

Defending against Speculative Attacks

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(joint work with Henk Jager and Franc Klaassen)



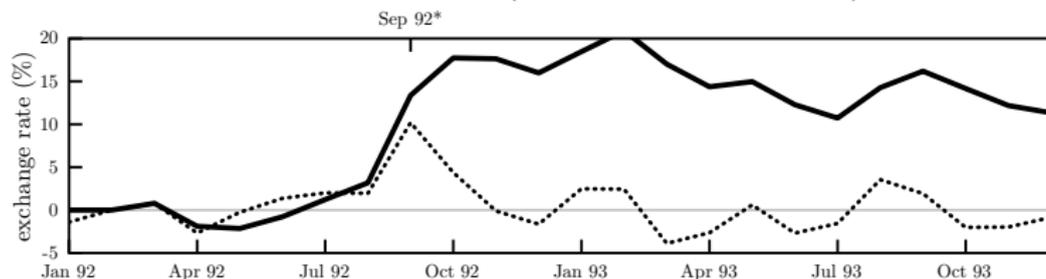
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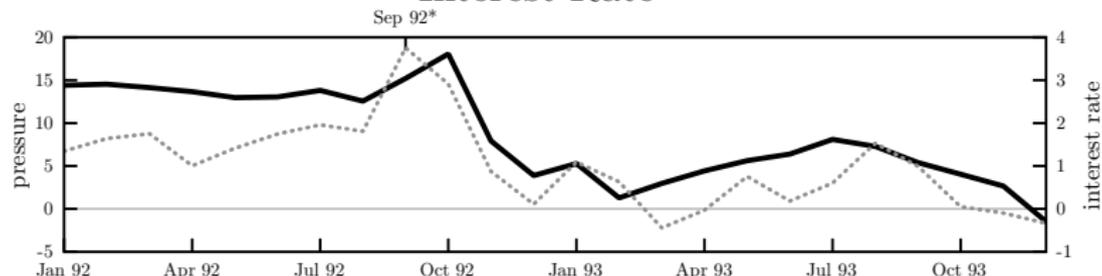
SFB649 *jour fixe*: 28th January 2009

The 92–93 EMS Crises: United Kingdom

Exchange Rate (cumulative change)

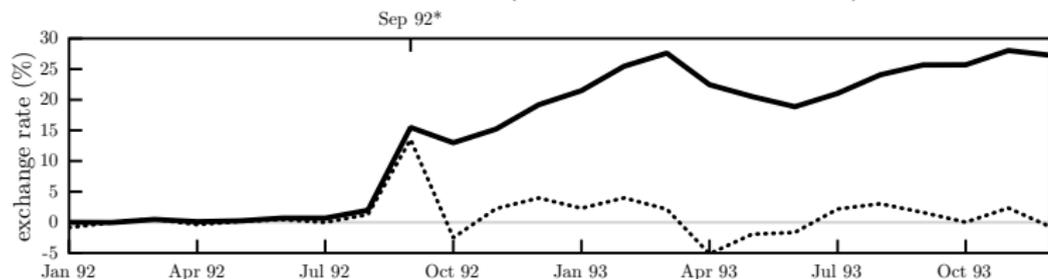


Interest Rate

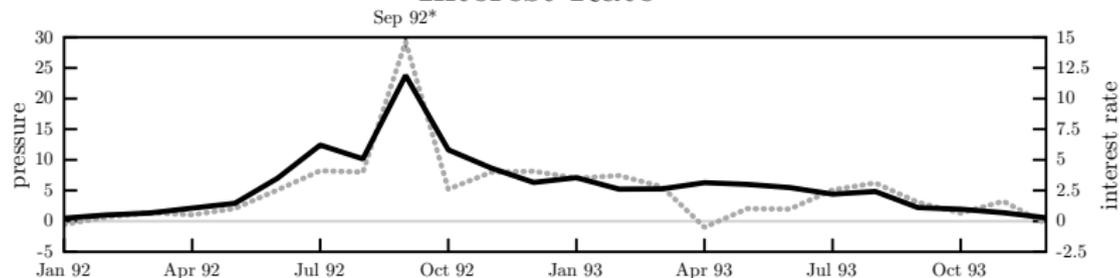


The 92–93 EMS Crises: Italy

Exchange Rate (cumulative change)



