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International Finance (Econ 741)
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Handout # 10

BALANCE OF PAYMENTS CRISES: THE BASIC MODEL

This handout sets up a simple optimizing model of a balance of payment crisis, in the spirit of Krugman (1979). The idea is to focus on the essential features of a balance of payments crisis and abstract from all other considerations (Chapter 9 of the book deals with several extensions of this basic model.).

Consider a small open economy perfectly integrated with the rest of the world in both goods and capital markets. Agents have perfect foresight (i.e., there is no uncertainty in the model). Unless otherwise noticed, the same notation as in previous handouts will be used.

1 Consumer

- Consumer's utility function:

$$\int_0^\infty [u(c_t) + v(m_t)] \exp(-\beta t) dt, \tag{1}$$

where c denotes consumption of the only (tradable and non-storable) good, m are real money balances, and $u(.)$ and $v(.)$ are increasing and strictly concave functions.

- Financial wealth:

$$a_t = b_t + m_t,$$

where b denotes the consumer's stock of net foreign bonds.

- Consumer's flow constraint:

$$\dot{a}_t = ra_t + y + \tau_t - c_t - i_t m_t, \tag{2}$$

where y is the constant flow endowment of the good, τ_t are lump-sum transfers from the government, and i is the nominal interest rate.

- Consumer's lifetime budget constraint:

$$a_0 + \frac{y}{r} + \int_0^\infty \tau_t \exp(-rt)dt = \int_0^\infty (c_t + i_t m_t) \exp(-rt)dt. \tag{3}$$

- Consumer's first-order conditions (maximize (1) subject to (3), assuming that $\beta = r$):

$$u'(c_t) = \lambda, \tag{4}$$
$$v'(m_t) = \lambda i_{t,} \tag{5}$$

where λ is the (time-invariant) Lagrange multiplier associated with constraint (3).

- By combining (4) and (5), we get $v'(m_t) = u'(c_t)i_t$, which implicitly defines the real money demand:

$$m_t = L(\underset{+}{c_t}, \underset{-}{i_t}), \tag{6}$$

where the partial derivatives follow from the properties of $u(.)$ and $v(.)$.

2 Government

- Government's budget constraint:

$$\dot{h}_t = rh_t + \dot{m}_t + \varepsilon_t m_t - \tau_t, \tag{7}$$

where h is the government's (monetary authority's) stock of net foreign assets (i.e., international reserves) and ε is the rate of devaluation/depreciation.

- Government's intertemporal constraint:

$$\int_0^\infty \tau_t \exp(-rt)dt = h_0 + \int_0^\infty (\dot{m}_t + \varepsilon_t m_t) \exp(-rt)dt. \tag{8}$$

3 Equilibrium conditions

- Perfect capital mobility (no foreign inflation)

$$i_t = r + \varepsilon_t. \tag{9}$$

- Economy's flow constraint (i.e., the current account) follows from (2), (7), and (9):

$$\dot{k}_t = rk_t + y - c_t,$$

where $k(\equiv b + h)$ denotes the economy's stock of net foreign assets.

- Economy's resource constraint follows from (3), (8), and (9):

$$k_0 + \frac{y}{r} = \int_0^\infty c_t \exp(-rt) dt. \tag{10}$$

4 Real equilibrium

Along any perfect foresight equilibrium path, it follows from (4) that c_t is constant over time. From (10), it then follows that consumption equals permanent income:

$$c_t = rk_0 + y. \tag{11}$$

Substituting (11) into (6), we obtain (using (9)):

$$m_t = L(rk_0 + y, r + \varepsilon_t). \tag{12}$$

5 Domestic credit policy

- To determine the path of international reserves, we need to specify the domestic credit policy followed by the Central Bank. The rate of growth of domestic credit is a policy instrument. Let us denote the (constant) rate of domestic credit by θ:

$$\frac{\dot{D}_t}{D_t} = \theta. \tag{13}$$

- This domestic credit rule implies that (using the central bank's balance sheet and (7)):

$$\tau_t = rh_t + \varepsilon_t h_t + \frac{\dot{D}_t}{E_t}. \tag{14}$$

- Combining (7) with (14), we obtain :

$$\dot{h}_t = \dot{m}_t - d_t(\theta - \varepsilon_t). \tag{15}$$

- If we define the fiscal surplus as $s_t^g = rh_t - \tau_t$, then:

$$-s_t^g = \dot{m}_t + \varepsilon_t m_t - \dot{h}_t. \tag{16}$$

6 Monetary equilibria

We assume that, as of time 0, the exchange rate is fixed at the level $\bar{E}$. Hence, by (9), $i_t = r$. The initial level of domestic credit, $D_{0,}$ is assumed to be such that the initial level of international reserves is positive:

$$h_0 = m_0 - \frac{D_0}{\bar{E}} = L(rk_0 + y, r) - \frac{D_0}{\bar{E}} > 0$$

Suppose that there is a lower bound for international reserves (say, $h_t = 0$). If that level is reached, the central bank ceases to intervene in the foreign exchange market and allows the exchange rate to freely float. We will now see how the perfect foresight path of monetary variables critically depends on whether the rate of growth of domestic credit, θ, is zero or positive.

6.1 Sustainable peg

Suppose that $\theta = 0$. From (6) and (15), it follows that the domestic credit policy is consistent with the fixed exchange rate. The fixed exchange rate can therefore be sustained over time. The corresponding stationary equilibrium for this economy is thus:

$$\begin{aligned} c_t &= rk_0 + y, \\ m_t &= L(rk_0 + y, r), \\ h_t &= h_0. \end{aligned}$$

6.2 Unsustainable peg: bop crisis

- Suppose now that the exchange is fixed but the rate of domestic growth is positive $(i.e, \theta > 0)$. From (15), this implies that international reserves are falling at the rate:

$$\dot{h}_t = -\theta d_t. \tag{17}$$

- Consumers know that this policy is unsustainable, in the sense that the lower bound of international reserves will be reached in finite time and the central bank will allow the exchange rate to float. Let T denote the instant in time in which this will happen. Hence, consumers know that

$$\varepsilon_t = \begin{cases} 0, & 0 \leq t < T, \\ \theta, & t \geq T. \end{cases}$$

- A key piece of information is that at T the exchange rate (E) cannot jump. If it did, there would be infinite arbitrage opportunities.

- How is T determined?

  Since the exchange rate cannot jump at T, money market equilibrium at T is given by

$$L(rk_0 + y, r + \theta) = \frac{D_0 \exp(\theta T)}{\bar{E}},$$

which implicitly defines

$$T = \tilde{T}(rk_0 + y, \theta, D_0).$$

- The discrete change in real money demand at the moment of the crisis T is given by

  $$\Delta m \equiv m_T - m_{T^-} = L(rk_0 + y, r + \theta) - L(rk_0 + y, r) < 0,$$

  which corresponds to the loss in international reserves since $\Delta h = \Delta m$.

- Figure 1 illustrates the paths of the main variables. The most remarkable feature of the model is the sudden loss of reserves at time T even though individuals have perfect foresight (i.e., nobody is taken by surprise).

Figure 1. Dynamics of BOP crisis