

Trade Under Increasing Returns and Imperfect Competition

ECON 171 · Spring 2026 · Week 7

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Today's Agenda

1. The Krugman model: structure of the economy
2. Consumers — demand for a single variety
3. Firms — cost, optimal price, free entry
4. Equilibrium — PP and CC curves, n^* , Q^* , P^*
5. Pro-competitive and love-of-variety gains from trade
6. The home market effect
7. Case study: intra-industry trade

What We Aim to Learn

- Why does H-O fail to explain trade between similar countries — and what does Krugman's setup add?
- What pins down each side of the market?
 - What demand does each firm face?
 - How does each firm set its price, and how does free entry pin down the number of firms?
- How do market size and fixed costs pin down the equilibrium price, output, and number of firms?
- Once countries trade,
 - what new gains arise from a larger integrated market?
 - why does the larger country host disproportionately more firms?

Who actually trades with whom?

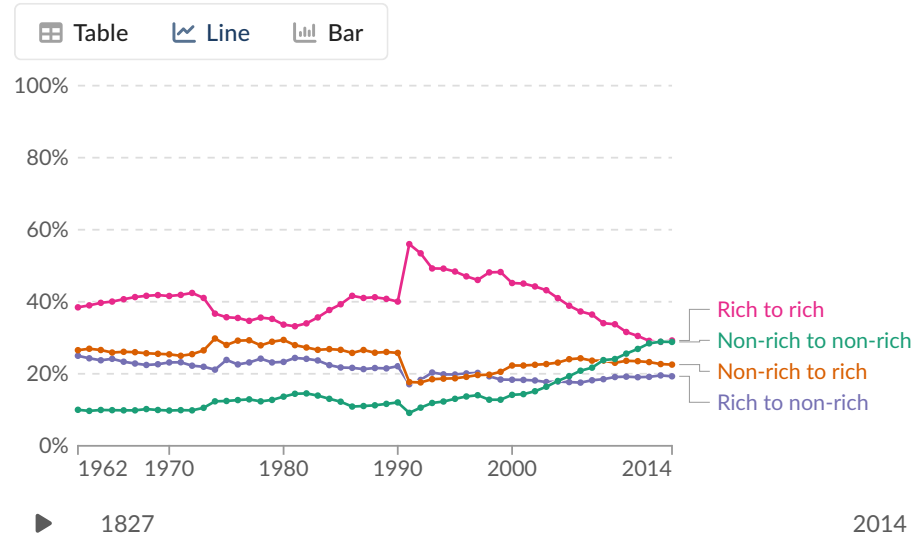
- Ricardo and H-O predict trade between **dissimilar** countries (different tech, different endowments).
- Data say the opposite: **rich-rich pairs** account for ~50% of world trade — and that share has *grown* since the 1960s.
- Half of that flow is **intra-industry**: the same HS-6 product crossing the same border in **both directions**.

What drives trade between similar countries — and why does it produce gains?

Share of global exports by income level of the trade partners

Our World in Data

Share of global merchandise exports occurring between country pairs at different income levels.



Data source: Fouquin and Hugot (2016) – [Learn more about this data](#)

Note: "Rich" countries in this chart are Australia, Austria, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. "Non-rich" countries are all the other countries in the world for which data is available.

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[Explore the data](#) →

BMW round-trips the Atlantic



X3 / X5 / X7 → world



3 / 5 / 7 series → US

- 2022: BMW shipped 227,029 X-models worth \$9.6 B from South Carolina to 120+ countries.
- Largest destination: **Germany (15.5%)**, ahead of China (13.5%) and South Korea (12.8%).
- That same year, the US imported BMW 3 / 5 / 7-series from Munich, Dingolfing, Leipzig.
- Spartanburg = **#1 US auto exporter by value** 9 yrs running; **\$113 B** cumulative 2014–25.



