Currency Crises, Twin Crises, and Debt Crises

Maurice Obstfeld
University of California, Berkeley

Main theme of this unit: To analyze alternative theories of currency crisis, including self-fulfilling features, along with empirical regularities.

- ***Topic*** A basic speculative attack model.
- ***Topic*** Self-fulfilling debt crises.
- ***Topic*** Debt default and bubbles.
- ***Topic*** Bailouts and crises.
- ***Topic*** Heterogeneous information.
- ***Topic*** Empirical analysis of crisis episodes.

1. The classic Krugman model of currency collapse

How can unsustainable macro policies determine whether and when a fixed exchange rate is attacked and collapses?

Krugman (*JMCB*, 1979) gave an answer. Flood and Garber (1984) developed a stochastic version.

The model:

Money demand: $m^{\mathrm{d}} - p = -\eta i$

PPP: $p = e + p^{*} = e$

Interest parity: $i = i^{*} + \dfrac{\mathrm{E}\{\mathrm{d}e\}}{\mathrm{d}t} = \dfrac{\mathrm{E}\{\mathrm{d}e\}}{\mathrm{d}t}$

Money supply: $m^{\mathrm{s}} = \log(D + \bar{E}F)$

Policy rule: $\dfrac{1}{D}\dfrac{\mathrm{E}\{\mathrm{d}D\}}{\mathrm{d}t} = \gamma$

Assumed policy scenario: The domestic-credit growth rule is followed forever. When foreign exchange reserves F equal 0, currency is allowed to float in perpetuity.

Key concept: The “shadow” floating exchange rate.

Definition : The “shadow" rate is the rate that would clear the foreign exchange market under a hypothetical free float with zero reserves.

Calculating the shadow rate (with the normalizations $i^* = p^* \equiv 0$):

Since we should have

$$i = \gamma,$$

the monetary equilibrium condition gives

$$m - e = -\eta\gamma.$$

The shadow rate, $\widetilde{e}$, therefore satisfies

$$\log D - \widetilde{e} = -\eta\gamma,$$

or

$$\widetilde{e} = \log D + \eta\gamma.$$

Pre-attack equilibrium:

Since initially the (log) exchange rate is pegged at $\bar{e}$,

$$i = i^* \ (= 0)$$

and so

$$m = \bar{e},$$

$$\mathrm{d}m = \frac{1}{M}(\mathrm{d}D + \bar{E}\mathrm{d}F) = 0,$$

or

$$\begin{aligned} \bar{E}\mathrm{d}F &= -D\frac{\mathrm{d}D}{D} \\ &= -D\gamma\mathrm{d}t + \text{shock}. \end{aligned}$$

$\Rightarrow$ Reserves are lost at an accelerating rate.

Speculative attack occurs when shadow rate equals peg:

