Beyond Icebergs: Toward A Theory of Biased Globalization

By

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Two Titles, Two Questions, and One Solution:

Two Former Titles of the Paper:

"Beyond Icebergs"

&

"Globalization as Biased Technical Change"

→

Final Title of the Paper:

"Beyond Icebergs: Toward a Theory of Biased Globalization"

Two Questions (or Motivations)

Question #1: "No Traders in the Study of International Trade?"

- Nobody makes a living doing international trade in the standard models of trade.
- In most models, no resources are used in foreign trade (Traded & Nontraded goods dichotomy)
- *Exception;* **the Iceberg Approach**, which effectively assumes that the resources used for foreign trade has the same with those used in manufacturing.

However, foreign trade requires the resources very different from manufacturing or even from domestic trade, e.g.

- ✓ Japanese *Sogo-shosha* (General Trading Companies)
- ✓ Language skills
- ✓ International Business Programs in many business schools
- ✓ maritime insurance, transoceanic shipping

In most cases, trade is introduced to "closed-economy models" as a mere "after-thought."

Shouldn't we model "international trade activities" in a model of international trade?

Question #2: "Globalization versus Skill Biased Technical Change?"

Recent debate on the Global Rise in Skill Premia

- Factor Proportion models of trade (e.g., Heckscher-Ohlin), based on the skill-intensity differences across traded goods, predict:
    - Factor Prices respond to Factor Content of Net Trade
    - Globalization moves the skill premia in the opposite direction
- Skilled Biased Technical Change in favor of Globalization

Isn't "Globalization versus Skill Biased Technical Change" a false dichotomy?

- Technical Change (such as IT) may be a driving force behind globalization.
- Globalization may affect the process of technical change.

    (Acemoglu, Thoenig-Verdier, Epifani-Gancia)

Related Questions:
What do we mean by "Skilled Labor"?
Are they skilled in what?
Are college graduates perfect substitutes?

A Simple Solution to both questions: Destination-Dependent Technologies

More specifically,

Divide each industry into "Domestic" and "Export" sectors with different factor intensities in otherwise standard classical trade models

- A Generalization of the Iceberg Approach
- Factor Proportions affect Globalization
- Globalization changes Relative Factor Demands, and hence Relative Factor Prices

  - ➢ A reduction in the trade barriers, or a Hicks-neutral technical change in the export sectors can move factor prices in the same direction

If the export sectors are skill labor intensive than the domestic sectors,

  - ➢ Globalization is skilled biased
  - ➢ Skill-Biased Technical Change can cause globalization

Notes:

- By "supply," we mean to include all the activities required to bring a good in a particular market, such as "designing, manufacturing, marketing, insuring, transportation, communication, etc."
  - "Supply" ≠ "Manufacture + Transport"

- By "Domestic (Export) Sectors," we mean to include all the factors that go into the activities of supplying goods to the domestic (export) market, which may scatter across many different firms in many different industries.
  - "Domestic Sectors" ≠ "manufacturing firms that do not export"
  - "Export Sectors" ≠ "manufacturing firms that export"

"Industries" and "Sectors" are identified by the goods they supply and by the markets they serve. They do not correspond to standard industry classification.

Road Map

1. Introduction

2. The main model, where
   Factor Intensities may differ across Destinations but not across Industries
   → A modified Ricardian Model a la Dornbusch-Fischer-Samuelson (AER 1977)

3. Unbiased Globalization (Restoring the DFS model with the iceberg cost)

4. Biased Globalization

5. An Application to Globalization and Skill Premia

6. *(Not in the Final Version)* Demand for local factors in the export sectors

7. *(Not in the Final Version)* A model, where
   Factors Intensities differ both across Destinations and across Industries
   → A modified Heckscher-Ohlin a la DFS (QJE 1980)

8. Summary and Some Broader Implications

2. The Model: **A Ricardian Model with A Continuum of Goods; AVariation of Dornbusch-Fischer-Samuelson (AER 1977)**

✓ *Two Countries*: Home and Foreign(*)

✓ *A Continuum of Competitive Industries indexed by the good it produces*; z ∈ [0,1].

✓ *Cobb-Douglas Preferences:*

$$U = \int_0^1 b(z)\log C(z)dz; \quad U^* = \int_0^1 b^*(z)\log C^*(z)dz$$

where

$$B(z) \equiv \int_0^z b(s)ds; \quad B^*(z) \equiv \int_0^z b^*(s)ds; \text{ strictly increasing, and}$$

$$B(0) = B^*(0) = 0; \text{ and } B(1) = B^*(1) = 1.$$

Two Key Departures from DFS:

- Multiple Factors
- Destination Dependent Technologies (Differential Factor Intensities)

#1: J Factors:

Endowments: J-dimensional Column Vectors

$V = (V_1, V_2, \ldots, V_J)^T$ $V^* = (V_1^*, V_2^*, \ldots , V_J^*)^T$

Factor Prices: J-dimensional Row Vectors

$w = (w_1, w_2, \ldots , w_J)$ $w^* = (w_1^*, w_2^*, \ldots, w_J^*)$

GDPs and Aggregate Expenditures: Inner Products

$E = wV$ $E^* = w^*V^*$

#2: Technologies:

Unit Cost Functions		Destination	
		Home	Foreign
Origin	Home	$a(z)\Phi(w)$	$A(z)\Psi(w;\tau)$
	Foreign	$a^*(z)\Psi^*(w^*;\tau^*)$	$a^*(z)\Phi^*(w^*)$

- Constant Returns to Scale
- $a(z)$ and $a^*(z)$; inverse of TFP in Industry z
- Φ and Ψ (Φ^* and Ψ^*) linear homogeneous, increasing, and concave.
- τ, τ^*; Shift Parameters (Export Technologies, or Sometimes Trade Barriers)
- TFP differ across Origins, but NOT across Destinations
- Factor Intensities differ across Destinations, but Not across Industries

(A1) $A(z) \equiv a^*(z)/a(z)$ is continuous and decreasing in z.

Home (Foreign) has Comparative Advantage in Lower (Higher) indexed goods.

(A2) $\Phi(w) < \Psi(w;\tau)$; $\Phi^*(w^*) < \Psi^*(w^*;\tau^*)$.

Supplying (i.e., producing, marketing, communicating, shipping, insuring etc.) goods to the Export Market is costlier than supplying the same goods to the Domestic Market.

Technologies (Continued)

Unit Cost Functions		Destination	
		Home	Foreign
Origin	Home	$a(z)\Phi(w)$	$a(z)\Psi(w;\tau)$
	Foreign	$a^*(z)\Psi^*(w^*;\tau^*)$	$a^*(z)\Phi^*(w^*)$

A Hybrid between the Ricardian and Factor Proportion Theories of Trade!

