Risk and Wealth in Self-Fulfilling Currency Crises

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Motivation 1: Economic Issues

- Effects of risk, wealth and portfolio distribution in currency crises.
- Examples
  - Russian crisis: contagion to Brazil via wealth effects
  - Asian crisis: "cross-hedging" (FSF report, 2000)
    * hedging motivations lead to contagion
  - General equilibrium effects of FDI, lines of credit and standstills (Giannini, 2002; Hausmann and Fernandez-Arias, 2000)

Motivation 2: Modelling

- Theoretically, it makes sense that risk and wealth matters
- But many models assume certainty in equilibrium, including
  - fundamentals driven models a la Krugman (1979)
  - multiple equilibrium models a la Obstfeld (1996)
- "Global game" models (Morris and Shin 1998) based on strategic uncertainty...
- Extension to continuous actions in this paper makes models more usable...
- Logic of results applies to wider class of models...

Preview of Results

- FDI, lines of credit, standstills induce hedging, increasing likelihood of crises
- Risk aversion increases likelihood of crises
- With "complete markets", wealth increases likelihood of crises
- Many intuitive comparitive statics reversed when $\rho > 1$ (income effects dominate substitution effects)

Setup: The Agent's Problem

- Agent has w_P wealth in dollars and w_P in pesos
- Chooses net demand for dollars y
- Interest rate: r in pesos, 0 in dollars
- Initial exchange rate e_0
- Final exchange rate $e_1 = e_0$ or E, where $E > e_0$

- Thus final wealth in dollars

$$\widetilde{w}\left(y,e_1\right)=w_D+\frac{w_P}{e_1}+y\left(1-\frac{e_0}{e_1}\left(1+r\right)\right)$$

- Agents maximize expected value of

$$\begin{aligned} & u\left(\widetilde{w}\left(y,e_1\right)\right) \\ = & \frac{1}{1-\rho}\left(\widetilde{w}\left(y,e_1\right)\right)^{1-\rho} \end{aligned}$$

i.e.,

$$\pi\left(\widetilde{w}\left(y,e_0\right)\right)^{1-\rho}+\left(1-\pi\right)\left(\widetilde{w}\left(y,E\right)\right)^{1-\rho}$$

- where π is the probability that the peg is maintained.

- Let $y^{*}(\pi)$ maximize this expression

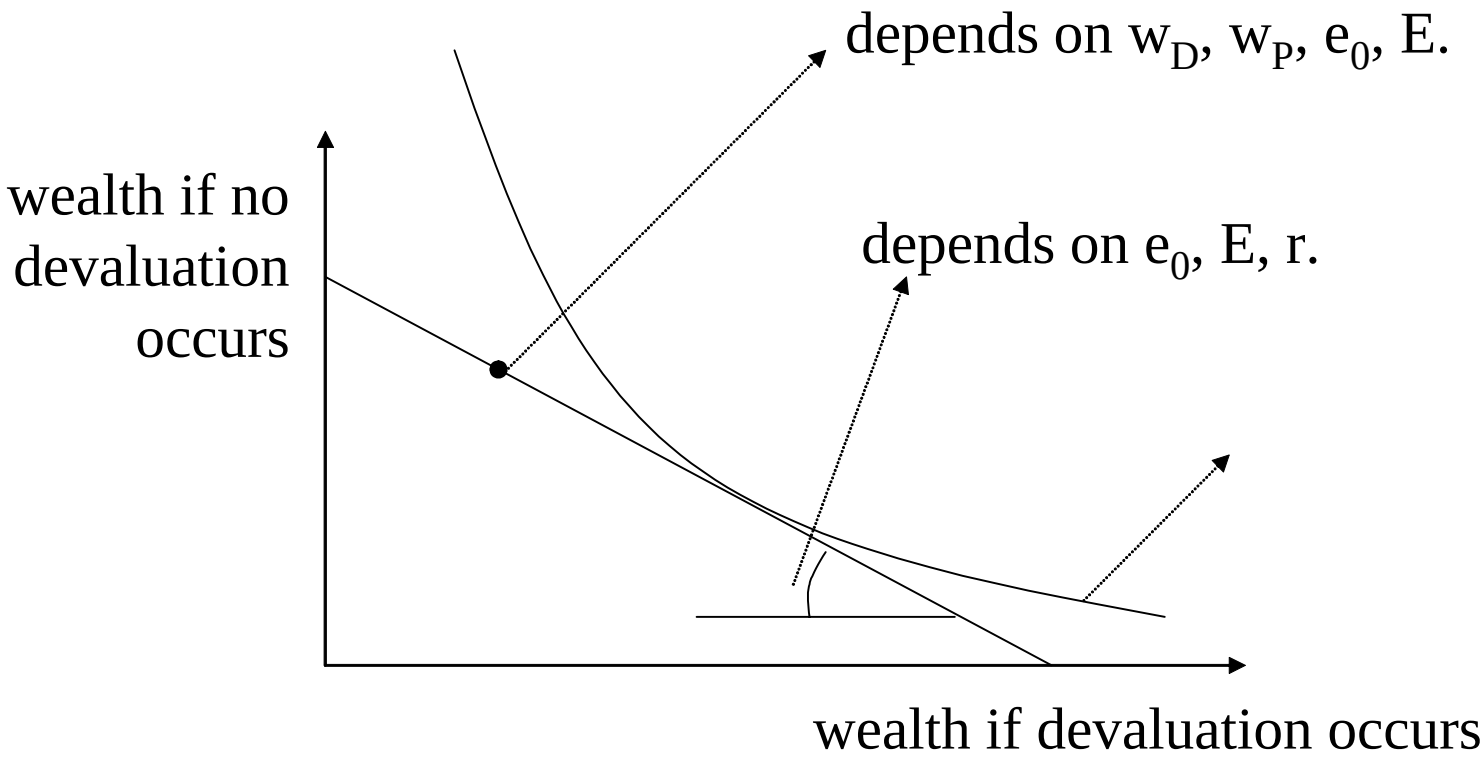
depends on w_D, w_P, e_0, E.
wealth if no devaluation occurs
depends on e_0, E, r.
wealth if devaluation occurs

