The Role of Quality Ladders in a Ricardian Model of Trade with Nonhomothetic Preferences

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Motivation

- Several articles on international trade show that *nonhomothetic preferences* help in capturing relevant features of North-South trade (Flam-Helpman, 1987; Stokey, 1991; Matsuyama 2000)
  - the North exports goods with *high income demand elasticity*
  - income rises imply demand deviates towards goods by the North
  - increased *initial income disparities* between the North and the South

- We argue that international trade might also generate income differentials between countries displaying *similar levels of development*
  - model based on *quality differentiation* and *nonhomothetic preferences*
  - standard *comparative advantages*, absence of *absolute* advantages
Fundamental Elements

- Quality ladders structure (Grossman and Helpman, 1991)
  - *large variety* of consumption goods in the economy
  - each variety present in *several levels of quality*
  - higher qualities increasingly costly to produce

- Consumer’s taste for quality
  - individuals *care about the quality* of consumed goods
  - willingness to pay for higher quality increases with income

- International production cost differentials
  - (similar) countries specialise in production of different varieties
  - comparative advantages dictate specialisation patterns
  - some varieties offer *larger scope for quality upgrading* than others
Demand Structure

- **Quality differentiation**
  - consumer’s *taste for quality* sets price/quality ratios rising with income
  - given income, a particular quality is (optimally) chosen for each variety

- **Cost structure**
  - the *cost of quality upgrading* (QU) differs across varieties
  - any price/quality ratio correspond to a *different quality for each variety*
  - quality levels differ across varieties

- **Nonhomothetic demand schedules**
  - variety’s *income demand elasticity* tied to optimal quality consumed
  - as income rises, demand shifts towards *higher-quality* varieties
World Economy

- Comparative advantages
  - countries’ relative *advantage in producing all qualities of some varieties*
  - *different scope for QU* implied by countries’ specialisation

- Regional product cycle
  - as income rises, higher qualities traded for *all varieties in both countries*
  - lower qualities are *no longer produced* in any country

- International product cycle (IPC)
  - demand towards country specialising in varieties with *lower cost of QU*
  - excess demand implies some *production transfers* to other country

- Divergent income dynamics
  - IPC implies *rising wages* for country producing higher-quality varieties
The goods space is defined along horizontal and vertical dimensions.

Horizontal dimension indexes the different types of goods:

\[ V \subset \mathbb{R} : v \in [0, 1] \]

The vertical dimension orders goods of the same type:

\[ Q \subset \mathbb{R} : q \in [1, \infty) \]

It is assumed an infinite elasticity of substitution across varieties.
The Model: Preferences

- Non-homotheticity obtained by *non-homogeneous* utility indices:

\[
\ln u_v = \begin{cases} 
\ln x_v & x_v < 1 \\
q_v \ln x_v & x_v \geq 1
\end{cases}
\]

where:
- \( q_v \) optimal quality of variety \( v \)
- \( x_v \) quantity of consumption for good \( q_v \)

- Consumption *unit threshold* to avoid quality regarded as a “bad”
  - (normalised) *subsistence* consumption level
  - consumers care about quality when they can overlook survival issues
The Model: Supply Side

- Unit labour requirements (URL) differ across countries (H and F):
  - in H, URL for commodity \((v, q) \in \mathbb{V} \times Q\) is: 
    \[ c_{vq} = a(v) q^{\eta(v)} / \kappa \]
  - in F, URL for the same commodity is: 
    \[ c_{vq}^* = a^*(v) q^{\eta(v)} / \kappa \]

where:

- \(\kappa\) world aggregate-productivity parameter
- \(a(v), a^*(v)\) variety-specific technological parameters (for H and F)
- \(\eta(v)\) the cost elasticity of quality upgrading, (same for H and F)

- The international price of each commodity \(q_v\) is given by:
  \[ p_{vq} = \alpha(v) q^{\eta(v)} / \kappa, \]
  where \(\alpha(v) \equiv \min \{a(v) w, a^*(v) w^*\}\)
The Model: Simplifying Assumptions