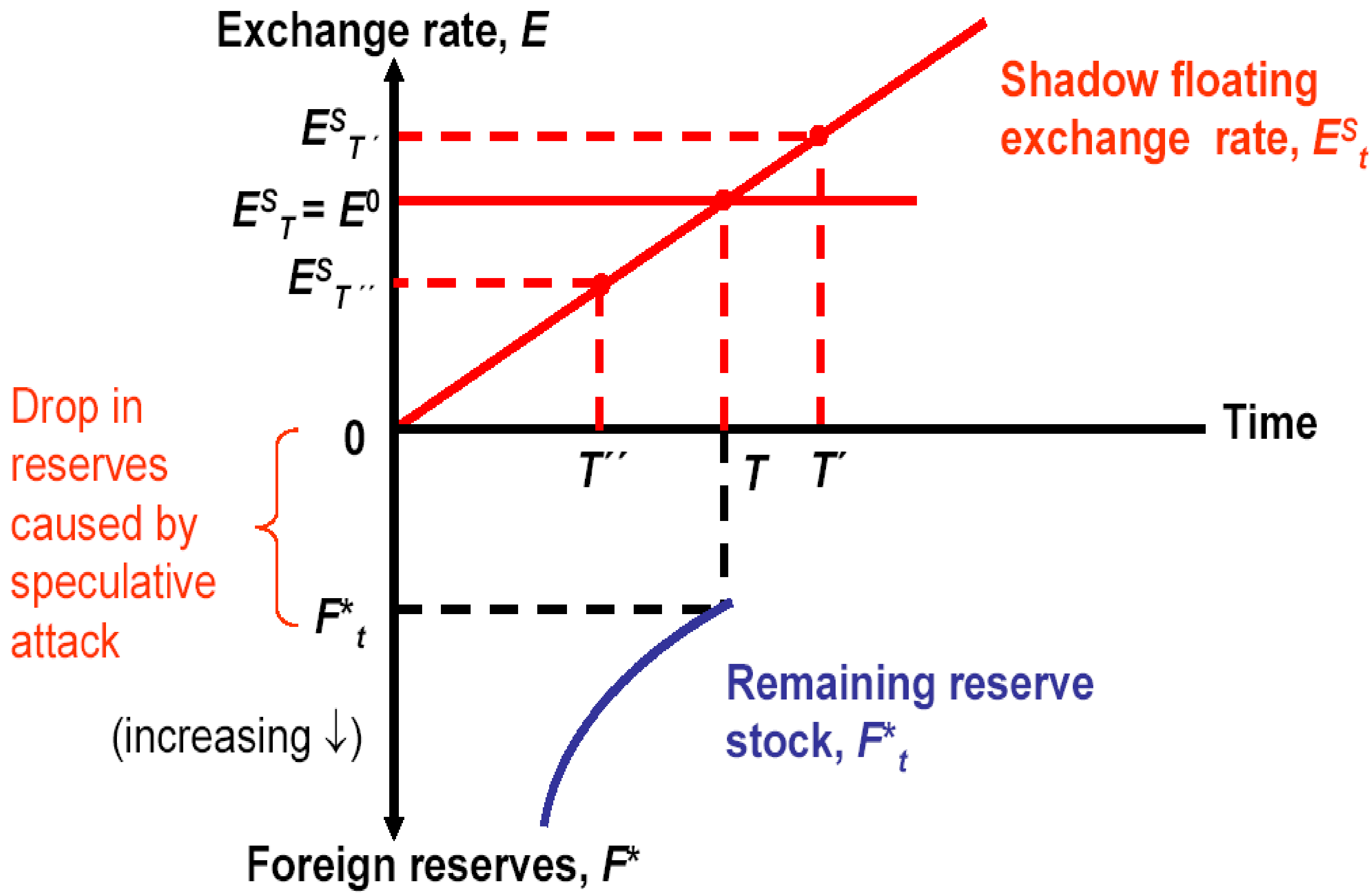
$$\widetilde{e} = \bar{e}.$$

Discrete loss in reserves reduces money supply by amount $\eta\gamma$, so that exchange rate takes no anticipated discrete jump (see picture next page).

Asset-price arbitrage therefore ties down uniquely the timing of the attack, which occurs even though reserves are positive.

Implications for nominal interest rate?

- But are attacks always uniquely determined, and due to unsustainable policies? Hell, heaven, purgatory....



Exchange rate, E
$E^S_{T'}$
$E^S_T = E^0$
$E^S_{T''}$
Shadow floating exchange rate, E^S_t
0
Time
T′′
T
T′
Drop in reserves caused by speculative attack
F^*_t
Remaining reserve stock, F^*_t
(increasing ↓)
Foreign reserves, F*

2. Public debt crises: The role of currency and maturity mismatch

Next is a "second-generation" model in which self-fulfilling expectations play a central role.

Two periods (1 and 2).

Government enters period 1 with nominal domestic-currency obligations

$$\{{}_0D_1,\ {}_0D_2\}$$

and foreign-currency assets (possibly negative)

$$\{{}_0f_1,\ {}_0f_2\}.$$

The profile $\{g_1, g_2\}$ of real government consumption is given; taxes τ may be levied, but in period 2 only (fiscal lags); and the government can print money. The one period interest rate on date 1 is i.

Key budget constraints: In period 1 the exchange rate is fixed ($E_1 = E_0$), so there is no revenue from seigniorage. Thus we have (expressed in domestic-currency terms)

Date 1 constraint :

$$ {}_1D_2 = (1+i)\left[{}_0D_1 + E_1 g_1 - E_1({}_0f_1) + \frac{E_1({}_1f_2)}{1+i^*} \right] $$

Date 2 constraint :

$$ {}_1D_2 + {}_0D_2 + E_2 g_2 $$

$$ = E_2({}_1f_2 + {}_0f_2) + E_2 \tau y + M_2 - M_1 $$

Interest parity condition :

$$ 1 + i = \left(\frac{E_2}{E_1}\right)(1+i^*) $$

Eliminating

$$ {}_1D_2 - \left(\frac{1+i}{1+i^*}\right)E_1({}_1f_2) = {}_1D_2 - E_2({}_1f_2) $$

from the two period finance constraints above, we derive the standard intertemporal constraint:

$$ E_1({}_0f_1) - {}_0D_1 + \frac{E_2({}_0f_2) - {}_0D_2}{1+i} $$

$$ = E_1g_1 + \frac{E_2g_2 - E_2\tau y - (M_2 - M_1)}{1+i} $$

Authorities' loss function is

$$\mathrm{L} = \frac{1}{2}\tau^2 + \frac{\theta}{2}\varepsilon^2$$

where

$$\varepsilon \equiv \frac{E_2 - E_1}{E_2}.$$

If we assume the simple quantity equation

$$M_t = kE_t y \qquad (t = 1, 2),$$

we can write the two period constraints of the government in real terms as:

