

Engel's Law in the Global Economy:  
Demand-Induced Patterns of Structural Change, Innovation, and Trade

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## Motivation

- *Endogenous Demand Composition due to Nonhomothetic Demand (Engel's Law)*
  - ✓ Expenditure shares more skewed towards higher income elastics in richer countries.
  - ✓ An important channel through which economic growth and globalization affect
    - Sectoral compositions in employment and in value-added
    - Variations in innovation/productivity growth rates across sectors (**Schmookler**)
    - Patterns of intersectoral trade between rich and poor countries (**Linder**)
    - Migration of industries from rich to poor countries (**Vernon's Product Cycles**)
- These effects are *interconnected*, yet studied *separately*, which can be *misleading*.
  - ✓ *False dichotomy* of income elasticity vs. productivity growth differences
    - *Endogenous* productivity response to the relative market size
  - ✓ *Alleged* claim that globalization *reduces* the power of domestic demand composition
    - Gains from trade have *the income effect*
    - The Linder Effect *magnifies* the power of domestic demand composition
    - Migration of industries from the rich to the poor *facilitate* structural change in both
- By capturing all these interactive effects of Engel's Law, we offer a *unifying* perspective on how economic growth and globalization affect patterns of structural change, innovation, and trade.

## Framework: 2-Country Directed Technical Change with Endog. Demand Compositions

- One Nontradeable Factor (labor)
- **2 Countries**; differ only in *population size* ( $N$ ) and *labor productivity* ( $h$ ), hence also in the economy size, measured in *effective labor supply* ( $L = hN$ )
- **Continuum of Nontradeable Consumption Goods**,  $s \in I$ , with *Isoelastic Nonhomothetic CES preferences*
  - Goods-specific income elasticity parameters,  $\varepsilon(s)$ , increasing in  $s \in I$
  - Constant elasticity of substitution parameter,  $\eta$ , *not* linked to income elasticity parameters,  $\varepsilon(s)$ ; Goods can be complements ( $\eta < 1$ ) or substitutes ( $\eta > 1$ ).
- Production side deliberately standard, *a la* Dixit-Stiglitz-Krugman
  - Each nontradeable consumption good produced in a competitive sector by assembling tradeable differentiated inputs with *CES aggregators*.
  - **Tradeable differentiated intermediate inputs**:
    - ✓ supplied by *monopolistic competitive* firms with labor for both production and entry
    - ✓ subject to *iceberg trade cost*
  - **Endogenous Sectoral TFP**, depend on the availability of differentiated inputs in each sector, endogenous through entry and trade.

## Isoelastic Nonhomothetic CES

$$\tilde{U} = U(C_s, s \in I), \text{ implicitly additive as } \left[ \int_0^1 (\beta_s)^\frac{1}{\eta} (\tilde{U})^\frac{\varepsilon(s)-\eta}{\eta} (C_s)^\frac{\eta-1}{\eta} ds \right]^\frac{\eta}{\eta-1} \equiv 1$$

- $(\varepsilon(s) - \eta)/(1 - \eta) > 0$  for global monotonicity & quasi-concavity
- If  $\varepsilon(s)$  is constant, homothetic CES. If not, *nonhomothetic CES*.
- $\varepsilon(s)$  *increasing* in  $s \in I \rightarrow \omega(s, \tilde{U}) \equiv (\beta_s)^\frac{1}{\eta} (\tilde{U})^\frac{\varepsilon(s)-\eta}{\eta}$  *log-supermodular* in  $s$  &  $\tilde{U}$
- $\omega(s, \tilde{U}) \equiv (\beta_s)^\frac{1}{\eta} (\tilde{U})^\frac{\varepsilon(s)-\eta}{\eta}$  *isoelastic* in  $\tilde{U}$ , generating the stable slope of the Engel curve

**(Double-Log) Demand System:**  $m_s$ : expenditure shares of  $s$ ;  $U$ : per capita real income

$$\log(m_s / m_{s'}) = \log(\beta_s / \beta_{s'}) + (\varepsilon(s) - \varepsilon(s')) \log(U) + (1 - \eta) \log(P_s / P_{s'})$$

