LECTURE 25:
Speculative Attack Models

• Generation I
• Generation II
• Generation III

Breaching the central bank’s defenses.
Speculative Attacks

Traditional pattern:
Reserves gradually run down to zero, at which point CB is forced to devalue.

Breaching the central bank’s defenses.
In 1990s episodes, reserves seem to fall off a cliff

See graph for Mexico, 1994....

An “irrational” stampede?

Not necessarily. Rational expectations theory says $S$ can’t jump unless there is news; this turns out to imply that $Res$ must jump instead.
Mexico Reserves Profile: Dec. 94 Crisis

Reserves fell abruptly in December 1994

API-120 - Prof.J.Frankel
# Models of Speculative Attacks

## First Generation

<table>
<thead>
<tr>
<th>Episodes that inspired model</th>
<th>&quot;Whose fault is it?&quot; and why</th>
<th>Seminal authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bretton Woods crises 1969-73; 1980s debt crisis</td>
<td><strong>Macro policies:</strong> excessive credit expansion</td>
<td>Krugman (1979); Flood &amp; Garber (1984)</td>
</tr>
</tbody>
</table>
Models of Speculative Attacks, continued

**Second Generation**

**Episode inspiring model**

ERM crises 1992-93: Sweden, France

**"Whose fault is it?"**

International financial markets: multiple equilibria

**Seminal authors**

1. *Speculators’ game*  
   Obstfeld (1994);
2. *Endogenous monetary policy*  
3. *Bank runs*  
4. *With uncertainty*  
   Morris & Shin (1998)
Models of Speculative Attacks, concluded

**Third Generation**

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<th>Episode inspiring model</th>
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</table>
1st-generation model of speculative attack:  
**Krugman-Flood-Garber version**

uses the flexible-price monetary model of exchange rate determination.

Start with money demand function:

\[ m - p = y - \lambda i \]

Add uncovered interest parity:

\[ i = i^* + \Delta s^e \]

Assume flexible prices, implying PPP:

\[ s = p - p^* \]

and output at potential

\[ m - s = \bar{y} - \lambda \Delta s^e \]

(We have normalized \( p^* - \lambda i^* = 0 \): foreign monetary conditions are exogenous.)
Consider a transition in regimes from fixed to floating rates.

Under fixed rates, move $s=\bar{s}$ to the RHS to get an equation that determines the money supply:

$$m = \bar{s} + \bar{y} - \lambda \Delta s^e.$$  

(Recall $M \equiv NDA + R$, where $R \equiv$ forex reserves expressed in terms of domestic currency.)

Or under floating ($s = \tilde{s}$), move $m$ to the RHS to get an equation that determines the exchange rate:

$$\tilde{s} = m - \bar{y} + \lambda \Delta s^e.$$  

**Krugman experiment:**

Central bank undertakes a fixed rate of growth of domestic credit

$$\frac{d(NDA)}{dt}/NDA \equiv \frac{d(nda)}{dt} \equiv \mu. \quad \Rightarrow \quad nda_t = nda_0 + \mu t.$$  

As long as $s$ is fixed, at $\bar{s}$,  

$$\frac{d(R)}{dt} = -\frac{d(NDA)}{dt}.$$
Flood-Garber shadow floating exchange rate:

Define shadow price \( \tilde{S}_t = nda_t - \bar{y} + \lambda \mu = nda_0 + \mu t - \bar{y} + \lambda \mu. \) (After all reserves are lost, \( m \) will consist only of \( nda. \))

When does the speculative attack occur, defined as \( t=T \) ? Rational expectations precludes jumps. Therefore it happens when

\[
\tilde{S}_t = \bar{S} = nda_0 + \mu T - \bar{y} + \lambda \mu
\]

\[
=> T = \frac{\bar{S} - nda_0 + \bar{y} - \lambda \mu}{\mu}
\]

While rate is still fixed: \( \bar{S} = m - \bar{y} + (\lambda)(0) = m - \bar{y} = \log(NDA+R) - \bar{y}. \)

\[
=> T = \frac{\log(NDA_0+R_0) - nda_0 - \lambda \mu}{\mu}
\]

Lessons:
(1) If initial \( R_0 \) is high, \( T \) is far off.   (2) If \( \mu \) is high, \( T \) is soon.
1. Assume the exchange rate is pegged at $\bar{s}$.

