International Trade Theory (1/2008)
Chulalongkorn University
Lecture 2: Extensions of the Ricardian Model

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In this lecture, we will relax some of assumptions in the Ricardian Model to make this model more realistic.

Many goods

First, we consider the case of two countries, one factor; however, many goods. Suppose that each country is able to produce a large number of goods, N. Goods are labeled from 1 to N. Technology that each country uses can be described by unit labor requirement like we have in the last chapter. Suppose that a_{Li} is the unit labor requirement to produce one unit of good i in Canada, i={1,…,N} and a_{Li}^* is the unit labor requirement to produce one unit of good i in Japan.

For any good, we can calculate the ratio of Canada's unit labor requirement to Japan's and rank the ratio in increasing order as follows:

$$\frac{a_{L1}}{a_{L1}^*} < \frac{a_{L2}}{a_{L2}^*} < ... < \frac{a_{LN}}{a_{LN}^*}$$

Next, in order to determine the pattern of trade or comparative advantage of each country, we need to know the ratio of Home to Foreign wages. Logically, the good will be produced in Canada if it is less costly to do so. The unit cost of good i in Canada is cheaper than in Japan when:

$$wa_{Li} < w^* a_{Li}^*$$

Or equivalently:

$$\frac{a_{Li}}{a_{Li}^*} < \frac{w^*}{w}.$$

We have ranked the goods according to increasing order. Therefore, there exists a cut-off point of good i=n in which:

$$\frac{a_{Ln}}{a_{Ln}^*} = \frac{w^*}{w}$$

Hence, all goods left to "n", i.e. i={1,…,n} will be exported by Canada (Canada has comparative advantage in good 1,…,n) and all good right to "n", i.e. i={n,…,N} will be exported by Japan.

Transportation Cost and Non-traded goods

We now extend the Ricardian model closer to the reality by introducing transportation costs. Samuelson (1954) introduces a simple way to include transportation costs into the Ricardian model. This idea is called the "iceberg transportation costs": of each unit of a good leaving an origin, only a fraction reaches the destination, similar to an iceberg melts away in transit.

Assume that when one unit of each good are exported, only a fraction g of the good reaches its destination. In this case, Canada will produce good i itself if:

$$wa_{Li} < w^* a_{Li}^* / g$$

$$\frac{a_{Li}}{a_{Li}^*} < \frac{w^*}{gw}$$

Similarly, Japan will produce good i itself if:

$$wa_{Li} / g > w^* a_{Li}^*$$

$$\frac{a_{Li}}{a_{Li}^*} > \frac{gw^*}{w}$$

Therefore, good i are non-traded goods if they are such that :

$$\frac{w^* g}{w} < \frac{a_{Li}}{a_{Li}^*} < \frac{w^*}{gw} .$$

Therefore, transportation costs can discourage trade. We can use the same logic to show that sufficiently high transportation costs (with sufficiently low g) can eliminate all trades between Canada and Japan.

Tariffs and Non-traded goods

Similar to transportation cost, tariffs can eliminate trade as well. Suppose that Canada decides to add the ad valorem tariff on imported goods (regardless of the good). Then the domestic price of the imported good becomes $p = p^w(1+t)$. (Suppose that p is the relative price of chips to fish). Suppose that p^A is the autarky price, then Canada will import goods from Japan if $p^A > p^w(1+t)$ or $p^A /(1+t) > p^w$. We can apply the similar logic to the case that Canada imports fish instead to derive that Canada will import if $p^A(1+t) < p^w$. Therefore, if the government decides to impose the ad valorem tariff t on imports regardless of the good, then if the world price lies in the interval $p^A(1+t) < p^w < p^A(1+t)$, Canada and Japan will not trade with each other.

Problems of the Ricardian Model

1. Endogenous variables are not continuously differentiable function of parameters.
2. Extreme patterns of specialization are not believable.
3. Difficult to think about empirical works to test.

