International Relative Prices

A simple model

- Consider a simple model
- 1 period, 2 countries, 2 goods Y_1, Y_2
- Country 1 produces good 1
- Country 2 produces good 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 $u(c_{21}, c_{22})$ $\quad c_{21} + q c_{22} = q Y_2$

- Given $\{Y_1, Y_2\}$ we want to determine $\{c_{11}, c_{12}, c_{21}, c_{22}, q\}$
- $c_{11} : Uc_{11} = \lambda_1$
- $c_{12} : Uc_{12} = \lambda_1 q$
- q=Uc_{12}/Uc_{11}
- q= Uc_{22}/Uc_{21}

- Example 1 with particular specifications of utility:
- $u_1 = \ln c_{11} + \theta \ln c_{12}$
- $u_2 = \ln c_{21} + \theta \ln c_{22}$
- If $\theta > 1$ then both countries like good 2 better.

- The first order conditions are:
- $q=\theta c_{11}/c_{12}$
- $q=\theta c_{21}/c_{22}$
- One can use these equations to derive:
- $\theta(c_{11}+c_{21})=q(c_{12}+c_{22})$
- Or: $\theta Y_1=qY_2$
- The relative price is then: $q=\theta Y_1/Y_2$

- We have the optimality conditions. q=θc_{11}/c_{12} q=θc_{21}/c_{22}
- The relative price (which is the terms of trade) q=θY_1/Y_2
- The two budget constraints. $c_{11} + qc_{12} = Y_1$ and $c_{21} + qc_{22} = qY_2$
- The two market clearing conditions: $c_{11} + c_{21} = Y_1$ and $c_{12} + c_{22} = Y_2$

The distribution of consumption across countries

- Combining $\theta c_{11} = qc_{12}$ with $c_{11} + qc_{12} = Y_1$ gives $c_{11} = Y_1 / (1+ \theta)$
- Using the market clearing condition $c_{11} + c_{21} = Y_1$ gives $c_{21} = \theta Y_1 / (1+ \theta)$
- We can also derive $c_{12} = Y_2 / (1+ \theta)$ *and* $c_{22} = \theta Y_2 / (1+ \theta)$.

- If $\theta > 1$ and if $Y_1 = Y_2$ $\Rightarrow$ $q > 1$. Then country 2 is richer.
- As a result: $c_{21} > c_{11}$ and $c_{22} > c_{12}$