Plant Spartanburg, SC



Plant Munich, Germany

Same firm. Same broad product. Same year.
Both directions across the Atlantic. H-O cannot explain this.

Source: BMW Group US, [Feb 2024](#) & [Feb 2025](#) press releases. Photos via Wikimedia Commons: X5 (OWS Photography, CC BY 4.0) · 330i (Vauxford, CC BY-SA 4.0) · Plant Spartanburg (Ken Lund, CC BY-SA 2.0) · Plant Munich (Diego Delso, CC BY-SA 3.0).

The Krugman model

Structure of the economy

Consumers

- A representative consumer with **love of variety** — utility rises in the *number* of varieties consumed, not just in total quantity.
- Spends total income S across n differentiated varieties of one good.

Firms

- n symmetric firms, one variety each.
- Cost: fixed F + variable c per unit.
- Choose price P_i given a downward-sloping residual demand.

Why this needs imperfect competition

- Fixed cost $F \Rightarrow AC(Q) = F/Q + c > c = MC$ for any finite Q .
- Under perfect competition $P = MC \Rightarrow$ firms lose F on every variety.
- $P > MC$ is required to break even $\Rightarrow$ **monopolistic competition** with free entry to $\pi = 0$.

A model where **consumers value variety** and **firms have IRS** generates two-way trade between identical countries — exactly what H-O could not.

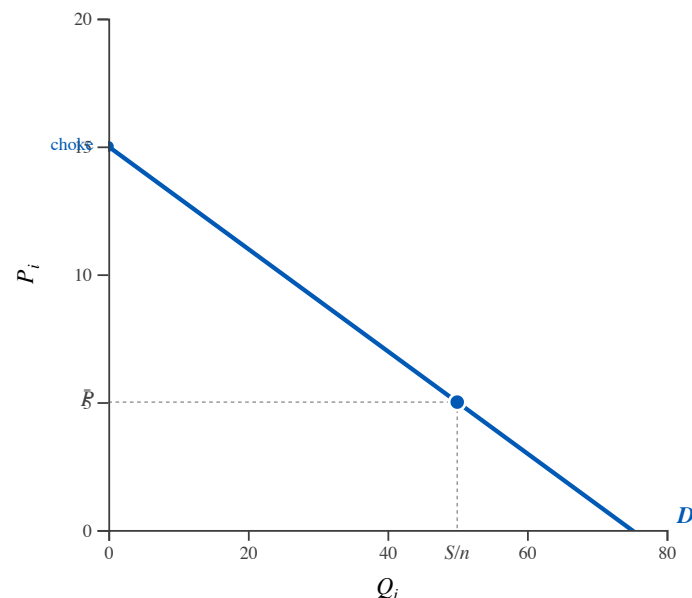
Consumers

Demand for a single variety

The residual demand each firm faces (KMO §8.2):

$$Q_i = S \cdot \left[\frac{1}{n} - b(P_i - \bar{P}) \right]$$

- S — **total industry expenditure**: scales overall demand.
- $1/n$ — firm i 's **fair share**: at common prices ($P_i = \bar{P}$), the firm sells S/n .
- P_i — firm i 's **own price** (chosen by the firm); $\bar{P}$ — **competitors' average** (taken as given).
- b — **substitutability**: how strongly customers switch when P_i deviates from $\bar{P}$. Smaller $b \Rightarrow$ varieties feel more distinct $\Rightarrow$ less elastic demand.



