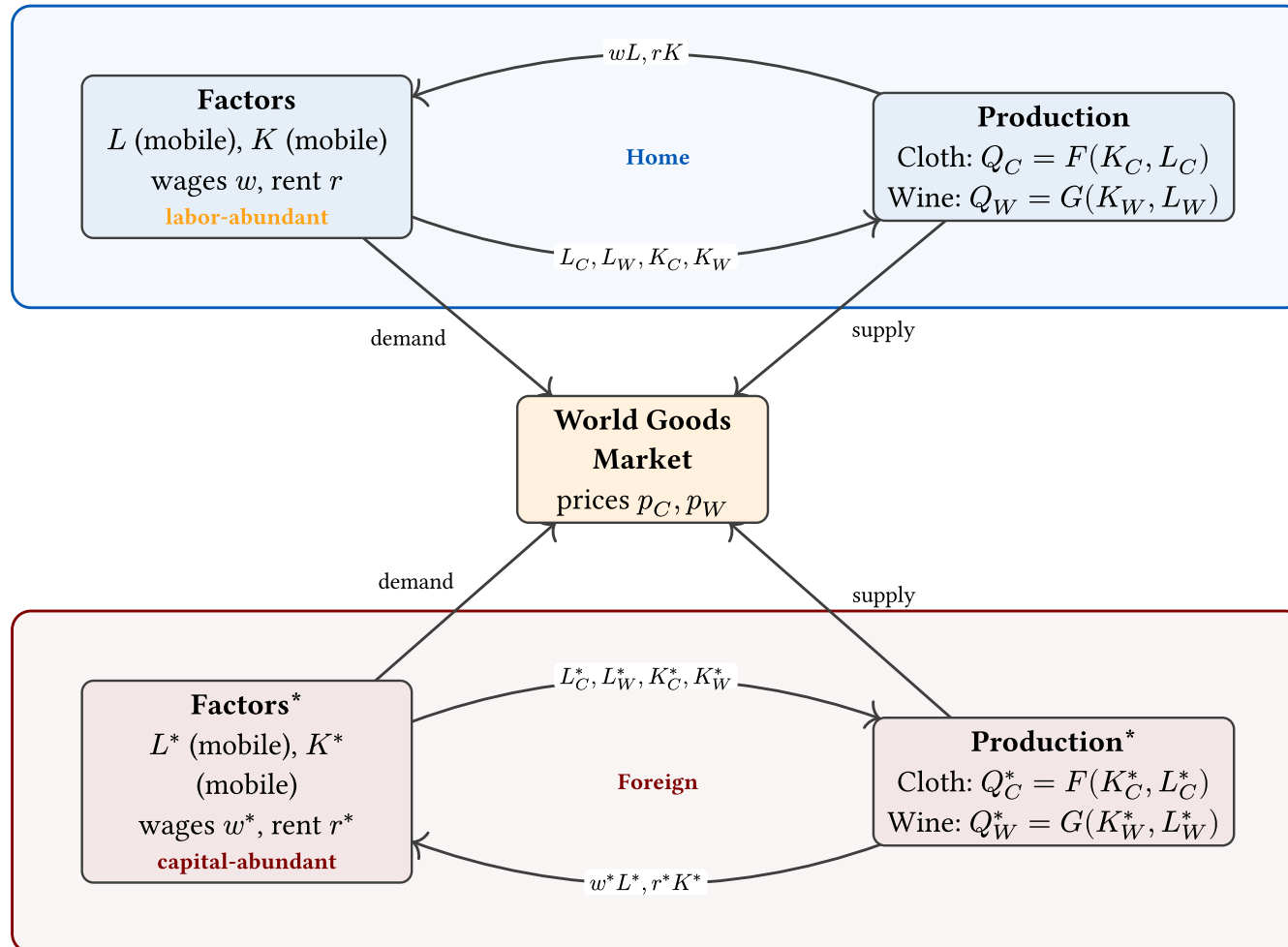
- Countries differ *only* in their factor endowments (K/L vs. K^*/L^*)
- Identical homothetic preferences (Cobb-Douglas utility)

Key difference from specific factors: both factors are mobile across sectors, so the model describes the *long run*.

