Models of Currency Crisis

Why do fixed exchange rate regimes collapse?

First generation models

- They identify in government budget deficits the main source of currency crisis
  - Government deficits make the commitment to maintain fixed exchange rate not credible
    1. Fiscal deficit is financed issuing money
    2. Inflation arises
    3. Real exchange rate appreciates
    4. A current account deficit appears
    5. Foreign exchange reserves decrease
    6. The fixed exchange rate cannot be maintained

First generation models

- A formal model with perfect forecast (Krugman)

$$m_t - p_t = \hat{y} - ki_t$$

Domestic money supply is a weighted average of domestic credit *b* and foreign exchange reserves *ru*

$$m_t = \gamma b_t^d + (1-\gamma) ru_t \quad 0 < \gamma < 1$$

Setting *P* = 1* PPP equation in logarithmic form becomes $p_t = s_t$

$$i_t = i_t^* + \dot{s} \quad \text{(UIP condition)}$$

$$\dot{b}^d = \mu \quad \text{(Rate of growth of domestic credit)}$$

First generation models

- Central Bank finances government debt purchasing treasury bonds

If we define $\delta = \hat{y} - ki^*$ from UIP $i_t = i_t^* + \dot{s}$

$$\delta = \hat{y} - k\left(i - \dot{s}\right)$$
$$\delta = \hat{y} - ki + k\dot{s}$$

$$m_t - s_t = \delta - k\dot{s} \quad \left[p = s\right]$$

First generation models

- Central Bank has a commitment to defend a fixed exchange rate that conflicts with the need to finance government deficit
- In a fixed exchange rate regime $s_t = \bar{s}$ $\quad \dot{s} = 0$

Equation $m_t - s_t = \delta - k\dot{s} \quad [p = s]$ Becomes $m_t - \bar{s}_t = \delta$

Using $m_t = \gamma b_t^d + (1-\gamma) r u_t$ $\quad m_t - \bar{s}_t = \delta$ becomes

$$\gamma b_t^d + (1-\gamma) r u_t = \bar{s} + \delta$$

$$(1-\gamma) r u_t = \bar{s} + \delta - \gamma b_t^d$$

therefore

$$r u_t = \frac{\bar{s} + \delta - \gamma b_t^d}{(1-\gamma)}$$

First generation models

According to $ru_t = \dfrac{\overline{s} + \delta - \gamma b_t^d}{(1-\gamma)}$

Foreign exchange reserves depends on official exchange rate and domestic credit

Defining $\Theta = \dfrac{1-\gamma}{\gamma}$ the change of official reserves is

$$dru_t = -\frac{\gamma}{1-\gamma} db_t^d \qquad r\dot{u} = \frac{dru}{dt} = -\Theta \frac{db^d}{dt} = -\Theta\mu$$

Foreign exchange reserves decrease at a rate that depends on the monetary financing of government deficit

First generation models

- The timing of currency crisis
  - If government deficit is continuous, foreign exchange reserve stock eventually fully depletes
  - Fixed exchange rate cannot be maintained once reserves vanish ($ru = 0$)
  - When $ru = 0$ Central Bank announces that the fixed exchange rate will be abandoned
  - Rational agents anticipate that event and a speculative attack arises *before* $ru = 0$ is reached
  - As a consequence, exchange rate is allowed to freely float before Central Bank announces it

First generation models

- The timing of currency crisis
  - Speculators compare the fixed exchange rate with the exchange rate that would prevail if the exchange rate were free to float (*shadow exchange rate)*

If $\tilde{s} < \overline{s}$ No speculation against domestic currency arises since the shadow exchange rate is *lower* than official parity (expected *appreciation)*

if $\tilde{s} > \overline{s}$ Agents speculates against domestic currency

Speculative attack arises when $\tilde{s} = \overline{s}$

The higher is the official reserve stock and the lower is domestic credit growth, the longer is the period of time before a currency crisis occurs

Second generation models

- In first generation models, Government and Central Bank behaviour is not fully rational
- In the 1990s currency crisis occurred even in the presence of good "economic fundamentals"
- As a consequence new currency crisis model were developed
- In 2° generation models the exit from a fixed exchange rate regime is the result of a strategic game between government and private agents

Second generation models

- Government minimizes a loss function that incorporates agents expectations

$$L = \left\{ \alpha\left(\hat{s} - s\right) + \beta\left(s^{e} - s\right)\right\}^{2} + C\left(\Delta s\right)$$

$C\left(\Delta s\right)$ Is the loss of credibility from exiting the fixed exchange regime

$\left(\hat{s} - s\right)$ Is the cost of currency deviation from PPP long run equilibrium level

$\left(s^{e} - s\right)$ Is the cost of maintaining a fixed exchange rate when agents expect a depreciation

If exchange rate remains fixed, then $C\left(\Delta s\right) = 0$

Second generation models

- Case 1: agents expect the fixed exchange rate regime to continue $s^e = \overline{s}$

If government keep the exchange rate fixed, then $s = \overline{s} \rightarrow \Delta s = 0 \rightarrow C = 0$

