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 comparative 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

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

• Agents maximize expected value of

\[ u(\tilde{w}(y, e_1)) = \frac{1}{1 - \rho} (\tilde{w}(y, e_1))^{1-\rho} \]

i.e.,

\[ \pi (\tilde{w}(y, e_0))^{1-\rho} + (1 - \pi) (\tilde{w}(y, E))^{1-\rho} \]

• where \( \pi \) is the probability that the peg is maintained.
• Let $y^*(\pi)$ maximize this expression
wealth if no devaluation occurs

wealth if devaluation occurs

depends on \( w_D, w_p, e_0, E \).

depends on \( e_0, E, r \).

Figure 1:
Effective Cost of Attacking

\[ \tilde{w}(y, e_0) = w_D + \frac{w_P}{e_1} - yr \]

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

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

One way bet assumption: \( t < \frac{1}{2} \)
Devaluation Rule

- Devaluation occurs if $\int y_i > \theta$
- $\theta$ 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

$$1 - F(x_i - \theta^*)$$
• Equilibrium condition:

\[ \theta^* = \int_{\varepsilon=-\infty}^{\infty} y^* (1 - F(\varepsilon)) f(\varepsilon) d\varepsilon \]

\[ = \int_{\pi=0}^{1} y^* (1 - \pi) d\pi, \text{ by c.o.v. } \pi = F(\varepsilon) \]

\[ = \int_{\pi=0}^{1} y^* (\pi) d\pi \]
Figure 2:
Closed Form

- Let $y$ and $\bar{y}$ be largest and smallest positions determined by Inada conditions.

- Without noise, there would be multiple equilibria for all $y \leq \theta \leq \bar{y}$

- Now

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