Income Distribution, Product Quality and International Trade

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Motivation

There are systematic patterns of vertical specialization in international trade flows:

- if rich & poor countries export goods of the same product category, then rich countries export those products with higher unit values
- positive correlation between per capita income & quality of exports?
- when a country imports goods of the same product category from different countries, then higher quality goods are imported from higher income countries

- Fajgelbaum et. al. propose a new analytical framework to study trade in vertically differentiated products
- Their model explains for example why Germany exports high-quality cars to Korea while importing low-quality cars from there.
1. The Model- Set-Up
2. Utility Function and Optimization Problem
3. Profits and Prices in the Heterogenous Good Market
4. Autarky Equilibrium
5. Trade Equilibrium with high transport costs
6. Trade Equilibrium with low transport costs
7. Extension: Trade with many quality levels and many countries
1. The Model-Set-Up

- nonhomothetic preferences over goods of differentiated quality
- only one factor of production: labour
- homogenous good requires one unit of eff. labour for production
- perfect competition in homogenous good market
- differentiated products require fixed input & constant variable input
- monopolistic competition in differentiated product market
- assume labour supply to be large enough -> wage is equal to one
- individuals are endowed with different amounts of eff. labour
  -> non-equal distribution of income: income heterogeneity
- each individual buys the unit of differentiated product that yields him
  highest utility, considering price, quality level and other attributes
2. The Utility Function

- $j$ is the index of the individual varieties of the differentiated product
- $J_q$ is the set of varieties that have quality level $q$
- $\varepsilon_j^h$ measures the idiosyncratic evaluation of $j$'s particular attributes

\[ u_j^h = z_q + \varepsilon_j^h \text{ for } j \in J_q \]

- utility function features the complementarity between the QUANTITY of the homogenous and the QUALITY of the differentiated good
- those consumers consuming more of the homogenous good, value the quality of the differentiated good higher
2. The Optimization Problem

- Individuals’ optimization problem:

\[
\max_{q,j} (y^h - p_j) q + \epsilon_j^h
\]

- **Income after paying for variety** \( j \) = quantity of homog. product

- **Quality of variety** \( j \)

- **Evaluation of the particular attributes of variety** \( j \)
3. Profits and Prices in Heterogenous Good Market

- A firm that produces a variety of the differentiated product with quality $q$ earns profits:
  \[ \pi_j = d_j(p_j - c_q) - f_q \]
- $d_j$ denotes aggregate demand for variety $j$.
- The firm maximizes profits by setting a price:
  \[ p_q = c_q + \frac{\theta_q}{q} \text{ for } q \in Q \]
- $\theta_q$ is a dissimilarity parameter (measures degree of heterogeneity in preferences over the varieties in the set $J_q$)

> The bigger the differences among the varieties, the higher the prices, because if my best alternative is quite dissimilar, I tend not to buy it.

> The higher the quality of the heterog. good, the bigger the marginal utility of consumption of the homog. good and the higher price-sensitivity when choosing among the varieties of the heterog. good.
4. Autarky Equilibrium

- Let $x_q$ denote the quantity to be produced by a firm offering a good of quality $q$ to break-even:
  \[ x_q = \frac{f_q q}{\theta_q} \]

- In equilibrium $x_q$ has to be produced by each firm in the market for the differentiated product with quality $q$ (otherwise: exit/enter)

- Demand per variety $j$ with quality $q$ has to be $x_q$, otherwise no firm is producing this variety

  - If $n_q > 0$, then $d_q = x_q$. But if $d_q < x_q$, then $n_q = 0$. \( \sum_{q \in Q} n_q x_q = N \)

Proposition 1: If $Q \in \{H, L\}$ there exists a unique autarky equilibrium with $n_H > 0$ and $n_L > 0$
4. Autarky Equilibrium

- consequences of an increase in population \((N \uparrow)\)
  - \(d_q \uparrow\) for both quality levels H and L
  - if \(\theta_H = \theta_L\) proportionally same \# of entrants: \(\hat{n}_H = \hat{N} = \hat{n}_L > 0\)
  - We assume \(\theta_H > \theta_L\), therefore \(\hat{n}_H > \hat{N} > \hat{n}_L > 0\)

- consequences of an upward shift in income distribution (FOSD)
  - added income makes it more likely to buy a high-quality product
  - \(d_H \uparrow, d_L \downarrow\) and therefore: \(\hat{n}_H > 0 > \hat{n}_L\)

- consequences of an increase in income inequality
  - poorest buy more low quality, richest buy more high quality
  - if in initial distribution more low quality consumed, \(-\) \(\hat{n}_H > 0 > \hat{n}_L\)
5. Trade Equilibrium with high transport costs