Notes:

- CRS for "Industries" and "Sectors," not necessarily for firms. The firm-level fixed cost is not inconsistent with the CRS at the industry level. The shipping or marketing costs might be fixed costs for each shipping, for each project, or for each firm, but can be variable costs for the industry.

- We assume that Ψ is independent of w^* and that Ψ^* is independent of w. → Exporting goods does not require any factors local to the export market. This assumption is relaxed later.

Patterns of Trade:

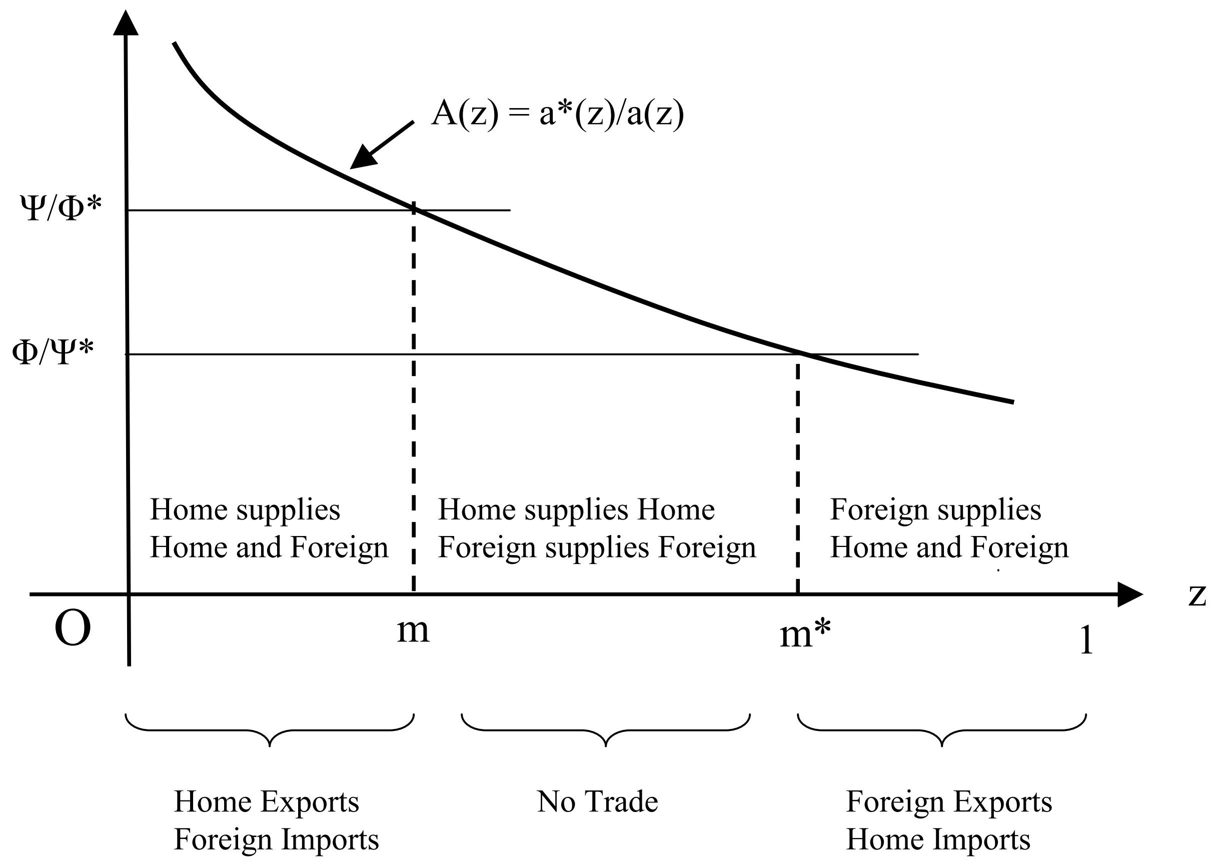
$$p(z) = \min\{a(z)\Phi(w),\ a^*(z)\Psi^*(w^*;\tau^*)\} = \begin{cases} a(z)\Phi(w) & \text{if } z < m^* \\ a^*(z)\Psi^*(w^*;\tau^*) & \text{if } z > m^* \end{cases}$$

$$p^*(z) = \min\{a(z)\Psi(w;\tau),\ a^*(z)\Phi^*(w^*)\} = \begin{cases} a(z)\Psi(w;\tau) & \text{if } z < m \\ a^*(z)\Phi^*(w^*) & \text{if } z > m \end{cases}$$

where

(1) $A(m) = \dfrac{\Psi(w;\tau)}{\Phi^*(w^*)}$; (2) $A(m^*) = \dfrac{\Phi(w)}{\Psi^*(w^*;\tau^*)}$

Figure 1



(A2) implies $m < m^*$ ➔ Nontraded Goods!

Calculating the Factor Demands:

Demand for Home Factor-j by the Home Domestic Sector $z \in$ [0,m*]:

$$a(z)\Phi_j(w)D(z) = p(z)\frac{\Phi_j(w)}{\Phi(w)}D(z) = \frac{\Phi_j(w)}{\Phi(w)}b(z)wV\,,$$

By integrating over [0,m*],

Domestic Demand for Home Factor-j: $\dfrac{\Phi_j(w)}{\Phi(w)}B(m^*)wV$

Demand for Home Factor-j by the Home Export Sector $z \in$ [0,m]:

$$a(z)\Psi_j(w;\tau)D^*(z) = p^*(z)\frac{\Psi_j(w;\tau)}{\Psi(w;\tau)}D^*(z) = \frac{\Psi_j(w;\tau)}{\Psi(w;\tau)}b^*(z)w^*V^*$$

By integrating over [0,m],

Foreign Demand for Home Factor-j: $\dfrac{\Psi_j(w;\tau)}{\Psi(w;\tau)}B^*(m)w^*V^*$

Market Equilibrium for the Home Factor-j:

$$V_j = \frac{\Phi_j(w)}{\Phi(w)} B(m^*) w V + \frac{\Psi_j(w;\tau)}{\Psi(w;\tau)} B^*(m) w^* V^*$$

By multiplying by w_j,

(3) $$w_j V_j = \alpha_j(w) B(m^*) w V + \beta_j(w;\tau) B^*(m) w^* V^*$$

$$\alpha_j(w) \equiv \frac{w_j \Phi_j(w)}{\Phi(w)};$$ Factor-j Share in the Home Domestic Sector

$$\beta_j(w;\tau) \equiv \frac{w_j \Psi_j(w;\tau)}{\Psi(w;\tau)};$$ Factor-j Share in the Home Export Sector

$$\sum_{j=1}^{J} \alpha_j(w) = \sum_{j=1}^{J} \beta_j(w;\tau) = 1.$$

Similarly,

Market Equilibrium for the Foreign Factor-j:

