Lecture 2: Ricardian Comparative Advantage

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Outline of Lecture 2

- Ricardian Model
- Extension to a Continuum of Goods: Dornbusch Fischer Samuelson (1977)

Ricardian Trade Theory: Bottom Line

- countries specialize according to *comparative*, not absolute productivity advantage
- a country has comparative advantage in a good if to produce it, less of the other good is sacrificed than in the other country.
- all countries gain from reallocating resources to comparative advantage sectors, rather than diversifying production
- Ricardo's 1817 model is the basis for the Eaton Kortum (2002) stochastic comparative advantage model

The Ricardian model: Assumptions

- 2 countries, Home and Foreign. Foreign variables denoted by stars.
- 1 factor: labor. Endowments L and L^*.
- 2 sectors: $i = 1, 2$. labor unit requirements a_i and a_i^*, e.g. $y_i = \frac{L_i}{a_i}$.
- labor is perfectly mobile across sectors and perfectly immobile across countries.
- perfect competition, constant returns
- convex, homothetic and identical preferences, representative consumer

Comparative and Absolute Advantage

- Suppose that a given quantity of labor allows Portugal to produce 20m of cloth (good 1) or 300l of wine (good 2), and England to produce 10m of cloth or 100l of wine.
- Portugal has **absolute advantage** in both sectors.
- England has **comparative advantage** in cloth because the relative opportunity cost of producing cloth rather than wine is lower than in Portugal:

$$\frac{a_1}{a_2} < \frac{a_1^*}{a_2^*} \Leftrightarrow \frac{\frac{1}{10}}{\frac{1}{100}} < \frac{\frac{1}{20}}{\frac{1}{300}}$$

- Producing cloth sacrifices less wine in England than in Portugal.
- The labor mobility, perfect competition and CRS assumptions make that ratio equal to relative prices in autarky...

The Ricardian model: Autarky Equilibrium

- goods market-clearing conditions
- perfect competition: price equals unit cost (zero profit condition)

$$w = \frac{p_1}{a_1} = \frac{p_2}{a_2} \Leftrightarrow p^a \equiv \frac{p_1}{p_2} = \frac{a_1}{a_2} \quad (ZP_{Home})$$

$$w^* = \frac{p_1^*}{a_1^*} = \frac{p_2^*}{a_2^*} \Leftrightarrow p^{a^*} \equiv \frac{p_1^*}{p_2^*} = \frac{a_1^*}{a_2^*} \quad (ZP_{Foreign})$$

  if both goods are produced, labor mobility equalizes wages
- full employment: labor market-clearing conditions

$$a_1 y_1 + a_2 y_2 = L \quad (FE_{Home})$$

$$a_1^* y_1^* + a_2^* y_2^* = L^* \quad (FE_{Foreign})$$

- equilibrium relative prices are equal to the slope of the PPF and the consumer's MRS

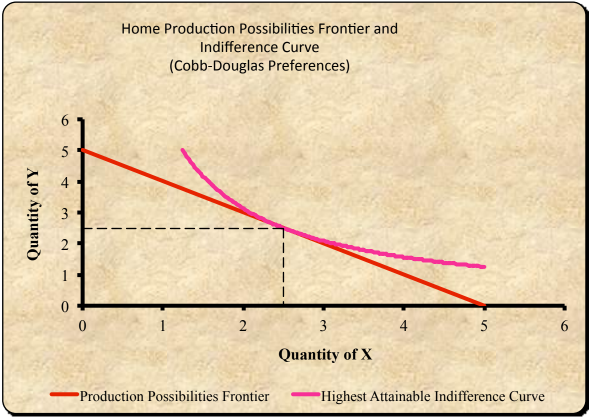

Figure: Autarky equilibrium.