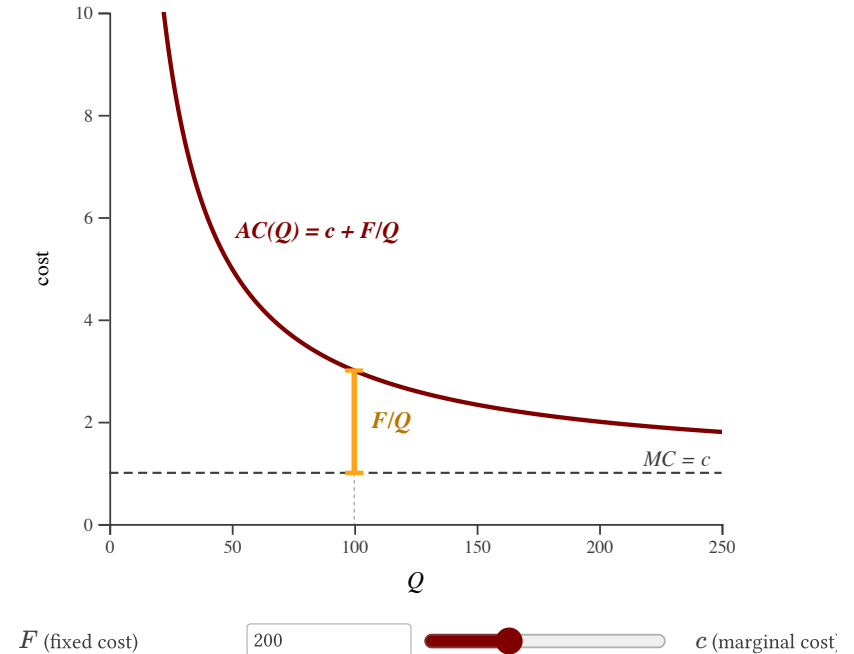
$\bar{P}$ (avg competitor price)	5	<input type="range" value="5"/>
n (number of firms)	10	<input type="range" value="10"/>
b (demand slope)	0.01	<input type="range" value="0.01"/>
S (Home market size)	500	<input type="range" value="500"/>

Derivation from CES preferences: see appendix.

Firms

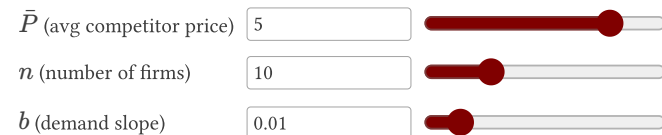
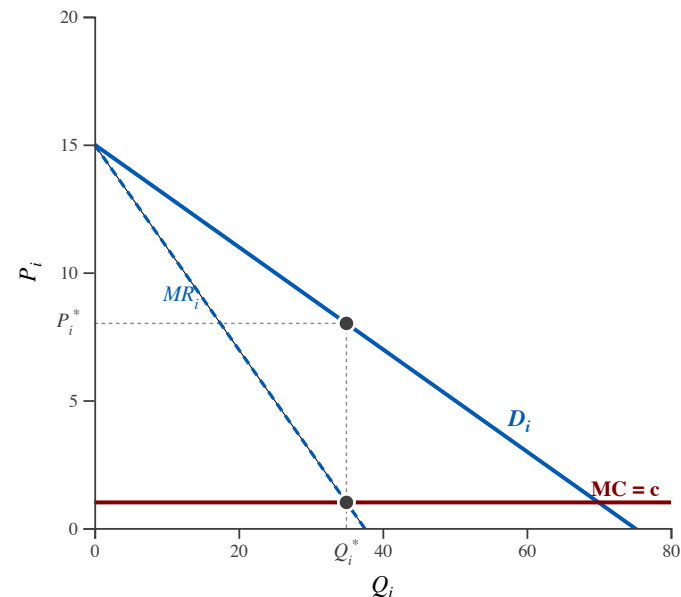
Cost function

- Total cost: $TC(Q) = F + c \cdot Q$.
- Marginal cost: $MC = c$ (constant).
- Average cost: $AC(Q) = F/Q + c$ — falls with scale (IRS).
- The vertical gap $AC - MC = F/Q$ is the per-unit “fixed-cost burden” the firm must cover via markup.
- This is the simplest cost structure that produces internal economies of scale and a non-degenerate scale-vs-variety trade-off.