Interest Rate



Stylised Facts

- ▶ The jump in the exchange rate is **large**.
- ▶ during an exchange rate crisis, policy makers raise the interest rate.
- ▶ much of the action is hidden in the interest rate *before* the depreciation occurs.
- ▶ a period of “stress” precedes the actual devaluation.
- ▶ **Standard crisis models *never* model how policy makers raise interest rates to defend against an attack, but focus simply on the devaluation decision.**
- ▶ unfortunately, they are also very bad at explaining the size of the devaluation

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Our model

- ▶ models the size of the devaluation **endogenously**
- ▶ has a simple focus on (non-trivial) costwise implications of attack/defence (using global games)
- ▶ explains the jump of the exchange rate following attack (\Leftrightarrow much of the literature)
- ▶ explains the build-up of pressure preceding the attack (\Leftrightarrow much of the literature)
- ▶ explains why the build-up of pressure may take substantial time (\Leftrightarrow much of the literature)
- ▶ develops a connection with empirical literature (\Leftrightarrow much of the literature)
- ▶ has policy implications for making a successful defence
- ▶ models the interest rate defence **endogenously**

Relation to the Literature

- ▶ Traditional currency crisis models (Salant Henderson 1978, Krugman 79 Flood Garber 84, Obstfeld 86, 96) do not model interest rate defence.
- ▶ Global games: Morris and Shin (AER98) do not model interest rate defence.
- ▶ In most global games, the size of the devaluation is **exogenously** put to some large value.
- ▶ **Exceptions:** There is a number **signalling** of models where the policy maker sets r_t (Drazen wp00, Angeletos *et al* AER06).
- ▶ There is a number of models that addresses the output cost of raising interest rates (Flood Jeanne JIE05, Lahiri Végh EJ07)

Mechanics of Speculation (1)

Speculators

- ▶ Speculators take short position in forward market
- ▶ Earn a profit of $s_{t+1} - f_t^{t+1}$ (in logs)
- ▶ Do not actually have to hold currency!

Banks

- ▶ Offer forward contracts
- ▶ Try to reduce mismatches, this involves swaps
- ▶ Price forward contracts according to **covered interest rate parity (CIP)** (why?).

Mechanics of Speculation (2)

Defence against Speculation

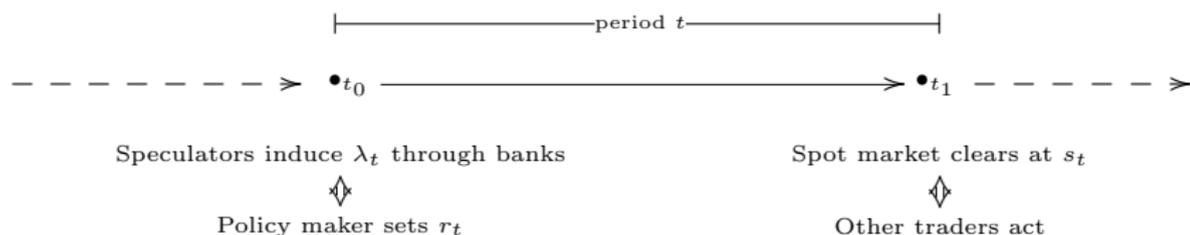
- ▶ Central bank increases interest rate r_t .
- ▶ Influences price of forward contracts
- ▶ Induces noise and carry traders to hold positions in the weak currency

But...