The Ricardian model: Free Trade Equilibrium

- At a free trade equilibrium:
  - unique price, new world market-clearing conditions
  - same (ZP) conditions, but some sectors may not produce
  - same (FE) conditions, but some sectors may not produce
- Suppose $p^a < p^{a^*}$. The world relative price p is such that:
  - If $p > p^{a^*}$ both countries specialize in 1, no equilibrium.
  - If $p < p^a$, both countries specialize in 2, no equilibrium.
  - If $p = p^a$, Home diversifies as in autarky, while Foreign specializes in 2.
  - If $p = p^{a^*}$ Foreign diversifies as in autarky, while Home specializes in 1.
  - If $p^a < p < p^{a^*}$, Home specializes in 1 and Foreign in 2.

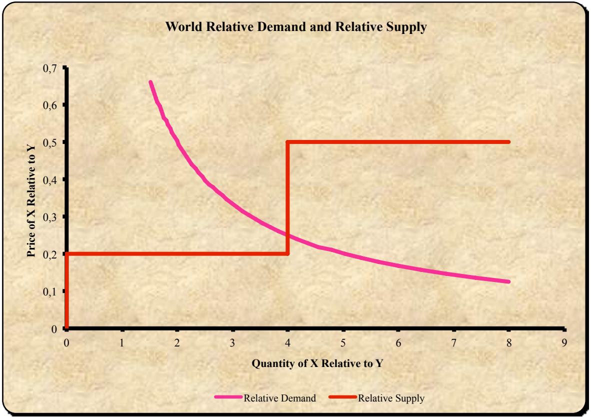

Figure: Free trade equilibrium with full specialization.

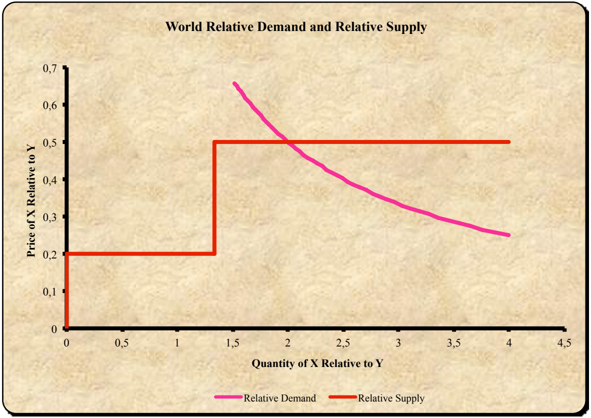

Figure: Free trade equilibrium with incomplete specialization.

The Ricardian model: Gains from Trade

- Autarky equilibria lie at the tangency of the PPF and indifference curves: A and A^*.
- At world relative price p both countries specialize in their comparative advantage good.
- Trade Equilibria lie at the tangency of the PPF and the new price line: C and C^*.

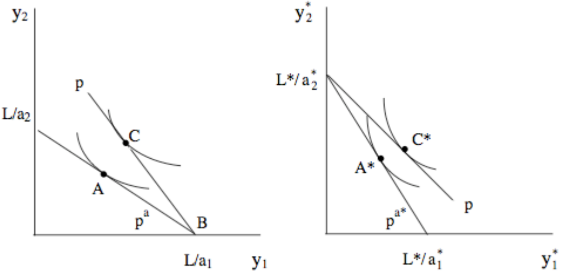

Figure 1.1(a): Home Country **Figure 1.1(b): Foreign Country**

Extension: Dornbusch Fischer Samuelson (1977)

Additional assumptions:

- **continuum** of goods indexed by $z \in [0, 1]$
- goods ranked by relative productivity: $A(z) \equiv \frac{a^*(z)}{a(z)}$ decreasing and continuous.
- identical Cobb-Douglas preferences:

$$ln(U) = \int_0^1 b(z) ln[c(z)] dz$$

b(z) budget share of good z, $\int_0^1 b(z)dz = 1$, $\forall z, b(z) = b^*(z)$

- Home has comparative advantage in low-index goods, since $A(z)$ is decreasing.

$$z < z' \Leftrightarrow A(z) > A(z') \Leftrightarrow \frac{a^*(z)}{a(z)} > \frac{a^*(z')}{a(z')} \Leftrightarrow \frac{a(z)}{a(z')} < \frac{a^*(z)}{a^*(z')}$$

- Consider the cutoff good $\bar{z}$ defined by:

$$a(\bar{z})w = a^*(\bar{z})w^* \Leftrightarrow \frac{w}{w^*} = \frac{a^*(\bar{z})}{a(\bar{z})} \qquad \text{(S)}$$

- At given wages, Home can price out Foreign in goods with $z < \bar{z}(w, w^*)$, and vice-versa for goods with $z > \bar{z}(w, w^*)$.

