Lecture 5: International Trade under Monopolistic Competition

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Motivation

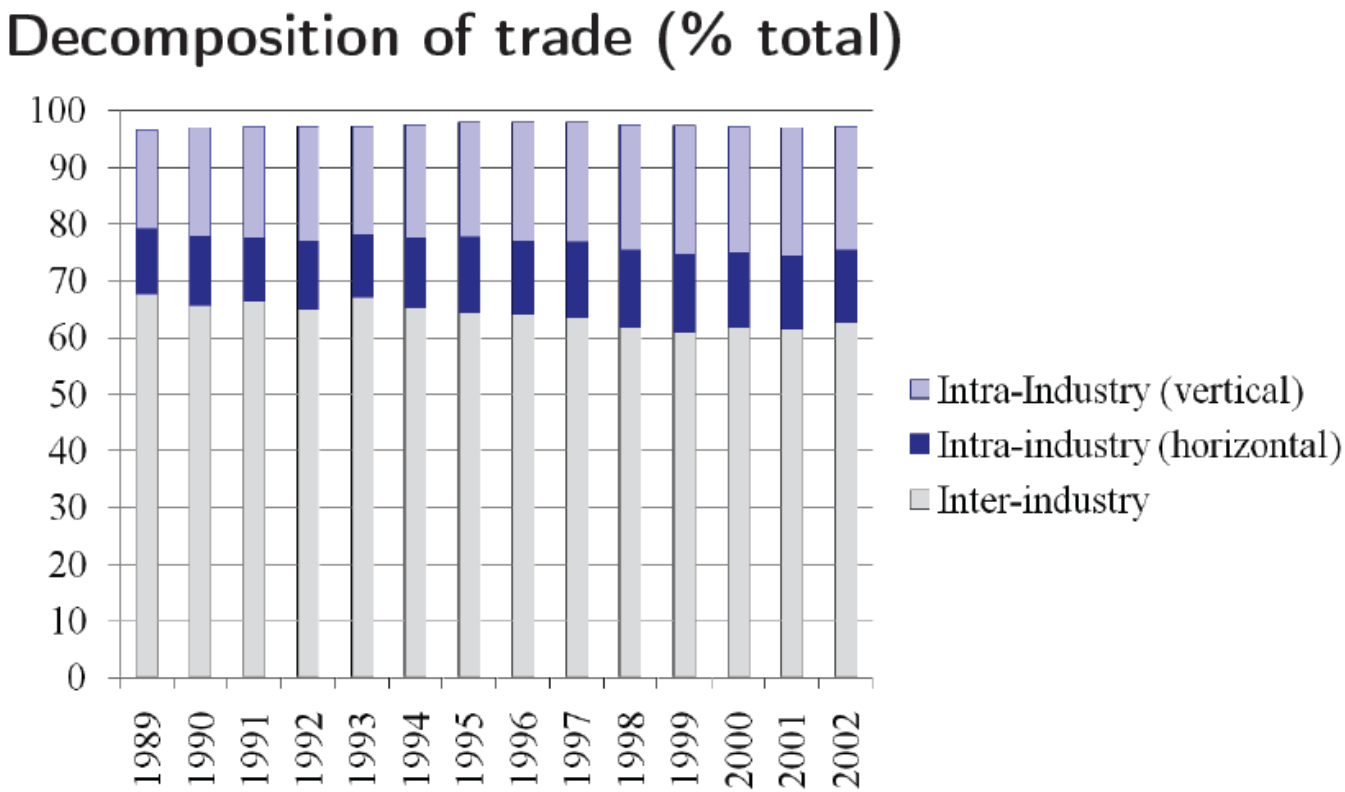
- Some uncomfortable features about neoclassical trade theory:
  - Stresses country asymmetries, while the bulk of trade flows between similar (or more precisely, rich) countries, and it involves little net factor trade (a large and growing part of world trade is intra-industry)
  - Hard (though not impossible) to generate predictions for bilateral trade flows, while the evidence suggests robust patterns (gravity equation);
  - Misses important aspects of the effects of trade liberalization (within industry reallocations; Balassa, 1964);
  - Hard to think about firms
- We will discuss the workhorse models with scale economies, imperfect competition and product differentiation, which have proved to be very useful for dealing with these caveats.
- These models not attempt to replace neoclassical trade theory; effort to embed new features in the factor proportions framework

Today's lecture

International Trade and Monopolistic Competition

- Intra-industry trade: some empirical evidence
- Monopolistic competition
- Krugman (1980)

Inter- or intra-industry trade?