The real exchange rate with non-traded goods

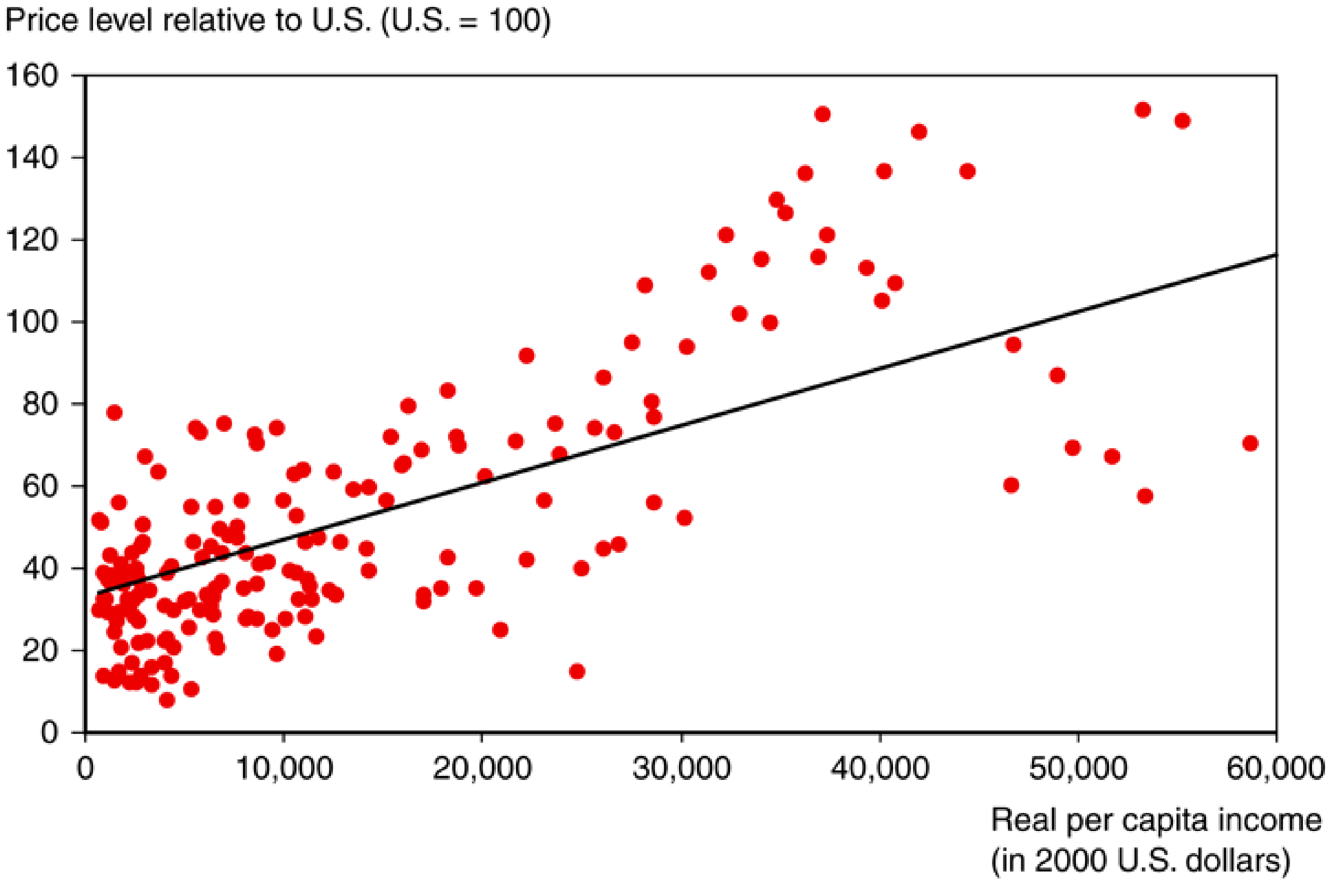
- Now, we consider an economy with traded and non-traded goods
- Real exchange rate: P/P^*
- P is the domestic price level. P^* is the foreign price level.

Balassa-Samuelson (B-S)

- Real appreciation and growth
- Fast growing countries experience a real exchange rate appreciation,
  → Rich countries have higher price levels

Price Levels and Real Incomes, 2007

- Price level and per capita income are correlated
- Why? Potential explanation: Balassa-Samuelson effect



Source: Krugman, Obstfeld, Melitz, 2011. Penn World Table, version 6.3.

- 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)
- $L = L_T + L_N$
- $\alpha_T Y_T = L_T$
- $\alpha_N Y_N = L_N$
- where T = traded good and N = non-traded good
- Consumption of tradable goods and non-tradable goods:

$C = C_T^{(1-\theta)} C_N^{\theta} / ((1-\theta)^{(1-\theta)} \theta^{\theta})$

- 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 (inverse of labor productivity)
- The price index is (will be derived in class)

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

The real exchange rate can then be expressed as:

- $P/P^* = P_T/P_T^* (\alpha_N/\alpha_N^*)^{\theta} (\alpha_T^*/\alpha_T)^{\theta}$

- Assume the law of one price holds for traded goods: $P_T = P_T^*$

- 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
- 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.