Dornbusch Fischer Samuelson (1977): Trade Equilibrium

- Utility maximization implies demand for good z

$$D(z) = \frac{b(z)wL}{p(z)}; \qquad D^*(z) = \frac{b^*(z)w^*L^*}{p^*(z)}$$

- Denote $B(z) = \int_0^z b(s)ds$. Home income equals world expenditure spent on Home goods:

$$wL = B(\bar{z})(wL + w^*L^*) \Leftrightarrow \frac{w}{w^*} = \frac{B(\bar{z})}{1 - B(\bar{z})} \frac{L^*}{L} \qquad \text{(D)}$$

- Notice that (D) is equivalent to a trade balance condition.

$$\underbrace{(1 - B(\bar{z}))wL}_{\text{Home imports}} = \underbrace{B(\bar{z})w^*L^*}_{\text{Home exports}}$$

- (D) and (S) characterize the equilibrium.
- Full specialization: $z < \bar{z}$ produced at Home, $z > \bar{z}$ in Foreign.

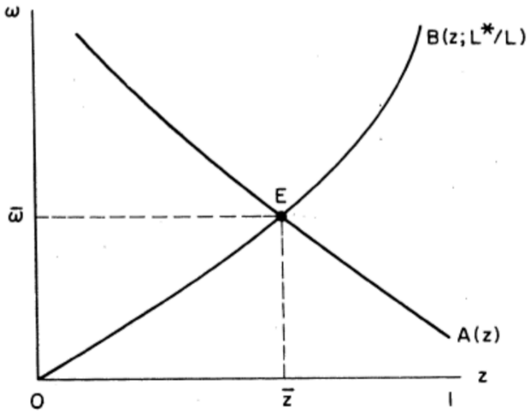

FIGURE 1

Figure: Free trade equilibrium in the Dornbusch et al. (1977) model.

Gains From Trade

- Set the Home wage w as the numeraire.
- Indirect utility is homogenous of degree zero.
  $v(\{p(z)\}, wL) = v(\{\frac{p(z)}{w}\}, L)$ which depends only on goods prices.
- $z < \bar{z}$ goods are produced at Home under both autarky and free trade. No change in their relative price.
- The production of $z \geq \bar{z}$ goods moves to Foreign, but their price falls $\frac{p(z)}{w} = a^*(z)\frac{w^*}{w} < a(z)$
- Since all prices are constant or go down and income is constant, indirect utility must go up.

Three Applications

We will now consider 3 applications of the Dornbusch et al. (1977) model:

- Increase in size of one country
- Technological progress in one country
- Trade costs and nontraded goods

Increase in Size

- Consider an increase in L^* holding L constant (eg. new trade partner).
- The (D) schedule rotates leftwards, while the (S) schedule is unaffected.
- Home produces fewer goods, but the relative Home wage increases.
- Intuition:
  - at the initial wage there is excess supply of Foreign labor and excess demand of Home goods.
  - downward pressure on Foreign wages, upward pressure on Home wages, until a new equilibrium is reached.
  - alternative interpretation: prices and wages adjust to eliminate the initial Home trade surplus.
- The real wage increases in Home, falls in Foreign.