- To ease illustration, varieties are sorted by cost of quality upgrading:
  - cost elasticity of quality upgrading is increasing with varieties, formally:
    \[ \eta (v) : [0, 1] \rightarrow \mathbb{R}^{++}, \text{ where } \eta' (\cdot) > 0 \text{ and } \eta (0) > 1 \]
  - technological parameters are also increasing with varieties, formally:
    \[ a (v) : [0, 1] \rightarrow \mathbb{R}^{++}, \text{ where } a' (\cdot) \geq 0 \]
    \[ a^* (v) : [0, 1] \rightarrow \mathbb{R}^{++}, \text{ where } a^{*'} (\cdot) \geq 0 \]

- In addition, we assume symmetric comparative advantages:
  \[ A (0.5) = 1 \text{ and } A' (v) < 0, \text{ where } A (v) \equiv a^* (v) / a (v) \]

- marginal variety \( m \) (same production cost in H and F) satisfies:
  \[ A (m) = w / w^* \]
The Model: Comparative Advantages

- Lower-indexed varieties are produced by country H
- Advantages in production hold at all levels of quality
Consumer’s decision discussed with reference to country H

Problem The representative consumer maximises utility by solving:

\[
\max_{\{q_v, \beta_v\}_{v \in \mathcal{V}}} U = \int_{\mathcal{V}} q_v \ln \left( \frac{w \beta_v}{p_{vq_v}} \right) dv,
\]

subject to:

\[
\int_{\mathcal{V}} \beta_v dv = 1,
\]

\[
q_v \geq 1, \quad \forall v \in \mathcal{V},
\]

\[
p_{vq_v} = \kappa^{-1} \alpha(v) q_v^{\eta(v)}, \quad \forall v \in \mathcal{V}.
\]
Individual’s Optimal Consumption Choice

First-order conditions deliver an expression for optimal demand intensity:

$$\beta_v = \frac{q_v}{Q}, \quad \forall v \in V.$$ 

where:
- $$\beta_v \equiv p_v x_v / w$$ demand intensity for variety $$v$$
- $$Q \equiv \int_V q_z dz$$ consumption bundle’s average quality index

Claim The fraction of income spent on variety $$v$$ is determined by its optimal quality relative to the average quality index.
Claim Optimal qualities are increasing functions of productivity

Claim Demand intensities are increasing functions of productivity only for lower-indexed varieties

Increases in consumed qualities generates a *regional* product cycle
Corollary  Let \( \vartheta (v) \equiv \int_0^v \beta_z \, dz \). Then:

(1) \( \forall \kappa \in (0, \kappa) \Rightarrow \frac{\partial \vartheta (v)}{\partial \kappa} = 0, \forall v \in \mathbb{V} \);

(2) \( \forall \kappa \geq \kappa \Rightarrow \frac{\partial \vartheta (v)}{\partial \kappa} \geq 0, \forall v \in \mathbb{V} \).

- Corollary synthesizes our model’s nonhomothetic demand schedules:
  - for \( \kappa < \kappa \), demand schedules are homothetic across varieties
  - for \( \kappa \) above \( \kappa \), income spent ever more on lower-indexed varieties

- As productivity rises, demand deviates towards goods produced by H.
General Equilibrium in the World Economy

Claim  For all $\kappa \leq \kappa$, in equilibrium: $w = 1$ and $m = 0.5$

Proposition  Let $\kappa > \kappa$. Then, in equilibrium:

(1) $w > 1; m < 0.5$;
(2) $\partial w / \partial \kappa > 0; \partial m / \partial \kappa < 0$.

- Wage in country F is taken as the *numeraire*: $w^* = 1$
  - $w$ equals per capita income in country H relative to country F

- Subsistence economy
  - wages in the two countries are levelled
  - varieties produced in H and F are equally split

- Modern economy
  - wages differ and diverge with productivity growth
  - marginal variety shifts leftward: *international* product cycle
Concluding Remarks

- Proposed model with advantages *unrelated* to countries’ development
- Novel finding: trade as a source of divergence for similar countries
- Productivity growth generates two types of product cycle phenomena:
  - *international product cycle* à la Linder-Vernon
  - a novel *regional product cycle* within each economy
- Ongoing research focuses on:
  - success/failure of economies with similar comparative advantages
  - why similar countries trade among themselves