Source : Fontagné L., Freudenberg M., Gaulier G. (2006). Definitions : Intra-industry trade is identified as simultaneous exports and imports within the same industry. Distinction of vertical and horizontal relies on price differences.

Inter- or intra-industry trade?

Top-10 country pairs (% of bilateral trade, 2000)

Top total IIT shares (per cent)		
Germany	France	86.20
Netherlands	Belgium and Luxembourg	85.01
France	Belgium and Luxembourg	80.42
France	United Kingdom	77.08
Germany	Switzerland	76.99
Germany	Belgium and Luxembourg	76.83
Austria	Germany	76.63
France	Spain	76.55
Germany	Netherlands	76.01
Canada	United States	73.55

Source : Fontagné, Freudenberg & Gaulier (2006)

Intra-industry trade

- How to quantify intra-industry trade?

- Grubel and Lloyd (1975) propose the following index:

$$GL_{ijkt} = 1 - \frac{|X_{ijkt} - M_{ijkt}|}{X_{ijkt} + M_{ijkt}}$$

- Measures for given countries i and j, the proportion of non-overlapping trade flows in total bilateral trade of good k

- Ranges from 0 (perfect inter-industry trade) to 1 (perfect intra-industry trade)

- Issue: what is a "good"?

Intra-industry trade

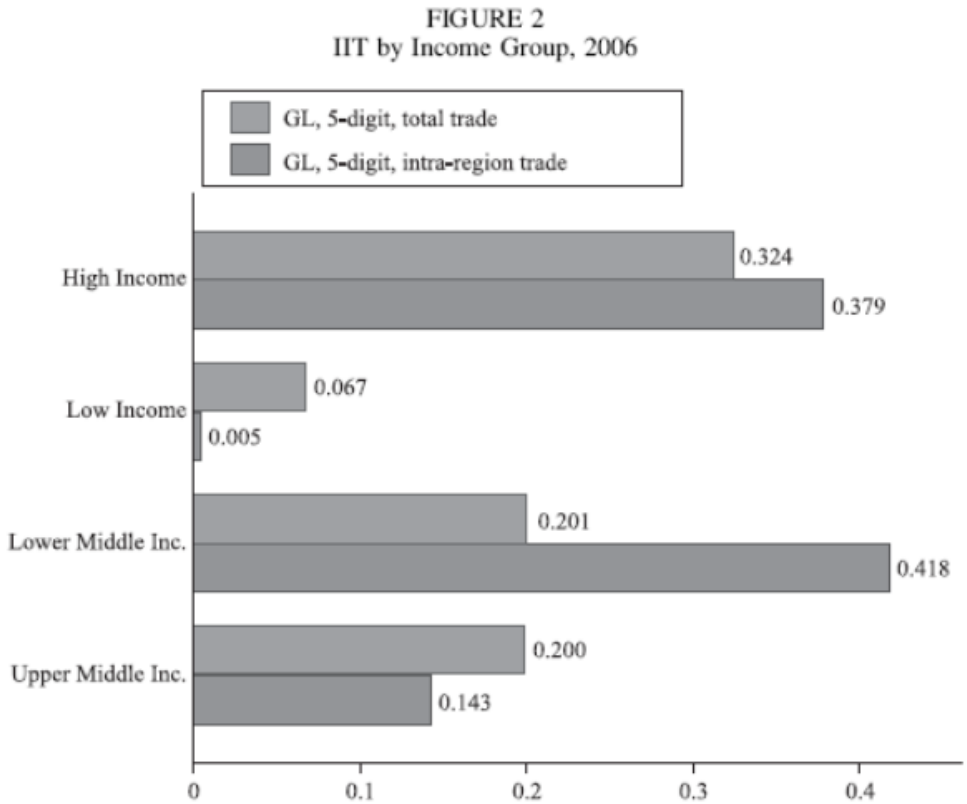
- Brulhart (2009)
- UN-COMTRADE, 1962-2005
- SITC Rev. 1 / 5 digit
- 1,161 products, up to 214 countries