2. Assume *NDA* grows exogenously at rate $\mu$, to finance $BD$.

3. Reserves, $R$, flow out through the balance of payments, so $MB$ does not grow beyond the level of money demand (in accordance with the MABP). With complete offset, every $1$ of $NDA$ creation causes $1$ of reserve loss.

4. We want to find $T$, date of speculative attack. Will speculators wait until $R$ hits $0$? No: By then there would not be enough foreign reserves to go around.
Krugman-Flood-Garber Model of Speculative Attack Made Easy (JF)

NDA

MB

S

R

1

2

3

4

5

6

7

8

9

10

...
5. If speculators waited until $R$ ran down to 0, disequilibrium between demand & supply of money would require a discontinuous jump in $S$ -- predictable ahead of time, a violation of rational expectations.

=> The attack must come sooner.

6. Does the attack come as soon as the trend of expansion in domestic credit ($NDA$) is set? No:

Before $T$ arrives, there is no reason for money demand to fall, because inflation and depreciation have not yet risen. and so $M$ demand does not change during initial period.
7. Assume new regime will be a pure float. => $S$ & $P$ will also increase at rate $\mu$ in the post-attack regime.

8. When $T$ arrives, people switch discretely out of domestic money into foreign. The magnitude of the shift is $\lambda \mu$, where $\lambda$ is the semi-elasticity of money demand with respect to the rate of inflation.
9. This can only happen if at time $T$, $\Delta R = -\lambda \mu$. On one day, speculators acquire the central bank’s entire remaining stock of $R$. $T$ is determined by the date when $R$ has fallen to $\lambda \mu$. This is the central result.

10. The attack occurs when Flood-Garber “shadow floating rate” $\tilde{S}_t$ – the $s$ that would occur at any time $t$ if the currency were to float, determined by the level of $NDA$ at $t$ – crosses the peg level $\bar{s}$. Only in this way is a jump in $S$ precluded at the time of the transition from one regime to another -- the no-jump condition required by rational expectations.
2nd-generation model of speculative attack: Obstfeld version

(a) Strong fundamentals

(b) Weak fundamentals

(c) Intermediate fundamentals

Stylized Illustration of a 2\textsuperscript{nd}-Generation Model of Speculative Attack

Obstfeld (1986). Assume:

* If the central bank’s reserves are exhausted, it has to devalue, by 50%.
* Each trader’s holdings of domestic currency = 6.
* Transaction cost = 1 (e.g., foregone interest when holding forex).

(a) If fundamentals are strong (high $R$), neither speculator sells the currency $\leq$
Each realizes if he were to sell, the central bank could withstand the attack.

=> Equilibrium: no attack.

(b) If fundamentals are weak (low $R$), speculators sell the currency.
Each realizes that even if he does not sell, the other will; the central bank exhausts its reserves & is forced to devalue, earning profit for seller $(50\% \times 6 - 1) = 2$ if one sells; $(50\% \times (6/2) - 1) = \frac{1}{2}$ if both sell. There are not enough reserves to go around.

=> Equilibrium: successful speculative attack.

(c) If fundamentals are in between ($R$ is intermediate), outcome is indeterminate.
Each speculator will attack iff he thinks the other will attack. If either sells alone, the central bank can defend, and the seller loses. But if both sell, the central bank exhausts its reserves and devalues, leaving a profit for each $(50\% \times (10/2) - 1 = 1 \frac{1}{2})$.

=> There are two Nash equilibria: either nobody attacks or both do.
The crisis occurs at $T$, when stock of liabilities that have a claim on being bailed out equals pot of Reserves to bail them out with.

Moral hazard: “crony capitalists” borrow to undertake dubious projects, knowing the government will bail them out if the projects go bad.

Dooley’s insurance model
Appendix 2: Definitions of external financing crises

- **Current Account Reversal** \( \equiv \) disappearance of a previously substantial CA deficit.

- **Sudden Stop** \( \equiv \) sharp disappearance of private capital inflows, reflected (esp. at 1st) as fall in reserves & (soon) in disappearance of a previous CA deficit. Often associated with recession.

- **Speculative attack** \( \equiv \) sudden fall in demand for domestic assets, in anticipation of abandonment of peg. Reflected in combination of \( \Delta s - \Delta res \) & \( \Delta i >> 0 \). (Interest rate defense against speculative attack might be successful.)

- **Currency crisis** \( \equiv \) Exchange Market Pressure \( \Delta s - \Delta res \gg 0 \).

- **Currency crash** \( \equiv \Delta s >> 0 \), e.g., >25%.

- But falls in securities prices & GDP are increasingly relevant.