The cost of that policy is $L = \left\{\alpha\left(\hat{s} - \overline{s}\right)\right\}^2$

If domestic currency devaluates, government loss is

$$L = \left\{\beta\left(\overline{s} - \hat{s}\right)\right\}^2 + C\left(\Delta s\right)$$

Government keeps the fixed exchange rate if

$$\left\{\alpha\left(\hat{s} - \overline{s}\right)\right\}^2 < \left\{\beta\left(\overline{s} - \hat{s}\right)\right\}^2 + C\left(\Delta s\right) \text{ or } \left(\alpha^2 - \beta^2\right)\left(\hat{s} - \overline{s}\right)^2 < C\left(\Delta s\right)$$

Second generation models

- Case 2: agents expect the fixed exchange rate regime to collapse: $s^e = \hat{s}$

If government keep the exchange rate fixed, then $s = \bar{s} \rightarrow \Delta s = 0 \rightarrow C = 0$

The cost of that policy is

$$L = \left\{\alpha\left(\hat{s} - \bar{s}\right) + \beta\left(\hat{s} - \bar{s}\right)\right\}^2$$

$$L = \left\{(\alpha + \beta)\left(\hat{s} - \bar{s}\right)\right\}^2$$

Note that now the defence of exchange rate is more expensive since

$$\left\{\alpha\left(\hat{s} - \bar{s}\right)\right\}^2 < \left\{\alpha\left(\hat{s} - \bar{s}\right) + \beta\left(\hat{s} - \bar{s}\right)\right\}^2$$

If domestic currency devaluates, government loss is $L = C\left(\Delta s\right)$ since $s = \hat{s}$

Devaluation is convenient when $\left\{(\alpha + \beta)\left(\hat{s} - \bar{s}\right)\right\}^2 > C$

Second generation models

- To devaluate or not?
- Define $F_1 = \left(\alpha^2 - \beta^2\right)\left(\hat{s} - \bar{s}\right)^2, F_2 = \left\{\left(\alpha + \beta\right)\left(\hat{s} - \bar{s}\right)\right\}^2$

Government compare the cost of credibility loss with the costs of maintaining the fixed exchange rate

Case 1: it is always convenient to devaluate if $C < F_1 < F_2$

Case 2: it is always convenient to keep the fixed exchange rate if

$$F_1 < F_2 < C$$

Case 3: multiple equilibria are possible when $F_1 < C < F_2$

In case 3, the final outcome depends on self-fulfilling expectations:

- if agents expect devaluation, then it occurs
- if agents expect stability of exchange rate, then it occurs

Third Generation Models

- They were developed after the Asian crisis of 1997
  - First and second generation models were not able to predict it
  - Economic fundamental were sound
- Moral hazard was a major problem
- Asian countries received huge flow of foreign investment
- Foreign investors were “protected” by governments against default risks
- Asian commercial banks obtained large dollar loans
- Asian countries exchange rates were pegged to the dollar

Third Generation Models

- Three majors disequilibria arose:
  - An excess of risky investments because of moral hazard (government bail-out of foreign debt)
  - Mismatch between short term debt an long term investments (housing bubble)
  - Mismatch between dollar foreign debt and domestic money investments
- The crisis started in Thailand because of the default of one of the most important bank
- Contagion problem: the crisis very soon spread all over the region hitting Korea, Malesia, Indonesia...

Third Generation Models

- A formal model

$$\frac{M_t^s}{P_t} = L(Y_t, i_t) \quad \text{(LM)}$$

$$1 + i_t = (1 + i^*)\frac{S_{t+1}}{S_t} \quad \text{(UIP)}$$

There are two periods: t = 1,2. In period 2 PPP holds, $i = i^*$, $P^* = 1$. Therefore

$$S_2 = P_2 \qquad 1 + i_1 = (1 + i^*)\frac{S_2}{S_1} = (1 + i^*)\frac{P_2}{S_1} \rightarrow S_1 = \frac{1 + i^*}{1 + i_1}P_2$$

And, using LM

$$P_2 = \frac{M_2^S}{L(Y_2, i^*)} \rightarrow S_1 = \frac{1 + i^*}{1 + i_1}\frac{M_2^S}{L(Y_2, i^*)}$$

Third Generation Models

- Agents have a wealth W and can borrow only a fraction of their wealth. They can also borrow from abroad
- The maximum amount of investment is

$$(1+\beta)W = (1-\mu)\beta W + \mu S\beta W$$

β Is the fraction of wealth μ Is the share of foreign debt

$Y = \gamma(1+\beta)W$ Is the production function

Third Generation Models

- Profits in period 1 are

$$\Pi_1 = P_1 Y_1 - \left(1+i_1\right)\left(1-\mu\right)\beta W_1 - \left(1+i^*\right)S_1 \mu\beta W_1$$

