Dornbusch, Fischer and Samuelson

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Outline

1. Model of Dornbusch, Fischer and Samuelson (1979).
    1. Ricardian model with continuum of goods.
    2. Nontraded goods and transfers.
2. Applications.
    1. Costs of eliminating trade deficit.
    2. The US trade deficit and the value of the dollar.

Technology

- Continuum of goods z located on unit interval [0,1].
- Two countries: Home and Foreign ('*')
- Unit labor requirements to produce z are $a(z)$ and $a^*(z)$.
- Goods z are ordered in order of diminishing comparative advantage of Home:

$$A(z) = \frac{a^*(z)}{a(z)} \qquad \text{where} \qquad A'(z) < 0$$

Specialization

- Wages in Home and Foreign: w and w^*.
- Relative wage of Home: $\omega = w/w^*$.
- Home produces z if $a(z)w < a^*(z)w^*$. In other words, Home produces if its relative wage is smaller than its relative productivity:

$$\omega \leq A(z)$$

- Denote $\tilde{z}$ as the cutoff between goods produced in Home and goods produced in Foreign, where

$$\omega = A(\tilde{z}) \tag{1}$$

Relative prices

- If both z and z' are produced in Home:

$$\frac{P(z)}{P(z')} = \frac{wa(z)}{wa(z')} = \frac{a(z)}{a(z')}$$

- If z is produced in Home and z'' is produced in Foreign:

$$\frac{P(z)}{P(z'')} = \frac{wa(z)}{w^* a^*(z'')} = \omega \frac{a(z)}{a^*(z'')}$$

- These relative prices will be relevant for welfare analysis.

Preferences

- Cobb-Douglas preferences.
- Denote by $b(z)$ the income share spent on good z, where $b(z) = b^*(z)$ and $\int_0^1 b(z)dz = 1$.
- Range of commodities produced in Home: $(0, \tilde{z})$.
- Fraction of income spent on goods produced in Home:

$$\theta(\tilde{z}) = \int_0^{\tilde{z}} b(z)dz$$

- Fraction of income spent on goods produced in Foreign:

$$1 - \theta(\tilde{z}) = \int_{\tilde{z}}^1 b(z)dz$$

Clearing of goods markets

- Income of Home is equal to spending on goods produced at Home:

$$wL = \theta(\tilde{z})(wL + w^* L^*)$$

- Equivalent to trade balances: value of Home imports is equal to value of Home exports.

$$(1 - \theta(\tilde{z}))wL = \theta(\tilde{z})w^* L^*$$

- This can be re-written as:

$$\omega = \frac{\theta(\tilde{z})}{1 - \theta(\tilde{z})} \frac{L^*}{L} = B(\tilde{z}; \frac{L^*}{L}) \tag{2}$$

Interpretation: (i) the greater $\tilde{z}$, the more goods Home produces, so that the greater the demand for labor in Home, and the higher the relative wage of Home; (ii) increasing $\tilde{z}$ pushes Home into a trade surplus, so that its wages must increase to eliminate that trade surplus.

Equilibrium

- Two equations in two unknowns: equations (1) and (2). Recall:

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

$$\omega = \frac{\theta(\tilde{z})}{1-\theta(\tilde{z})}\frac{L^*}{L} = B(\tilde{z}; \frac{L^*}{L})$$

- These equations depend on the technologies, $A(z)$, the preferences, $\theta(z)$, and the relative size, L^*/L.

Equilibrium

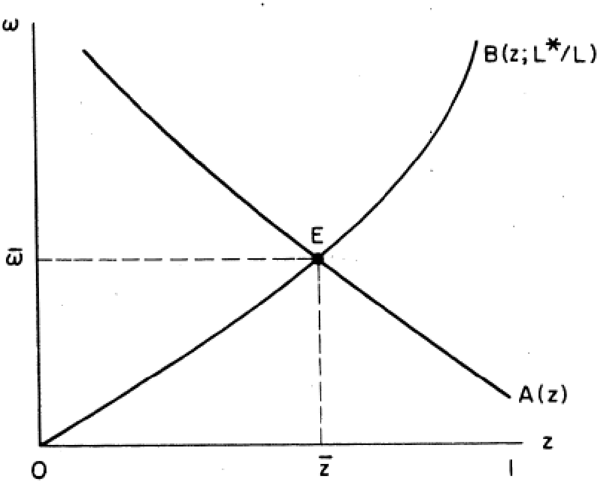
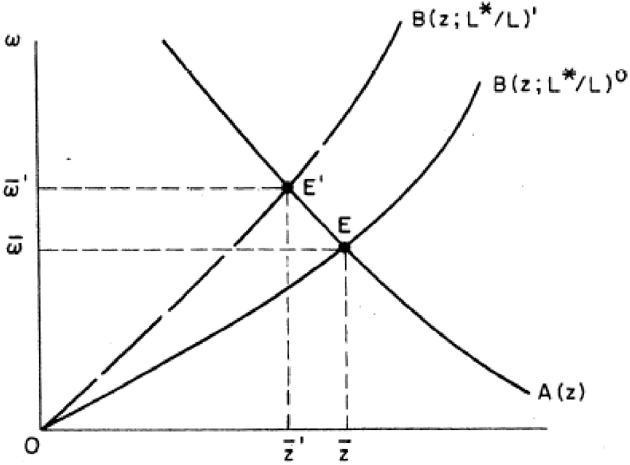