Optimal price-setting

- Each firm faces residual demand
 $Q_i = S [1/n - b(P_i - \bar{P})]$ given n competitors and their average price $\bar{P}$.
- Profit: $\pi_i = (P_i - c) Q_i - F$. Firm chooses Q_i to maximize.
- FOC: **marginal revenue equals marginal cost**, $MR_i = MC = c$. This intersection pins down Q_i^* ; the price P_i^* is **read off the demand curve** at Q_i^* .
- Each firm has **market power** (residual demand slopes down) $\Rightarrow P_i^* > c$.
- Best response depends on $\bar{P}$ — strategic interaction. Equilibrium pins this down once we impose symmetric Nash.



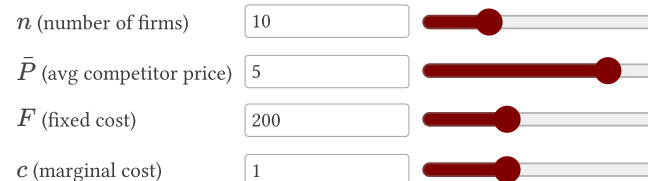
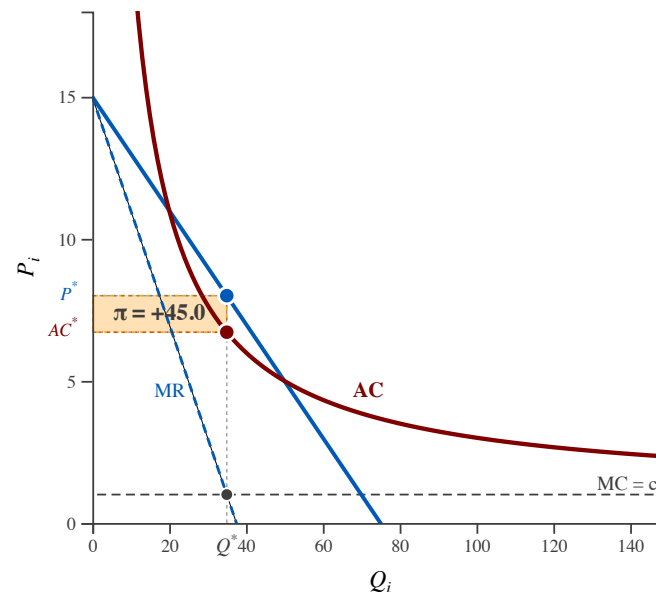
Scroll over the chart to zoom; double-click to reset.

Entry decision

- $\pi_i > 0 \Rightarrow$ new firms enter; $\pi_i < 0 \Rightarrow$ firms exit.
- Free entry pins down n where economic profits are **exactly zero**:

$$\pi_i = (P_i - c) Q_i - F = 0$$

- This is a **break-even condition** every operating firm must satisfy: the markup over marginal cost, multiplied by output, must cover the fixed cost.
- Equivalently: $P_i = AC(Q_i) = c + F/Q_i$ — the firm operates at a price equal to its average cost.
- It doesn't pin down (n, P, Q) on its own — but combined with the pricing FOC and symmetry, it will.



Scroll over the chart to zoom; double-click to reset.

Equilibrium

Symmetric assumption

Symmetric Nash equilibrium. Identical firms, identical conditions $\Rightarrow$ no firm deviates from the average:

$$P_i = \bar{P} = P^*, \quad Q_i = Q^* = S/n.$$

Cost: silent on which firms enter, who is most productive, who survives.

Next week (Melitz 2003): drop symmetry — firms differ in productivity; trade reallocates output to the most productive.