(4) $$w_j^* V_j^* = \alpha_j^*(w^*)[1 - B^*(m)]w^* V^* + \beta_j^*(w^*;\tau^*)[1 - B(m^*)]wV$$

$$\alpha_j^*(w) \equiv \frac{w_j^* \Phi_j^*(w^*)}{\Phi^*(w^*)}$$; Factor-j share in the Foreign Domestic Sector

$$\beta_j^*(w^*;\tau^*) \equiv \frac{w_j^* \Psi_j^*(w^*;\tau^*)}{\Psi^*(w^*;\tau^*)}$$; Factor-j Share in the Foreign Export Sector

$$\sum_{j=1}^{J} \alpha_j^*(w^*) = \sum_{j=1}^{J} \beta_j^*(w^*;\tau^*) = 1$$

Equilibrium:

Patters of Trade:

(1) $A(m) = \frac{\Psi(w;\tau)}{\Phi^*(w^*)}$; (2) $A(m^*) = \frac{\Phi(w)}{\Psi^*(w^*;\tau^*)}$

Factor Market Equilibrium:

(3) $w_j V_j = \alpha_j(w)B(m^*)wV + \beta_j(w;\tau)B^*(m)w^*V^*$ (j = 1, 2,…J)

(4) $w_j^* V_j^* = \alpha_j^*(w^*)[1 - B^*(m)]w^*V^* + \beta_j^*(w^*;\tau^*)[1 - B(m^*)]wV$ (j = 1, 2,…J)

Adding up (3) or (4) for all j yields

Balanced Trade Condition:

(5) $B^*(m)w^*V^* = [1 - B(m^*)]wV$

- 2J+1 Equilibrium Conditions;
- 2J+1 unknowns (m, m*, 2J −1 relative factor prices)

3. Unbiased Globalization: Restoring DFS (1977).

(A3) $$\Psi(w;\tau) = \tau\Phi(w) > \Phi(w);\ \Psi^*(w^*;\tau^*) = \tau^*\Phi^*(w^*) > \Phi^*(w^*)$$

- No Factor Intensity Differences: $\beta_j(w;\tau) = \alpha_j(w);\ \beta_j^*(w^*;\tau^*) = \alpha_j^*(w^*)$
- Hicks-Neutral Export Technology Improvement (a shift in τ and τ*)
- τ – 1, τ* – 1; the trade barriers imposed by the trading partner

Equilibrium:

(5) $$B^*(m)w^*V^* = [1 - B(m^*)]wV$$

(6) $$A(m) = \frac{\tau\Phi(w)}{\Phi^*(w^*)};$$

(7) $$A(m^*) = \frac{\Phi(w)}{\tau^*\Phi^*(w^*)}$$

(8) $$w_jV_j = \alpha_j(w)wV \qquad (j = 1, 2,\ldots J)$$

(9) $$w_j^*V_j^* = \alpha_j^*(w^*)w^*V^* \qquad (j = 1, 2,\ldots J)$$

Aggregation Theorem:

Define $F(x) \equiv \min_q \{qx \mid \Phi(q) \geq 1\}$. Then,

(10) $wV = \Phi(w)F(V) = WL$,

$W \equiv \Phi(w)$: the Home factor price index, "the Home wage rate"

$L \equiv F(V)$: the Home factor quantity index, called, "Home labor."

Define $F^*(x) \equiv \min_q \{qx \mid \Phi^*(q) \geq 1\}$,

(11) $w^*V^* = \Phi^*(w^*)F^*(V^*) = W^*L^*$,

$W^* = \Phi^*(w^*)$: "Foreign wage rate"

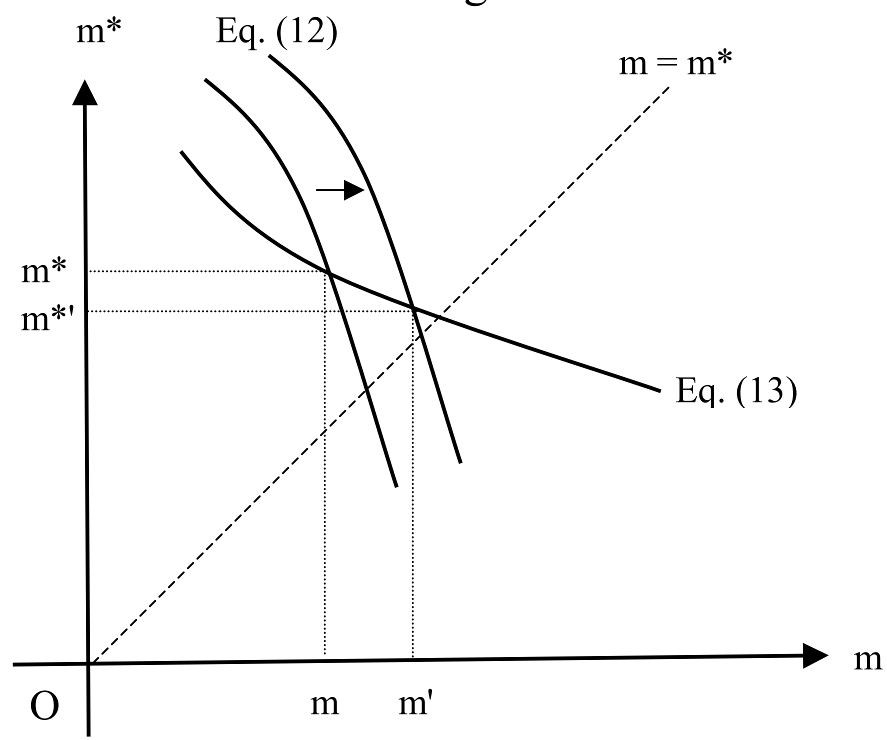
$L^* = F^*(V^*)$: "Foreign labor"

Equilibrium:

$$\begin{cases} (12)\quad \dfrac{A(m)}{\tau} = \dfrac{B^*(m)L^*}{[1-B(m^*)]L} \\[2ex] (13)\quad A(m^*)\tau^* = \dfrac{B^*(m)L^*}{[1-B(m^*)]L} \end{cases}$$

$$\begin{cases} (14)\quad V_j = \Phi_j(w)L \qquad (j = 1, 2,\ldots J) \\[2ex] (15)\quad V_j^* = \Phi_j^*(w^*)L^* \qquad (j = 1, 2,\ldots J). \end{cases}$$

Figure 2



Eqs. (12)-(13) determine m and m*,
as a function of τ and τ*, independent of w, w*, V and V* (Figure 2).

Eqs. (14)-(15) determine w and w*,
as a function of V and V*, independent of m, m*, τ and τ*.

In Summary,

Under (A3), i.e., without factor intensity differences between Domestic and Export Sectors, the model is Ricardian.

- An improvement in export technologies causes globalization without affecting factor prices

- Factor proportions do not affect globalization.