How does the economy work in autarky?



Opening to trade



Factor Intensity in Production

Factor intensity

Factor Intensity: Good i is *capital-intensive* relative to good j if the capital-labor ratio used in producing i exceeds that in j at every common factor price ratio:

$$(K/L)_i > (K/L)_j \quad \text{for all } w/r$$

- With $\alpha_W > \alpha_C$: wine is capital-intensive, cloth is labor-intensive
- Cost minimization $\Rightarrow$ each sector's K/L ratio depends on w/r :

$$\frac{K_i}{L_i} = \frac{\alpha_i}{1 - \alpha_i} \cdot \frac{w}{r}$$

- Since $\alpha_W > \alpha_C$: $(K/L)_W > (K/L)_C$ at *every* factor price ratio

Which good uses capital more intensively?

Factor Abundance: Home is *capital-abundant* relative to Foreign if $K/L > K^*/L^*$.

- In our example: Home has $K/L = 1$, Foreign has $K^*/L^* = 0.5$
 - Home is capital-abundant, Foreign is labor-abundant
- Factor abundance is a *relative* concept — it is the *ratio* that matters, not the absolute amount

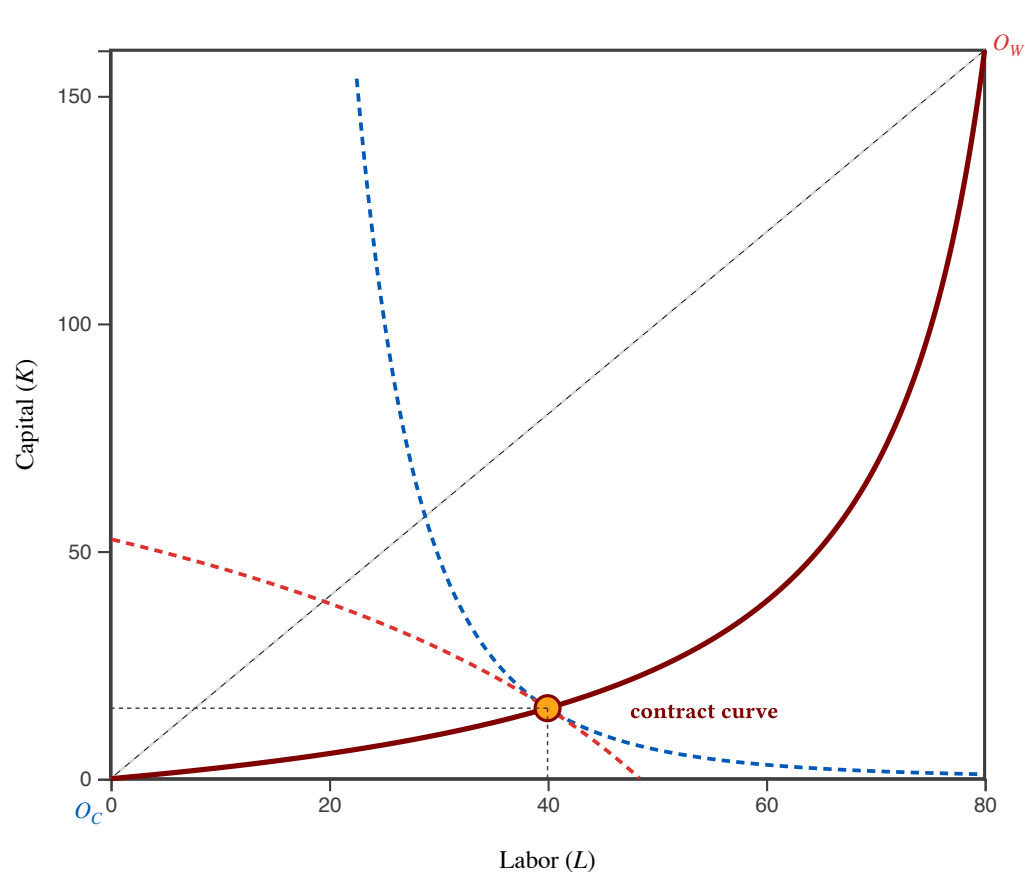
Factor intensity describes *technologies*; factor abundance describes *countries*. The H-O theorem connects the two.

