Lecture 8: Speculative attacks on fixed exchange rate (continued)

Krugman and Obstfeld: Ch. 17 p. 460-463

8.2 Pegging the exchange rate

Let us just remind ourselves of the ingredients of the (modern) monetary model.

- Agents have perfect foresight and $\Delta e_{t+1} = e_{t+1} - e_t$ is the expected depreciation.

Our equilibrium conditions are

$$\text{LM: } m_t - p_t = \bar{y} - \alpha i_t \tag{124}$$

$$\text{PPP: } e_t = p_t - p_t^* \tag{125}$$

$$\text{UIP: } i_t = i_t^* + \Delta e_{t+1} \tag{126}$$

Normalize, without loss of generality, i_t^*, p^* and $\bar{y}$ to zero. Replacing using PPP and UIP in LM, we obtain:

$$m_t - e_t = -\alpha \Delta e_{t+1}. \tag{127}$$

LHS (log of) real money supply. RHS (log of) real money demand.

Rearranging,

$$e_t = m_t + \alpha \Delta e_{t+1}. \tag{128}$$

- Markets have to be in equilibrium under flex or fixed exchange rates.
- The above equations apply under both exchange rate regimes.

The impossible triangle: fixed exchange rate, perfect capital mobility and monetary independence.

$$e_t = m_t + \alpha \Delta e_{t+1} \tag{129}$$

- Under a *credible* fixed exchange rate system it is $\Delta e_{t+1} = 0$ and $e_t = \bar{e}$.
- By equation (129), there is just one value of m_t consistent with this $\rightarrow$ m_t constant $\rightarrow \Delta e_{t+1} = \pi_{t+1} = 0$.
- Given fixed $\bar{e}$ equation (125) determines p_t.
- Home CB could set m_t if $i_t = \Delta e_{t+1}$ were free to clear the money market for given p_t (equation (124)). But under perfect capital mobility and credibly fixed e.r. it is $i_t = i_t^*$ (equation (126)).

- No dilemma if only two of the above three elements are in place.
  - Floating e.r. but perfect K mobility implies p_t is free to clear money market whatever m_t. e_t is free to adjust to satisfy PPP.
  - Fixed exchange rates but capital controls. Home interest rate does not have to satisfy UIP has capital is prevented from arbitraging away interest rate differential.

Implications:

1. *Provided CB is willing to make the fixed exchange rate* $\bar{e}$ *its only priority,* the peg is viable even with no reserves as what matters is $m_t = \log(D_t + R_t)$ not its composition. Provided CB is willing to cut domestic credit D_t by any amount consistent with the peg, the peg will survive.

2. The crucial message is that for a peg to collapse it *must* be the case that it is, or may become, a secondary priority (e.g. subordinate to achieving a not too high unemployment rate in a world of sticky prices as in the 1992 ERM crises).

8.3 Speculative attacks on a peg (first generation models)

8.3.1 Assumptions and intuition

- Simplest possible case: domestic credit D_t is subordinate to a different purpose from preserving the fixed exchange rate.
- Assume D_t grows at a constant rate of μ percent. This may be the case if, for example, the government stock of debt is growing at rate μ and the central bank is printing money to buy all the new government bonds.
- In this world the primary objective is the monetary financing of government borrowing rather than the peg.

- CB can sustain the peg only as long as it can keep the money supply unchanged despite increasing domestic credit. For this to be the case is has to be

$$\Delta M_t = \Delta R_t + \Delta D_t = 0 \tag{130}$$

  or $\Delta R_t = -\Delta D_t$. Reserves have to fall by the same amount as the increase in domestic credit to keep the money supply and the exchange rate constant.

- Lower bound on reserves: $R_t \geq 0$. Eventually reserves are exhausted and M_t increases with D_t $\rightarrow$ speculative attack due to inconsistency between internal and external objectives (deficit financing versus maintaining the peg).

Crucial elements:

- CB gives up defending the peg when reserves are exhausted; i.e when $R_t = 0$.
- The rate of money growth, hence the rate of expected depreciation and the nominal interest rate, increase discontinuously between immediately before and immediately after reserves are exhausted $\rightarrow$ real money demand jumps down $\rightarrow$ in equilibrium so must do the real money supply. Two possibilities:
    1. Nominal money supply does not jump, but price level and, given PPP, the nominal exchange rate jump up at the time reserves hit zero (reserve are exhausted gradually).
    2. The price level and the exchange rate do not jump but the nominal money supply jumps down (discrete change in reserves through a speculative attack).