- The model is isomorphic to Dornbusch-Fischer-Samuelson with the iceberg costs (with $B(z) = B^*(z)$ and $\tau = \tau^*$).

4. Biased Globalization

Mirror Image Assumption:

(M) $A(z)A(1-z) = 1$;

$\Phi = \Phi^*$, $\Psi = \Psi^*$, $\tau = \tau^*$,

$B(z) = B^*(z)$, $B(z) + B(1-z) = 1$ for $z \in [0,1/2]$;

$V = V^*$.

$A(z)A(1-z) = 1 \rightarrow$

$A(z) > 1$ for $z \in [0,1/2)$; $A(1/2) = 1$; $A(z) < 1$ for $z \in (1/2, 1]$

Equilibrium: Symmetric,

$w = w^*$, $m = 1 - m^* < ½$,

$$(16)\quad A(m) = \frac{\Psi(w;\tau)}{\Phi^*(w^*)}$$

$$(17)\quad w_j V_j = \{\alpha_j(w) + [\beta_j(w;\tau) - \alpha_j(w)]B(m)\}wV \qquad (j = 1, 2,\ldots J)$$

An improvement in export technologies (a shift in τ) can affect factor demands in TWO separate routes: **Composition and Direct Effects**

Composition Effect: *By Shifting the Activities from the Domestic to Export Sectors*
A higher m or B(m) affects factor demands due to factor intensity differences between the Domestic and Export Sectors ($\alpha_j \neq \beta_j$)

Direct Effect: *By Changing the Factor Intensity of the Export Sectors*
$\beta_j(w;\tau)$ depends on τ.

We focus on the Composition Effect by assuming Hicks-neutrality.

(A4) $\Psi(w;\tau) = \tau\Psi(w)$ with τ > 1 and $\Psi(w) > \Phi(w)$.

$\beta_j(w;\tau) = \beta_j(w)$

Again, τ can be interpreted as the trade barriers.

Equilibrium

(16) $$A(m) = \frac{\Psi(w;\tau)}{\Phi^*(w^*)}$$

(17') $$w_j V_j = \{\alpha_j(w) + [\beta_j(w) - \alpha_j(w)]B(m)\}wV \qquad (j = 1, 2, \ldots J)$$

Two-Factor Case (J = 2)

(18) $$A(m) = \frac{\psi(\omega;\tau)}{\varphi(\omega)}$$

(19) $$\frac{V_1}{V_2} = \left[\frac{\alpha_1(\omega) + [\beta_1(\omega;\tau) - \alpha_1(\omega)]B(m)}{1 - \alpha_1(\omega) - [\beta_1(\omega;\tau) - \alpha_1(\omega)]B(m)}\right] \Big/ \omega,$$

where

$\omega \equiv w_1/w_2$ $(= \omega^* \equiv w_1^*/w_2^*)$

$\varphi(\omega) \equiv \Phi(\omega,1) = \Phi(w_1,w_2)/w_2$,

$\psi(\omega;\tau) \equiv \Psi(\omega,1;\ \tau) = \Psi(w_1,w_2;\ \tau)/w_2$;

$\alpha_1(\omega) = 1 - \alpha_2(\omega)$; $\beta_1(\omega;\ \tau) = 1 - \beta_2(\omega;\tau)$

Factor Intensity Assumption: $\alpha_1(\omega) < \beta_1(\omega;\tau)$.

Eq. (18) is downward-sloping.

A lower ω →
The Cost of the Export Sectors Declines Relative to the Domestic Sectors
→ A Higher m and A lower m* = 1−m.

Eq. (19) is upward-sloping.

A Higher m and a lower m* = 1−m →
A Higher Relative Demand for Factor 1

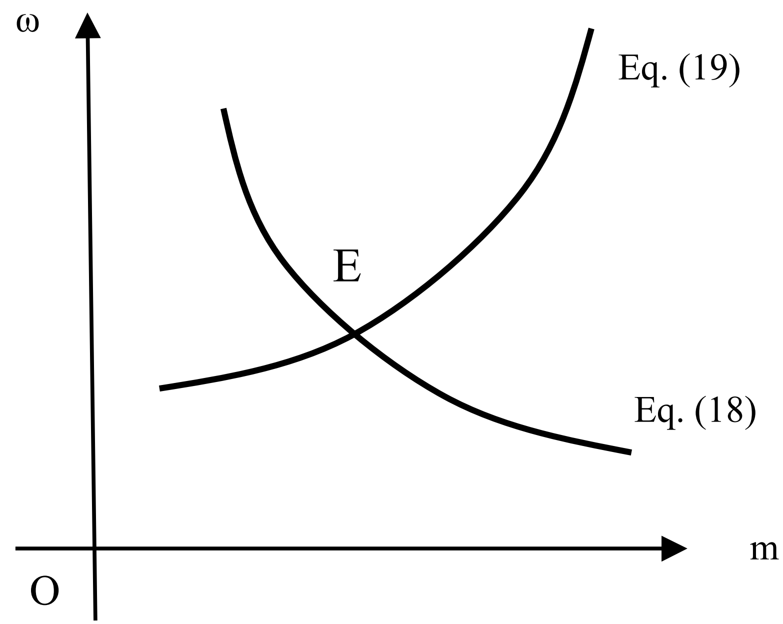
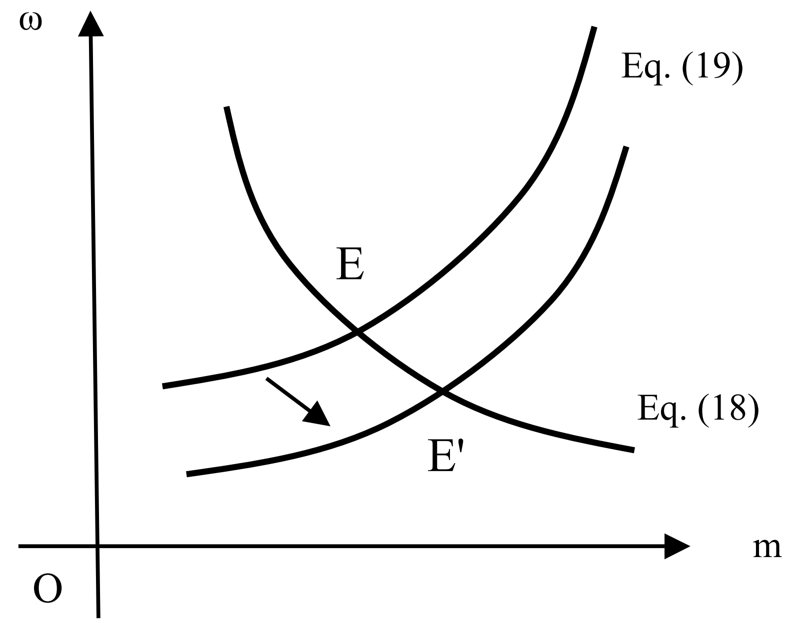