- ✓ Higher-indexed more income elastic
- ✓ Price elasticity is *not* linked to sector-specific income elasticity

## Main Results in a Closed Economy

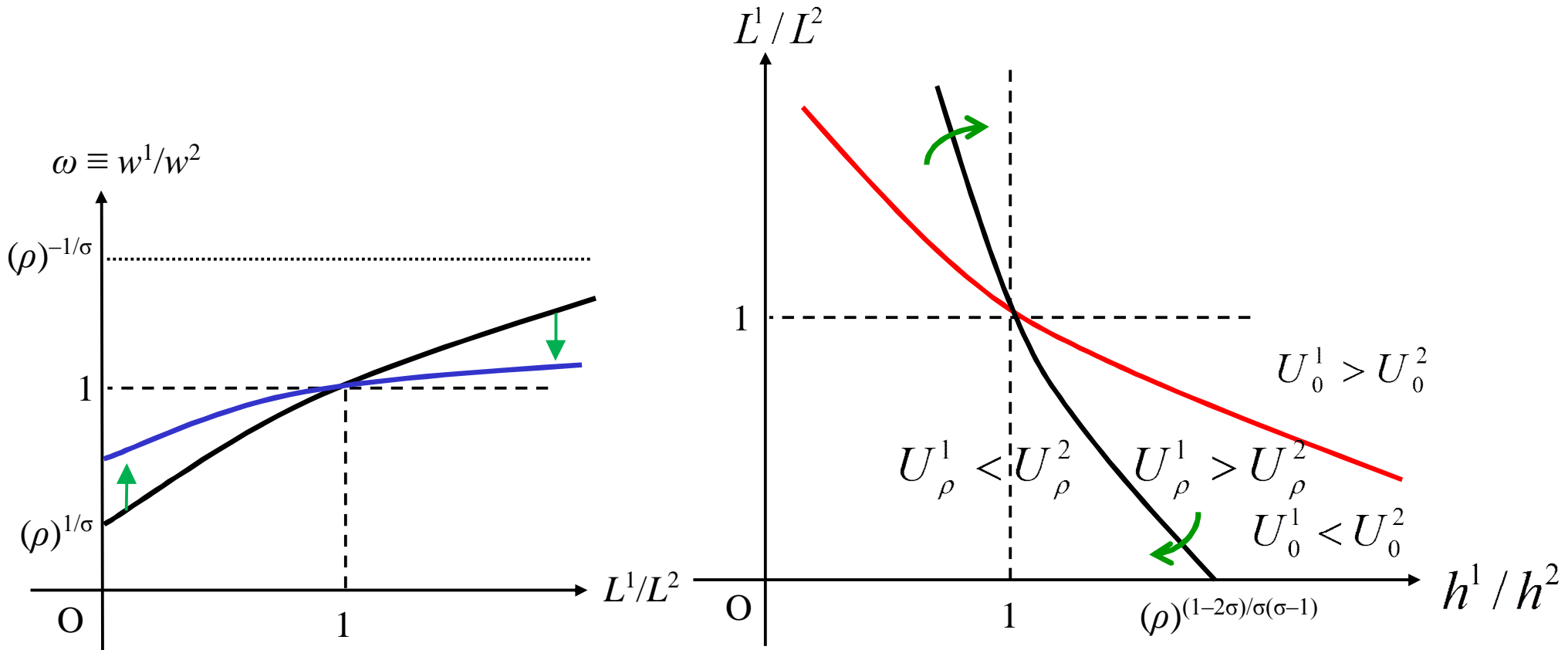
- Employment (valued-added) shares  $f_s =$  Expenditure shares  $m_s$ .
- A higher  $h$  or  $N$  leads to
  - ✓ A higher per capita real income (welfare),  $U$
  - ✓ Sectoral shares in employment shift toward higher- $s$  in the sense of **Monotone Likelihood Ratio** (MLR)
  - ✓ Productivity growth faster in higher- $s$  through entry and exit (Schmookler effect)
  - ✓ Relative prices changes would moderate (amplify) sectoral shifts when consumptions goods are complements (substitutes)

The usual dichotomy of income elasticity vs. productivity growth differences in the structural change literature would be false in the presence of Schmookler effect.