Agents consume a share of their profits α

Wealth in period 2 is $W_2 = \left(1-\alpha\right)\frac{\Pi_1}{P_1}$

Output in period 2 is $Y_2 = \gamma\left(1+\beta\right)W_2$ $\qquad Y_2 = \gamma\left(1+\beta\right)\left(1-\alpha\right)\frac{\Pi_1}{P_1}$

$$Y_2 = \gamma\left(1+\beta\right)\left(1-\alpha\right)\left[Y_1 - \left(1+i_1\right)\left(1-\mu\right)\beta\frac{W_1}{P_1} - \left(1+i^*\right)S_1\mu\beta\frac{W_1}{P_1}\right]$$

Third Generation Models

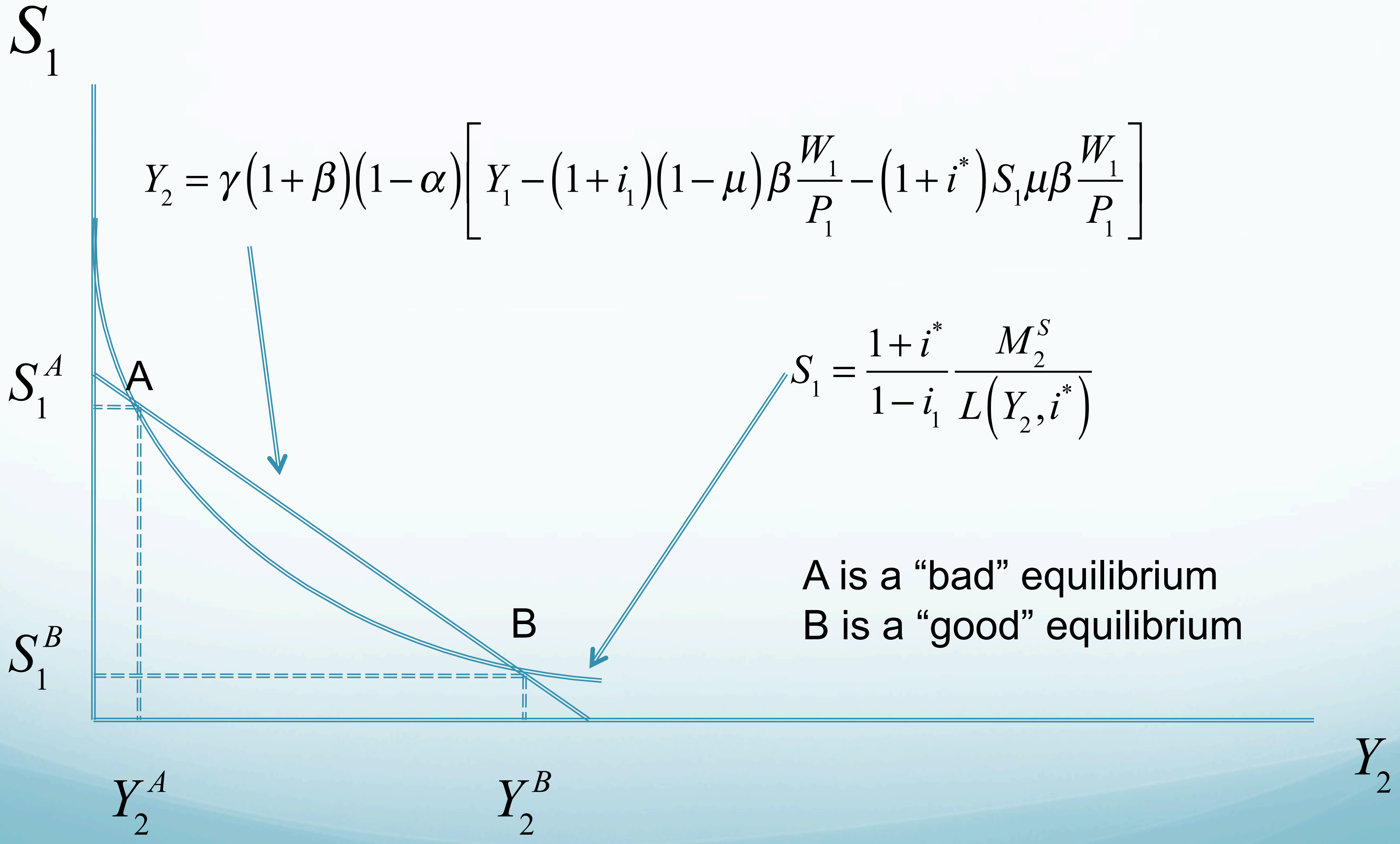
$$Y_2 = \gamma\left(1+\beta\right)\left(1-\alpha\right)\left[Y_1 - \left(1+i_1\right)\left(1-\mu\right)\beta\frac{W_1}{P_1} - \left(1+i^*\right)S_1\mu\beta\frac{W_1}{P_1}\right]$$

Output in period 2 is a decreasing function of period 1 exchange rate

We may find equilibria drawing the above function together with

$$S_1 = \frac{1+i^*}{1-i_1}\frac{M_2^S}{L\left(Y_2, i^*\right)}$$

Third Generation Models



A is a “bad” equilibrium
B is a “good” equilibrium