Figure 3a

Effects of a Higher V_1/V_2:

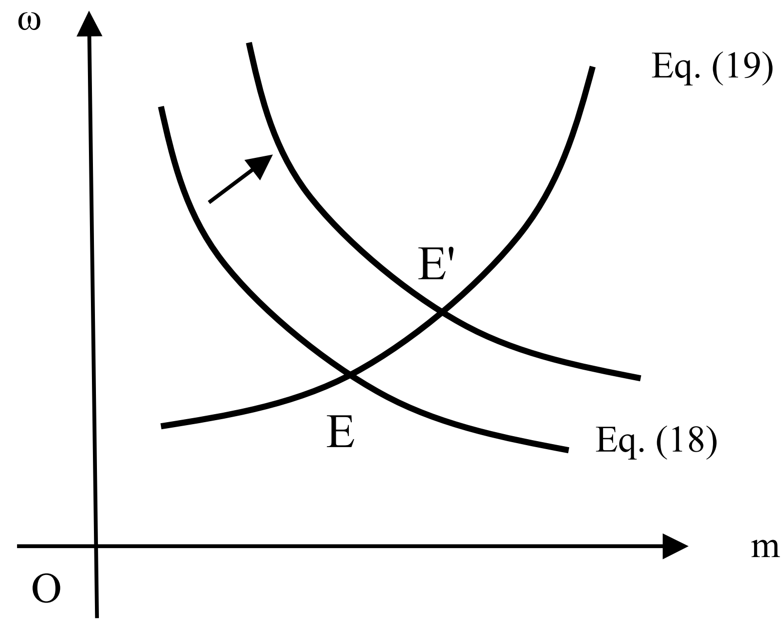


A *world-wide* increase in the relative supply of the factor used more intensively in export activities leads to a decline in the cost of supplying the foreign markets relative to the cost of supplying the domestic markets, which leads to globalization.

A Contrast to the Heckscher-Ohlin Mechanism

Figure 3b

Effects of A Decline in τ,



An increase in both m and ω.

An improvement in the export technologies (or a decline in the trade barriers) leads to globalization, which leads to a *world-wide* rise in the relative price of the factor used intensively in the export sectors.

A Contrast to the Stolper-Samuelson Mechanism

Effects of a change in A(z).

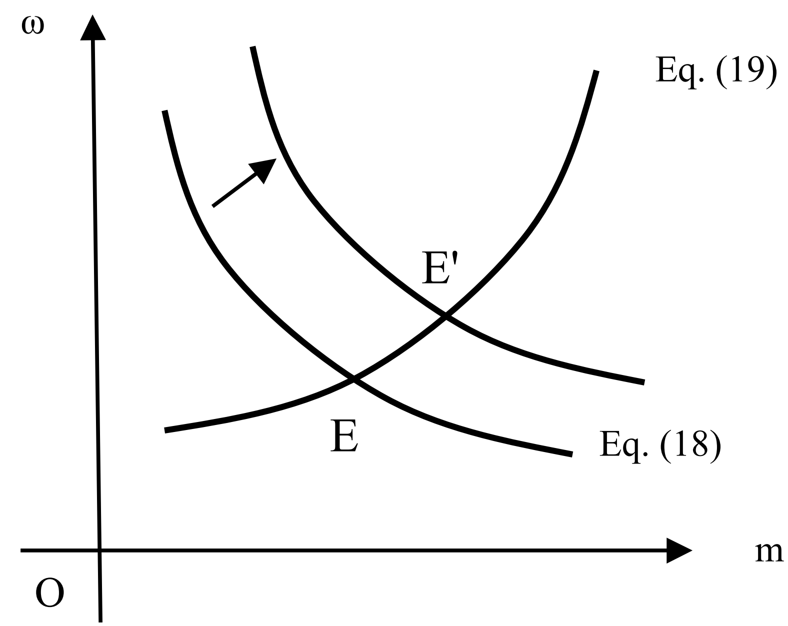
Generalize A(z) to $[A(z)]^{\theta}$, with $\theta > 0$.

A higher θ magnifies the TFP difference

More Reasons to Trade

→ An increase in both m and ω.

Figure 3b



5. An Application: Globalization, Technical Change, and Skill Premia

Two Approaches

The First Approach: Globalization *is* inherently skilled-biased

Assume that Export Sector is More Skill Intensive than Domestic Sector

→

- A world-wide increase in the relative supply of skilled labor leads to globalization (Figure 3a).
- An improvement in the export technologies or a reduction in the trade barriers leads to globalization and a world wide rise in the skill premia (Figure 3b).

The Second Approach:

Globalization *induced by* skilled-labor augmenting technical changes.

Two-Factors; Skilled and Unskilled Labor

Unit Cost Functions		Destination	
		Home	Foreign
Origin	Home	$a(z)\Phi(\tau w_s,w_u)$	$a(z)\Psi(\tau w_s,w_u)$
	Foreign	$a^*(z)\Psi^*(\tau^* w_s, w_u)$	$a^*(z)\Phi^*(\tau^* w_s^*, w_u^*)$

a reduction in τ (and τ^*) means a skilled-labor augmenting technical change, and hence it reduces the costs of both the domestic and export sectors for fixed wage rates.

(A5) $\Phi(\tau w_s, w_u) < \Psi(\tau w_s, w_u)$ and $\Phi^*(\tau^* w_s^*, w_u^*) < \Psi^*(\tau^* w_s^*, w_u^*)$.

Under the Mirror Image Assumption,

$$(20) \qquad A(m) = \frac{\psi(\tau\omega)}{\varphi(\tau\omega)}$$

$$(21) \qquad \frac{V_s/\tau}{V_u} = \left[\frac{\alpha_s(\tau\omega) + [\beta_s(\tau\omega) - \alpha_s(\tau\omega)]B(m)}{1 - \alpha_s(\tau\omega) - [\beta_s(\tau\omega) - \alpha_s(\tau\omega)]B(m)}\right] \Big/ (\tau\omega),$$

Skill Premia: $\omega \equiv w_s/w_u$ ($= \omega^* \equiv w_s^*/w_u^*$)

Under the Hicks-Neutrality Assumption (Uzawa's Theorem)