## Main Results in a Trade Equilibrium: Cross-Country Variations-I

*Terms of Trade:* The wage rate lower in the country smaller in  $L = hN$

*Country Ranking.* The country higher in  $h$  but smaller in  $L = hN$  may be poorer at a high trade cost but richer at a low enough trade cost.



$0 < \rho < 1$ : degree of globalization, inversely related to the iceberg trade cost.

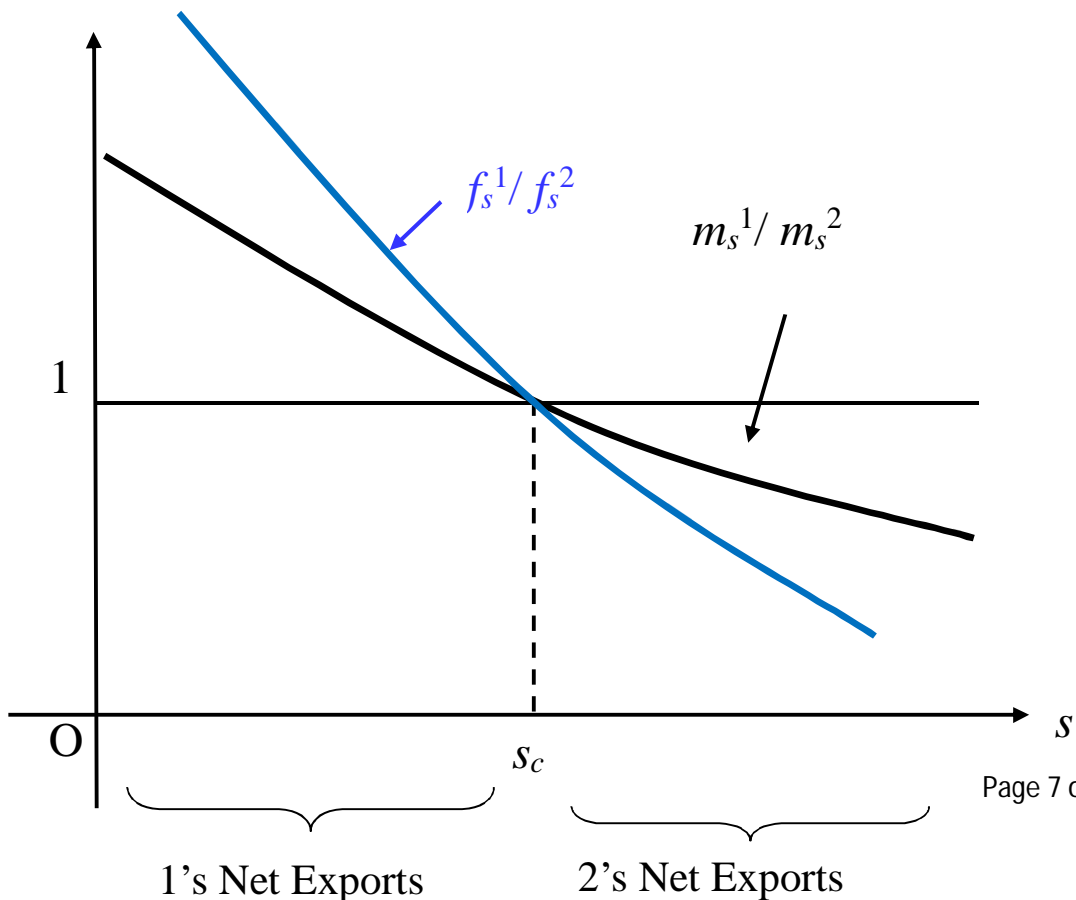
## Main Results in a Trade Equilibrium: Cross-Country Variations-II

- *Sectoral Composition in Expenditures*,  $m_s^1 / m_s^2$ . More skewed towards higher-income elastic sectors in the richer country.
- Trade *amplifies* the effects of domestic demand composition via *Home Market Effect*
  - *Sectoral Composition in Employment (or value-added)*