Why must factor-intensity rankings be unambiguous? (No FIR)

- A *factor intensity reversal* occurs when good i is capital-intensive at one w/r but labor-intensive at another
- With Cobb-Douglas technology, reversals *cannot* happen:
 - $(K/L)_i = [\alpha_i/(1 - \alpha_i)] \cdot (w/r)$ is always proportional to w/r
 - Since $\alpha_W > \alpha_C$: wine always uses a higher K/L ratio

No factor intensity reversals is a critical assumption. It guarantees that the ranking of goods by capital intensity is the same in *both* countries. Without it, the H-O theorem fails.

How are factors split between sectors? (Edgeworth box)



K (Home capital)	160	<input type="range" value="160"/>
L (Home labor)	80	<input type="range" value="80"/>
α_C (cloth K share)	0.2	<input type="range" value="0.2"/>
α_W (wine K share)	0.7	<input type="range" value="0.7"/>
L_C/L	0.5	<input type="range" value="0.5"/>

	Cloth	Wine
L	40.0	40.0
K	15.5	144.5
K/L	0.39	3.61
Q	33.1	98.3

What do countries trade? (Heckscher-Ohlin theorem)

What do countries trade? (H-O theorem)

Heckscher-Ohlin Theorem

A country will export the good that uses its *abundant* factor intensively, and import the good that uses its *scarce* factor intensively.

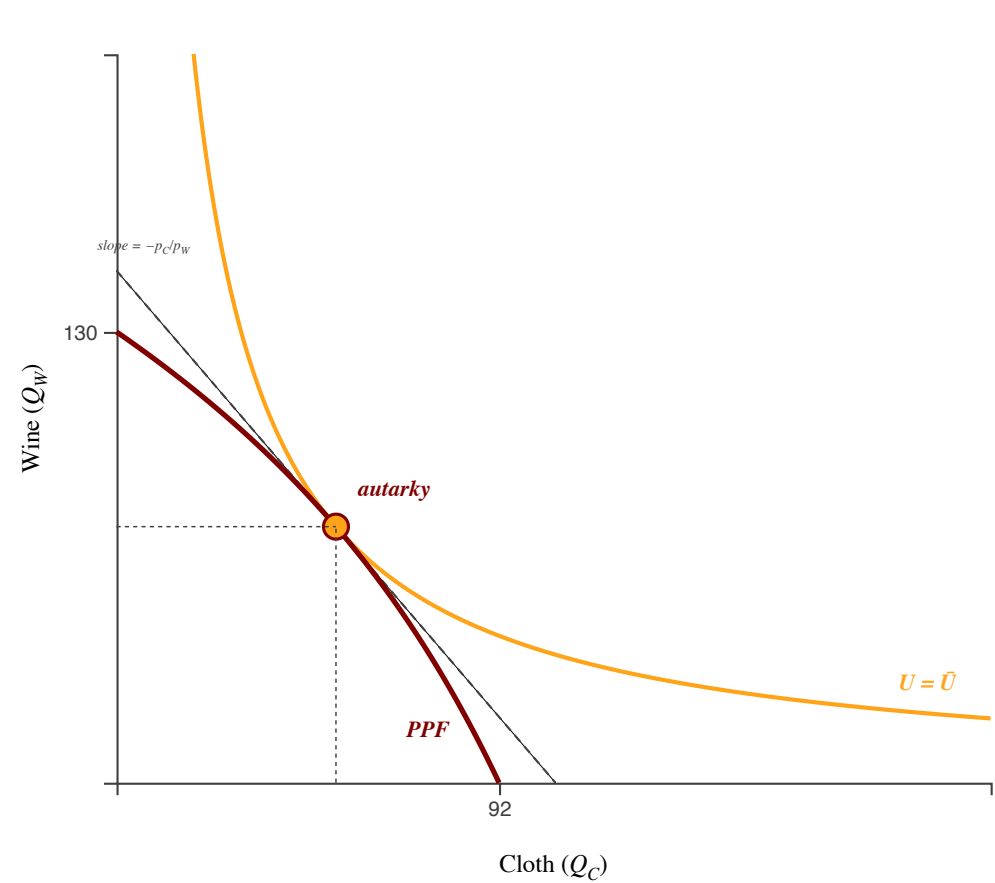
- Home is capital-abundant ($K/L > K^*/L^*$), wine is capital-intensive ($\alpha_W > \alpha_C$)
 - $\Rightarrow$ Home exports wine, Foreign exports cloth
- Trade pattern is determined entirely by *relative factor endowments* and *factor intensities*
 - No role for absolute productivity differences (contrast with Ricardo)