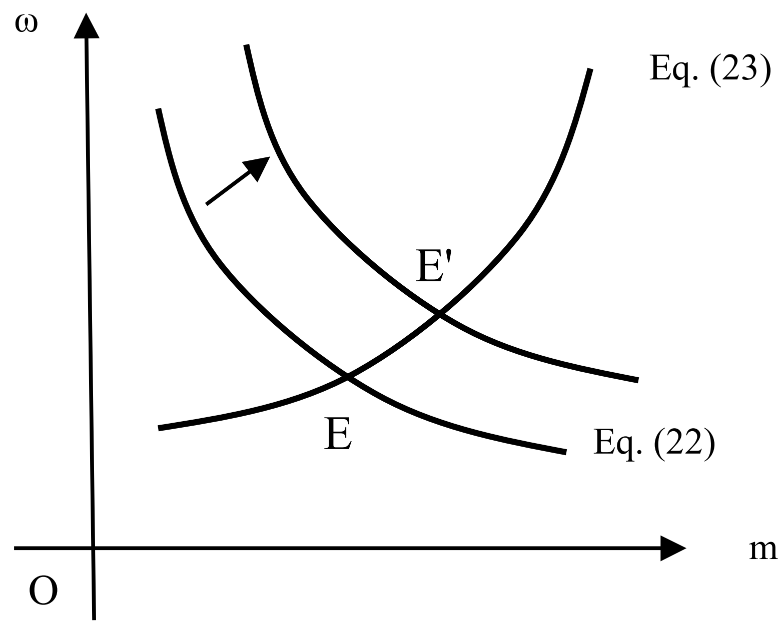
$$(\text{A6}) \qquad \Phi(\tau w_s, w_u) = (\tau w_s)^{\alpha}(w_u)^{1-\alpha}, \;\; \Psi(\tau w_s, w_u) = \Gamma(\tau w_s)^{\beta}(w_u)^{1-\beta}$$

with Γ large enough to ensure that $\Phi(\tau w_s, w_u) < \Psi(\tau w_s, w_u)$ in equilibrium.

If Export Sector is More Skill Intensive: $0 < \alpha < \beta < 1$.

(22) $A(m) = \Gamma(\tau\omega)^{\beta-\alpha}$,

(23) $$\frac{V_s}{V_u} = \left[\frac{\alpha + (\beta-\alpha)B(m)}{(1-\alpha)-(\beta-\alpha)B(m)}\right] \Big/ \omega,$$



A skilled-labor augmenting technical change (a reduction in τ) shifts the downward-sloping curve to the right, leading to globalization and an increase in skill premia.

6. **Demand for Local Factors in the Export Market (Omitted from the Final Version)**

Unit Cost Functions		Destination	
		Home	Foreign
Origin	Home	$a(z)\Phi(w)$	$a(z)\Psi(w, w^*;\tau)$
	Foreign	$a^*(z)\Psi^*(w^*,w; \tau^*)$	$a^*(z)\Phi^*(w^*)$

Consider J = 2, Cobb-Douglas

$$\Phi(w_1,w_2) = (w_1)^{\alpha}(w_2)^{1-\alpha},$$

$$\Psi(w_1,w_2;\ w_1^*,\ w_2^*;\ \tau) = \tau\Gamma[(w_1)^{\beta}(w_2)^{1-\beta}]^{1-\sigma}[(w_1^*)^{\gamma}(w_2^*)^{1-\gamma}]^{\sigma},$$

$$\Phi^*(w_1^*,w_2^*) = (w_1^*)^{\alpha^*}(w_2^*)^{1-\alpha^*},$$

$$\Psi^*(w_1^*,w_2^*;\ w_1,w_2;\ \tau^*) = \tau^*\Gamma^*[(w_1^*)^{\beta^*}(w_2^*)^{1-\beta^*}]^{1-\sigma^*}[(w_1)^{\gamma^*}(w_2)^{1-\gamma^*}]^{\sigma^*},$$

with Γ and Γ^* sufficiently large to ensure that $\Phi < \Psi$ and $\Phi^* < \Psi^*$.

Mirror Image Assumption:

(M') $A(z)A(1-z) = 1$

$B(z) = B^*(z)$ and $B(z) + B(1-z) = 1$ for $z \in [0,1/2]$,

$\Phi = \Phi^*$, $\Psi = \Psi^*$ and $V = V^*$, and $\tau = \tau^*$.

Equilibrium: Symmetric, ω ($\equiv w_1/w_2$) = ω^* ($\equiv w_1^*/w_2^*$) and $m = 1-m^* < ½$, and characterized by

(24) $A(m) = \tau\Gamma(\omega)^{[\beta(1-\sigma)+\gamma\sigma]-\alpha}$

(25) $$\frac{V_1}{V_2} = \left[\frac{\alpha + \{[\beta(1-\sigma)+\gamma\sigma]-\alpha\}B(m)}{(1-\alpha)-[\beta(1-\sigma)+\gamma\sigma]-\alpha)B(m)}\right]\Big/\omega.$$

If $\beta(1-\sigma)+\gamma\sigma > \alpha$ → Figure 3a and Figure 3b

7. **Factor Intensity Differences Across Goods (Omitted from the Final Version)**

Some factors are used intensively in producing some goods (and industries).
Some factors are used intensively in the export sectors across industries.

How to combine the above mechanism with the Stolper-Samuelson mechanism?

Heckscher-Ohlin Model with a Continuum of Goods (DFS QJE 1980)

- *Two Countries Share the Same Technologies*

- *Two Countries Differ in Factor Endowments* (The Reason for Trade)

- *Three Factors (J = 3)* e.g.

Factor 1; MBAs (skilled)		Factor 1; Human Capital (Skilled)
Factor 2: Engineers (skilled)	OR	Factor 2: Land
Factor 3: Unskilled		Factor 3: Labor (Unskilled)

Technologies

Unit Cost Functions		Destination	
		Home	Foreign
Origin	Home	$\Phi^z(w_1, w_2, w_3)$	$\Psi^z(w_1, w_2, w_3; \tau)$
	Foreign	$\Psi^z(w_1^*, w_2^*, w_3^*; \tau)$	$\Phi^z(w_1^*, w_2^*, w_3^*)$

$$\Phi^z(w_1, w_2, w_3) = (w_1)^{\alpha}[(w_2)^{\delta(z)}(w_3)^{1-\delta(z)}]^{1-\alpha}$$

$$\Psi^z(w_1, w_2, w_3; \tau) = \tau\Gamma(w_1)^{\beta}[(w_2)^{\delta(z)}(w_3)^{1-\delta(z)}]^{1-\beta}$$

- Γ large enough $\Phi^z < \Psi^z$ for all z.
- α, β, Factor-1 Intensity; differ across the destinations, not across industries
- $\delta(z) \in [0,1]$ strictly increasing in $z \in [0,1]$:
  - ✓ Higher Indexed Goods; Factor-2 Intensive
  - ✓ Lower Indexed Goods: Factor-3 Intensive

e.g.,

- Export Sector is More MBAs (or Human Capital) Intensive than Domestic Sector
- Manufacturing Higher Indexed Goods; More Engineer-Intensive (or Land-Intensive)

***Patterns of Trade*:**

No Factor Price Equalization

$w_2/w_3 > w_2^*/w_3^*$ → Home produces and exports $z \in [0, m)$
Foreign produces and export $z \in (m^*, 1]$.
Nontraded Goods, $z \in (m, m^*)$.