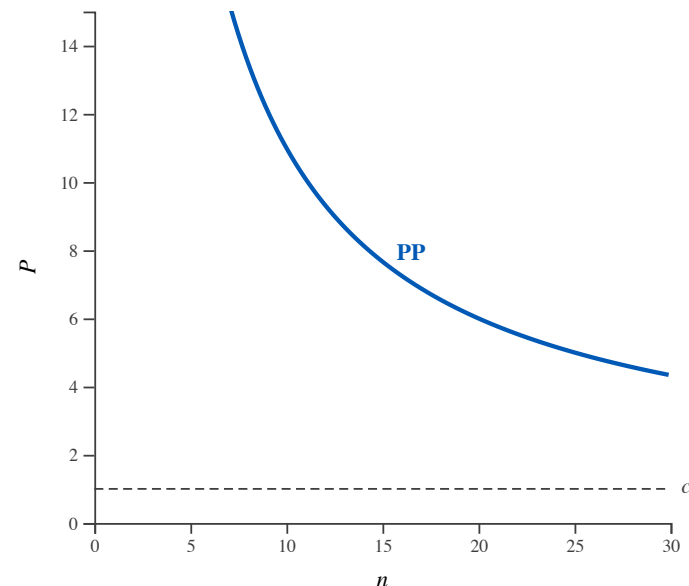
- Pricing FOC ($Q_i = bS(P_i - c)$) + symmetry collapses into one equation in (n, P) — the **PP curve**.
- Zero-profit ($\pi_i = 0$, $Q_i = S/n$) + symmetry collapses into one equation in (n, P) — the **CC curve**.
- We derive each in the next two slides, then intersect.

PP curve: derivation

- Pricing FOC for any firm: $Q_i = bS(P_i - c)$.
- At the symmetric Nash equilibrium $P_i = \bar{P} = P$ — so each firm's residual demand is just its share of the market: $Q_i = S/n$.
- Substitute $Q_i = S/n$ into the FOC:

$$\frac{S}{n} = bS(P - c) \iff P = c + \frac{1}{bn}$$

- The **PP curve**: P as a function of n , holding firm behavior fixed.
- **Downward-sloping** in n : more competitors $\Rightarrow$ lower price.
- **Asymptotic** to $P = c$ as $n \rightarrow \infty$. Independent of S and F .



b (demand slope)

0.01

c (marginal cost)

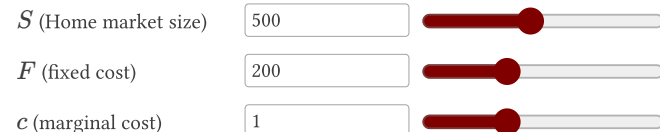
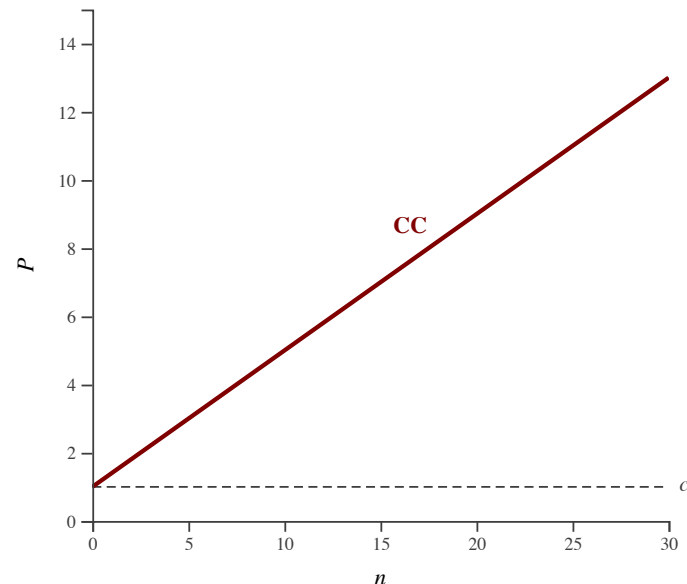
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CC curve: derivation

- Zero-profit condition: $P_i = AC(Q_i) = c + F/Q_i$.
- At symmetric quantities $Q_i = S/n$, so each firm's average cost is $c + nF/S$.
- Substitute:

$$P = c + \frac{nF}{S}$$

- The **CC curve**: the price at which each firm just breaks even, as a function of n .
- **Upward-sloping** in n : more firms $\Rightarrow$ smaller scale $\Rightarrow$ higher AC $\Rightarrow$ higher break-even price.
- **Pivots flatter** as S rises (bigger market lowers AC at every n); **steeper** when F rises.