- two countries $R$ (Rich) and $P$ (Poor) with equal wages
- trade costs: $\tau_q$ of effective labour to ship an unit of quality $q$
- $\tau_q \to \infty$, autarky equilibrium will be realized
- If trading costs are high enough, both countries produce both quality levels
- to serve foreign consumers, firms have costs: $c_q + \tau_q$ (instead of $c_q$)
- they maximize profits by charging price $p_q = c_q + \tau_q + \frac{\theta_q}{q}$
  - profit margins equal for all sales, shipping is paid by consumers
  - break-even quantity is unchanged $x_q$ but can be written as:
    \[ x_q = d^R_q + \lambda_q d^P_q = d^P_q + \lambda_q d^R_q \] which implies $d^R_q = d^P_q$
Proposition 2: If trade costs are sufficiently high, there exists a unique trade equilibrium in which each country produces both high- and low-quality differentiated products. In this equilibrium:

(i) If $N^R > N^P$ and $G^R(y) = G^P(y)$ for all $y$, then $R$ has net-exports of high-quality goods.

(ii) If $N^R = N^P$ and $G^R(y) < G^P(y)$ for all $y$, then $R$ has net-exports of high-quality goods and has net-imports of low-quality goods.

(iii) If $N^R = N^P$, initially more low-quality products are consumed in all income-groups in both countries and $G^R(y)$ is a mean-preserving spread of $G^P(y)$ then $R$ has net-exports of high-quality goods and has net-imports of low-quality goods.
5. Trade Equilibrium with high transport costs

Proposition 3: In a trade equilibrium with incomplete specialization, a decline in trade cost $\tau_q$ raises the effective number of brands of quality $q$ and reduces the effective number of brands of quality $q' \neq q$ in both countries. Any reduction in trade costs must benefit the average member of some income group. If, as a result of reduction in trade costs, the effective number of high-quality (low quality) varieties falls in some country, then the highest-income (lowest-income) groups in that country may lose.

- Those individuals, that would have purchased the variety that is not on the market anymore lose.
- Others may benefit, if they now consume a good of quality $q$ instead of a good with another quality level.
5. Trade Equilibrium with high transport costs
6. Trade Equilibrium with low transport cost

Proposition 4: Suppose demand for all quality-levels in country R is higher than in country P and trade costs are sufficiently small. Then all goods are produced in country R, if trade costs are low enough.

Corollary: Suppose that trade costs are sufficiently small.
   (i) If $G^R(y) = G^P(y)$ for all $y$ and $N^R > N^P$, then only country R is producing and exporting.
   (ii) If $N^R = N^P$ and $G^R(y) < G^P(y)$ for all $y$, then country R only produces high-quality goods and country P only produces low-quality goods.
7. Many Quality Levels and Many Countries

- $Q$ quality levels and $K$ countries (equal population, non-equal wealth)
- A country $k'$ is called richer than another country $k$ if it has (for any two diff. income-levels) relatively more consumers at the higher level of income.

**Proposition 5:** Suppose all quality levels are produced in all countries. Then for every pair of countries $(k, k')$ with $k'$ being richer than $k$, there is a cutoff-quality level $q^*(k, k')$ such that country $k'$ exports on net to country $k$ all goods with quality greater than or equal to $q^*(k, k')$ and imports on net good with quality less than $q^*(k, k')$. 
Proposition 6: Suppose each quality level is only produced in one country. Then, if the relatively poorer country $k$ produces quality $q$ and the relatively richer country $k'$ produces quality $q'$, then $q' > q$.

Proposition 7: Suppose transport costs are very small. Then, if the relatively poorer country $k$ and the relatively richer country $k'$ import goods of quality $q$ and $q' > q$, then $k'$ imports relatively more of quality $q'$.

implies that every country imports higher-quality goods from richer countries and is therefore consistent with the observation that Germany exports high-quality cars to Korea and imports low-quality cars from there.
• The model yields predictions about the pattern of trade that are consistent with empirical evidence.

• Trade between two countries with different wealth tends to benefit the poorer consumers in the richer country and the richer consumers in the poorer country.

• If transport costs are low enough, rich countries do specialisation on high-quality products, because for these products there is a quite large home-market (home-market effect), whereas poor countries tend to produce the low-quality products.

• If transport costs are high (but not too high) all quality levels are produced in all countries but the rich country is still a net-exporter of high-quality goods and the poor country is a net-exporter of low-quality goods.

• If transport costs are very high there might be no trade at all.
Thank you for your attention!

If you are interested, you may have a look into the original paper: