

A Ricardian Model with a Continuum of Goods under Nonhomothetic Preferences: Demand Complementarities, Income Distribution, and North-South Trade

Kiminori Matsuyama

Northwestern University

July, 2012

Motivation

- Most studies assume that consumers have homothetic preferences (for analytical convenience)
 - this assumption is rejected empirically
 - homothetic preferences are not appropriate to address a number of issues
 - product cycles: a new product is born in North, as only rich consumers can afford to purchase it
- It is important to take into account nonhomotheticity of preferences (especially when one talks about policies)
- The paper develops a tractable Ricardian model of trade with nonhomothetic preferences

The Model

- There is a continuum of competitive industries indexed by $z \in [0, \infty)$
- The only factor of production is labor
- Labor requirements: $a(z)$ and $a^*(z)$
- $a^*(z)/a(z)$ is decreasing
- Foreign is numeraire: $w^* = 1$

The Model: Production

- The price of good z is then

$$p(z) = \min(wa(z), a^*(z)).$$

- As a result, there is a marginal product m such that Home produces only goods in $[0, m]$ and Foreign produces only goods in (m, ∞) .
- The marginal product is determined by

$$w = \frac{a^*(m)}{a(m)}.$$

- This part of the model is the same as that in the Dornbush-Fischer-Samuelson model.

The Model: Consumption

- There are N households in Home and N^* households in Foreign
- There is income distribution due to skill differences: $F(h)$ and $F^*(h^*)$
 - a household with h units of effective labor earns wh

- The utility is given by

$$U = \int_0^{\infty} b(z)x(z)dz,$$

where $x(z) \in \{0, 1\}$ and $b(z)$ the utility weight attached to good z .

- $b(z)/a(z)$ and $b(z)/a^*(z)$ are decreasing implying that $b(z)/p(z)$ is decreasing

The Model: Consumption

- Households purchase products starting with index 0 and so on, when the income is exhausted.
- Home has a comparative advantage in lower-indexed products, which even poor households purchase. Foreign has a comparative advantage in higher-indexed goods, which are purchased by wealthier households.
- We then define

$$E(z) = \int_0^z p(s) ds,$$

as the total spending on products from $[0, z]$.

- Then, a Home household with income wh chooses $x(z) = 1$ if $wh \geq E(z)$, $x(z) = 0$ if $wh < E(z)$ (the household does not have enough income to purchase the product).
- Same for the Foreign households

Labor Market Clearing Condition

- Perfect competition: total revenues are equal to the total labor income

$$wN \int_0^{\infty} h dF(h) = N \int_0^{\infty} \min\{wh, E(m)\} dF(h) + N^* \int_0^{\infty} \min\{h^*, E(m)\} dF^*(h^*).$$

- Same for Foreign:

$$N^* \int_0^{\infty} h^* dF^*(h^*) = N \int_0^{\infty} \max\{wh - E(m), 0\} dF(h) + N^* \int_0^{\infty} \max\{wh - E(m), 0\} dF^*(h^*).$$

Trade Balanced Condition

- Trade is balanced meaning that

$$N^* \int_0^\infty \min\{h^*, E(m)\} dF^*(h^*) = N \int_0^\infty \max\{wh - E(m), 0\} dF(h).$$

- Taking into account that

$$E(m) = \int_0^m p(s) ds = w \int_0^m a(s) ds,$$

we derive that

$$N \int_0^\infty \max\{h - \int_0^m a(s) ds, 0\} dF(h) = N^* \int_0^\infty \min\{h^*/w, \int_0^m a(s) ds\} dF^*(h^*)$$

Comparison to the DFS model

There are three main differences:

- In the DFS, income distribution does not play any role because of homothetic preferences. In the present setup, the equilibrium values of m and w depend on the distribution of h and h^* .
- Second, as w goes to zero, m goes to some positive number (0 in the DFS).
 - in the DFS, as the Home wage becomes cheaper (and therefore the price of Home goods), all the households increase the amount of consumption of Home goods, which increases demand for Home labor. To maintain the labor market clearing condition, m should go down. As a result, if $w = 0$, then $m = 0$.
 - In the current model, the households do not increase the amount of consumption of lower-indexed goods when their prices go down. For this reason, Home must continue to produce a certain range of lower-indexed products to keep all the Home labor employed.

Comparison to the DFS model

- Third, there is asymmetry between $a(z)$ and $a^*(z)$. Reducing $a(z)$ and hence the prices of the Home goods shifts spending toward Foreign goods increasing relative demand for Foreign labor. As a result, Home must expand its production.
- $a^*(z)$ in turn does not affect the labor market clearing condition.
- We have the asymmetry!!!

Homogenous Population

- We assume homogenous households: $h = h^* = 1$.
- The labor market clearing condition is then

$$wN = N \min\{w, E(m)\} + N^* \min\{1, E(m)\}.$$

- Note that since Foreign imports some goods produced in Home, Home has to import some Foreign goods in exchange. That is, $w > E(m)$. Then,

$$wN = NE(m) + N^* \min\{1, E(m)\}.$$

- The latter can be rewritten as follows:

$$\int_0^m a(s) ds = \frac{N}{N + N^*} \text{ if } w \leq 1 + \frac{N^*}{N}$$

$$\int_0^m a(s) ds = 1 - \frac{N^*}{wN} \text{ if } w > 1 + \frac{N^*}{N}.$$

- PICTURE!

Equilibrium: North-South Trade

- We assume that $a^*(z) < a(z)$ for all z . Home is less developed South, Foreign is high-income North: $w < w^* = 1$.
- Then, the equilibrium can be seen at the picture.
- From the budget constraints:

$$w = w \int_0^m a(s) ds + \int_m^u a^*(s) ds,$$

where u is the index of last good consumed by the Home households: some measure of utility at Home.

- For Foreign,

$$1 = w \int_0^m a(s) ds + \int_m^{u^*} a^*(s) ds.$$

- As Foreign is richer, $u^* > u$ (recall that $u > m$). PICTURE from the paper!

North-South Trade: Changes in Productivities

A productivity improvement in the North:

- $a^*(z)$ goes down uniformly.
- m does not change, w goes down $\implies u^*$ goes up. As a result, Foreign gains and new industries are born in the North.
- What about Home?
- In the class, it was shown that u does not change and, therefore, Home welfare does not change as well. Lower wage is exactly compensated by lower prices of foreign products. There is no positive spillover effect to South (in contrast to the DFS model).
- **Intuition:** a decrease in $a^*(z)$ results in an increase of income of North households. Therefore, demand increases only for Northern products. As a result, the South is not directly affected.
- Comparison with the DFS.

North-South Trade: Changes in Productivities

A productivity improvement in the South:

- $a(z)$ goes down uniformly
- m increases unambiguously: some industries migrate from North to South
- It can be shown that u^* goes up, so the North gain
 - the pattern of product cycles emerges: the birth of new industries in the North and the migration of some industries from South to North.
- The effect on w and, thereby, u is unclear in general: the South can even lose!!!!
- **Intuition:** South is specialized in goods whose demand does not go up in response to a rising income. South's productivity improvement, without generating an increase in demand for its goods, reduces the demand for southern labor.

Conclusion

- A tractable Ricardian model of trade with nonhomothetic preferences
- Income distribution plays a role
- Assymetry in the effects of productivity changes:
 - North is always better off from a rise in its productivity
 - South can be even worse off from a rise in its productivity