Exchange Rate Economics

Philip R. Lane, TCD

October 2009

Introduction

- Medium-term behaviour of real exchange rates (CPI-based RER)
- Invariant to exchange rate regime
- Relation to macroeconomic fundamentals
- Equilibrium relations and time series econometrics

Balassa-Samuelson Model I

- Small open economy
- Two sectors: traded and nontraded
- CRS in each sector
- International capital mobility
- Intersectoral labour mobility

Balassa-Samuelson Model II

- Real exchange rate driven by productivity differential
- No role for demand factors

The Transfer Problem

- Net liabilities imply long-run net outward transfer to foreign investors
- Lower domestic wealth; higher foreign wealth
- Steady-state trade surplus; lower domestic demand; higher labour supply
- Presumption: if demand matters for NT sector, real depreciation
- LMF (2002, 2004)

Government Spending and the Long-Run Real Exchange Rate

- IMF: higher government consumption associated with substantial real appreciation
- Impact of government investment more ambiguous
- "The Composition of Government Spending and the Real Exchange Rate" (Galstyan and Lane, JMCB, 2009)

Model

- The production functions for traded and nontraded goods are respectively

$$Y_T = A_T^* F(L_T, K_T) = (A_T Z^{\alpha_Z}) L_T^{\alpha_L} K_T^{\alpha_K} \quad (1)$$

$$Y_N = A_N^* G(L_N, K_N) = (A_N Z^{\beta_Z}) L_N^{\beta_L} K_N^{\beta_K} \quad (2)$$

- Productivity in both sectors is enhanced by a larger stock of public capital but we allow for the impact to be potentially different across sectors (if $\alpha_Z \neq \beta_Z$).
- We assume that $\alpha_L + \alpha_K = 1$, but $\beta_L + \beta_K < 1$.

- The price of the traded good is equal to world price of the good and is normalized to 1, while the price of non-traded goods is P_N.
- The accumulation functions for the private capital stocks in the traded and nontraded sectors are given by

$$\Delta K_T = I_T^K - \delta K_T \tag{3}$$

$$\Delta K_N = I_N^K - \delta K_N \tag{4}$$

  where I denotes the level of gross investment and δ is the depreciation rate.
- The public capital stock evolves according to $\Delta Z = I^Z - \delta Z$
- We assume that private capital formation in the traded and nontraded sectors only requires the traded good as an input, while public capital formation uses only the nontraded good as an input.

- The representative household has an instantaneous utility function over the goods defined as

$$C = \frac{C_T^{1-\gamma} C_N^{\gamma}}{(1-\gamma)^{1-\gamma}\gamma^{\gamma}} \tag{5}$$

- The welfare-based price index consistent with equation (5) is

$$P = P_N^{\gamma} \tag{6}$$

The government runs a balanced budget, levying lump-sum taxes equal to the value of total government consumption and government investment

$$T = G_T + P_N(G_N + I^Z) \tag{7}$$

where G_T, G_N are the levels of public consumption of the traded and nontraded goods respectively and I^Z is the level of public investment.

- Households face the following budget constraint

$$\Delta B = rB + r(K_T + K_N) + w(L_T + L_N) - (I_N^K + I_T^K) - C_T - P_N C_N + \Pi_N \tag{8}$$

- Labor is perfectly inter-sectorally mobile, such that the equilibrium in the labor market is

$$L_N + L_T = L \tag{9}$$

The equilibrium in the non-traded goods sector is $Y_N = C_N + G_N + I^Z$ while the trade balance is determined by

$$TB = Y_T - C_T - G_T - (I_N^K + I_T^K) \tag{10}$$

Equations (1) to (7) together with the first-order
In the benchmark steady state, the relative price of non-traded goods is

$$P_N = \left(\eta L_N^{\frac{1-\beta_L-\beta_K}{1-\beta_K}} Z^{\frac{\alpha_Z}{1-\alpha_K} - \frac{\beta_Z}{1-\beta_K}} \right)^{1-\beta_K} \tag{11}$$

- In the next stage, we log-linearize around this steady state and solve the system.
- The equation of primary interest is the one governing the real exchange rate, $\hat{P} = \gamma \hat{P}_N$, with the relative price of non-traded goods given by

$$\hat{P}_N = -\hat{A}_N + \frac{1-\beta_K}{1-\alpha_K}\hat{A}_T + \mu_0(r\hat{B} + [G_N - G_T]) + \mu_1 \hat{Z} \qquad (12)$$