- Case 1. cannot happen given rational expectations (perfect foresight). It is incompatible with no arbitrage.

- The exchange rate cannot jump up in a foreseen way[7] at the time reserves are exhausted. People holding the home currency would see it depreciating discretely and would be making a (perfectly anticipated!) capital loss. Given perfect foresight, they could have avoided this loss by selling the currency. In fact, they could made an infinitely large profit by selling the home currency short at the fixed exchange rate $\bar{e}$.

- To support the currency in the face of this flight from it, the central bank has sell reserves and buy the home currency. Before being exhausted gradually, reserves fall faster (indeed discretely) than the increase in domestic credit.

[7] This is not strictly true in discrete time, but I am being sloppy with the treatment of time to keep the analysis simple.

8.3.2 The model

Independently from the exchange rate regime, the exchange rate has to satisfy equation (129)

$$e_t = m_t + \alpha \Delta e_{t+1} \tag{131}$$

CASE I: peg. Until peg is viable, $m_t = \log(D_t + R_t)$ is constant $\rightarrow \Delta e_{t+1} = m_{t+1} - m_t = 0$.

$$\bar{e} = \log(D_t + R_t) \tag{132}$$

CASE II: free float. After reserves have been exhausted, it is $m_t = \log D_t$; i.e. $\Delta e_{t+1} = m_{t+1} - m_t = \mu$.

$$e_t = \log D_t + \alpha \mu. \tag{133}$$

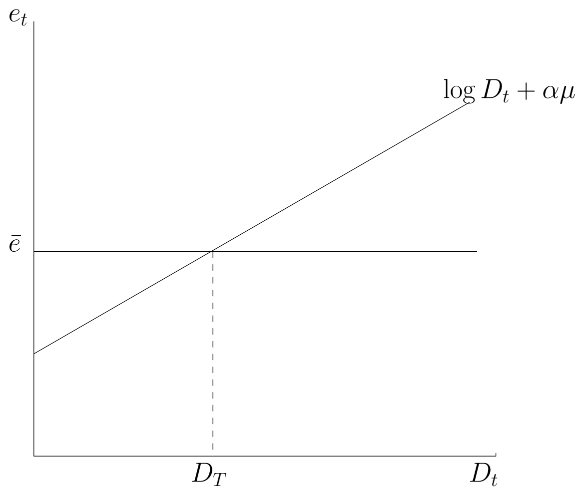
- Equation (133) characterizes the **shadow exchange rate,** the exchange rate which applies *after* reserves are exhausted.

- The exchange rate before reserves are exhausted equals $\bar{e}$.

- Denote by T the time when reserves are exhausted and the currency start floating. For the exchange rate not to jump at time T it has to be

$$\bar{e} = \log D_T + \alpha\mu. \tag{134}$$

  This uniquely determines the value of domestic credit at which the system collapses. Since D_t is an increasing function of time it also uniquely determines T (see Figure on next page).


e_t
$\log D_t + \alpha\mu$
$\bar{e}$
D_T
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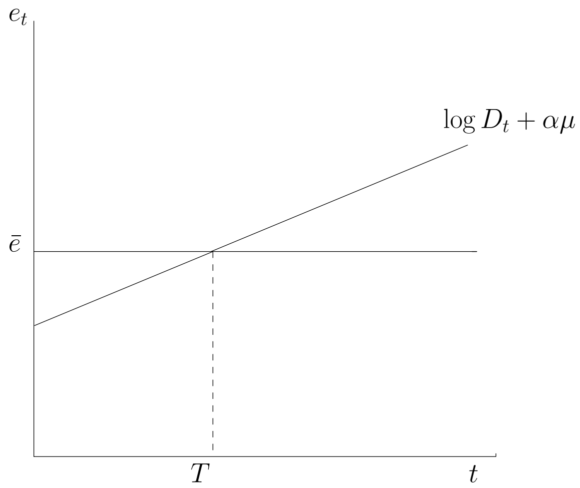

e_t
$\log D_t + \alpha\mu$
$\bar{e}$
T
t

- The peg collapses, that is all reserves are exhausted and the exchange rate floats, the moment the shadow exchange rate equals the level of the peg $\bar{e}$.