**Amplification:**  $f_s^1 / f_s^2 > m_s^1 / m_s^2 > 1$  or  $f_s^1 / f_s^2 < m_s^1 / m_s^2 < 1$

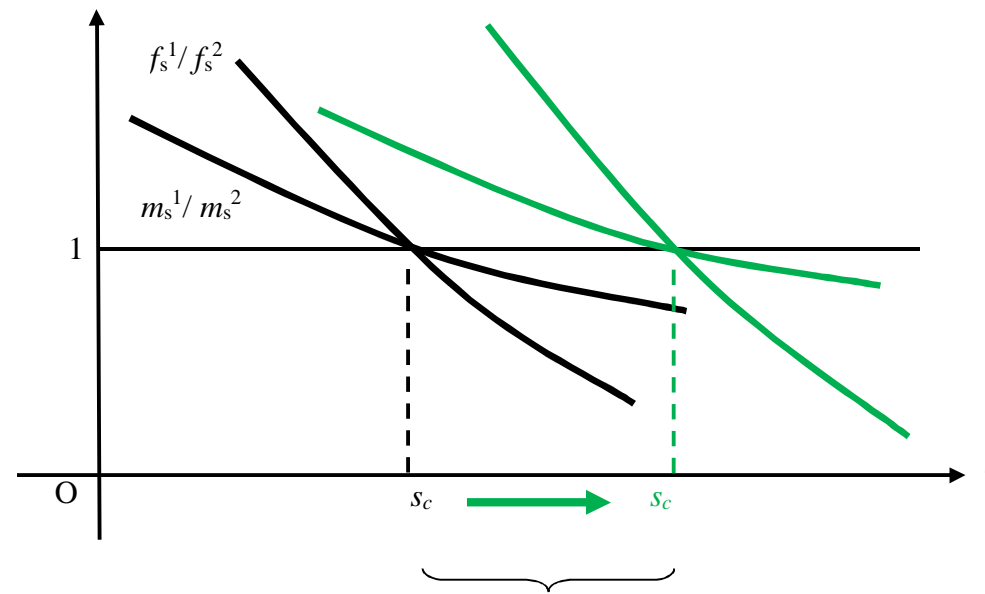
- *The Linder Effect*; a cut-off sector,  $s_c \in I$ , above which Rich is a net-exporter.

For  $U_\rho^1 < U_\rho^2$



## Main Results in a Trade Equilibrium: Comparative Statics-I

- **A uniform increase in  $h$  (or  $N$ )**
    - ✓ *No effect on ToT nor on Country Ranking*
    - ✓ *Structural Change*: Expenditure & employment shares shift towards higher- $s$  in both
    - ✓ *Product cycles*: a cut-off sector,  $s_c \in I$ , goes up, turning the richer country from a net-exporter to a net-importer in the middle.
    - ✓ *Per capita real income gaps narrow* if sectors produce complements
  - **A (uniform) decline in iceberg trade cost** (when the countries equal in  $L = hN$ )
    - ✓ Isomorphic to a uniform increase in  $h$ .
- Under Engel's Law, globalization, through its productivity effect, causes structural change and product cycles.*