Intra-industry trade

Richer countries do more IIT

IIT between low income countries is almost inexistent

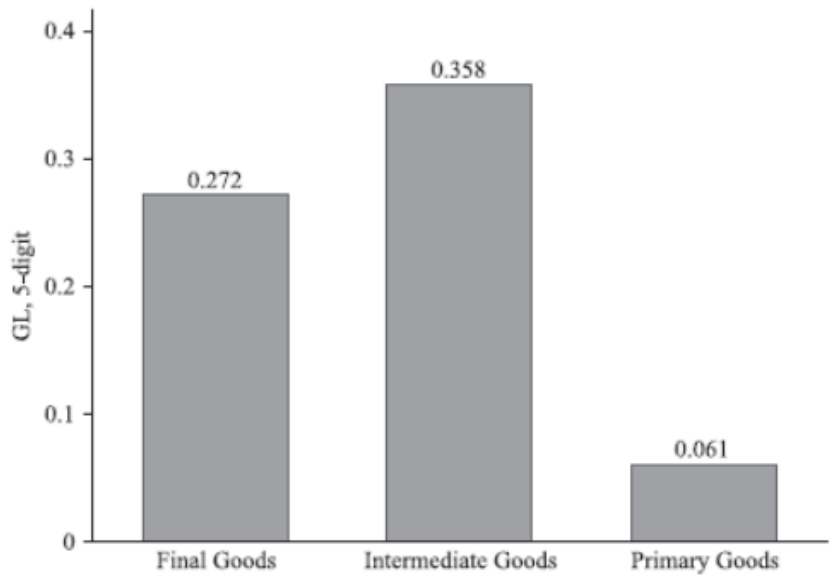
IIT between middle income countries is large: probably due to processing trade within vertically fragmented industries.



Intra-industry trade

IIT concerns mainly intermediate goods (processing trade)
and a priori sophisticated
and differentiated
goods.