Date 1 constraint(after division by E_1) :

$$ {}_1d_2 = (1+i)\left({}_0d_1 + g_1 - {}_0f_1 + \frac{{}_1f_2}{1+i^*} \right) $$

Date 2 constraint (after division by E_2) :

$$ \varepsilon({}_1d_2 + {}_0d_2 + k_y) + \tau y = {}_1d_2 + {}_0d_2 + g_2 - {}_1f_2 - {}_0f_2 $$

The government's optimal depreciation choice is

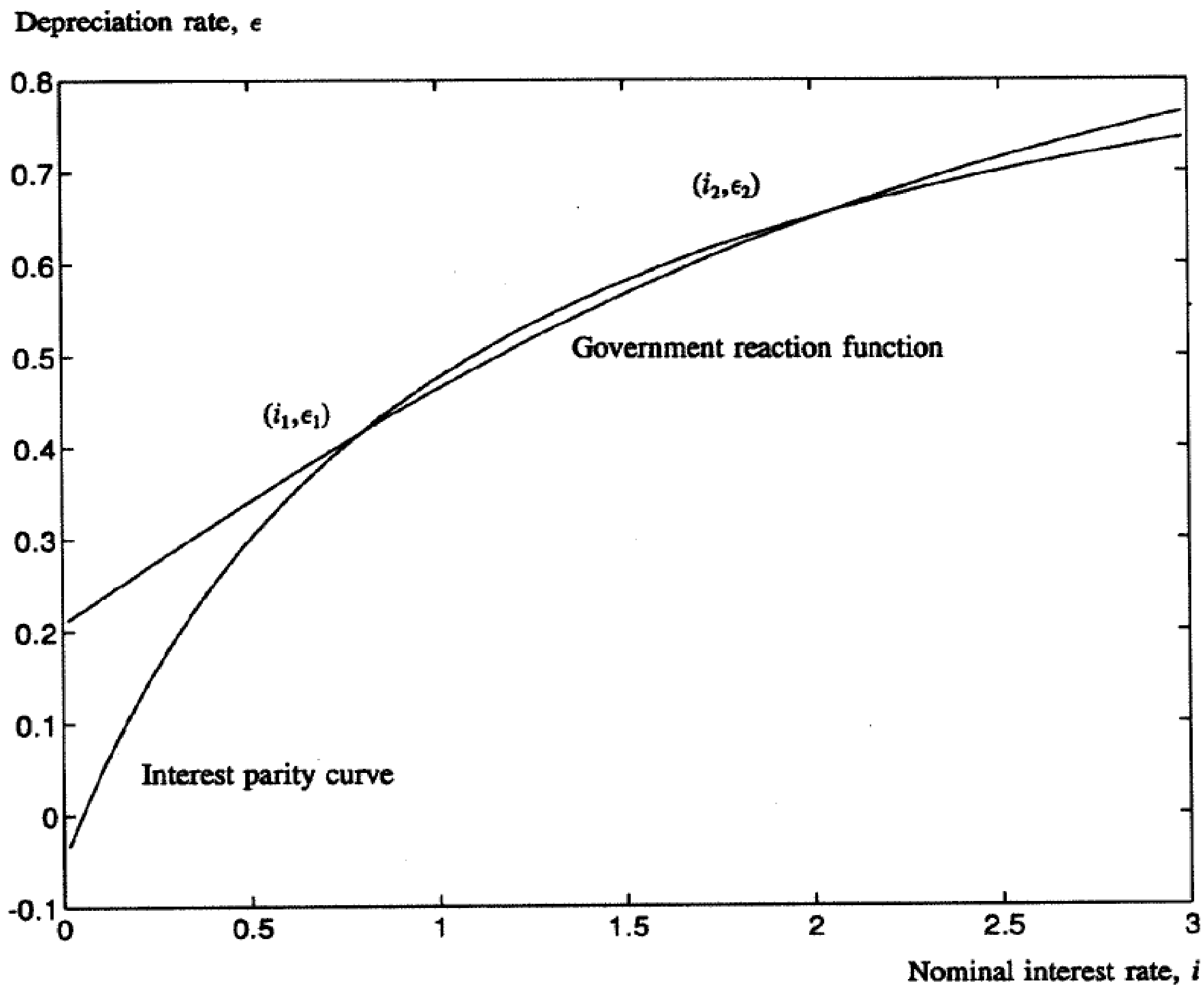
$$\varepsilon = \frac{({}_1d_2 + {}_0d_2 + k_y)({}_1d_2 + {}_0d_2 + g_2 - {}_1f_2 - {}_0f_2)}{({}_1d_2 + {}_0d_2 + k_y)^2 + \theta y^2},$$

which is increasing in $1+i$ because ${}_1d_2$ (new domestic-currency debt) is.

Interest parity condition takes the form:

$$\varepsilon = \frac{i - i^*}{1+i}.$$

Graphing this together with the authorities' reaction function, we may get two equilibria (see figure).