- Suppose reserves were exhausted at a level of domestic credit higher than d_T. The exchange rate would jump in a foreseen way and agents who held the home currency would make a foreseeable loss. Rational agents then should sell the home currency causing the central bank to sell its reserves before. Effectively rational agents should scramble to get hold of the CB reserves (i.e. reduce their demand for the home currency) before that time

- $$\log D_T = \bar{e} - \alpha\mu \tag{135}$$

  The level of domestic credit at which the peg collapses equals nominal money demand immediately after the float. It is increasing in $p_T = \bar{e}$ and decreasing in the nominal interest rate μ.

- Since D_t increases with time, the same reasoning implies that there exists a unique time T at which the peg collapses. Reserves cannot be exhausted after T because the exchange rate would jump up (foreseeable capital loss by holding the currency). They cannot be exhausted before T because the exchange rate would jump down (foreseeable capital loss by selling the currency).

- Remember that if D_t grows at μ percent it is

$$\log D_{t+1} = \log D_t + \mu \tag{136}$$

or $\log D_T = \log D_t + \mu (T - t)$.

So if we are at time t, the time T at which the peg will collapse satisfies

$$\bar{e} = \log D_t + \mu (T - t) + \alpha\mu \tag{137}$$

or

$$(T - t) = \frac{\bar{e} - \log D_t}{\mu} - \alpha. \tag{138}$$

- The expected survival time of fixed exchange rate regime is increasing in $\bar{e}$ and decreasing in the initial level of domestic credit d_t and its rate of growth μ. Notice that $(T - t)$ may not be positive if $\bar{e}$ is too low with respect to the initial level of domestic credit. In that case the peg will collapse as soon at it is instated.

We can also explore the relationship between the initial level of reserves and the expected survival time of the peg. Notice that at any moment the peg is credible it is $\Delta e_{t+1} = 0$ and equation (132) applies.

$$\bar{e} = \log(D_t + R_t), \tag{139}$$

Replacing in equation (138) we obtain

$$(T - t) = \frac{\log(D_t + R_t) - \log D_t}{\mu} - \alpha. \tag{140}$$

At any time t, the expected survival time of the exchange rate is an increasing function of the stock of remaining reserves R_t. Again unless the initial stock of reserves is large enough the peg collapses as soon as it is instated.

Discrete fall in reserves at the time of the attack

Up to now we have not really seen a speculative attack in the sense of people running to get hold of the CB's reserves and reserves being depleted discontinuously.

To understand what happens at the time of the collapse T, note that the exchange rate satisfies equation (132)

$$\bar{e} = \log(D_t + R_t) \tag{141}$$

before the collapse and equation (133)

$$e_t = \log D_t + \alpha\mu \tag{142}$$

after the collapse. At time T *both* equations must be satisfied and $e_T = \bar{e}$.