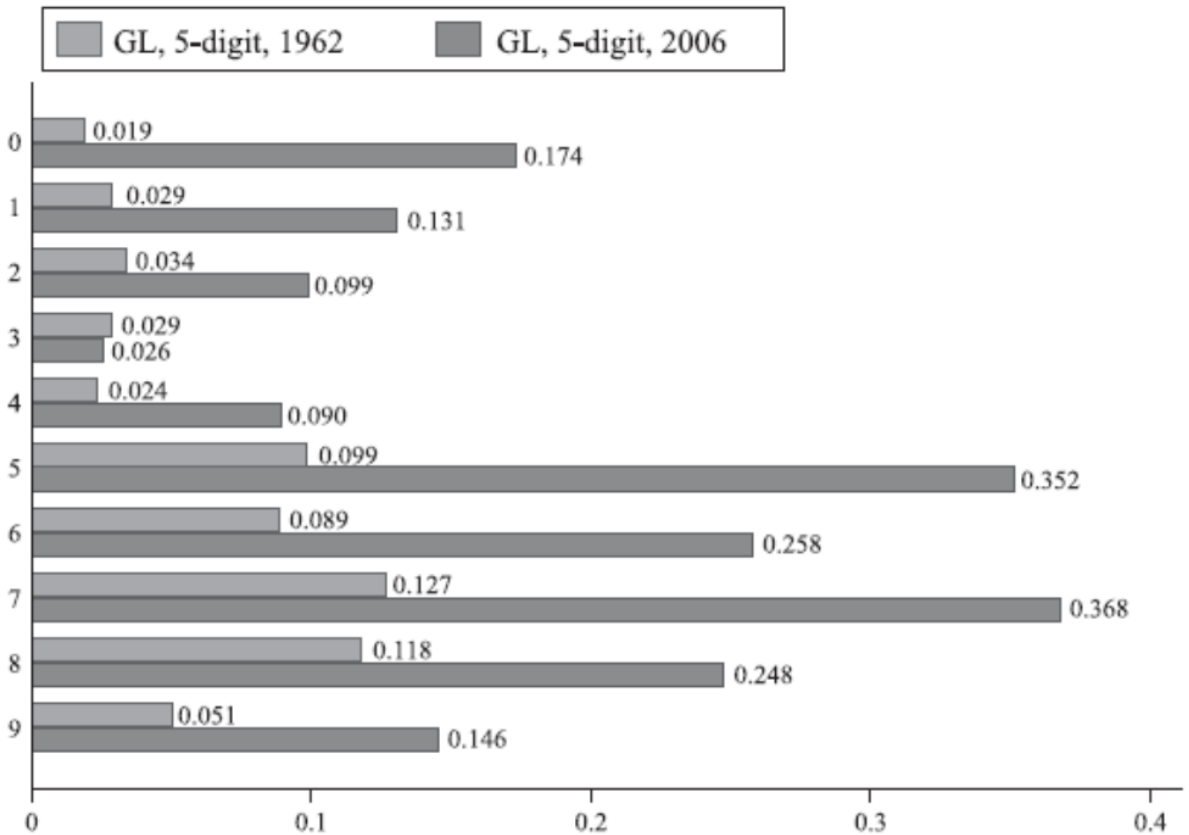
FIGURE 3
IIT by Product Group, 2006



Intra-industry trade

IIT concerns mainly sophisticated and differentiated goods.

FIGURE 6
Global IIT by SITC 1-Digit Sector, 1962 and 2006



Notes:
'wide coverage' dataset; SITC 1-digit sectors: 0 – Food and Live Animals, 1 – Beverages and Tobacco, 2 – Crude Materials Excluding Fuels, 3 – Mineral Fuels Etc., 4 – Animal & Vegetable Oils & Fats, 5 – Chemicals, 6 – Basic Manufactures, 7 – Machines & Transport Equipment, 8 – Misc. Manufactures, 9 – Goods Not Classified by Kind.

Intra-industry trade

- IIT is larger between richer countries

TABLE 4
Cross-Country Determinants of IIT, 1965, 1990 and 2006
(Dependent variable = log transformed GL index, estimation by OLS)

	1965				*1990*				*2006*			
	All Sectors	*Primary*	*Intermed.*	*Final*	*All Sectors*	*Primary*	*Intermed.*	*Final*	*All Sectors*	*Primary*	*Intermed.*	*Final*
log mean per-cap. GDP	1.753*** (0.09)	1.322*** (0.11)	1.944*** (0.11)	1.854*** (0.12)	2.193*** (0.09)	1.855*** (0.10)	2.378*** (0.10)	2.045*** (0.10)	1.617*** (0.08)	1.534*** (0.10)	1.918*** (0.08)	1.513*** (0.08)
log diff per-cap. GDP	−0.0811 (0.08)	0.018 (0.09)	−0.133 (0.09)	−0.210** (0.09)	0.0890 (0.08)	0.00854 (0.08)	0.140* (0.08)	−0.132 (0.09)	0.0444 (0.07)	−0.097 (0.09)	0.189*** (0.07)	−0.0668 (0.07)
log distance	−1.464*** (0.10)	−1.092*** (0.11)	−1.231*** (0.11)	−1.754*** (0.11)	−1.163*** (0.10)	−1.019*** (0.10)	−1.021*** (0.11)	−1.285*** (0.11)	−0.700*** (0.09)	−1.161*** (0.11)	−0.622*** (0.09)	−0.923*** (0.09)
contiguity	1.330*** (0.47)	1.827*** (0.50)	1.464*** (0.51)	0.890* (0.53)	1.486*** (0.48)	1.801*** (0.50)	1.812*** (0.51)	0.969* (0.52)	1.571*** (0.41)	1.672*** (0.53)	2.006*** (0.45)	1.327*** (0.44)
constant	−9.555*** (1.23)	−10.500*** (1.35)	−13.500*** (1.35)	−7.902*** (1.43)	−14.730*** (1.26)	−15.180*** (1.34)	−17.591*** (1.36)	−12.263*** (1.40)	−12.570*** (1.12)	−10.361*** (1.44)	−16.150*** (1.21)	−9.665*** (1.20)
Observations	1,196	1,090	1,101	1,069	1,411	1,340	1,373	1,354	1,375	1,354	1,374	1,373
R^2	0.41	0.27	0.37	0.39	0.41	0.32	0.39	0.36	0.33	0.28	0.34	0.31

***, ** and * indicate statistical significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively. Numbers in parentheses are standard errors.

Intra-industry trade

- IIT is (not really) larger between more similar countries

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Intra-industry trade

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	(0.10)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.11)	(0.11)	(0.09)	(0.11)	(0.09)	(0.09)
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Monopolistic competition: introduction

- Balassa (1964) proposed monopolistic competition as a setup for explaining the observed trade flows within the European common market.
- These types of models gained prominence in the 1980s, because they can explain trade between similar countries and intraindustry trade:
  - Even within industries, firms may produce varieties of the industry's product;
  - If consumers value "variety", many brands are consumed;
  - With increasing returns, production of an individual variety is concentrated in one location and therefore brands are internationally traded.
- These features lead naturally to intra-industry trade, and can generate large volumes of trade between similar countries.