Why does the H-O theorem hold?

- Home's relative abundance of capital makes capital relatively cheap in autarky
- Cheap capital $\Rightarrow$ cheap production of capital-intensive goods $\Rightarrow$ low autarky price of wine relative to cloth
- p_C/p_W is *higher* at Home than at Foreign in autarky
- When trade opens, Home has a comparative advantage in wine (the capital-intensive good)

From specific factors to H-O: in the specific factors model, trade patterns depend on which sectors have which factors. In H-O, trade patterns follow from *economy-wide* factor abundance — a deeper, more structural explanation.

How do endowments shape the PPF?



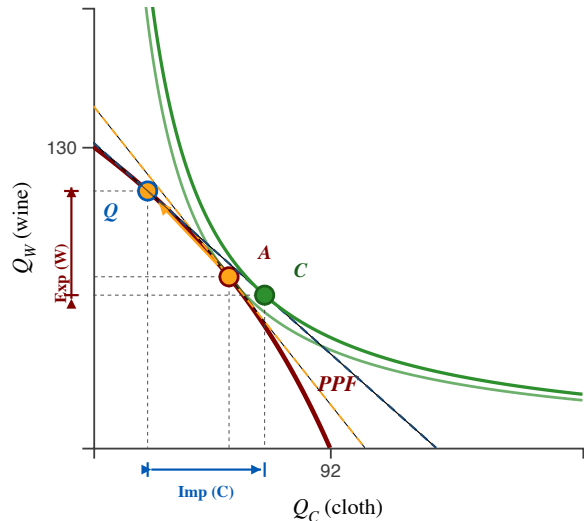
K (Home capital)	160	
L (Home labor)	80	
α_C (cloth K share)	0.2	
α_W (wine K share)	0.7	
β (cloth expenditure share)	0.5	

Autarky equilibrium

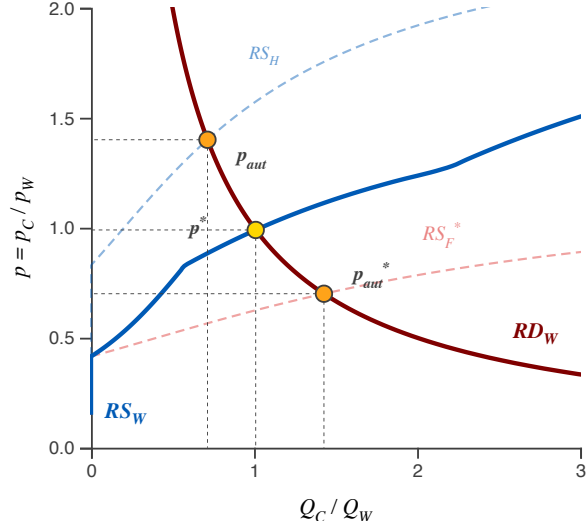
	Value
Q_C	52.7
Q_W	73.8
p_C / p_W	1.40
U	62.38