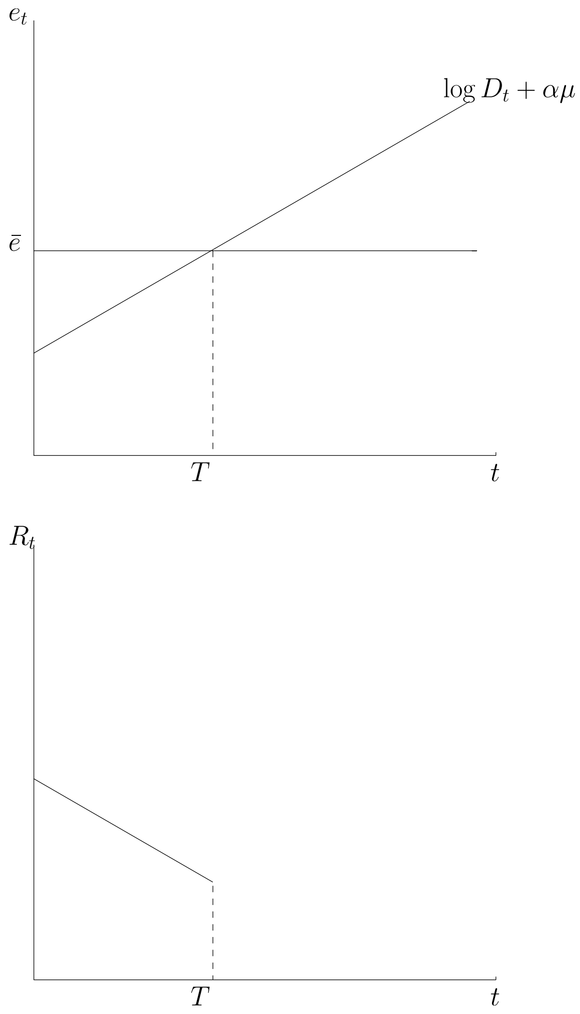
This implies

$$\log(D_T + R_T) = \log D_T + \alpha\mu. \tag{143}$$

or

$$\log\left(D_T + R_T\right) - \log\left(D_T\right) = \alpha\mu. \tag{144}$$

- At time T, reserves fall discretely from R_T to zero. See Figure on next page.
- The stock shift depletion of reserves is exactly the speculative attack. When reserves reach the critical level in the above equation, everybody at the same time scrambles to get hold of the remaining reserves.


e_t
$\log D_t + \alpha\mu$
$\bar{e}$
T
t
R_t
T
t

- The expected exchange rate depreciation and the nominal interest rate jump up discretely at the time the peg is abandoned.

  Since $e_T = \bar{e}$, at time T equations (141) and (142) can be rewritten as

$$\log(D_T + R_T) - \bar{e} = 0 \tag{145}$$

$$\log D_T - \bar{e} = -\alpha\mu. \tag{146}$$

  LHS is (log of) real money supply. RHS is (log of) real money demand.

- Money demand jumps down discretely as the rate of money growth, hence the expected rate of inflation and the nominal interest rate jump up. For money market equilibrium to be maintained without a jump in the price level and the nominal exchange rate, the nominal money supply has to jump down discretely through a stock-shift fall in reserves.

- (Aside) Note that commitment to the peg, while viable, implies a commitment to zero money growth and zero inflation. That is one reason why countries have often pegged their currency as a way of committing to low inflation (e.g. Argentina). If their policies are inconsistent with the peg, though, eventually the peg collapses.

- Note that the speculative attack is not the result of a conspiracy against the currency or of herd behaviour (everybody copying what other people do without any rationale). Here rational investors all try to get hold of the remaining reserves to avoid a foreseeable capital loss if the attack were delayed. The peg collapses ahead of the time when it would have collapsed if no attack had taken place and reserves had been exhausted gradually. So, it may seem to have been caused by the attack, but the attack is indeed an endogenous rational response.

- The model gives extremely clear insight about why a peg may collapse exactly because rather than, in the absence of, investors' rationality.

- In this first generation of models, the cause of the collapse is the inconsistency between the central bank/government internal objective (domestic credit creation) and the external one (the peg).

- While this description of government behavious may capture some currency crises in developing countries monetizing ongoing government benefits, it cannot explain currency crises (such as the ERM 1992 crises, the Mexican 1994 crises and the Asian crises).
  - No excessive domestic credit creation.
  - No mechanical link between capital flight and abandonment of the peg: (e.g. in 1992, UK abandoned the peg but not France).
  - Importance of policy choice in deciding to abandon the peg or not.

8.4 Speculative attacks on a peg (second generation of models)

- Two way causation between expectations and policy decisions. Multiple equilibria with possibility of self-fulfilling crises.
- Central bank may be willing to print no money while the peg is credible (reputation costs of abandoning the peg more than offset cost of refraining from money printing; e.g. short term unemployment).
- But central bank switches to printing money at rate μ if the peg collapses (external objective becomes irrelevant).

- Two possible types of equilibria.

  1. Speculators believe the peg is credible, do not attack and the interest rate does not jump up. The peg survives.

  2. Speculators believe the peg is not credible, interest rate jumps up because so do expectations of depreciation. Government is unwilling to bear the cost of higher interest rates (and associated low unemployment). The peg collapses and the government does indeed switch policy (but it would have not switched in the absence of the attack).

Difference relative to first generation of models:

- No inconsistent policy to start with.
- Collapse of the peg is not inevitable (just one possible equilibrium).
- Yet, the government is not committed to the peg *at all costs.*
- If the country abandon the pegs, no fall in unemployment and output.