Monopolistic competition

- With internal economies of scale there cannot be perfect competition.
- Chamberlain (1933) proposed monopolistic competition as the market structure:
  - Every firm has some market power; it faces a downward sloping demand curve.
  - There is a large number of firms so that a price change by a single firm has no effect on the level of demand faced by the other firms.
  - There is free entry so that firm's profits are driven down to zero (the large group case).
- With product differentiation a firm has an incentive to differentiate its brand.

Product differentiation

- Where does the downward sloping demand come from?
- Several approaches to product differentiation have been proposed. The most popular is the "love-of-variety" approach of Dixit and Stiglitz (1977)
- Let there be I sectors or goods and denote by Ω_i the set of varieties of good i; denote by $\omega \in \Omega_i$; a particular variety of good i.
- Preferences of a representative consumer are of the form

$$U = U[u_1(.), u_2(.), ..., u_I(.)]$$

with

$$u_i = u_i[C_{i1}, C_{i2}, ..., C_{i\omega}, ..., C_{in}]$$

Product differentiation

- In the constant elasticity (CES) case with a continuum of varieties:

$$u_i = [\int_0^{n_i} x_i(\omega)^{\alpha_i} d\omega]^{1/\alpha_i}, 0 < \alpha_i < 1 \quad (1)$$

- The elasticity of substitution across varieties is constant and given by $\sigma_i = 1/(1-\alpha_i)$
  - as $\alpha_i \to 1$, $\sigma_i \to \infty$ and varieties become perfect substitutes ;
  - as $\alpha_i \to 0$, $\sigma_i \to 1$ and we get the Cobb-Douglas case;
  - $\alpha_i < 0$ is ruled out for reasons that will become clear

Product differentiation

- Notice the "love-of-variety" feature. Under perfect symmetry, *i.e.*, $x_i(\omega) = x_i$ for all ω, and we have

$$u_i = n_i^{1/\alpha_i} x_i = n_i^{(1-\alpha_i)/\alpha_i} \times \underbrace{(n_i x_i)}_{\text{"real" spending}}$$

- This approach has also been used to represent production; producers may prefer a larger variety of inputs (e.g., more specialized inputs) because they yield higher productivity.
- How do you solve this demand system? Use two-stage budgeting:
  1. choose $x_i(\omega)s$ to maximize u_i subject to $\int_0^{n_i} p_i(\omega)x_i(\omega)d\omega \leq E_i$
  2. choose E_i to maximize $U(.)$ subject to $\sum_{i=1}^{I} E_i \leq E$

Krugman (1980)

- Consumers have identical CES preferences as in (1) over varieties of a single good.
- Technology:
  - There is a constant marginal cost of production equal to $1/\phi$ units of the unique factor of production, labor;
  - There is a fixed cost of production f in terms of labor.
  - Market structure in the single sector is characterized by monopolistic competition with a continuum of firms of endogenous measure n_i.
    Solving the utility maximization problem yields demand for each variety:

$$x_i(\omega) = \frac{E_i}{P_i}\left(\frac{p_i(\omega)}{P_i}\right)^{-\sigma_i} \tag{2}$$

where

$$P_i = \left[\int_0^{n_i} p_i(\omega)^{1-\sigma_i} d\omega\right]^{1/(1-\sigma_i)}, \tag{3}$$

is the ideal price index of sector i (minimum cost of obtaining one unit of utility).

Krugman (1980)

Demand for varieties

Proof:

Krugman (1980): closed economy

- Focus on one sector environment; drop subscript i for simplicity
- Each firm maximizes profits $\pi(\omega) = p(\omega)x(\omega) - (1/\phi)wx(\omega) - wf$ subject to (2)
- Because firms take E and P as given (continuum assumption), we get the standard constant-markup pricing formula of a monopolist facing a constant price elasticity of demand:

$$p(\omega) = \frac{\sigma}{\sigma - 1}\frac{w}{\phi}$$

Krugman (1980): closed economy

Proof:

Krugman (1980): closed economy

- Now we can write the free-entry (or zero-profit) condition as $\frac{1}{\sigma}p(\omega)x(\omega) = wf$, or simply:

$$x(\omega) = (\sigma - 1)f\phi$$

- Labor market clearing implies, however, that $(f + x/\phi)n = L$, yielding:

$$n = \frac{L}{\sigma f}$$

- Scale Effects: Note that the resulting welfare is $n^{1/\alpha}(x/L)$, which is proportional to $L^{1/\sigma-1}$, i.e., larger economies produce more varieties and achieve higher welfare.