Figure 1:

Effective Cost of Attacking

$$\widetilde{w}(y, e_0) = w_D + \frac{w_P}{e_1} - yr$$

$$\widetilde{w}(y, E) = w_D + \frac{w_P}{E} + y\left(1 - \frac{e_0}{E}(1+r)\right)$$

$$t = \frac{r}{r + \left(1 - \frac{e_0}{E}(1+r)\right)}$$

One way bet assumption: $t < \frac{1}{2}$

Devaluation Rule

- Devaluation occurs if $\int_i y_i > \theta$
- θ has uniform distribution
- Each agent i observes a signal $\theta + \varepsilon_i$, where $\varepsilon_i \sim f(\cdot)$

Solving for Equilibrium

- Look for "threshold equilibrium" where devaluation occurs if and only if $\theta \leq \theta^*$
- Observing $x_i = \theta + \varepsilon_i$, an agent thinks devaluation occurs if and only if

$$\theta = x_i - \varepsilon_i \leq \theta^*$$

i.e. if

$$\varepsilon_i \geq x_i - \theta^*$$

i.e. with probability

$$1 - F\left(x_i - \theta^*\right)$$

- Equilibrium condition:

$$\begin{aligned}
\theta^* &= \int_{\varepsilon=-\infty}^{\infty} y^* \left(1 - F\left(\varepsilon\right)\right) f\left(\varepsilon\right) d\varepsilon \\
&= \int_{\pi=0}^{1} y^* \left(1 - \pi\right) d\pi, \text{ by c.o.v. } \pi = F\left(\varepsilon\right) \\
&= \int_{\pi=0}^{1} y^* \left(\pi\right) d\pi
\end{aligned}$$