- The other key coefficients are

$$\mu_0 = \frac{\alpha_L(1-\beta_L-\beta_K)(1-\gamma)}{\alpha_L(1-\gamma)+\beta_L\gamma} > 0 \quad (13)$$

$$\mu_1 = \frac{(1-\beta_K)\alpha_Z-(1-\alpha_K)\beta_Z}{\alpha_L} <=> 0 \quad (14)$$

- If an increase in public capital has a symmetric impact on productivity in both sectors ($\alpha_Z = \beta_Z$) and both sectors have similar capital shares ($\alpha_K = \beta_K$), the real exchange rate is unaffected by the level of the public capital stock.
- If $\alpha_Z = \beta_Z$ but the nontraded sector is less capital intensive ($\alpha_K > \beta_K$), then an increase in public capital generates real appreciation, by the same logic as a symmetric improvement in the sector-specific productivity terms A_T and A_N.

Empirical specification

- For the long run estimation we take panel cointegration approach
- Dynamic OLS:

$$y_{it} = \alpha_i + \theta_t + \boldsymbol{\beta}' \mathbf{x}_{it} + \sum_{j=-1}^{j=1} \Delta \mathbf{x}_{it-j} + \epsilon_{it}$$

Table: Real Exchange Rates: Long-Run Behavior

	(1)	(2)	(3)	(4)	(5)	(6)
Rel. Govt. Consumption	1.22	3.57	1.06	0.53	0.53	0.40
	(.47)***	(1.45)**	(.38)***	(.39)	(1.28)	(.42)
Rel. Govt. Investment	-0.81	-8.40	-1.01	-0.88	1.23	-1.36
	(1.07)	(4.79)*	(.96)	(.97)	(2.78)	(1.10)
Rel. GDP per capita	0.37	0.77	0.34	0.30	0.34	0.33
	(.08)***	(.90)	(.07)***	(.08)***	(.40)	(0.09)***
Trade Balance	-1.23	-2.13	-1.14	-1.26	-0.93	-1.39
	(.15)***	(1.73)	(.14)***	(.17)***	(.68)	(.20)***
R^2	0.67	0.64	0.63	0.62	0.32	0.70
Marginal R^2	0.27	0.33	0.31	0.38	0.29	0.44
Observations	418	66	352	242	88	154
Sample	All	G3	Non-G3	EMU	E4	Non-E4

Table: Relative Price of Nontradables: Long-Run Estimates

	(1)	(2)	(3)	(4)	(5)	(6)
Govt. Consumption	0.41	1.65	0.43	1.71	7.46	1.2
	(.72)	(.83)*	(.79)	(1.03)*	(1.24)***	(1.1)
Govt. Investment	-2.14	0.77	-3.35	-2.06	0.93	-3.29
	(1.06)**	(3.02)	(1.21)***	(1.2)*	(2.35)	(1.18)***
GDP per capita	0.65	0.79	0.61	0.65	0.87	0.55
	(.039)***	(.082)***	(.042)***	(.045)***	(.106)***	(.054)***
Trade Balance	-.69	-4.0	-0.62	0.19	1.04	0.25
	(0.29)**	(1.16)***	(.3)**	(.32)	(.56)*	(.41)
R^2	0.71	0.88	0.69	0.75	0.92	0.72
Marginal R^2	0.58	0.83	0.56	0.71	0.89	0.70
Observations	418	66	352	242	88	154
Sample	All	G3	Non-G3	EMU	E4	Non-E4

Table: Relative Sectoral Productivity Levels

	(1)	(2)	(3)	(4)	(5)	(6)
GDP per capita	-0.92	-1.21	-0.89	-1.02	-0.97	-1.05
	(.06)***	(.13)***	(.07)***	(.07)***	(.11)***	(.08)***
Govt. Investment	3.4	-2.3	3.9	3.3	-1.1	5.4
	(1.4)**	(2.8)	(1.6)**	(1.3)**	(2.3)	(1.4)***
R^2	0.87	0.87	0.88	0.89	0.85	0.91
Marginal R^2	0.72	0.81	0.70	0.79	0.79	0.80
Observations	418	66	352	242	88	154
Sample	All	G3	Non-G3	EMU	E4	Non-E4

Other Influences on the Long-Run Real Exchange Rate

- Trade Liberalisation
- Administered Prices
- Commodity Terms of Trade
- IMF CGER exercise

Deviations from Long-Run Real Exchange Rate

- Error correction term
- Nominal exchange rate regime (Mussa)
- Short-term interest rate differentials (carry trade)
- Momentum trading
- Absorption of temporary portfolio shifts
- Learning about current and future shifts in fundamentals