Krugman (1980): open economy

- Now suppose that the world consists of two economies, identical in all respects except for population size: L ,L^*
- Given constant mark-up pricing, the free entry condition implies that for every variety ω output $x(\omega)$ is given by (4)
- Goods market clearing requires all varieties to be demanded in the same amount, which in light of (2) requires $w = w^*$ (FPE)
- Using the labor market clearing conditions yields

$$n^c = \frac{L^c}{\sigma f}$$

- Note that Home consumes a fraction $L/(L + L^*)$ of the world's production of **all** varieties (two-way intraindustry trade)
- Welfare is now

$$U = \frac{\sigma - 1}{\sigma}\phi\left(\frac{L + L^*}{\sigma f}\right)^{1/(\sigma-1)}$$

which is higher than in autarky. Here the gains from trade stem from a larger variety choice

Krugman (1980): open economy with trade costs

- Assume **iceberg trade** costs $\tau > 1$

  Definition: for one unit of good to arrive at the importing country, τ units must be shipped.

- **Price on the foreign market** is $p^X(\omega) = \tau \frac{\sigma}{\sigma-1} \frac{w}{\phi} = \tau p(\omega)$

  Proof:

$\rightarrow$ Note that there is complete tariff pass-through

Krugman (1980): open economy with trade costs

- **Total production**. $q = q^D + \tau q^X$
- **Total profit**. $\pi = pq - w(F + \frac{q}{\phi}) = \frac{w}{(\sigma-1)\phi} q - wF$
- **Free entry**. $\pi = 0 \Rightarrow q = (\sigma - 1)\phi F$
- **Number of firms**: n such that $n(F + \frac{q}{\phi}) = L \Rightarrow n = \frac{L}{\sigma F}$
- No change in price, no change in output per firm, no change in number of firms... Why?

Krugman (1980): trade and welfare

- **Autarky**. $P = pn^{\frac{1}{1-\sigma}}$ and $P^* = p^* n^{*\frac{1}{1-\sigma}}$
- **Open economies**. $P = [p^{1-\sigma} n + (\tau p^*)^{1-\sigma} n^*]^{\frac{1}{1-\sigma}}$

  and $P^* = [p^{*1-\sigma} n^* + (\tau p)^{1-\sigma} n]^{\frac{1}{1-\sigma}}$

  $\rightarrow$ Welfare increases in both countries due to the increased diversity, even with the presence of trade costs

The Krugman (1980) model: wages

- To balance trade we must have:

$$X = n\tau pq^X = X^* = n^*\tau p^* q^{*X},$$

that is:

- $\Rightarrow \frac{L}{\sigma F} \times \left(\frac{\tau w}{P^*}\frac{\sigma}{(\sigma-1)\phi}\right)^{1-\sigma} \times L^* w^* = \frac{L^*}{\sigma F} \times \left(\frac{\tau w^*}{P}\frac{\sigma}{(\sigma-1)\phi}\right)^{1-\sigma} \times Lw$
- $\Rightarrow \frac{w}{w^*} = \left(\frac{Lw^{1-\sigma}+L^*(\tau w^*)^{1-\sigma}}{L(\tau w)^{1-\sigma}+L^* w^{*1-\sigma}}\right)^{1/\sigma}$
- Without trade costs ($\tau = 1$), wages are equalized across countries
- When $\tau \to \infty$, $\frac{w}{w^*} \to \frac{L}{L^*}^{\frac{1}{2\sigma-1}}$: **higher wages in the largest country**

The Krugman (1980) model: wages

- When $\tau \to \infty$, $\frac{w}{w^*} \to \frac{L}{L^*}^{\frac{1}{2\sigma-1}}$: **higher wages in the largest country**. Why?
- Intuition: with transportation cost, prices are lower in the largest countries. Demand for imports is lower are the large country already has access to more varieties.
- To balance trade, its exports should be lowered by a higher marginal cost: $w > w^*$
- What happens if workers are mobile? This is the foundation of the **New Economic Geography model**

Acknowledgment

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