Depreciation rate, ϵ
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
0
0.5
1
1.5
2
2.5
3
Nominal interest rate, i
(i₂,ϵ₂)
Government reaction function
(i₁,ϵ₁)
Interest parity curve

Crises

$$L = \frac{1}{2}\tau^2 + \frac{\theta}{2}\varepsilon^2 + cZ \quad (Z = 1 \text{ for } \varepsilon \neq 0,\ Z = 0 \text{ otherwise})$$

where c is a policymaker personal cost.

Authorities devalue if $L^{\text{fix}} - L^{\text{dev}} > c$, but inequality depends on value of i.

Defensive foreign-currency borrowing:

Government insulated from domestic interest rate if

$$ {}_0d_1 + g_1 - {}_0f_1 + \frac{{}_1f_2}{1 + i^*} = 0, $$

that is, if period 1 domestic borrowing needs are nonpositive. By making ${}_1f_2$ negative—foreign-currency borrowing—government can reduce this effect. But:

- If borrowing is insufficient to preclude a crisis, crisis is more severe if one occurs.
- In a many-period model, ${}_{t-1}f_t$ will be more negative next period (under short-term borrowing), exacerbating financing problem then.
- Default versus devaluation! Compare eurozone experience ....

3. Debt default and bubbles

Crises linked to moral hazard at the micro level.

From Franklin Allen and Douglas Gale, "Bubbles and Crises," *Economic Journal*, 2000 (sketch).

- Gross world interest rate is r^{w}.
- Domestic investors borrow from foreign banks at gross loan rate $r > r^{w}$
- Investors can buy safe asset with $f'(\cdot) = r$, or
- Risky asset paying random gross return R with cdf $H(R)$.
- P = risky asset price.

Investor payoff, given default option, is:

$$\max\{RX_R + rX_S - r(X_S + PX_R), 0\}$$

$$= \max\{RX_R - rPX_R, 0\}.$$

Investor therefore maximizes

$$\int_{rP}^{R_{MAX}} (RX_R - rPX_R)\mathrm{d}H(R) - c(X_R)$$

where $c(X_R)$ is a “nonpecuniary” (convex) cost.

First order condition :

$$\int_{rP}^{R_{MAX}} (R - rP)\mathrm{d}H(R) - c'(X_R) = 0.$$

Equilibrium conditions:

$$X_R = 1$$

- $f'(X_S) = r$
- $X_S + P = B$

where B is the (endogenous) amount that banks are willing to lend.

Equilibrium is given by:

$$\int_{rP}^{R_{MAX}} (R - rP)\mathrm{d}H(R) - c'(1) = 0$$

$$r = f'(B - P)$$

$$r^{\mathrm{w}} = \frac{r(B - P) + \int_{rP}^{R_{MAX}} rP\mathrm{d}H(R) + \int_{0}^{rP} R\mathrm{d}H(R)}{B} < r.$$

These determine P, r, B.

$$\text{Bubble in asset price}: \; P = \frac{1}{r}\left[\frac{\int_{rP}^{R_{MAX}} R\,\mathrm{d}H(R) - c'(1)}{\Pr\{R \geq rP\}}\right]$$

"Fundamentals" asset-price—given r—is

$$P^* = \frac{1}{r}\left[\int_0^{R_{MAX}} R\,\mathrm{d}H(R) - c'(1)\right] = \frac{1}{r}[\bar{R} - c'(1)] < P.$$

Even at $r = r^{\mathrm{w}}$, there is a bubble.

(Proof: Differentiate w.r.t. x function $P(x) = \frac{1}{r}\left[\frac{\int_x^{R_{MAX}} R\,\mathrm{d}H(R) - c'(1)}{\Pr\{R \geq x\}}\right]$.)

Rise in world interest rate $\Rightarrow$ fall in B, rise in r, fall in P—and a financial collapse?

4. Bailouts and crises

This is the theme of several papers, for example, Dooley and Corsetti-Pesenti-Roubini. Often the anticipated bailouts apply to the banking system, giving a theory of "twin" banking and currency crisis.

Kaminsky and Reinhart (1999) is a classic empirical study covering advanced as well as developing countries. A "headline" finding is that banking crises tend to precede currency crises, with banking problems leading to fiscal problems coupled with currency collapses.

The Asian crises of the late 1990s featured such dynamics.

Dooley setup:

The foreign-currency liabilities of the home banking system are L_t. The government's reserves, including borrowing capacity over foreign currency, equal F_t.

