The Ricardian Model

Part 1: Dornbush, Fischer and Samuelson (1977)

International Trade (PhD), Fall 2019

Ahmad Lashkaripour

Indiana University

Roadmap

– In the next two classes, I show how the Armington gravity equation can be reproduced using a Ricardian model that builds on a rich micro-foundation.

– Today, I cover the two-country many goods Ricardian model: *Dornbusch, Fischer, and Samuelson (1977, AER)*

– Next class, I cover the many-country, many goods Ricardian model: *Eaton and Kortum (2002, Econometrica)*

Environment

- Two countries: Home (H) and Foreign (F).

- A continuum of homogeneous goods $z \in [0, 1]$.

- Labor is the only factor of production:
  - Country $i \in \{H, F\}$ is populated by L_i workers.
  - Each worker is paid a wage, w_i.

- Perfect competition + constant returns to scale.

Demand

– The representative consumer in country $j \in \{H, F\}$ has a Cobb-Douglass utility

$$U_j(\mathbf{q}) = \int_0^1 b(z) \ln q(z) dz$$

- z indexes the good.
- $b(z)$ is the share of expenditure on good z.
- by assumption: $\int_0^1 b(z) dz = 1$

Demand

– Utility maximization implies

$$\begin{cases} p_H(z)q_H(z) = b(z)Y_H \\ p_F(z)q_F(z) = b(z)Y_F \end{cases}.$$

– $p_i(z)q_i(z)$: expenditure on good z in country i.

– $Y_i = w_i L_i$: total income in country i

Supply

Let $a_i(z)$ denote the unit labor requirement for producing good z in country i.

Order the goods so that $A(z) \equiv \frac{a_F(z)}{a_H(z)}$ is decreasing.

- H has a comparative advantage in the low-z goods.
- F has a comparative advantage in the high-z goods.

– Assume $A(z)$ is strictly monotone.

Supply

– Suppose trade is costless: $p_H(z) = p_F(z) = p(z)$.

– Good z will be produced by H if

$$a_H(z)w_H < a_F(z)w_F \iff A(z) > \frac{w_F}{w_H}$$

– Good z will be produced by F if

$$a_H(z)w_H > a_F(z)w_F \iff A(z) < \frac{w_F}{w_H}$$

Equilibrium

- ***Equilibrium Outcomes:***
  1. relative wage $\omega = \frac{w_H}{w_F}$
  2. cut-off $\tilde{z}$, such that
     - H produces every good $z \in [0, \tilde{z}]$;
     - F produces every good $z \in [\tilde{z}, 1]$.

- ***Equilibrium Condition 1:***

$$A(\tilde{z}) = \omega$$

Equilibrium

– Let $\theta(\tilde{z}) \equiv \int_0^{\tilde{z}} b(z)dz$ denote the fraction of income spent on goods produced in H.

– ***Equilibrium Condition 2*** [Balanced Trade]

$$\underbrace{\theta(\tilde{z}) w_F L_F}_{\text{Home exports}} = \underbrace{[1 - \theta(\tilde{z})] \, w_H L_H}_{\text{Home imports}}$$

– Note that $B'(.) > 0$.

Equilibrium

– Let $\theta(\tilde{z}) \equiv \int_0^{\tilde{z}} b(z)dz$ denote the fraction of income spent on goods produced in H.

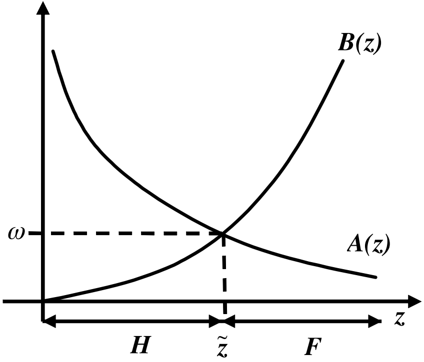
– ***Equilibrium Condition 2*** [Balanced Trade]

$$\omega = \frac{\theta(\tilde{z})}{1-\theta(\tilde{z})}\left(\frac{L_F}{L_H}\right) \equiv B(\tilde{z})$$

- Note that $B'(.) > 0$.

Equilibrium

– Equilibrium conditions 1 and 2 jointly determine $(\tilde{z}, \omega)$



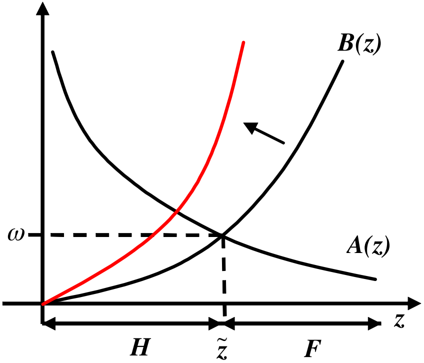
Gains from Trade

- Assign Home labor as the numeraire: $w_H = 1$
- After opening to trade
  - $Y_H = w_H L_H = L_H$ remains the same
  - $p_H(z)$ remains the same if z is not imported
  - $p_H(z)$ decreases if z is imported.
- So, Home gains from trade!

