Lecture Note 2

Harris Dellas

MODEL 5: International Relative Prices

A. The real exchange rate: The terms of trade

In this sections we investigate the determinants of the real exchange rate (RER). In particular, we examine how the RER responds to changes in supply and demand conditions

A static version: 1 period, 2 countries, 2 goods Y_1, Y_2

Home country has the utility function

$$u(c_{11}, c_{12})$$

and faces the budget constraint

$$p_1 c_{11} + p_2 c_{12} = p_1 Y_1 \Rightarrow$$
$$c_{11} + q c_{12} = Y_1$$

where $q = p_2/p_1$ is the relative price of good 2 in terms of good 1.

Similarly, the foreign country has the utility function and the budget constraint

$$u(c_{21}, c_{22}) \qquad c_{21} + q c_{22} = q Y_2$$

Given $\{Y_1, Y_2\}$ we want to determine $\{c_1, c_2, q\}$

c_{11} : $u_{c_{11}} = \lambda_1$

c_{12} : $u_{c_{12}} = \lambda_1 q$

$$\frac{u_{c_{12}}}{u_{c_{11}}} = q = \frac{u_{c_{22}}}{u_{c_{21}}}$$

In general q depends on both supply (the levels of Y_1, Y_2) and demand side (the distribution of the endowments ownership across countries, for instance, home residents may own part of the foreign output) and the demand side (preferences). In a dynamic model it may be very hard to keep track of the distribution of world wealth when trying to determine prices and quantities.

To avoid this difficulty we can make assumptions such as

- complete asset markets
- incomplete markets together with particular specifications of utility (+ production)

Example 1

$$u_1 = \ln c_{11} + \theta \ln c_{12}$$
$$u_2 = \ln c_{21} + \theta \ln c_{22}$$

If $\theta > 1$ then both countries like good 2 better.

$$\frac{\theta c_{11}}{c_{12}} = q = \frac{\theta c_{21}}{c_{22}}$$

$$\theta c_{11} = q c_{12} \qquad + \qquad \theta c_{21} = q c_{22}$$

$$\theta \underbrace{(c_{11} + c_{21})}_{Y_1} = q \underbrace{(c_{12} + c_{22})}_{Y_2}$$

$$q = \theta \frac{Y_1}{Y_2} \qquad \frac{dq}{d\theta} > 0$$

Supply shocks: $Y_1 \uparrow, q \uparrow$

Demand shocks: $\theta \uparrow, q \uparrow$

Key implication: Faster growth (an increase in supply) deteriorates a country's real exchange rate (leads to a real depreciation).

The distribution of consumption across countries

Combining $\theta c_{11} = q c_{12}$ with $c_{11} + q c_{12} = Y_1$ give $c_{11} = \frac{1}{1+\theta} Y_1$. Using the market clearing condition $c_{11} + c_{21} = Y_1$ gives $c_{21} = \frac{\theta}{1+\theta} Y_1$

Hence

$$c_{12} = \frac{1}{1+\theta} Y_2 \qquad c_{22} = \frac{\theta}{1+\theta} Y_2$$
$$c_{11} = \frac{1}{1+\theta} Y_1 \qquad c_{21} = \frac{\theta}{1+\theta} Y_1$$

If $\theta > 1$ and if $Y_1 = Y_2 \quad \Rightarrow \quad q > 1$. Then country 2 is richer.

$$c_{21} > c_{11} \qquad \text{and } c_{22} > c_{12}$$

Example 2

Let $u = c_1$, $u^\star = c_2$ with

$$c_1 = \left[\gamma^{\frac{1}{\theta}} c_{11}^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} c_{12}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \qquad \theta > 0$$

$$c_2 = \left[\gamma^{\frac{1}{\theta}} c_{21}^{\frac{\theta-1}{\theta}} + (1-\gamma)^{\frac{1}{\theta}} c_{22}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \qquad \theta > 0$$

Note that there is no home bias in consumption.

The determination of the terms of trade $q = p_2/p_1$. Similar results to those above.