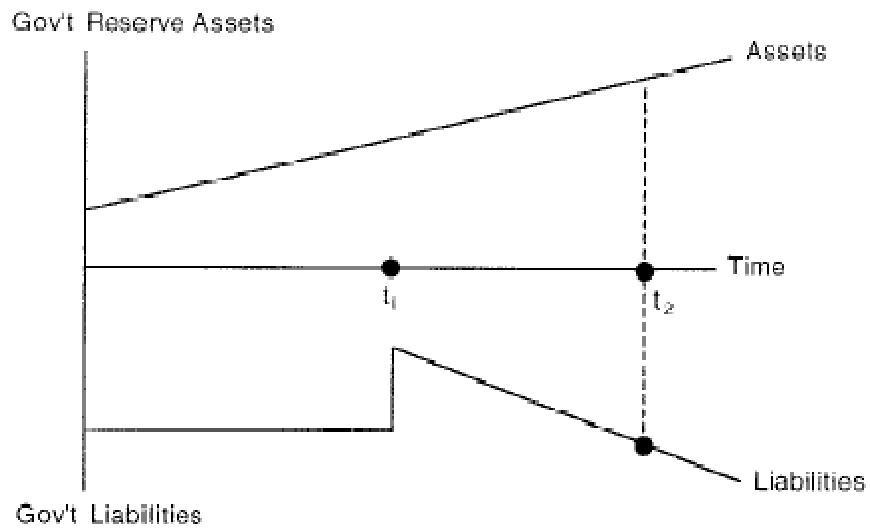
A bank manager expects that if he/she is unable to pay depositors, the government will bail him/her out using its own reserves to pay the private foreign-currency deposits.

So the bankers make risky loans. Only a fraction πL of these loans will be repaid, so the government's liability rises at rate $(1-\pi)\dot{L}$.

There is a fixed exchange rate and a current account deficit ($CA < 0$) big enough that government reserves are rising more slowly than the banking-system bailout liability:

$$\dot{F} = CA + \underbrace{\text{private financial inflows}}_{\dot{L}} < (1-\pi)\dot{L}.$$

The dynamics are illustrated in the figure (from Nancy Marion, "Some Parallels between Currency and Banking Crises," *International Tax and Public Finance*, 1999).



At time t_2 in the figure, the "bailout fund" starts to fall below the banking system's foreign liabilities, so all foreign deposits flee, official reserves fall to zero, and the currency collapses.

This *looks* like a unique equilibrium ... but not so fast.

In the model, *every* bank manager expects a bailout. But suppose managers expect to get bailouts only if most other managers are receiving bailouts – that is, in *systemic* crises.

Now we do have multiple equilibria.

If every banker thinks all others are prudent, he/she will be prudent too. But if they see others taking risky bets and making high (ex post) profits, they will do the same.

This illustrates the concept of *collective moral hazard* formalized by Farhi and Tirole, as well as some prior authors.

Varieties of crises

It has been typical in the literature to speak of three "generations" of crisis models:

- First generation: Unique equilibrium as in Krugman, with crisis due to unsustainability of policies.
- Second generation: Possible multiple equilibria when government optimizes and fundamentals are less than stellar – see debt model from earlier.
- Third generation: Vulnerable balance sheets lead to multiple equilibria. For example, expectation that government will bail out banks with foreign-currency debt, perhaps through money creation and depreciation, leads to an attack on the currency that fulfills this expectation.

- Or: sudden demand for repayment of a country’s short-term debt, in excess of reserves, leads to currency depreciation, in analogy with a bank run.

Sometimes it is hard to shoehorn a particular model into this mold. Dooley model without collective moral hazard (CMH) has a first-generation flavor.

But with CMH the Dooley model looks more third-generation. The vulnerability to crisis arises from the banks’ balance sheets and the resulting implicit contingent government liability in foreign currency.

How has expeience and theory changed our views*?*

Before Asian crisis Dornbusch wrote ("Brazil's Incomplete Stabilization and Reform," *BBPEA* (1:1997), p. 382):

"Where and how the crisis comes about depends on the particular circumstances. For example, a political reversal could break a pattern of continuity and credibility and lead to a sell off; a bout of easy money would hasten such a crisis, a fragile banking system with foreign currency exposure would magnify the collapse, and a liquid debt structure would accelerate and magnify the collapse. *Financial considerations are all important in interpreting specific events, but must not be misconstrued as the primary or sole source of a collapse.*" [Italics added.]

These views now look overoptimistic. Many factors, especially financial sector weakness, can create the ***vulnerability*** to a self-fulfilling panic.

5. Heterogeneous information

The Morris-Shin model

1. How robust are multiple equilibria to an absence of *common knowledge* about the economy? In the multiple equilibrium models, speculators have full information about the actions of other speculators and of the government.

2. What do we mean by common knowledge? The military "attack" model is a good example.

3. Morris and Shin (*AER*, 1998) were the first to take this on, applying the insights of global games.

4. Absent common knowledge, we may get uniqueness.

Assumptions of the Morris-Shin Model

- We can summarize the state of the macro ”fundamentals” by a parameter θ that is *uniformly* distributed over $[0, 1]$.

- Fundamentals are weakest when $\theta = 0$ and strongest when $\theta = 1$.