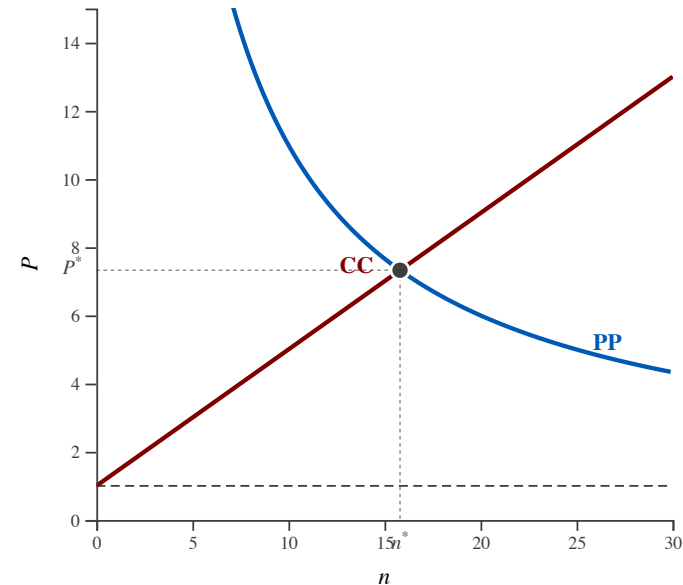
Equilibrium: PP meets CC

- Equilibrium (n^* , P^*): $PP = CC$,
 $c + 1/(bn^*) = c + n^* F/S$.

- Solving:

$$n^* = \sqrt{\frac{S}{bF}}, \quad P^* = c + \sqrt{\frac{F}{bS}}, \quad Q^* = \sqrt{bFS}$$

- Both more firms and bigger firms** with a larger market: $n^*, Q^* \propto \sqrt{S}$.
- Markup falls** with S : $P^* - c \propto 1/\sqrt{S}$.



Same logic applies to **trade**: opening borders raises effective market size to $S + S^*$.

S (Home market size)	500	<input type="range" value="500"/>
F (fixed cost)	200	<input type="range" value="200"/>
b (demand slope)	0.01	<input type="range" value="0.01"/>
c (marginal cost)	1	<input type="range" value="1"/>

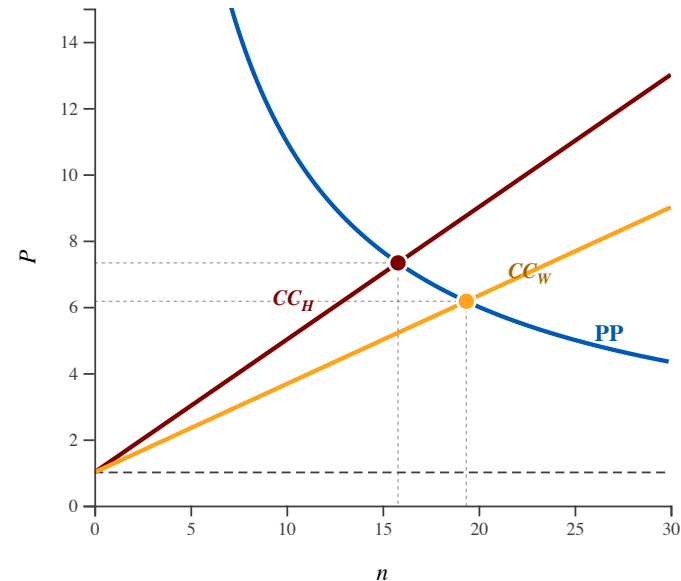
What are the gains from trade?