Trade Equilibrium Overview

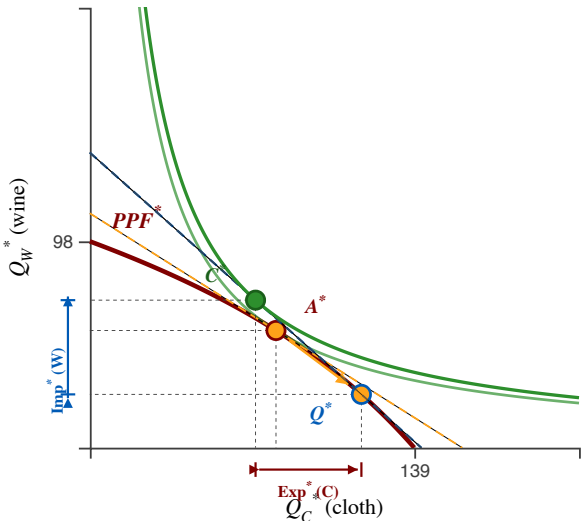
Home (K -abundant)



World market



Foreign (L -abundant)



Stage 3 —

Trade equilibrium: countries consume on the world budget line; gains from trade realized.

$p_{aut,H}$	p^*	$p_{aut,F}$	U_H^{trade}/U_H^{aut}	U_F^{trade}/U_F^{aut}
1.400	0.990	0.700	1.061	1.059

K (Home capital)

K^* (Foreign capital)

α_C (cloth K share)

β (cloth expenditure)

L (Home labor)

L^* (Foreign labor)

α_W (wine K share)

reveal stage

How does trade affect the income distribution?

(Stolper-Samuelson theorem)

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Stolper-Samuelson Theorem

An increase in the relative price of a good raises the *real* return to the factor used intensively in producing that good, and lowers the *real* return to the other factor.

- If p_C/p_W rises: w rises and r falls — in terms of *both* goods (labor gains, capital loses)
- *Magnification effect*: factor prices move proportionally *more* than goods prices

In equilibrium, each factor's payment equals its marginal revenue product:

Cloth sector

$$w = p_C \cdot \text{MPL}_C \quad r = p_C \cdot \text{MPK}_C$$

Wine sector

$$w = p_W \cdot \text{MPL}_W \quad r = p_W \cdot \text{MPK}_W$$

How do factor markets adjust to a price shock? (Cobweb mechanism)

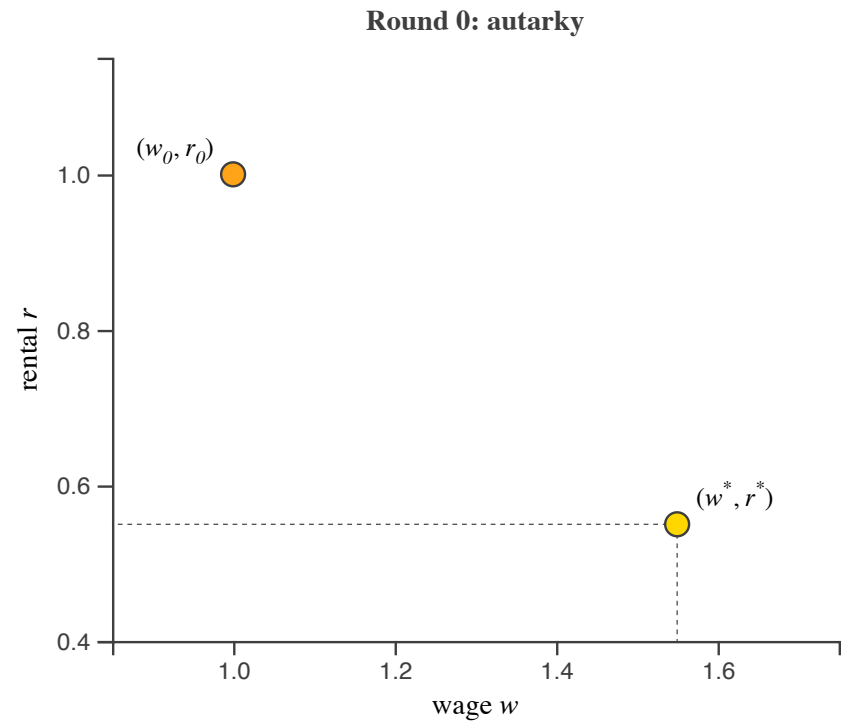
Trigger. p_C/p_W rises — cloth becomes relatively more profitable, so cloth expands and wine contracts.