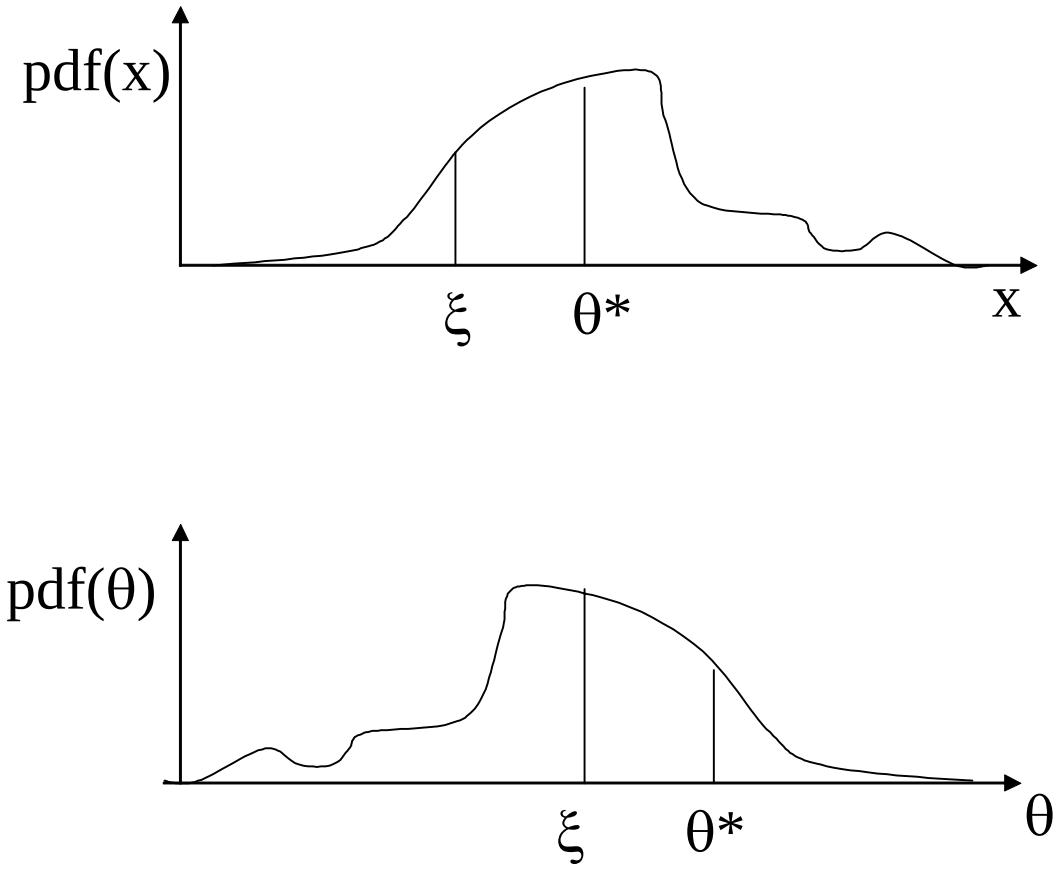

Figure 2:

Closed Form

- Let $\underline{y}$ and $\overline{y}$ be largest and smallest positions determined by Inada conditions.
- Without noise, there would be multiple equilibria for all $\underline{y} \leq \theta \leq \overline{y}$
- Now

$$y^*(\pi) = \underline{y} + \frac{1}{1 + \left(\frac{\pi}{1-\pi}\right)^{\frac{1}{\rho}} \left(\frac{t}{1-t}\right)^{1-\frac{1}{\rho}}} \left(\overline{y} - \underline{y}\right).$$

Results: Risk Aversion

- If $t < \frac{1}{2}$, risk aversion makes a crisis less likely
  - one way bet assumption implies that more investors are short than long, so risk aversion reduces short positions more than it reduces long positions
- for $\rho > 1$, attacks more likely when returns to attack are lower (i.e., t is closer to 0)
  - income effects outweigh substitution effects