FIGURE 1

Comparative statics 1: increase relative size Foreign



Comparative statics 1: increase relative size Foreign

- Home produces a smaller range of products. Its relative wage must therefore increase.
- The increase in the relative size of Foreign would lead to an increase in demand in Home. This pushes up the demand for labor in Home, and thus the relative wage.
- Alternative interpretation: the increase in demand for goods produced in Home pushes Home into a trade surplus. To keep trade balanced, income in Home should increase, so that Home starts importing more.

Comparative statics 1: increase relative size Foreign

Real income in Home increases.

- Goods it bought from Home and still buys from Home: no change.

$$\frac{w}{wa(z)} = \frac{1}{a(z)}$$

- Goods it already bought from Foreign and still buys from Foreign.

$$\frac{w}{w^* a^*(z)} = \frac{\omega}{a^*(z)}$$

  where ω increases, so that real wage increases.

- Goods it previously bought from Home and now buys from Foreign.

$$\frac{w}{w^* a^*(z)} = \frac{\omega}{a^*(z)}$$

  where $\omega / a^*(z) > 1/a(z)$, otherwise it would continue to buy from Home. Since before it bought from Home, the real wage was $1/a(z)$, so that once again the real wage has increased.

Comparative statics 2: technological progress Foreign

- Proportional decrease in $a^*(z)$ for all z.
- $A(z)$ schedule shifts proportionately downwards.
- Relative wage of Home, ω, goes down (proportionately *less* than the technological progress), and Home produces a smaller range of goods.
- Interpretation: at the initial wage technological progress in Foreign implies the loss of comparative advantage in some industries, and thus a decrease in demand for Home labor. This pushes down the wages. (Alternative explanation: the loss of comparative advantage implies initially a trade deficit in Home, so that wages must drop to rebalance trade.)

Comparative statics 2: technological progress Foreign

Real income in Home increases.

- Goods it bought from Home and still buys from Home: no change.

$$\frac{w}{wa(z)} = \frac{1}{a(z)}$$

- Goods it already bought from Foreign and still buys from Foreign.

$$\frac{w}{w^*a^*(z)} = \frac{\omega}{a^*(z)}$$

Decrease in ω is less than increase in $a^*(z)$: real wage increases.

- Goods it previously bought from Home and now buys from Foreign.

$$\frac{w}{w^*a^*(z)} = \frac{\omega}{a^*(z)}$$

where $\omega/a^*(z) > 1/a(z)$, otherwise it would continue to buy from Home. Since before it bought from Home, the real wage was $1/a(z)$, so that once again the real wage has increased.

Comparative statics 2: technological progress in Foreign

Real income in Foreign increases.

- Goods it bought in Foreign and still buys from Foreign: improves.

$$\frac{w^*}{w^* a^*(z)} = \frac{1}{a^*(z)}$$

- Goods it bought in Home and still buys in Home.

$$\frac{w^*}{wa(z)} = \frac{1}{\omega a(z)}$$

  where ω is lower, so real wage is higher.

- Goods it previously bought from Home and now buys from Foreign.

$$\frac{w^*}{w^* a^*(z)} = \frac{1}{a^*(z)}$$

  where $1/a^*(z) > 1/(\omega a(z))$, otherwise it would still buy from Home. Since $1/(\omega a(z))$ has gone up, real wage has increased.

Unilateral transfers

- Foreign makes unilateral transfer to Home.
- Technology does not change. Therefore, the $A(\tilde{z})$ schedule does not change.
- Total income does not change. Because of homothetic preferences, $\theta(\tilde{z})$ does not change, and therefore the $B(\tilde{z})$ schedule does not change either.
- Result: unilateral transfers does not change the relative wages, the relative prices, and the specialization patterns. (Of course, Home becomes better off, and Foreign becomes worse off.)

Nontraded goods

- There is still a continuum of traded goods, indexed by z, located on the unit interval [0,1]. However, now there are also a bunch of nontraded goods.
- A fraction k of income is spent on traded goods, and a fraction $1 - k$ on nontraded goods, so that:

$$k = \int_0^1 b(z)dz$$

- No change to the $A(\tilde{z})$ schedule.