- Workers move from wine to cloth
 - MPL falls in cloth, rises in wine → wage equalizes
 - But MPK now higher in cloth, lower in wine → **rental gap opens**
- Capital chases that gap, moving from wine to cloth
 - MPK falls in cloth, rises in wine → rental rate equalizes
 - But MPL now higher in cloth, lower in wine → **smaller wage gap reopens**
- The chain repeats — *each move closes its own factor's gap and reopens the other's* — but every round's gap is smaller → the system **converges**.

How does the cobweb play out, round by round?

#	Move	Closes (own market)	Reopens (cross channel)
0	—	autarky (pre-shock) — both gaps zero	—

Channel — round 0: autarky equilibrium; both factor markets clear. Price shock arrives → wage gap > rental gap (cloth is L-intensive), so **L moves first**.



Why do factor prices move in the opposite directions?

- All reallocation forces push the rental price up
 - *Directly* due to the price increase of cloth
 - *Indirectly* as workers also move to cloth from wine, increasing capital's marginal product
- Two reallocation forces push the wage in different directions
 - The price increase of cloth pushes the wage up
 - The exit of capital from wine pushes the wage down
- But the downward pressure on the wage dominates
 - As workers move to cloth from wine, the wage is equalized between the sectors
 - The exit of capital from wine drives the lower bound of the equalized value down

Who wins and who loses from trade?

- Trade raises the relative price of the exported good
- In Home (capital-abundant, exports wine): trade raises r and lowers w
 - *Capital owners gain, workers lose*
- In Foreign (labor-abundant, exports cloth): trade raises w^* and lowers r^*
 - *Workers gain, capital owners lose*
- Winners and losers are determined by *which factor you own*, not which sector you work in

Contrast with specific factors: there, the mobile factor's real wage was ambiguous. Stolper-Samuelson gives a *sharp* prediction: winners and losers are determined by *factor type*, not sector of employment.

**How does endowment
growth reshape
output?** (Rybczynski theorem)

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Rybczynski Theorem

At constant goods prices, an increase in the endowment of a factor raises output of the good that uses that factor intensively, and *lowers* output of the other good.

- If Home's capital K rises (at fixed p_C/p_W):
 - Wine output rises (wine is capital-intensive)
 - Cloth output *falls* (labor is pulled into wine)
- This is another magnification effect: output changes are proportionally *larger* than the endowment change

What does Rybczynski tell us about growth and trade?

- Capital accumulation in a capital-abundant country *reinforces* comparative advantage
 - More wine production $\Rightarrow$ more wine exports
- Immigration (increase in L) shifts comparative advantage toward labor-intensive goods
- Rybczynski explains *biased growth*: factor accumulation changes the pattern of production and trade

Rybczynski links *economic growth* to *trade patterns*. A country that accumulates the factor it is already abundant in will see its exports grow; accumulating the scarce factor erodes the trade pattern.