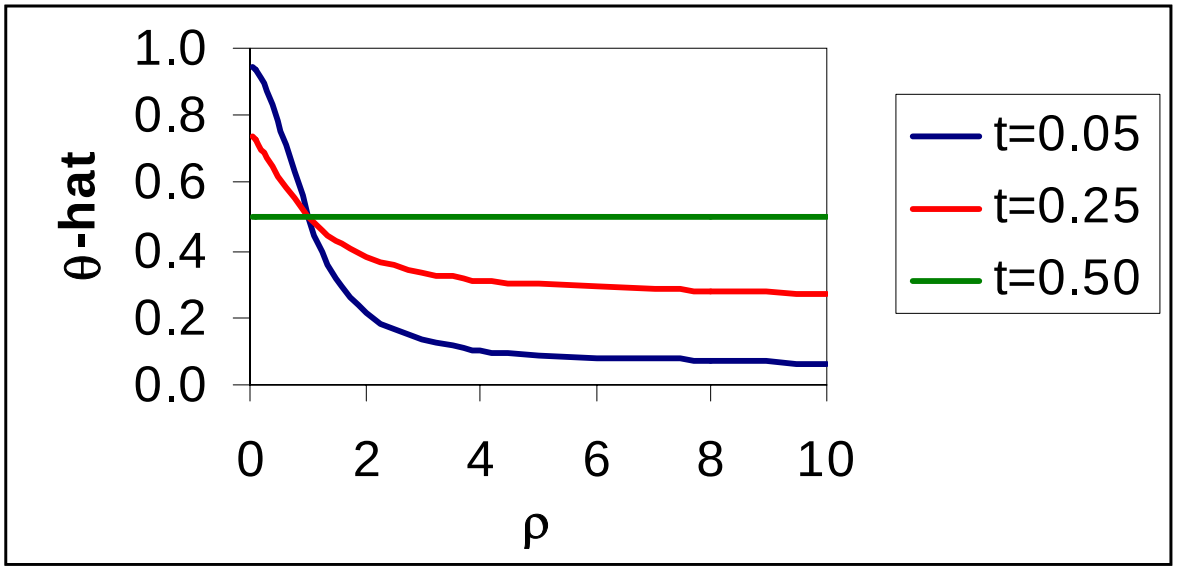

Figure 3:

Risk aversion effects - Complete Markets

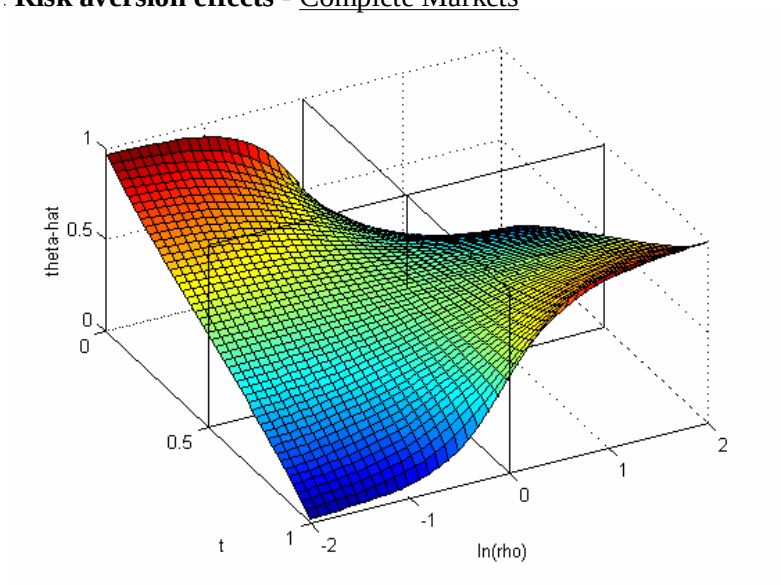

Figure 4:

Results: Risk Aversion

Market assumptions matter: suppose

- shorting is impossible
- agents consume foreign goods only and have all wealth in dollars

then risk aversion increases the probability of a crisis

Results: Wealth

- With complete markets, lower wealth reduces likelihood of attack
- Must have short selling constraint to support the wealth contagion story....

Results: Portfolio Effects

- In our model, increased illiquid exposure leads to increased hedging demand...

- In our examples, only imperfect hedges will exist....

Conclusions 1: global games methodology

- tractable extension to continuous action choices
- risk, wealth and portfolio effects matter only because strategic uncertainty, not arbitrage conditions, pin down equilibrium
- large ongoing literature examines robustness to various stylized assumptions (exogenous interest rates, static modelling...)
- key ingredient, strategic uncertainty, would deliver similar qualitative conclusions in a variety of models...

Conclusions 2: theories of crises

- striking and determinate comparative statics...
- conclusions sensitive to market assumptions (because of strategic assumptions...)
- risk, wealth and portfolio effects important in how strategic complementarities translate into economic outcomes
- important in a wide variety of economic issues

Conclusions 3: empirical work?

- Were Mahathir and the popular press right (the nature of the speculators matters)?
- Understanding international portfolio choices may be especially important in crises....
- Fixed peg crises especially easy to model strategically, but logic may be important more generally....