Dynamic extension

- 2 period
- storable goods Y_{1t}, Y_{2t}

Question: How does the relative price in any period respond to changes in current or future economic conditions?

For instance, describe the following effects (do both the log and the CES utility):

dq_t/dY_{t+1}, $dq_t/d\theta_{t+1}$ (for the log) and $dq_t/d\gamma_{t+1}$ (for the CES)

Project: There is a popular claim that countries with a strong CA position also have a strong real exchange rate (terms of trade). Use the 2 country, 2 good, 2 period model with various shocks to derive the correlation between the CA and q. Under what conditions do you get this positive correlation? Do these correlations imply anything for international trade competitiveness?

B. The real exchange rate with non-traded goods

$$\text{Real exchange rate} \begin{cases} \frac{p_N}{p_T} \\ \\ \frac{P}{P^\star} \end{cases}$$

Balassa-Samuelson:

→ Real appreciation and growth

Fast growing countries experience a real exchange rate appreciation

But there are no implications for international competitiveness

(Does the experience of a country like Greece fit to the B-S framework?)

→ Rich countries have higher price levels

Demonstrate the B-S result using the Ricardian model

Assumptions:

- 2 sectors
- 1 factor of production (L)
- perfect L mobility across sectors
- linear production technology (AP=MP=constant)

$$L = L_T + L_N$$
$$Y_T = \alpha_T L_T$$
$$Y_N = \alpha_N L_N$$

where T = traded good and N = non-traded good

Perfect competition means $P = MC \Rightarrow P_T = \alpha_T w$ and $P_N = \alpha_N w$

where α_T = number of units of labor needed to produce 1 unit of the traded good

$$\alpha_T = \frac{1}{\text{labor productivity in T}}$$

The price index is

$$P = P_T^{(1-\theta)} P_N^{\theta}$$

Observation 1: $\frac{P_N}{P_T} = \frac{\alpha_N}{\alpha_T}$ That is, the real exchange rate is independent of demand (due to the fact that the PPF is linear).

Observation 2:

$$\left.\begin{array}{l} P = P_T \left(\frac{P_N}{P_T}\right)^{\theta} \\ P^{\star} = P_T^{\star} \left(\frac{P_N^{\star}}{P_T^{\star}}\right)^{\theta} \end{array}\right\} \frac{P}{P^{\star}} = \frac{P_T}{P_T^{\star}} \left(\frac{\alpha_N}{\alpha_N^{\star}}\right)^{\theta} \left(\frac{\alpha_T^{\star}}{\alpha_T}\right)^{\theta}$$

$$\left.\begin{array}{l} P_T = P_T^\star \\ \alpha_N = \alpha_N^\star \end{array}\right\} \begin{array}{l} \alpha_T^\star > \alpha_T \\ \frac{1}{\alpha_T} > \frac{1}{\alpha_T^\star} \end{array}$$

Then $P > P^\star$

Rich countries are more productive (have lower α_T) $\Rightarrow$ will have higher price levels

Source of price differences: difference in prices of NON traded goods

$P_T = \alpha_T w \qquad\qquad P_N = \alpha_N w$

Similarly, if a country experiences fast productivity growth (typically in manufacturing goods which tend to be traded) then it will experience an appreciation in its real exchange rate (defined either as $\frac{p_N}{p_T} or \frac{P}{P^\star}$

$\frac{P_N}{P_T} \uparrow$ and $\frac{P}{P^\star} \uparrow$ as a country grows fast

B-S when the production function is concave (C-D)

$$Y_T = A_T K_T^{\beta_T} L_T^{(1-\beta_t)}$$

$$L = L_T + L_N \qquad\qquad K = K_T + K_N$$

In this case demand conditions, for instance, the level of government spending matter for the real exchange rate (how?)

Empirical project: To what extent the changes in the real exchange rates in the various countries of the EU following monetary integration (EMU) reflect B-S factors? To what extent real appreciations (Greece, Spain,...) represent a worsening in international competitiveness?