Case Study: Globalization and Inequality

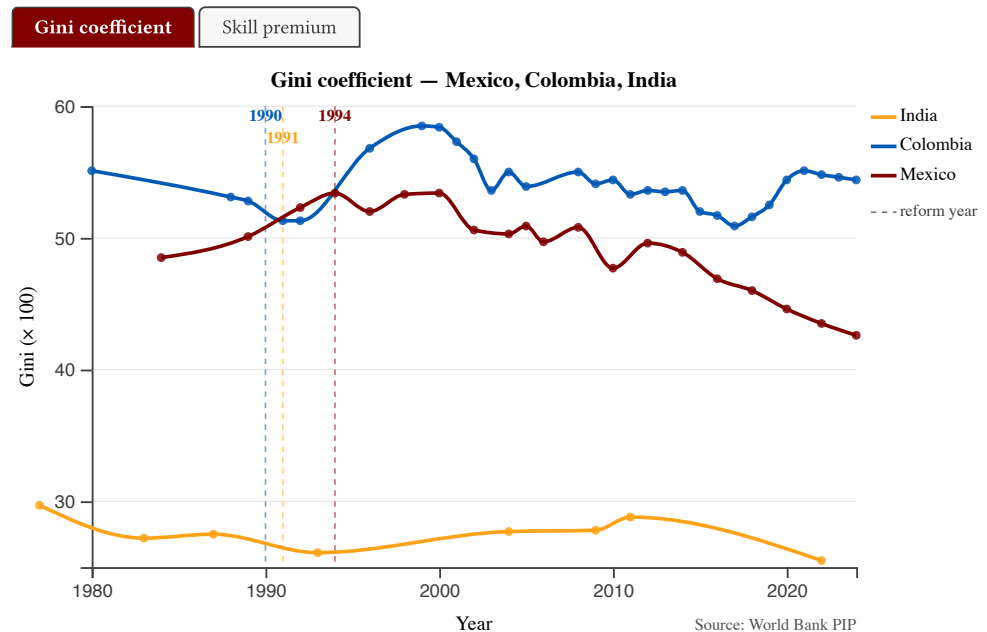
What does H-O predict for developing countries?

- Developing countries are labor-abundant relative to developed countries
- H-O predicts they export labor-intensive goods (textiles, assembly manufacturing)
- Stolper-Samuelson predicts: trade should *raise* wages for unskilled labor in developing countries
 - Trade opening should *reduce* inequality in the developing world

Standard H-O prediction: globalization should *compress* wage inequality in developing countries by raising the returns to their abundant factor (unskilled labor).

What do the wage data show?

- Contrary to Stolper-Samuelson, wage inequality *rose* in many developing countries after trade liberalization (Mexico, Colombia, India in the 1990s)
- The skill premium (wages of college vs. non-college workers) *increased*, not decreased
- This is the **H-O paradox** for developing countries



Reform sources: [Colombia 1990](#) · [India 1991](#) · [Mexico 1994](#)

“The 1990s dealt a blow to Heckscher–Ohlin.” —
Harrison, McLaren & McMillan (2011)

Further reading: Goldberg & Pavcnik, [Distributional Effects of Globalization in Developing Countries](#) (JEL 2007) · [Goldberg & Pavcnik on VoxDev](#) (2018, accessible summary).

Where does H-O fall short?

1. Skill-biased technological change

- Trade opening (1980s–90s) overlapped the IT revolution (PCs, automation, robots)
- These technologies **complement** college-educated workers and **automate** routine manual tasks
- Developing countries imported the new goods *and* the technology — raising skill demand **everywhere**

2. Offshoring of tasks

- A U.S. firm keeps *design, R&D, marketing* at home and offshores *assembly* to Mexico or Vietnam
- Those tasks are **unskilled in the U.S.** but require **literacy, numeracy, discipline** — above average locally
- So demand for skilled workers rises in *both* regions — a channel H-O misses

Both mechanisms lift the skill premium in *both* rich and developing countries — something pure H-O cannot explain.