7 Lecture 7(I): Exchange rate overshooting - Dornbusch model

Reference: Krugman-Obstfeld, p. 356-365

7.1 Assumptions: prices sticky in SR, but flex in MR, endogenous expectations

Clearly it applies only to flexible exchange rates as, under a credible fixed exchange rate regime, expectations are actually exogenous; i.e. $\Delta e^e = 0$.

Main differences from Mundell-Fleming:

- Both short run and long run within the same model. Prices are sticky in the short run, but flexible in the long run.
- Expectations are endogenous.
- So, you should expect similar results to Mundell-Fleming. Monetary but not fiscal policy affects the level of output under flexible exchange rate.

- Expectations are formed rationally; i.e. $E_t e_{t+1} = e_{t+1}$ or $\Delta e^e_{t+1} = \Delta e_{t+1}$.

- We restrict attention to a simple case: prices are fixed for one period. Namely: **Prices are fixed at $\bar{p}$ in period t but are fully flexible from period t+1 onwards.**

- We write the model in logs and assume for simplicity that aggregate expenditure does not depent on the the interest rate and money demand depends on the medium run equilibrium level of output not its current level.

- Restrict attention to equilibria in which all exogenous variables grow at a constant (possibly zero) rate.

- Initially the economy is in equilibrium with full employment output (i.e. price is the same as in flexible price equilibrium).

$$\text{IS: } y_t = \bar{z} + \eta(e_t + p_t^* - p_t) \tag{108}$$

$$\text{LM: } m_t - p_t = \bar{y} - i_t \tag{109}$$

$$\text{UIP: } i_t = i_t^* + \Delta e_{t+1} \tag{110}$$

$$\text{Constant money growth: } m_{t+1} - m_t = \mu \tag{111}$$

$$\text{Period 1 AS: } p_1 = \bar{p} \tag{112}$$

$$\text{Period } t > 1 \text{ AS: } y_t = \bar{y}. \tag{113}$$

Note that $\bar{p}$ is at level that would prevail under flexible prices in the absence of any policy change. (i.e. economy is initially in MR equilibrium).

7.2 Solving backwards from period 2 (flexible prices).

AS is given by equation (113). Replacing into IS

$$e_t + p_t^* - p_t = \frac{\bar{y} - \bar{z}}{\eta}, \quad \text{for all } t \geq 2. \tag{114}$$

Real exchange rate determined by goods + labour market. Constant at all future periods (relative PPP holds). Hence, (114) and (111) imply

$$\Delta e_{t+1} = \pi_{t+1} - \pi_{t+1}^* = \mu - \pi_{t+1}^*, \quad \text{for all } t \geq 2. \tag{115}$$

Replacing into LM using UIP

$$m_t - p_t = \bar{y} - (\underbrace{i_t^* - \pi_{t+1}^*}_{r_t^*} + \mu), \quad \text{for all } t \geq 2. \tag{116}$$

Hence, for all $t \geq 2$, e_t and p_t are determined by the following system of equations

$$e_t + p_t^* - p_t = \frac{\bar{y} - \bar{z}}{\eta}, \tag{117}$$

$$m_t - p_t = \bar{y} - (r_t^* + \mu) \tag{118}$$

- Fiscal expansion (higher $\bar{z}$) results in appreciation of the real exchange but unchanged p_t. So, all the adjustment in the real exchange rate takes place through appreciation of e_t (same as flex price Mundell-Fleming).

- Expansionary monetary policy shock (e.g. higher m_t or μ) results in higher p_t but unchanged real exchange rate (money neutrality). Nominal exchange rate adjusts one to one to keep real one unchanged (same as flex price Mundell-Fleming or monetary model).

7.3 Solving for period 1: fixed prices

Replacing using (112) into (109)

$$\text{LM: } m_1 - \bar{p} = \bar{y} - (i_1^* + e_2 - e_1) \tag{119}$$

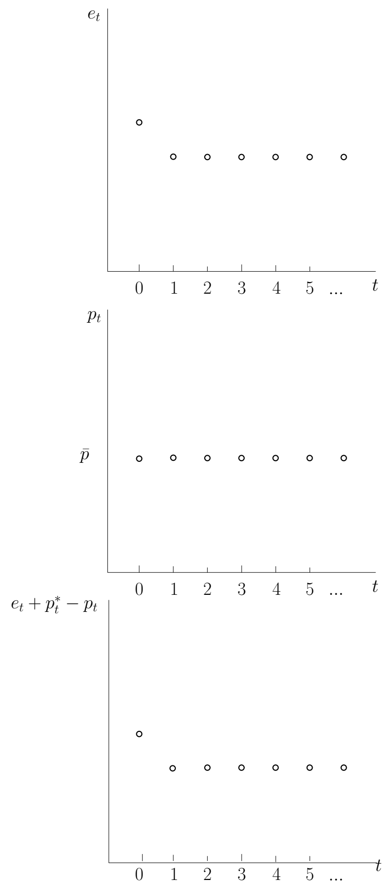
$$\text{IS: } y_1 = \bar{z} + \eta(e_1 + p_1^* - \bar{p}). \tag{120}$$

$$\tag{121}$$

With e_2 given from flexible price equilibrium in period 2, LM curve determines e_1 and then IS determines y_1.