Continuum-of-good Model (DFS model, AER 1977)

Dornbusch, Fischer, and Samuelson (1977) fix the first problem by introducing a continuum-good model. Consider a continuum of goods on an interval [0,1]. Given $a(z)$ and $a^*(z)$ are the unit labor requirements of good z with:

$$A(z) = \frac{a^*(z)}{a(z)} \qquad \text{and } A'(z) < 0 \text{ from the ranking .}$$

Any good will be produced at home if:

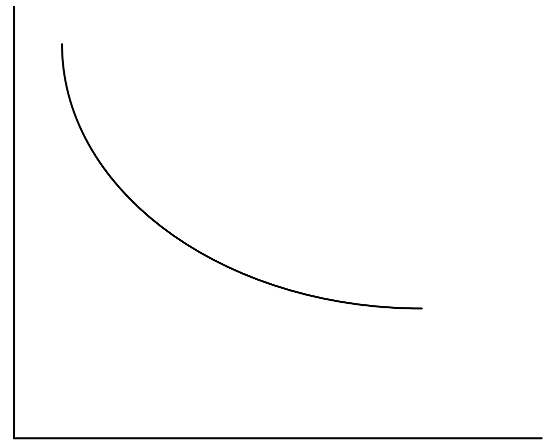
$$wa(z) < w^* a^*(z)$$

Or equivalently,

$$A(z) > \frac{w}{w^*} .$$

Given $\omega = \frac{w}{w^*}$ as a relative wage, Canada will efficiently produce good z if and only if $0 \le z \le \tilde{z}(\omega)$ with $\tilde{z}(\omega) = A^{-1}(\omega)$. In the same way, Japan will produce good z in the interval $\tilde{z}(\omega) \le z \le 1$.

From our setting, we can plot $A(z)$ as follows:



<u>Demand</u>

- Uniform homothetic Cobb-Douglas utility function
- Constant budget share b_i for commodity i.
- $b_i = b_i^*$ from identical taste
- $\int_0^1 b(z)dz = 1$ with $b(z) = \frac{p(z)c(z)}{y}$ y = income
- Fraction of income spent in Canada's produced goods are:

$$v(\tilde{z}) = \int_0^{\tilde{z}} b(z)dz > 0$$

$$1 - v(\tilde{z}) = \int_{\tilde{z}}^1 b(z)dz > 0$$

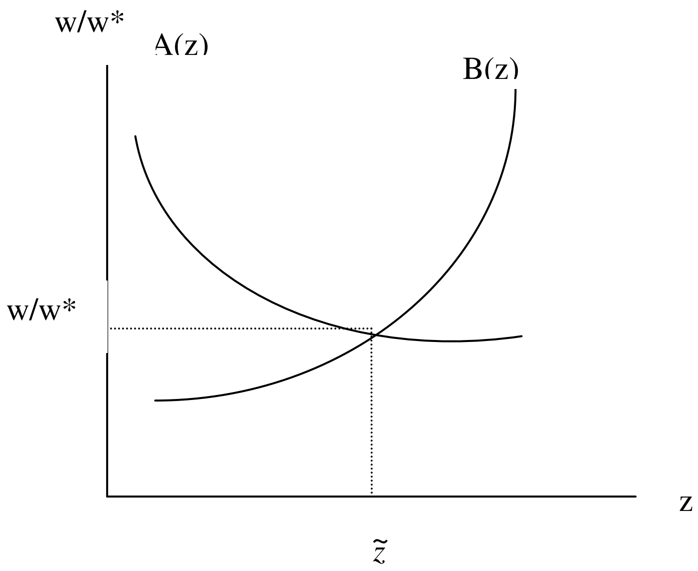
With $v'(\tilde{z}) = b(\tilde{z}) > 0$

<u>Equilibrium relative wages and specialization</u>

Equilibrium requires Canada income equals world spending on Canada goods:

$$wL = v(\tilde{z})[wL + w^* L^*]$$

$$\frac{w}{w^*} = \frac{v(\tilde{z})}{1 - v(\tilde{z})} \frac{L^*}{L} = B(\tilde{z}; \frac{L^*}{L}) \text{ with } B'(z) > 0$$


w/w*
A(z)
B(z)
w/w*
z
$\tilde{z}$