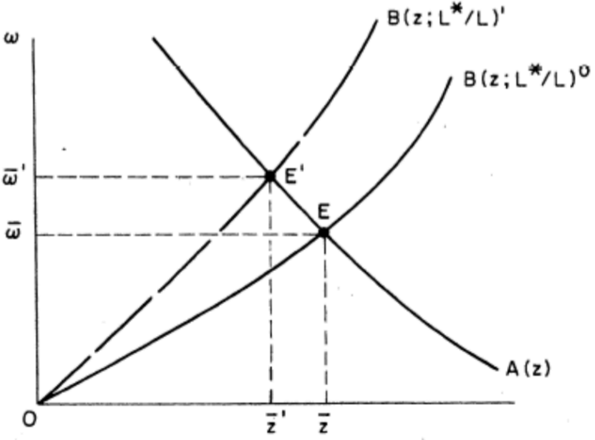

Figure: Increase in Foreign size in the Dornbusch et al. (1977) model.

Technological Progress

- Consider a proportional fall in $a^*(z)$ in Foreign for all z.
- The (S) schedule shifts downwards, the (D) schedule is unaffected.
- Home produces fewer goods and the relative Home wage falls, though proportionately less.
- Intuition:
  - Home loses comparative advantage in some goods. Lower labor demand means lower wages.
  - alternatively: prices and wages adjust to eliminate the initial Home trade deficit
- The real wage increases in Foreign but also in Home (improved terms of trade).

Trade Costs

- Consider an ad-valorem cost $t - 1 > 0$ on cross-border flows.
- (S) is replaced by two conditions

$$a(\bar{z})w = ta^*(\bar{z})w^* \qquad \Leftrightarrow \frac{w}{w^*} = t\frac{a^*(\bar{z})}{a(\bar{z})}$$

$$ta(\hat{z})w = a^*(\hat{z})w^* \qquad \Leftrightarrow \frac{w}{w^*} = \frac{1}{t}\frac{a^*(\hat{z})}{a(\hat{z})}$$

- Endogenous range of nontraded goods $[\hat{z}; \bar{z}]$, increasing in t.
- Home spends a fraction $B(\bar{z})$ of income on domestic goods, while Foreign spends a fraction $B(\hat{z})$, so that:

$$wL = B(\bar{z})wL + B(\hat{z})w^*L^* \Leftrightarrow \frac{w}{w^*} = \frac{B(\hat{z})}{1 - B(\bar{z})}\frac{L^*}{L}$$

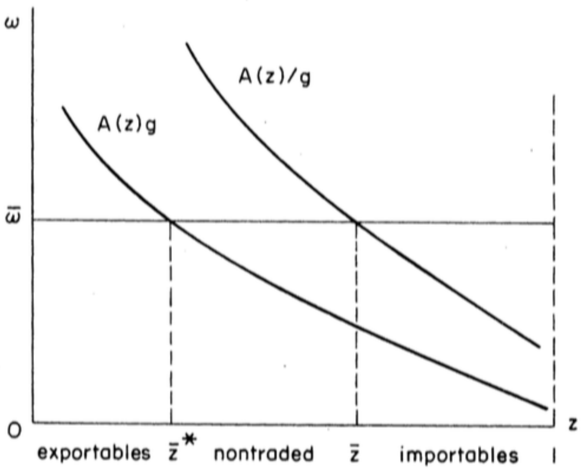

Figure: Comparative advantage for given wages in the Dornbusch et al. (1977) model with trade costs. (g corresponds to $\frac{1}{t}$ in the text.)

Extension: the Eaton-Kortum Model

- Multi-country extension of DFS (1977) with *random* productivity.
- Countries are *more likely* to export where they have comparative advantage, but full specialization is unlikely.
- For each good z each country i draws productivity $\frac{1}{a(z)}$ from a Frchet (type II extreme value) distribution.
- The extreme value distribution describes the minimum of random variables that follow some distributions (Pareto...).
- It captures the idea that perfect competition selects the most productive technology.
- The Eaton-Kortum model predicts gravity bilateral trade patterns and its calibration is parsimonious.

Main Conclusions of the Ricardian Model

- Technological differences are enough for otherwise identical countries to gain from trade.
- Trade frees up resources for the comparative advantage sector in each country.
- Trade allows the consumption set to be larger than the production possibility set.
- A country with absolute disadvantage will gain from trade but it will have lower wages.
- An increase in Foreign country size or productivity benefits the Home country.