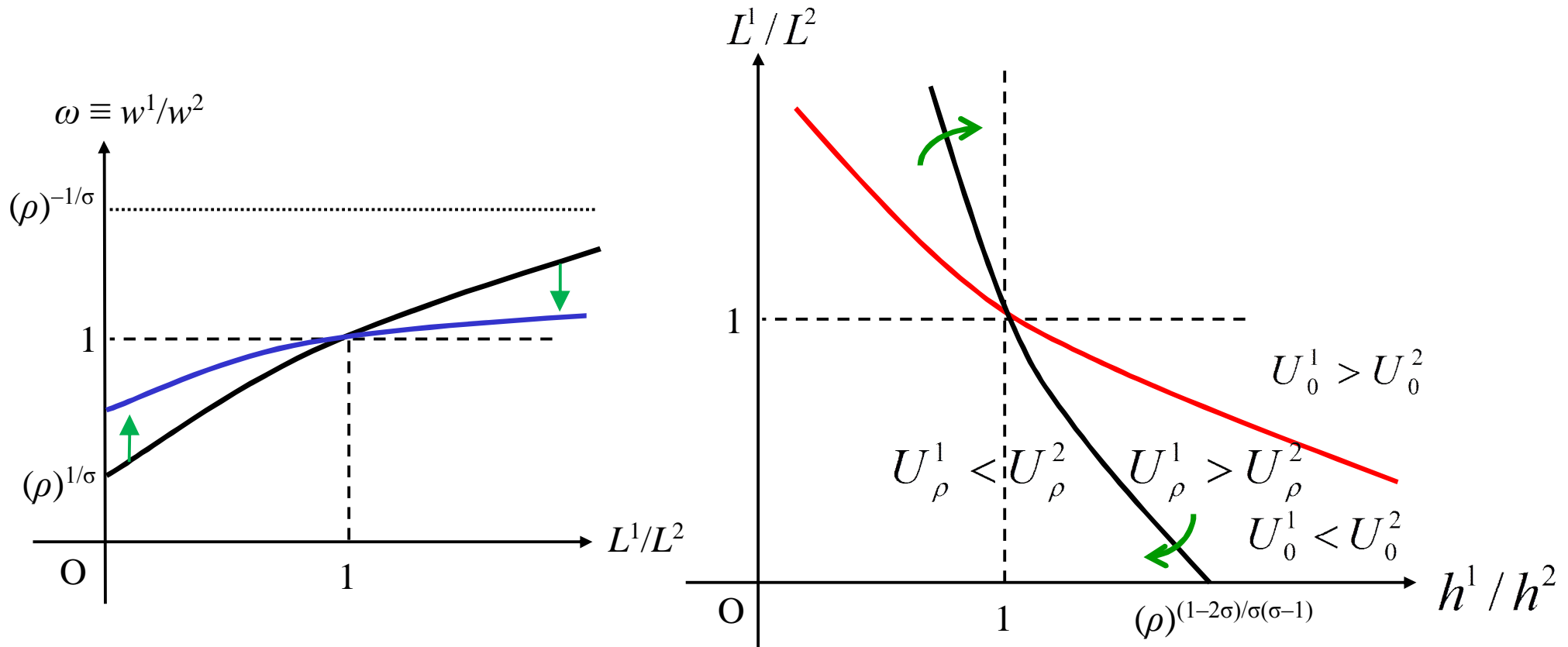


The richer country's sectoral trade balances switch from surpluses to deficits



## Main Results in a Trade Equilibrium: Comparative Statics-II

- A (uniform) decline in iceberg trade cost (when the countries differ in  $L = hN$ ).
  - ✓ *ToT change in favor of the smaller country* → *Factor Price Convergence*
  - ✓ *Leapfrogging*: The country higher in  $h$  but smaller in  $L$  may be poorer is a less globalized world, becomes richer with globalization
  - ✓ *Reversal of the patterns of trade*



## To Summarize:

- *Engel's Law* with implications on
  - i) Sectoral compositions in employment, innovation, and productivity growth.
  - ii) Patterns of trade and migration of industries across rich and poor countries
- A unifying framework, capturing all these effects and their interactions
  - ✓ **Two Countries** differ in population size and labor productivity
  - ✓ **Nonhomothetic CES** over a continuum of nontradeable consumption goods
  - ✓ **Endogenous Sectoral Productivity** due to the DS variety effect
  - ✓ **Costly Trade** a la Krugman
- **Home Market Effect** in employment and patterns of trade
  - ✓ Disproportionately large share of workers in higher income elasticities in Rich
  - ✓ *Linder Effect*: Rich (Poor) a net-exporter in higher (lower) income elasticities
- **Comparative Statics**: *Labor productivity growth and globalization cause*
  - ✓ *Sectoral Change* to the higher income elasticities
  - ✓ *Schmookler Effect*; Relative Price of high income elasticities go down
  - ✓ *Vernon's Product cycles*: Rich switches from an exporter to an importer in the middle sectors
  - ✓ *Leapfrogging and patterns of trade reversal* Globalization can help the smaller country with better labor force to overtake the other.