The Balassa Samuelson model with capital and labor

- A traded (Y_T) and non-traded (Y_N) good are produced according to Cobb-Douglas production functions:

- $Y_T = A_T L_T^{(1-\alpha_T)} K_T^{(\alpha_T)}$
- $Y_N = A_N L_N^{(1-\alpha_N)} K_N^{(\alpha_N)}$

- Labor L, capital K, and productivity A are sector specific.
- The tradable goods price is the numeraire: (P_T=1). The non-tradable goods price is P_N.

- Firms in the two sectors maximize profits:

$A_T L_T^{(1-\alpha_T)} K_T^{(\alpha_T)} - (W L_T + R K_T)$

$A_N L_N^{(1-\alpha_N)} K_N^{(\alpha_N)} - (W L_N + R K_N)$

Denote the capital-labor ratio in the two sectors by: $k_T = K_T / L_T$ and $k_N = K_N / L_N$.
The FOC's are:

(1) $R = A_T \alpha_T k_T^{(\alpha_T - 1)}$

(2) $R = P_N A_N \alpha_N k_N^{(\alpha_N - 1)}$

(3) $W = A_T (1-\alpha_T) k_T^{(\alpha_T)}$

(4) $W = P_N A_N (1-\alpha_N) k_N^{(\alpha_N)}$

- To solve the model, assume that R is the exogenously given world rental rate on capital (capital is mobile across countries and sectors).
- Solve equation (1) for k_T and substitute for k_T in equation (3). This gives:
- $W=A_T^{1/(1-\alpha_T)}(1-\alpha_T)(\alpha_T/R)^{\alpha_T/(1-\alpha_T)}$
- Substitute this expression into equation (4) and solve for k_N:
- $k_N=((1-\alpha_T)A_T^{1/(1-\alpha_T)}(\alpha_T/R)^{\alpha_T/(1-\alpha_T)})^{1/\alpha_N} / ((1-\alpha_T)A_N P_N)^{1/\alpha_N}$

- If we plug this expression into equation (2) and solve for P_N, one gets:

- $P_N = A_T^{(1-\alpha_N)/(1-\alpha_T)} C/A_N$

- where C is a positive constant.
- First, the relative price of non-traded goods P_N increases when A_T increases.
- Second, the relative price of non-traded goods P_N even increases when the growth rates of A_T and A_N are the same, if tradable goods production is relatively capital-intensive ($\alpha_N < \alpha_T$).
- If either of these two scenarios are correct, fast growing economies will see a rising relative price of nontradables and a real appreciation over time (since the overall price level increases faster).

- Crucial assumptions:
  - The BS theory assumes that labor is mobile across sectors (but not internationally)
  - the labor supply is given and cannot be extended (no migration)
  - capital is mobile internationally (R exogenous)
  - Production is determined by the supply side

  - BS model stresses the effects of productivity movements on the real exchange rate. But causality could also run from real exchange rates to productivity.

Balassa-Samuelson: empirical results

- The Balassa-Samuelson model mainly applies over very long time horizons. It does not seem to do well in explaining real exchange rates in the short-run (e.g. Chinn and Johnston, 1996, Rogoff, Lothian and Taylor, 2008, Chong, Jorda and Taylor, 2012, Bordo et al. (2014)).
- At least in the short-run, the evidence for the effect of productivity growth on real exchange rates is quite weak, especially for high-income and financially developed countries with flexible exchange rates.

Balassa-Samuelson and Baumol-Bowen

- Balassa-Samuelson effect is closely related to the so-called Baumol-Bowen effect, but not the same.
- Baumol and Bowen (1966): relative prices of service-intensive goods (education, health care, banking, etc) tend to rise because productivity growth in these activities has tended to be slower than in more capital intensive manufacturing. While one can assume that there is a substantial overlap between non-tradables and services, the presence of a rising relative price of services does not necessarily result in a Balassa-Samuelson effect. A higher rate of inflation in the domestic economy than in the foreign economy only occurs if productivity growth gaps between the sectors producing traded and non-traded goods is greater at home than abroad.
- As a result, in empirical studies, one may find a Baumol-Bowen effect but no Balassa Samuelson effect (and vice versa).