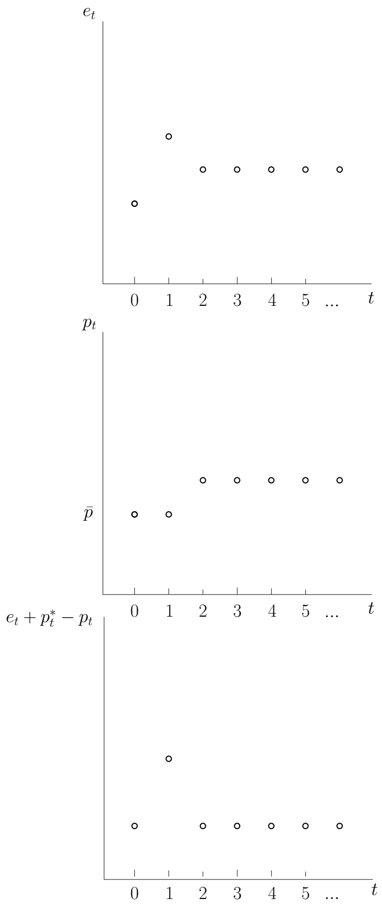
Goods market shocks. Consider a permanent, one-off, increase in government expenditure (i.e. $\bar{z}$ to $\bar{z}' > \bar{z}$). Figure on following page illustrates graphically.

- In period 2 the real exchange rate $rer_t = (e_t + p_t^* - p_t)$ has to be lower to crowd out foreign demand for home goods and ensure goods market equilibrium given $\bar{y}$.
- Since the shock does not affect the money market, p_2 is unchanged at its initial equilibrium $\bar{p}$. So change in rer is fully reflected in appreciation of e_2.
- At time 1, given that there is no change in m_1 and p_1 is given, $e_2 - e_1$ has to equal zero for the money market to be in equilibrium (i.e. nominal interest rate not to change).
- Since $e_2 - e_1 = 0$, e_1 has to jump to its MR equilibrium value e_2 and then stay constant. As in Mundell-Fleming: no effect on output.


e_t
0 1 2 3 4 5 ... t
p_t
$\bar{p}$
0 1 2 3 4 5 ... t
$e_t + p_t^* - p_t$
0 1 2 3 4 5 ... t

Money market shock. Consider a permanent, one-off, increase in the money supply m_t. Figure on following page illustrates graphically.

- From period 2 onwards, the real exchange rate is unchanged as the shock is not real.
- Yet, p_t has to increase from $t = 2$ onwards to keep money market equilibrium. Hence, e_t has to increase one-to-one from $t = 2$ onwards to keep rer unchanged.
- At time $t = 1$, though, p_1 cannot adjust to clear the money market. Since real money supply is higher, the nominal interest rate $i_1^* + e_2 - e_1$ has to fall for money demand to increase and reestablish money market equilibrium. So $e_2 - e_1$ has to fall from zero (before the shock) to a negative number to reduce the interest rate while ensuring no arbitrage.


e_t
0 1 2 3 4 5 ... t
p_t
$\bar{p}$
0 1 2 3 4 5 ... t
$e_t + p_t^* - p_t$
0 1 2 3 4 5 ... t

- The only way i_1 can fall below i_1^* to ensure money market clearing is if the exchange rate is expected to appreciate between 1 and 2. But we know that at 2 the exchange rate has to be higher than it was before the monetary shock. So, the only way it can *appreciate* between 1 and 2 is if immediately after the shock it jumps above (overshoots) its new long run value e_2.

- Note that with given prices at time t also the real exchange rate overshoots its long run value and output is temporarily above full employment.

- The model is able to capture excessive fluctuation (overshooting) of nominal and real exchange rates and the fact that monetary expansions and exchange rate depreciations are associated with falls in interest rates .

8 Lecture 7(I): Speculative attacks on fixed exchange rate

8.1 The central bank balance sheet

Please refer to chapter 17 in Krugman and Obstfeld.

Assets	Liabilities	
D Home assets	Bank deposits	$\Big\}\ H$
R Foreign asset reserves	Notes and coins	

Assume for simplicity the money supply multiplier is one; i.e. $M = H$. So, the money supply at time t is given by $M_t = D_t + R_t$. The central bank (CB) can alter the money supply M by buying/selling either home assets (altering domestic credit D) or foreign reserves R. $\Delta M = \Delta D + \Delta R$.

Sterilized versus unsterilized intervention on the foreign exchange market:

- Unsterilized: CB buys/sells reserves and lets the money supply change accordingly; i.e. $\Delta M = \Delta R$.
- Sterilized: CB buys/sells reserves but conducts offsetting open market operations in home assets to keep the money supply unchanged; i.e. $\Delta D + \Delta R = 0$.

All the models of the exchange rate we have studied imply that sterilized intervention cannot affect the exchange rate. What matters is the money supply M_t not its composition[6].

For example, the (modern) monetary model under constant money growth implies

$$e_t = fun_t + \alpha \Delta e_{t+1} \tag{122}$$

$$\Delta e_{t+1} = \Delta m_{t+1} - \pi^*_{t+1}. \tag{123}$$

with $fun_t = (m_t - m_t^*) - (\bar{y} - \bar{y}^*)$.

[6] There is one caveat to this statement which goes under the name of the *signalling hypothesis*. Sterilized intervetion can affect the current exchange rate if it alters expectations about *future* fundamentals (hence it affects Δe_{t+1}).

This result is common to any model of the exchange rate in which home and foreign assets are assumed to be perfect substitutes up to an exogenous risk premium. In these models changes in portfolio composition do not affect risk or returns.

Corollary 1 *A country can set any level it wants for e_t independently from whether it has or not enough reserve. If it has no reserves all it has to do is to set the right money supply by altering domestic credit.*