Nontraded goods

- Trade balance is now different:

$$(k - \theta(\tilde{z}))wL = \theta(\tilde{z})w^* L^*$$

- This changes the $B(\tilde{z})$ expression slightly:

$$\omega = \frac{\theta(\tilde{z})}{k - \theta(\tilde{z})} \frac{L^*}{L} = B(\tilde{z}; \frac{L^*}{L}) \tag{3}$$

- Can easily do the same comparative statics as in case without nontraded goods.

- Home receives transfer T from Foreign, where T is measured in terms of foreign labor.
- Spending on imports by Home is equal to spending on imports by Foreign plus transfers. (In other words, Home runs a trade deficit of T.)

$$(k - \theta(\tilde{z}))(\omega L + T) = \theta(\tilde{z})(L^* - T) + T$$

where foreign wage has been normalized to 1.

- The $B(\tilde{z})$ schedule then becomes:

$$\omega = \frac{1-k}{k-\theta(\tilde{z})}\frac{T}{L} + \frac{\theta(\tilde{z})}{k-\theta(\tilde{z})}\frac{L^*}{L} = B(\tilde{z}; L*/L, T) \quad (4)$$

Transfers in the presence of nontraded goods

- The expression (4) implies that a transfer from Foreign to Home shifts up the $B(\tilde{z})$ schedule.
- The relative wage of Home, ω, increases, and Home produces a smaller range of goods.
- Because of the presence of nontraded goods, transfers lead to an increase in demand for Home produced goods, and a decrease in demand for Foreign produced goods. This pushes up the relative wage in Home.

Transfers in the presence of nontraded goods

- Alternative explanation: at the initial wages, increase in imports is $(k - \theta(\tilde{z})$ times transfers (part of increased spending at Home is spent on Home produced nontradeable goods) and decrease in exports is $\theta(\tilde{z})$ times transfers.
- Since $k - \theta + \theta < 1$, the change in net imports by Home is smaller than the transfer received. Given that Home's income has gone up by the amount of the transfer, we have that "value of imports by Home" is smaller than "value of imports by Foreign plus transfers". To rebalance this equality, Home's imports should increase, so that relative wage of Home should increase.

Transfers and terms of trade

- The increase in the relative wage of Home (the receiving country) implies an increase in the relative price of Home's exports.
- Recall that if z is produced in Home and z'' is produced in Foreign:

$$\frac{P(z)}{P(z'')} = \frac{wa(z)}{w^*a^*(z'')} = \omega \frac{a(z)}{a^*(z'')}$$

- Therefore, Home experiences an improvement in its terms of trade. This validates the Keynes view on transfers: the receiving country gains twice, once because it receives transfers, and once because its terms of trade improve.

Transfers and trade deficits

- Recall the trade balance expression in the presence of transfers:

$$(k - \theta(\tilde{z}))(\omega L + T) = \theta(\tilde{z})(L^* - T) + T$$

  where imports by Home are $(k - \theta(\tilde{z}))(\omega L + T)$ and exports by Home are $\theta(\tilde{z})(L^* - T)$.

- This implies that Home has a trade deficit of T.

- A trade deficit can thus be interpreted as a transfer received from the rest of the rest of the world.

Transfers and trade deficits

- Transfers lead to an increase in the relative wage of Home (receiving country).
- Higher relative wage of Home implies an increase in the relative prices of Home exports, compared to Foreign exports. In other words, the terms of trade of Home improve.
- Higher relative wage of Home also pushes up the relative price of nontraded goods in Home. As a result, there is an increase in the overall relative price level of Home, compared to Foreign.

The cost of eliminating the trade deficit

- Direct cost: lose the transfers T.
- Indirect cost through change in terms of trade: worsening of terms of trade.
- Indirect benefit through lowering of relative price of nontraded goods.
- This latter effect is not discussed in DFS.
- See Dekle, Eaton and Kortum (2008).

Eliminating the US trade deficit and the dollar

- Eliminating the US trade deficit will lead to a drop in the relative price level in the US.
- This is equivalent to a *real* depreciation of the dollar.
- The real exchange rate of the dollar versus, say, the euro can be written as:

$$\varepsilon_{USD/EUR} = \frac{E_{USD/EUR} P_{EUR}}{P_{US}}$$

  where ε is the real exchange rate, E is the nominal exchange rate, and P are the price levels.
  Eliminating the US trade deficit, leads to an increase in ε, and thus a *real* depreciation of the dollar.
- This *real* depreciation can either be obtained by (i) lower inflation in the US, relative to the EU, or by (ii) a nominal depreciation of the dollar versus the euro.

Eliminating the US trade deficit and the dollar

- If both the Fed and the ECB have a target level of inflation, then the real depreciation of the dollar will be obtained by (ii), i.e., by a nominal depreciation of the dollar.
- This is the argument of Obstfeld and Rogoff (2003) and of Krugman (2006) of why the dollar will decline when the US trade deficit disappears.