- There is a “shadow” floating exchange rate $\widetilde{e}$, following Flood and Garber, with $\widetilde{e} = f(\theta)$, $f'(\theta) > 0$. (Here, “up” means *ap*ppreciation.)

- Rate initially pegged at e^* where $e^* > f(\theta)$, $\forall\theta \in [0, 1]$. (Overvaluation situation.)

Speculators

- There is a continuum of speculators indexed by [0,1]. Each can sell 1 unit of domestic currency for foreign currency.
- There is a transaction cost t to speculation.
- Payoff to speculation $= \begin{cases} e^* - f(\theta) - t \text{ (if peg collapses)} \\ -t \text{ (if peg holds)} \end{cases}$
- Assume that $e^* - f(1) < t$, i.e., speculation is unprofitable when fundamentals are strongest. (But this is due to cost t.)
- Define cutoff $\bar{\theta}$ where speculators break even, $e^* - f(\bar{\theta}) - t = 0$.
- See diagram.

Government objectives

- Government gets a payoff of v from maintaining the peg.
- But the *cost* of maintaining the peg is $c(\alpha, \theta)$, where:

$$\alpha \equiv \text{ fraction of speculators who attack}$$

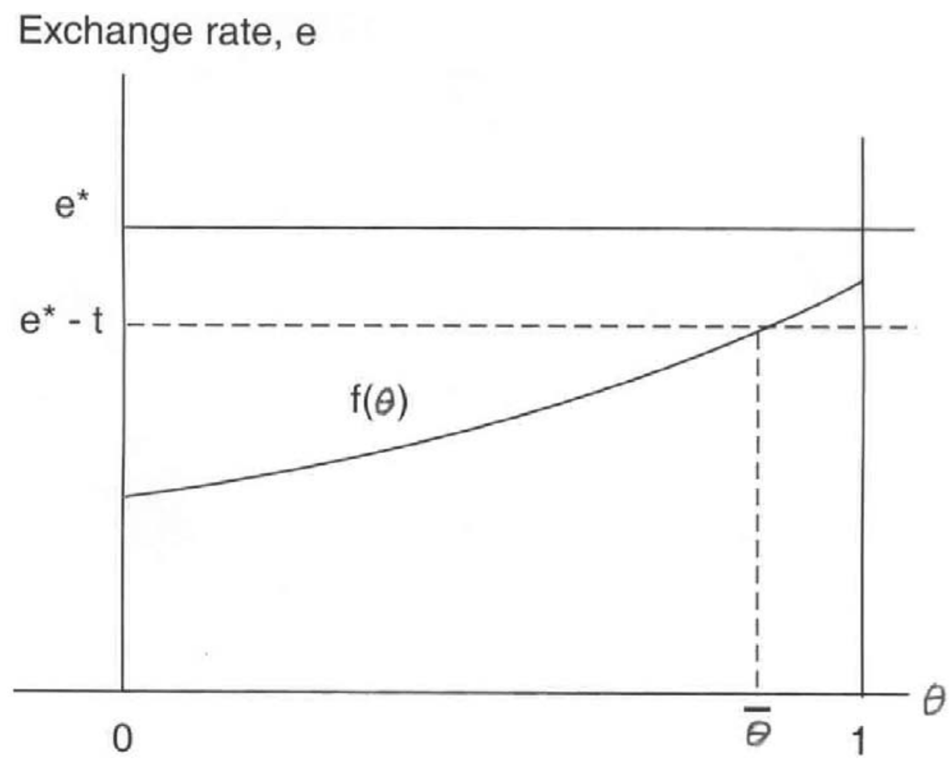
$$\frac{\partial c}{\partial \alpha} > 0, \ \frac{\partial c}{\partial \theta} < 0.$$

- $c(0,0) > v$ – In worst state of fundamentals, peg is too costly even if no one attacks.
- $c(1,1) > v$ – Should all speculators attack, peg is too costly even in best state of fundamentals.

Define the lower cutoff $\underline{\theta} \in (0,1)$ (assumed to exist) by

$$c(0, \underline{\theta}) = v,$$

so that $\underline{\theta}$ is the level of fundamentals where government is indifferent even if *nobody* attacks.



We now have 3 zones of fundamentals:

- $\theta \geq \overline{\theta}$ (Heaven) – peg will never be attacked; even if you believe everyone else is attacking, your dominant strategy is not to attack.
- $\theta \in (\underline{\theta}, \overline{\theta})$ (Purgatory) – peg is "ripe for attack"; value of defending the peg < cost if sufficiently many speculators join an attack.
- $\theta \leq \underline{\theta}$ (Hell) – even if no one attacks, currency peg is doomed.

Imperfect Information Game

1. Nature chooses a value of θ from the uniform distribution over $[0,1]$.

2. Each speculator $i \in [0,1]$ observes a personal signal x_i drawn independently from a uniform distribution over the interval $[\theta - \varepsilon, \theta + \varepsilon]$, where θ is the true θ that nature has just selected.