Mirror Image Assumption

(M'') $B(z) = B^*(z)$ and $B(z) + B(1-z) = 1$ for $z \in [0,1/2]$),
$\delta(z) = 1-\delta(1-z)$
$V_1 = V_1^*$
$V_2 = V_3^* < V_3 = V_2^*$.

Home; Factor-3 Abundant;
Foreign; Factor-2 abundant.

Equilibrium: Symmetric: $w_1 = w_1^*$, $w_2 = w_3^* > w_3 = w_2^*$, and $m = 1-m^* < ½$

(26) $$\frac{w_2 V_2}{w_3 V_3} = \frac{\Sigma_2(m)}{\Sigma_3(m)}$$

(27)

$$(\beta-\alpha)\log\left(\frac{w_1}{\sqrt{w_2 w_3}}\right) = \left(1-\frac{\alpha+\beta}{2}\right)\left(1-2\delta(m)\right)\left[\log\left(\frac{\Sigma_2(m)}{\Sigma_3(m)}\right) - \log\left(\frac{V_2}{V_3}\right)\right] - \log(\tau\Gamma)$$

(28) $$\left(\frac{w_1}{\sqrt{w_2 w_3}}\right)\left(\frac{V_1}{\sqrt{V_2 V_3}}\right) = \frac{\Sigma_1(m)}{\sqrt{\Sigma_2(m)\Sigma_3(m)}},$$

$\Sigma_1(m) \equiv \alpha + (\beta-\alpha)B(m)$; $\Sigma_2(m) \equiv (1-\alpha)/2 - (\beta-\alpha)D_2(m)$

$\Sigma_3(m) \equiv (1-\alpha)/2 - (\beta-\alpha)D_3(m)$,

where

$D_2(m) \equiv \int_0^m \delta(z)b(z)dz$ and $D_3(m) \equiv \int_0^m [1-\delta(z)]b(z)dz$, strictly increasing in m

$D_2(m) + D_3(m) = B(m)$.

$D_2(m)/D_3(m)$ is strictly increasing in m from $\delta(0)/[1-\delta(0)]$ to 1.

If $\alpha = \beta$,

$$\frac{w_2}{w_3} = \frac{V_3}{V_2}, \qquad \left(\frac{V_3}{V_2}\right)^{(1-\alpha)(1-2\delta(m))} = \tau\Gamma, \qquad \left(\frac{w_1}{\sqrt{w_2 w_3}}\right)\left(\frac{V_1}{\sqrt{V_2 V_3}}\right) = \frac{2\alpha}{1-\alpha}.$$

An Improvement in the Export Technologies (a decline in τ) →

Globalization (a higher m)

No Effect on the Relative Factor Prices.

A Greater Factor Endowment Difference (a higher V_3/V_2) →

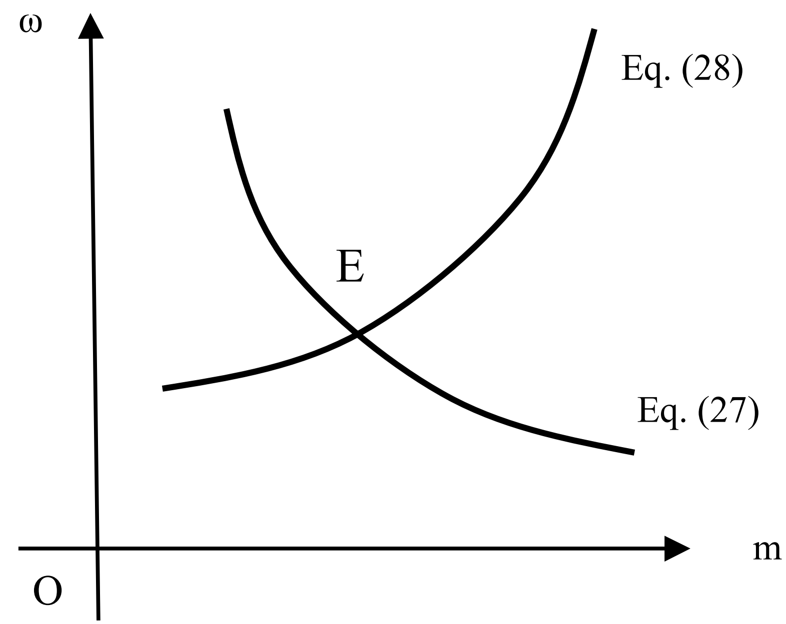
A Greater Factor Price Difference (a higher $w_2/w_3 = w_2/w_2^* = w_3^*/w_3$),

Globalization (a higher m)

No Effect on $\omega \equiv \frac{w_1}{\sqrt{w_2 w_3}} = \frac{w_1^*}{\sqrt{w_2^* w_3^*}}$ with a fixed $\frac{V_1}{\sqrt{V_2 V_3}} = \frac{V_1^*}{\sqrt{V_2^* V_3^*}}$.

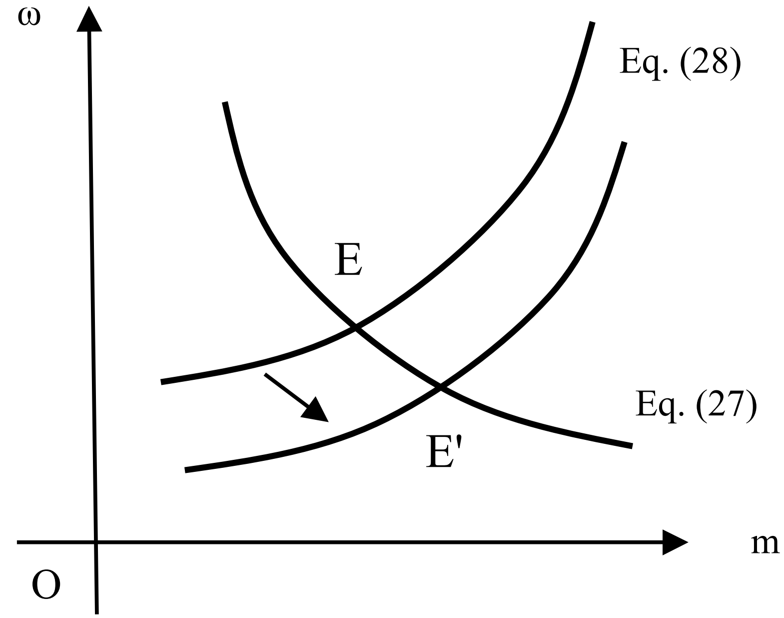
If $\alpha < \beta$,

Eqs (27) and (28) jointly determine ω and m.



$w_2/w_3 = w_2/w_2^* = w_3^*/w_3$ is determined by m through Eq. (26).