Trade as a larger integrated market

- Consider two countries, Home and Foreign, with the *same* technology, tastes, and factor endowments — H-O predicts no trade.
- Open the borders: the integrated market has size $S_W = S + S^*$, larger than either country alone.
- Krugman model says the integrated market supports

$$n_W^* = \sqrt{S_W / (bF)} > \max(n_H^*, n_F^*)$$

- Two distinct gains follow: **lower prices** (pro-competitive) and **more varieties** (love-of-variety).



S (Home market size) 

S^* (Foreign market size) 

Pro-competitive gains: lower markups, lower prices

- Larger market $S_W \Rightarrow$ more firms n_W^* enter $\Rightarrow$ each firm faces tougher competition.
- Markup falls:

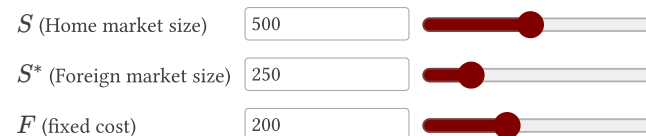
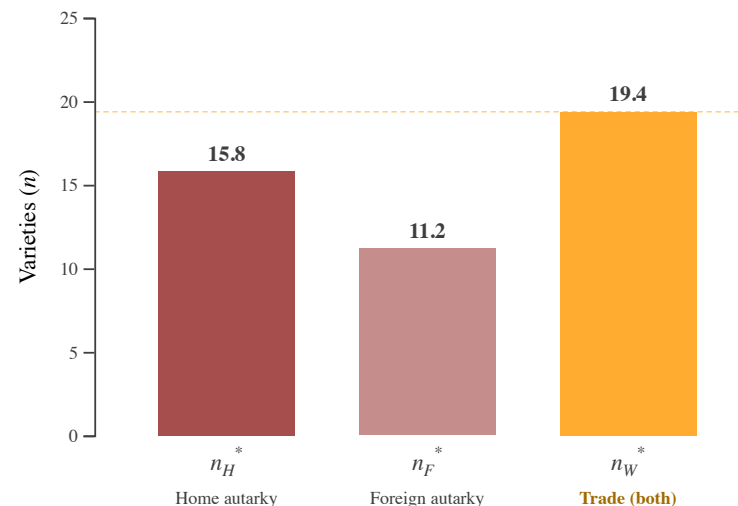
$$P_W^* - c = 1/(b \cdot n_W^*) < 1/(b \cdot n_H^*).$$
- Each firm produces more ($Q_W^* = \sqrt{bFS_W} > Q_H^*$): exploits scale economies — moves *down* the AC curve.
- Lower prices benefit consumers in both countries.



Gains here come from **market size**, not factor endowments — H-O is silent on both.

Love-of-variety gains: more varieties

- Even if prices stayed constant, opening to trade would still raise welfare.
- Each consumer now buys from $n_W^* = \sqrt{S_W/(bF)}$ varieties — strictly more than n_H^* alone (though $n_W^* < n_H^* + n_F^*$ due to consolidation).
- Welfare gain follows from **CES preferences** (Dixit–Stiglitz aggregator): utility rises in the number of available varieties.
- A gain *unique* to monopolistic competition — neither Ricardian nor H-O captures it.



What is the home market effect?

Where do firms locate? A gap in the model

- The model pins down **how many** varieties exist worldwide: $n_W^* = \sqrt{S_W / (bF)}$, with $S_W = S + S^*$.
- But it is **silent on where**: any split of these firms between Home and Foreign delivers the same equilibrium.
- Frictionless trade makes location neutral — a firm in Home or Foreign serves both markets on identical terms.
- The data say otherwise: bigger markets host **more firms** and **more production** of differentiated goods.
- **Missing ingredient**: trade costs ($\tau > 1$). Once shipping is costly, firms care **where** they sit relative to demand.