3. Given x_i, speculator i decides whether to attack or not.

4. Government observes both the true θ and α, and abandons peg iff $v \leq c(\alpha,\theta)$ (in which case its payoff is 0).

5. Speculators get their own payoffs.

Solution Strategy

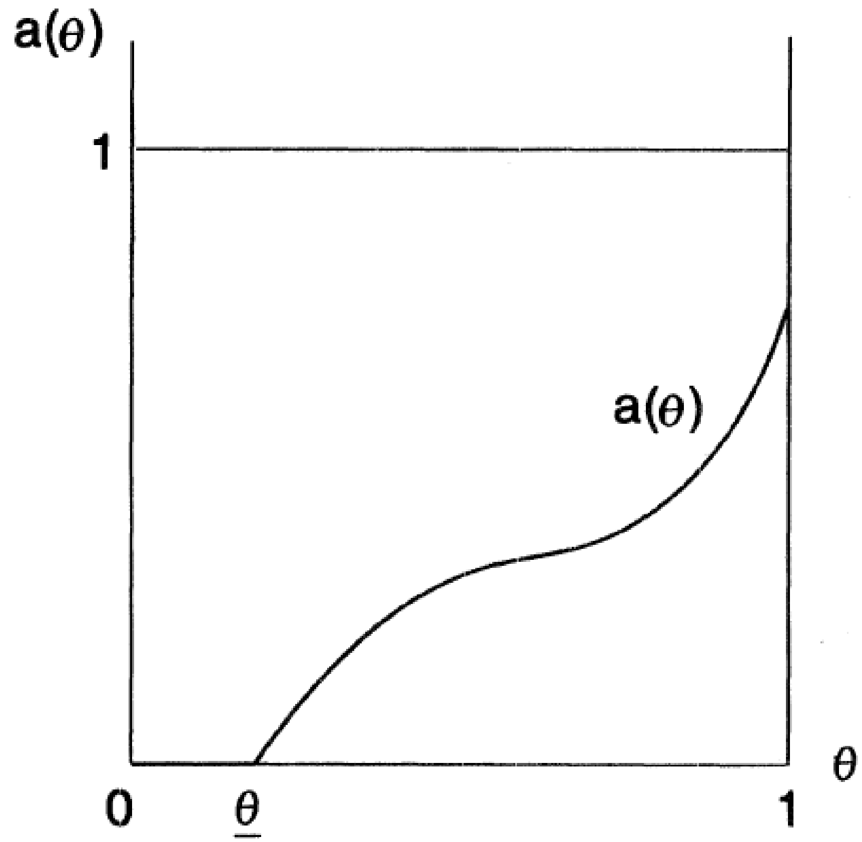
Solve for the government's strategy at final stage, then consider the game among speculators only.

Given θ, define the minimum size of attack such that the government abandons the peg:

$$a(\theta) \equiv \min_{\alpha \in [0,1]} \{c(\alpha, \theta) \geq v\}.$$

Note that $a(\theta)$ (see diagram for a picture of this policy function, which speculators take as *given*) satisfies

$$c(a(\theta), \theta) = v.$$


a(θ)
1
a(θ)
θ
0
θ
1

Speculator Strategy

Since speculators are identical ex ante, an *equilibrium* strategy for any speculator will be of the following form: attack for $x \leq x^*$, but don't attack for $x > x^*$.

The fraction of speculators attacking after observing a signal x would be given by integrating the indicator function:

$$I_{x^*}(x) = \begin{cases} 1 \ (x \leq x^*) \\ 0 \ (x > x^*) \end{cases} .$$

Of course, we will determine x^* endogenously. For now, we take it as ***given*** and find the implied θ^* in "purgatory" where a collapse occurs. (Of course it occurs at all lower θs, too.)

Define

$$s(\theta, x^*) = \text{ proportion of agents that attack } \mid \theta, x^*$$

We find θ^* where $s(\theta^*, x^*) = a(\theta^*)$, then seek the *equilibrium* x^* (the x^* that maximizes a speculator's expected profit).

Recall that for each individual, x is uniform over $[\theta - \varepsilon, \theta + \varepsilon]$. Therefore:

$$s(\theta, x^*) = \frac{1}{2\varepsilon} \int_{\theta-\varepsilon}^{\theta+\varepsilon} I_{x^*}(x)\mathrm{d}x.$$

Why? This is just the fraction of xs observed that are no greater than x^*.

How can we picture this function, and how is θ^* determined?

Suppose the true θ is below $x^* - \varepsilon$. Then $\theta + \varepsilon$ (the biggest x anyone can see) is below the cutoff x^*. So everyone attacks: $s(\theta, x^*) = 1$.

