Small Open Two-sector Economy

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1 Introduction

This model is based loosely on the Gali and Monacelli (2001) model of a small open economy. The main difference is the introduction of a non-tradable sector and the assumption that the economy is dollarised (this is a model of El Salvador which went fully dollarised in 2001) so there is no monetary policy and the interest rate is given exogenously.

To summarise the model, there are infinitely lived households that consume traded and non-traded goods and supply labour. In this simplified version of the model, labour supply is assumed to be fixed. On the production side, the tradable firms are perfectly competitive and sell all that they produce at an exogenously given price, either domestically or abroad. The non-tradable firms are monopolistically competitive. There are two versions of the model II and IV. In model II, prices are fully flexible and non-tradable firms sell their product to domestic consumers at a fixed mark-up over marginal cost. In model IV sticky prices are introduced, and the pricing rule becomes a forward looking Phillips curve.

2 Model II (in levels)

2.1 Households

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left(\ln C_t\right)(1)$$

The consumption index and corresponding price index are

$$C = \frac{C_T^{\gamma} C_N^{1-\gamma}}{\gamma^{\gamma}(1-\gamma)^{(1-\gamma)}} \tag{2}$$

$$P = P_T^{\gamma} P_N^{1-\gamma} \tag{3}$$

Households maximise their objective function subject to the budget constraint,

$$P_t C_t + E_t\{Q_{t,t+1} D_{t+1}\} = D_t + w_t \overline{L} + REM_t \tag{4}$$

where D_t is the nominal payoff of the portfolio held at the end of period $t-1$ and $Q_{t,t+1}$ is the stochastic discount factor for one period ahead payoffs. REM are remittances sent from abroad.

This gives the following intra-period demand curves for the two types of good,

$$C_T = \gamma \left(\frac{P}{P_T} \right) C \tag{5}$$

$$C_N = (1-\gamma) \left(\frac{P}{P_N} \right) C \tag{6}$$

The monopolistically competitive non-tradable firms face individual demand curves given by,

$$C_N = \left(\int_0^1 C_N(j)^{\frac{\epsilon-1}{\epsilon}} dj \right)^{\frac{\epsilon}{\epsilon-1}} \Rightarrow C_N(j) = \left(\frac{P_N(j)}{P_N} \right)^{-\epsilon} C_N \tag{7}$$

Maximising utility intertemporally leads to the usual Euler condition

$$\beta R_t E_t \left\{ \left(\frac{C_t}{C_{t+1}} \right) \left(\frac{P_t}{P_{t+1}} \right) \right\} = 1 \tag{8}$$

$$R_t = \frac{1}{E_t(Q_{t,t+1})} \tag{9}$$

R_t is the gross return on a riskless 1 period bond. As the economy is dollarised, R_t is exogenous and is given by the US interest rate plus a country risk premium.

2.2 Firms

Subscript N refers to nontradable firms, T to tradable firms. W is nominal wage.

$$Y_T = A_T L_T^{\alpha_T} \tag{10}$$

$$Y_N = A_N L_N \tag{11}$$

$$W_T = \frac{\alpha_T Y_T}{L_T} P_T \tag{12}$$

$$P_N = \left(\frac{\epsilon}{\epsilon - 1} \right) \frac{W_N}{A_N} \tag{13}$$

2.3 Equilibrium

The three equilibrium conditions in the goods and labour market are

$$Y_N = C_N \tag{14}$$

$$W = W_T = W_N \tag{15}$$

$$\overline{L} = L_T + L_N \tag{16}$$

3 Model II (loglinearised)

These are the loglinearised versions of the equations in the previous section. $\hat{x}$ denotes a log-deviation from the steady state and $\overline{X}$ denotes the steady state value.

$$\hat{c}_t = \gamma \hat{c}_{Tt} + (1-\gamma)\hat{c}_{Nt} \tag{17}$$

$$\hat{p}_t = \gamma \hat{p}_{Tt} + (1-\gamma)\hat{p}_{Nt} \tag{18}$$

$$\overline{PC}(\hat{p}_t + \hat{c}_t) + \frac{\overline{D}}{\overline{R}}(\hat{d}_{t+1} - \hat{r}_t) = \overline{D}(\hat{d}_t) + \overline{w}\overline{L}(\hat{w}_t) + \overline{REM}(r\hat{e}m_t)) \tag{19}$$

$$\hat{c}_{Tt} = \hat{c}_t + \hat{p}_t - \hat{p}_{Tt} \tag{20}$$

$$\hat{c}_{Nt} = \hat{c}_t + \hat{p}_t - \hat{p}_{Nt} \tag{21}$$

$$\hat{y}_{Nt} = E\{\hat{y}_{Nt+1}\} - r_t + \rho + E_t\{\pi_{Nt+1}\} \tag{22}$$

$$\hat{y}_{Tt} = \alpha_T \hat{l}_{Tt} + \hat{A}_{Tt} \tag{23}$$

$$\hat{y}_{Nt} = \hat{l}_{Nt} + \hat{A}_{Nt} \tag{24}$$

$$\hat{w}_t = \hat{y}_{Tt} + \hat{p}_{Tt} - \hat{l}_{Tt} \tag{25}$$

$$\hat{p}_{Nt} = \hat{w}_t - \hat{A}_{Nt} \tag{26}$$

$$\hat{y}_{Nt} = \hat{c}_{Nt} \tag{27}$$

$$\hat{l}_{Tt} = \left(\frac{1-\lambda}{\lambda}\right)\hat{l}_{Nt} \tag{28}$$

where $\lambda = \overline{L}_T$

4 Model IV

Model IV takes model II and introduces sticky prices. All the loglinearised equations are the same as before, except for equation 28. This is replaced by the forward looking Phillips curve. β_n is the firm's discount factor and $(1-q)$ is the probability that a firm changes its price (Calvo pricing).

$$\pi_{Nt} = \beta_n E_t(\pi_{Nt+1}) + b_{mc}(\hat{mc})_t \tag{29}$$

$$b_{mc} = \frac{(1-q)(1-q\beta_n)}{q} \tag{30}$$

$$(\hat{mc})_t = \hat{A}_{Tt} + \hat{p}_{Tt} - \hat{p}_{Nt} + \xi\hat{y}_{Nt} - (1+\xi)\hat{A}_{Nt} \tag{31}$$

where $\xi = \frac{(1-\alpha_T)(1-\lambda)}{\lambda}$ and as before $\lambda = \overline{L}_T$.