Comparative Statics

Question: What happens if $\frac{L_F}{L_H}$ goes up?

Answer: $\omega = \frac{w_H}{w_F}$ goes up and $\tilde{z}$ goes down (intuition?)



Welfare Analysis

Claim: if L^F/L^H increases:

- Home's welfare improves
- Foreign's welfare worsens.

Proof

- $Y'_H = Y_H = L_H$, by choice of numeraire ($w_H = 1$).
- If good z's production remains at H:

$$p_H(z) = p_H(z)'$$

- If goods z's production remains in F:

$$w'_F < w_F \implies p_H(z)' = w'_F a_F(z) < p_H(z)$$

- If goods z's production moves to F:

$$w'_F a_F(z) \leqslant a_H(z) \implies p_H(z)' < p_H(z)$$

Trade Costs

– Until now, we assumed costless trade $\Longrightarrow p_H(z) = p_F(z)$

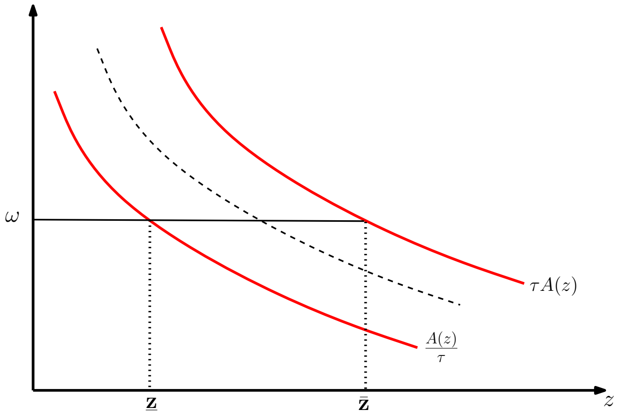
– Suppose trade is subject to an iceberg trade cost, $\boldsymbol{\tau}$:
  - Home will export good z if $\boldsymbol{\tau} w_H a_H(z) \leqslant w_F a_F(z)$
  - Foreign will export good z if $w_H a_H(z) \geqslant \boldsymbol{\tau} w_F a_F(z)$

– Define $\underline{z}$ such that: $\boldsymbol{\tau} w_H a_H(\underline{z}) = w_F a_F(\underline{z})$

– Define $\bar{z}$ such that: $w_H a_H(\bar{z}) = \boldsymbol{\tau} w_F a_F(\bar{z})$

  - Home will produce and export $z \in [0, \underline{z}]$
  - Foreign will produce and export $z \in [\bar{z}, 1]$
  - Goods $z \in [\underline{z}, \bar{z}]$ are non-traded.

Trade Costs



– See Dornbush, Fischer and Samuelson (1977) for the generalized trade balance equation that pins down ω in the presence of trade costs.

Extensions of DFS1977

– Costinot (2009): extends the analytical results to many countries and many goods.

– Matsuyama (2000)
  - Non-homothetic preferences: goods are indexed according to priority.
  - H has a comparative advantage in low-priority goods.

– Eaton, and Kortum (2002)
  - Parametric assumption on the distribution of $a_i(z)$'s.
  - Closed-form gravity equation in a multi-country framework.

A Limitation of the Ricardian Model

– The Ricardian model is silent about **the origins of cross-national productivity differences**.

– A big body of literature on *"Institutions and Trade"* seeks to answer to this question:

- Acemoglu, Antras, & Helpman (2007), Antras (2005), Costinot (2009), Levchenko (2007); Nunn (2007); Vogel (2007); Beck (2000), Kletzer & Bardhan (1987); Matsuyama (2005); Manova (2007); Davidson, Martin, & Matusz (1999); Cunat & Melitz (2007), Helpman & Itskhoki (2006).

Institutions and Trade

- **Basic Idea:**[1]
  1. Even if firms have access to the same technological know-how around the world, institutional differences across countries may affect how firms organize their production process.
  2. If institutional differences affect productivity relatively more in some sectors, then institutions become source of comparative advantage.

- **General Theme:**
  - Countries with "better institutions" tend to be relatively more productive, and so to specialize, in sectors that are more "institutionally dependent"

[1] Borrowed from Costinot and Donaldson's lecture notes.