Adding $\tau > 1$ pins down location of production — the prediction is the **home market effect**.

Home market effect: statement

- With **iceberg trade costs** $\tau > 1$ (a fraction of every shipment “melts in transit”), firms prefer to locate where demand is large.
- **Result** (Helpman-Krugman 1985): the country with the larger market hosts a **disproportionately** larger share of firms — and is a **net exporter** of the differentiated good.
- “Disproportionate” = if Home has a 60% share of world demand, Home hosts > 60% of firms (often much more).
- Trade pattern is determined not by comparative advantage but by **market size + scale economies + trade costs**.

How does the mechanism work?

- A firm based in Home pays no trade cost on Home sales but pays τ on Foreign sales (and vice versa).
- If demand is symmetric across countries, location is indifferent — but if Home demand is larger, **operating profit is higher** for a Home-based firm.
- Free entry until profits = 0 $\Rightarrow$ Home hosts more firms; the price index falls more in Home than in Foreign.
- Home becomes a **net exporter** of varieties; Foreign imports them at the iceberg-inflated price $\tau \cdot P^*$.

Bottom line: with trade costs and scale economies, **where firms locate is determined by where the market is**. The big-market country hosts a disproportionate share of production and is a net exporter of the differentiated good.

Looking ahead: from location to multinationals

- HME explains where **firms locate across countries** — driven by market size, trade costs, and scale.
- But each firm so far runs **one plant**. Many real firms operate **plants in several countries** — **multinational corporations (MNCs)**.
- Next week: same forces, but the firm picks **how many plants and where**:
 - **Exports**: one plant, pay τ to ship abroad.
 - **Horizontal FDI**: a plant in each market — avoid τ , duplicate fixed cost F .
 - **Vertical FDI**: split production stages across countries by factor cost.
- The **proximity–concentration trade-off**: HME logic internalized inside the firm.

HME → *where similar firms cluster across countries*. Multinationals → *the same forces inside a single firm choosing plant locations*.

Wrap-up

Main take-aways

- **Similar countries trade** because of **increasing returns** and **product differentiation**, not factor endowments — a complement to H-O, not a substitute.
- **Monopolistic competition** delivers a tractable equilibrium: many small firms, each producing one differentiated variety, with markup pricing and free entry.
- **PP-CC determines** (n^*, P^*, Q^*) from primitives (S, b, c, F) : market size S raises n^* , lowers P^* , raises Q^* per firm.
- **Two new gains from trade** beyond H-O:
 - **Pro-competitive**: larger integrated market $\Rightarrow$ tougher competition $\Rightarrow$ lower markups and lower prices.
 - **Love-of-variety**: more varieties available to consumers at the same total spend.
- **Home market effect**: with iceberg trade costs $\tau > 1$, the bigger market hosts a **disproportionately** larger share of firms and exports the differentiated good — a first answer to *where* firms locate.

The Krugman model explains **intra-industry trade between similar economies** and points to *market size* as a key determinant of *where* firms produce.

Skills you can now use

Solve the model

- Write a firm's demand $Q_i = S [1/n - b(P_i - \bar{P})]$ and derive the **markup** $P - MC = 1/(bn)$.
- Use **zero-profit** $(P - c)Q = F$ to write the CC curve $P = c + F n/S$.
- Combine PP and CC to solve $n^* = \sqrt{S/(bF)}$, $P^* = c + \sqrt{F/(bS)}$.
- Show how n^* , P^* , average cost respond to S , F , b .

Interpret and apply

- Decompose **gains from trade** into pro-competitive (markup) and love-of-variety channels.
- Predict who exports differentiated goods using the **home market effect**.
- Recognize where the *simple* Krugman model falls short — multinational production (next week).

You can now move between **primitives** (S , b , c , F , τ) and **observables** (P , Q , n , trade pattern) — the workhorse logic of modern trade theory.