- ▶ Raising interest rate affects economy adversely

The Model

- ▶ Simultaneous decisions of speculators ($\lambda_t \in [0, 1]$), banks (f_t^{t+1}) and policy maker (r_t) at t_0 .
- ▶ Carry trade at t_1 .



- ▶ difference with the literature

Interest Rate Defence

Policy Maker

- ▶ Fundamental u_t ;
- ▶ Domestic interest rate target $r_d(u_t)$, $r'_d(u_t) < 0$ (counterfactual);
- ▶ Maximum interest rate $\bar{r}(u_t)$, $r' < 0$).

Setting the Interest Rate to achieve s_t

$$r(u_t, \lambda_t, s_t)$$

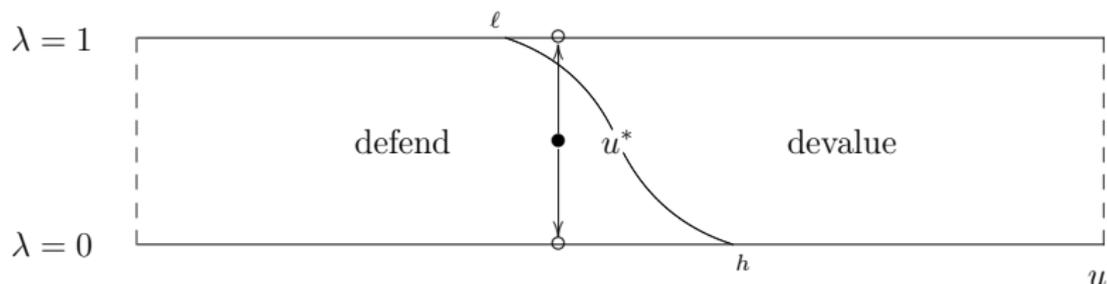
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- ▶ policy maker aims to set

$$r_t < \bar{r}(u_t) \text{ and } r_t = r(u_t, \lambda_t, \tilde{s})$$

\implies fixed exchange rate \tilde{s} .

characterising the decision



- ▶ Tripartition, familiar from literature on second generation models
- ▶ Optimal decision:

$$r^*(u_t, \lambda_t) = \begin{cases} r(u_t, \lambda_t, \tilde{s}) & \text{if } u_t \leq u^*(\lambda_t); \\ r_d(u_t) & \text{if } u_t > u^*(\lambda_t). \end{cases}$$

global game

- ▶ What will speculators do in the region $[\ell, h]$, the region in which the currency is ripe for attack?
- ▶ Following Morris and Shin (AER98) we model this by a global game
- ▶ Follow a modelling approach that allows for a lack of common knowledge about the fundamental among agents.
- ▶ True fundamental u_t revealed “privately” to agents.
- ▶ Speculator matched to Bank, together receive signal:

$$x_{it} \sim U(u_t - \epsilon, u_t + \epsilon), \text{ with } \epsilon \text{ arbitrarily small and fixed}$$

- ▶ Justification: R. Aumann “*agreeing to disagree*”

equilibrium: joint threshold strategies

An **equilibrium** is a situation where:

- ▶ Speculators attack if and only if $\mathbf{E}[s_{t+1}] > \mathbf{f}_{it}^{t+1}$;
- ▶ Banks set f_{it}^{t+1} such that $f_{it}^{t+1} = \tilde{s} + \mathbf{E}[r_t | x_{it}]$ (\leftarrow CIP);
- ▶ Policy maker sets r_t to r_t^*

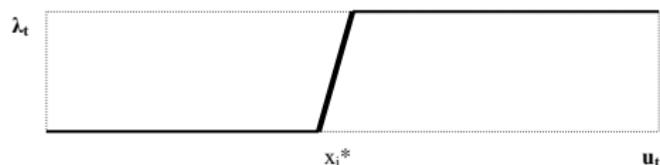
Our model does not satisfy the standard assumptions for global game currency crisis models. Nevertheless:

Theorem

There is an equilibrium such that each speculator i attacks if and only $x_i \geq \underline{x}$.