An Increase in $\frac{V_1}{\sqrt{V_2 V_3}} = \frac{V_1^*}{\sqrt{V_2^* V_3^*}}$



A higher m.

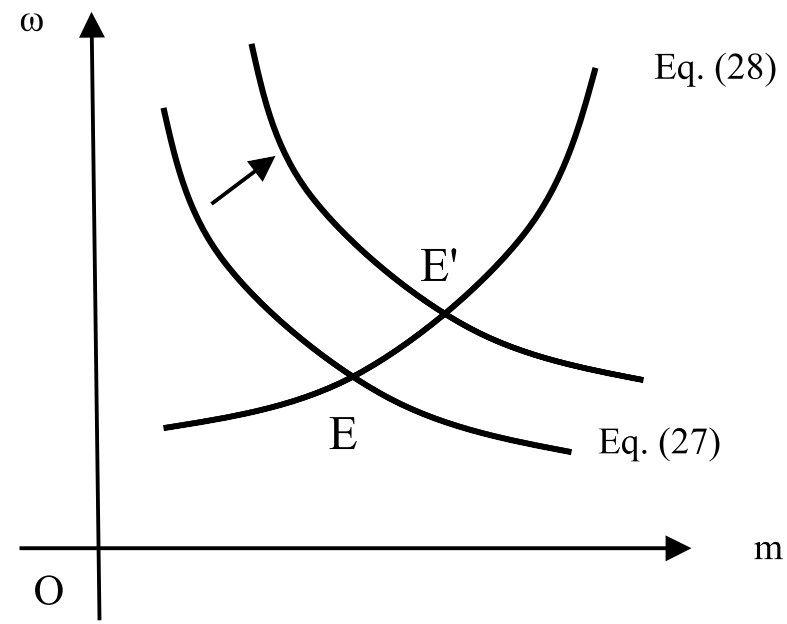
A lower ω ***New Effect***

A higher m (and a lower m* = 1 − m) →

A Smaller Factor Price Difference (a lower $w_2/w_3 = w_2/w_2^* = w_3^*/w_2^*$):
Stolper-Samuelson Effect

A higher m means a shift from the Domestic Sectors that use scarce factors intensively to to the Export Sectors that use the abundant factors intensively.

A Decline in τ,



Globalization (a higher m),

A higher ω; ***New Effect***

A Smaller Factor Price Difference
(a lower $w_2/w_3 = w_2/w_2^* = w_3^*/w_2^*$) **Stolper-Samuelson Effect.**

An Increase in $V_3/V_2 = V_2^*/V_3^* > 1$, keeping $V_1/(V_2V_3)^{1/2}$ constant.

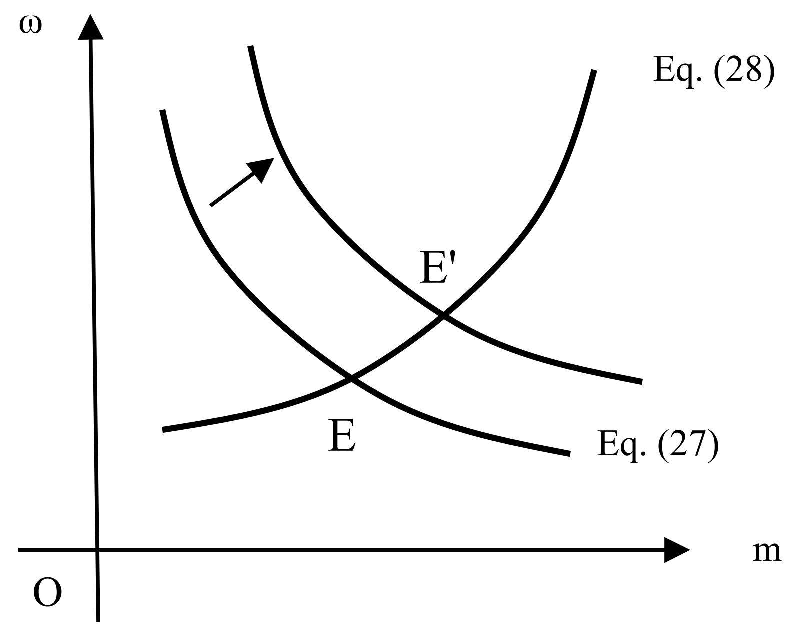
More Reasons to Trade

Globalization (a higher m)

Heckscher-Ohlin Effect

A higher ω

New Effect.



8. Summary and Some Broader Implications:

Motivations:

- International trade generates more demand for certain factors than domestic trade,
  e.g. international business, language skills, and maritime insurance.
  transoceanic transportation
- Need for generalizing the iceberg approach

My Approach:

- Introduce the export sectors separately from the domestic sectors, with different factor intensities, in the standard classical trade models

Key Results:

- A *world-wide* increase in the factors used intensively in international trade could lead to globalization.
- Globalization caused by a reduction in the trade barriers or a change in the export technologies leads to a *world-wide* increase in the relative prices of the factors used intensively in international trade.

Some Broader Implications and Additional Thoughts on

Trade (and Supply) Costs:

Export-Import businesses mean a lot more than just shipping goods. Stop thinking that Trade Costs equal Transportation Costs! (And stop thinking that supply equal production!)

Recent Debate on the Global Rise in Skill Premia

"Globalization versus Skill-Biased Technical Change" is a false dichotomy, because Globalization may

- be inherently skill-biased (in this paper)
- be induced by skill-biased technical change (in this paper)
- induce skill-biased technical change (in Acemoglu and Theonig-Verdier)

What do we mean "Skill Premia"? Skilled in what?

College Graduates are not homogenous. Are English Literature Majors Skilled Labor? Yet, those who speak English in non-English speaking countries might be the first to gain from globalization.

Some Suggestions for Next Steps:

- Monopolistic Competition Models
  - Similar Effects of Opening up Trade
  - What about Effects of FDI?
  - Domestic Outsourcing versus International Outsourcing
- Specific Factors Models, with some factors specific to the production of particular goods, while other factors are specific to export-import businesses
  - What are Political Economy Implications?
  - Do we get Free-trade biases, instead of protectionist biases?

Some Growth and Development Implications

- **Trade/GDP Ratio**:
  Human-capital driven growth leads to even a faster growth in trade, if the export-sectors are more human capital intensive.
- **Development Traps due to Complementary Inputs**
  Ciccone and Matsuyama (1996, 1999), Rodriguez (1996), and many others
  Trade may not be an easy way out from traps for many LDCs.

Some Modest Proposals:

Let us go "beyond icebergs" and model explicitly international trade activities in the theory of international trade!

Hundreds of papers have been written under the assumption that factor intensities differ across goods. It is time to start writing dozens (if not hundreds) of papers exploring the implications of factor intensity differences across destinations.