PC 9: Foreign-exchange crises

Exercice #1: A model of the first generation

Adapted from Paul Krugman, "A Model of Balance-of-Payment Crisis," *Journal of Money, Credit and Banking*, 1979.

Consider a small open economy whose currency is managed with reference to that of a large country. There is free capital mobility. The model is written in continuous time and all variables except interest rates are in logarithm. The functioning of the economy is given by four equations:

$$m_t - p_t = \alpha y - \beta i_t \qquad \alpha, \beta > 0 \qquad (1)$$
$$m_t = \gamma r_t + (1-\gamma)\, d_t \qquad 0 < \gamma < 0 \qquad (2)$$
$$e_t = p_t - p^* \qquad (3)$$
$$i_t = i^* + \hat{e}_t \qquad (4)$$

m_t is money supply, p_t the price level in the domestic economy and p^* the (exogenous) price level in the foreign economy, r_t foreign-exchange reserves, d_t credit to the domestic economy, y the (exogenous) real income, i_t the domestic interest rate, i^* the (exogenous) foreign interest rate, e_t the nominal exchange rate, and $\hat{e}_t = \frac{de_t}{dt}$. All variables are studied as deviations from their baseline level and γ denotes the share of foreign exchange reserves as a counterpart of money supply in the baseline equilibrium.

1. Describe the functioning of the economy in a fixed exchange-rate regime and in a free-floating regime, successively.

2. Assume that at time $t=0$, foreign-exchange reserves are r_0 and domestic credit is d_0. The government decides an expansionary fiscal policy financed through money creation: domestic credit will grow at a constant rate μ:

$$d_t = d_0 + \mu t \qquad (5)$$

For the sake of simplicity, we assume $p^*=0$, $d_0=0$ and $y=0$. How will foreign-exchange reserves evolve in a fixed exchange-rate regime? Calculate the fixed exchange rate $\bar{e}$. Is this regime sustainable? At which time T are foreign-exchange reserves depleted?

3. Denote by $\tilde{e}_t$ the shadow, floating exchange rate that would prevail should foreign exchange reserves be completely exhausted. Calculate $\tilde{e}_t$ as a function of d_t. Plot the relationship between d, $\tilde{e}$ and $\bar{e}$ in the *(d,e)* space. At which time T' does the exchange-rate crisis take place? Compare T' with T and explain.

Exercise #2: A model of the second generation

Adapted from Bernard Bensaïd and Olivier Jeanne, "The instability of fixed exchange rate systems when raising the nominal interest rate is costly," European Economic Review, 1997.

Consider a small open economy where prices are determined by purchasing power parity. The exchange rate is fixed but it can be devalued by δ percent. In this case, the domestic price level rises by δ percent as a result of purchasing power parity. The government (or the central bank, depending on the institutional arrangement) minimizes the following loss function:

$$L = u^2 + cz, \quad c > 0 \qquad (1)$$

where u denotes the unemployment rate, z is a dummy variable equal to 1 if the domestic currency is devalued and zero otherwise, and c is the devaluation cost in terms of foregone reputation. The unemployment rate depends on its lagged value (u_{-1}) and on surprise inflation, *i.e.* on the gap between inflation π and expected inflation π^e (surprise inflation leads the real wage to fall temporarily, which stimulates employment):

$$u = \rho u_{-1} - \lambda(\pi - \pi^e) \quad \text{with } 0 < \rho < 1, \qquad 0 < \lambda < 1 \qquad (2)$$

Expectations are assumed to be rational. Accordingly, expected inflation is equal to 0 if the exchange rate is expected to remain constant and to δ in the case of an expected devaluation of δ percent.

1. Explain the government's dilemma.

2. Assume that the exchange rate is expected to remain constant. Show the condition for the government to have an incentive to devalue.

3. Assume now that the domestic currency is expected to be devalued by δ percent. Same question.

4. Denoting $\Phi = \frac{c}{\lambda d} - 2\rho u_{-1}$, show that, for $-\lambda\delta < \Phi < \lambda\delta$, there are two equilibriums, whereas for extreme values of Φ, there is only one equilibrium. Comment.