Under a mild condition on $r(\cdot)$ this is the **unique** equilibrium.

Marginal Speculator



- ▶ in the threshold equilibrium λ_t increases abruptly around the threshold \underline{x} .
- ▶ Consider the **marginal** speculator:

$$\int_0^{\lambda^*} \tilde{s} d\lambda + \int_{\lambda^*}^1 s_{t+1}^e(x_i^*, \lambda) d\lambda - \tilde{s} = \tilde{s} + \int_0^1 r^*(x_i^*, \lambda) d\lambda$$

- ▶ Exchange rate jump substantial (why?)
- ▶ Implies that speculators “wait” for an attack that will cause large adjustment \rightarrow substantial misalignment of u_t .
- ▶ **Policy implication:** effectiveness interest rate vs. interventions using reserves.
- ▶ vs **Signalling:** can use both

Exchange Market Pressure

How to measure pressure on the exchange rate in practice?

slogan **pressure** = Δs_t + **counteracting policies**

(Counterfactually), if the policy maker would abandon the exchange rate, she would set:

$$r_t = r_d(u_t)$$

So:

$$s_t^H \text{ would solve } r(u_t, \lambda_t, s_t^H) = r_d(u_t)$$

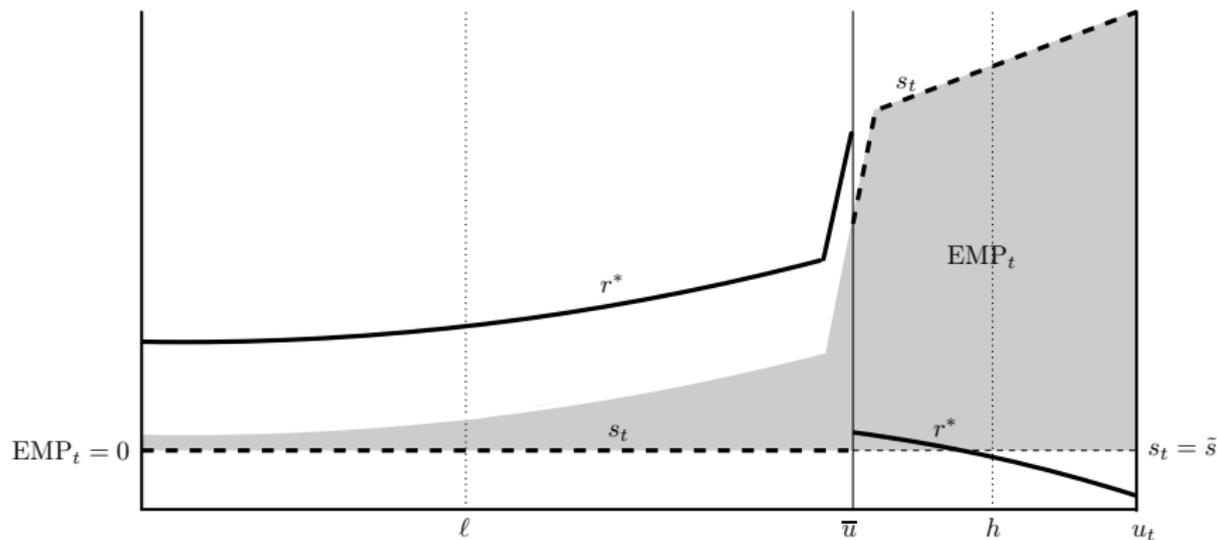
Measure pressure in “hypothetical” fx-rate changes:

$$EMP_t = s_t^H - s_{t-1} = \Delta s_t + w(r_t - r_d(u_t))$$

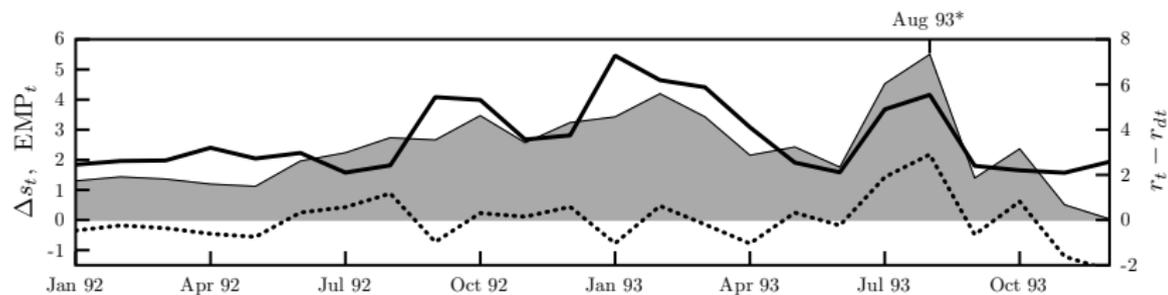
(where w_t is a monotonic weighting function)

Modelling EMP

Our model provides $r_t - r_d(u_t)$!



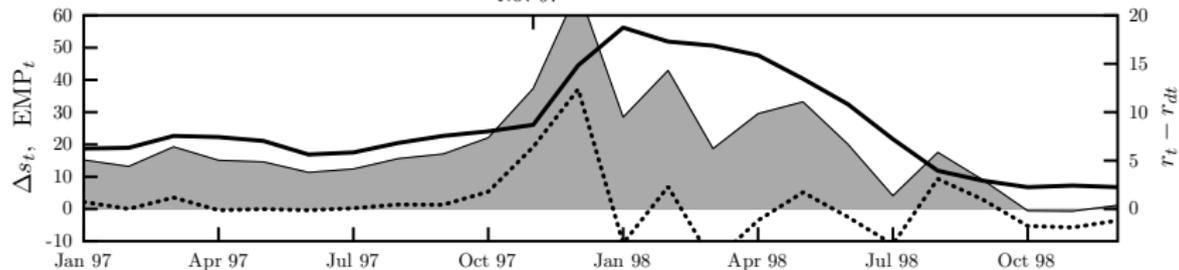
Stylised Facts Revisited (1) EMS Crisis in France



Stylised Facts Revisited (2) 1997 Crises in Asia

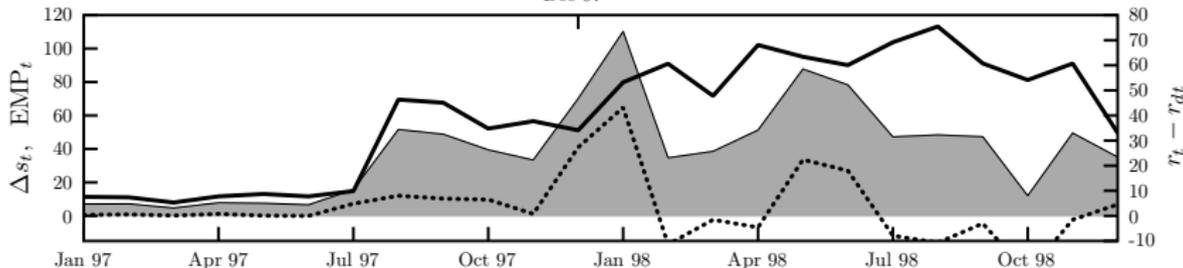
South Korea

Nov 97*



Indonesia

Dec 97*



Conclusion

In sum, **why model the mechanics of attack and the interest rate defence?**

- ▶ complete model, natural element
- ▶ explain stylised facts:
 - ▶ jump of exchange rate
 - ▶ “wait” of speculators
 - ▶ (build up of pressure before attack)
 - ▶ outperforms “standard” models of speculative attacks
- ▶ policy implication: effectiveness of interest rate defence
 - ▶ also in accordance with empirical findings (Goderis and Ioannidou 2008)
- ▶ empirical connection to EMP literature

THANK YOU!