Suppose, at the other extreme, that θ is above $x^* + \varepsilon$. Then the *smallest* x anyone observes, $\theta - \varepsilon$, is above the cutoff x^*. So no one attacks: $s(\theta, x^*) = 0$.

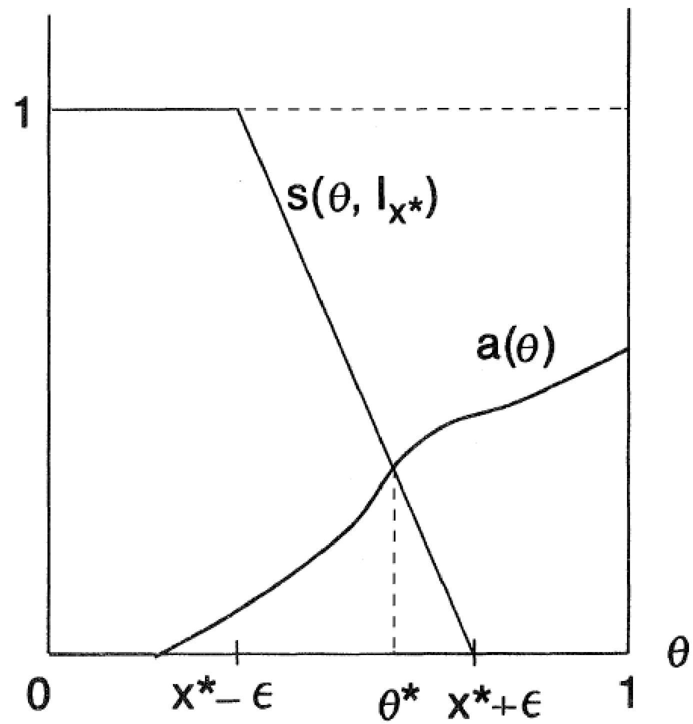
The only range in which different speculators will act differently, given their range of noisy observations on θ, is where

$$x^* - \varepsilon \leq \theta \leq x^* + \varepsilon.$$

In this range, the lower is θ, the more people attack.

The diagram illustrates the $s(\theta, x^*)$ function and the determination of θ^*, the point at which:

$$s(\theta, x^*) = a(\theta).$$



Algebraically speaking,

$$s(\theta, x^*) = \frac{1}{2\varepsilon}\int_{\theta-\varepsilon}^{\theta+\varepsilon} I_{x^*}(x)\mathrm{d}x = \frac{1}{2\varepsilon}\int_{\theta-\varepsilon}^{x^*} \mathrm{d}x = \frac{1}{2} - \frac{\theta - x^*}{2\varepsilon},$$

which is linear in θ.

We can do one comparative statics experiment already. A "tougher" government is one which either has low costs of defense or a high payoff to keeping the peg. In either case, given θ, more speculators will have to attack to cause a collapse. Thus the $a(\theta)$ function shifts upward and θ^* moves down: fundamentals can be worse without a collapse.

Equilibrium Determination of x*

We still have to analyze the behavior of speculators in terms of their specified objectives! Let x^* be the aggregate cutoff signal.

Define $A(x^*) \equiv \{\theta \mid s(\theta, x^*) \geq a(\theta)\}$.

If the aggregate cutoff is x^*, the ex post payoff to the individual from attacking, given the *true* value of θ, will be:

$$h(\theta, x^*) = \begin{cases} e^* - f(\theta) - t \ (\theta \in A(x^*)) \\ -t \ (\theta \notin A(x^*)). \end{cases}$$

But the speculator doesn't see θ, he/she must infer its distribution from x. Thus the speculator would need to compute

$$u(x, x^*) \equiv \mathsf{E}\{h(\theta, x^*) \mid x\}.$$

How to do so? The speculator knows that his/her observed x is in the interval $[\theta - \varepsilon, \theta + \varepsilon]$. Thus, the true θ must be within the interval $[x-\varepsilon, x+\varepsilon]$. (E.g., if $x=\theta-\varepsilon,$ then $\theta=x+\varepsilon$.) Thus

$$u(x,x^*) = \frac{1}{2\varepsilon}\int_{x-\varepsilon}^{\theta^*(x^*)}[e^* - f(\theta)]\mathrm{d}\theta - t.$$

The key observation is that

$$\frac{\partial u}{\partial x} < 0.$$

Why? Differentiating shows that

$$\frac{\partial u}{\partial x} = -\frac{1}{2\varepsilon}[e^* - f(x-\varepsilon)] < 0.$$

Intuition: If you see higher x, you expect fundamentals are stronger and therefore see less expected profit from speculation.

Finding equilibrium x^*:The individual speculator will attack for any x such that $u(x, x^*) \geq 0$. So his/her cutoff x_i^* is defined by $u(x_i^*, x^*) = 0$. But since all speculators are identical, the equilibrium is uniquely given by the condition

$$u(x^*, x^*) = \frac{1}{2\varepsilon} \int_{x^*-\varepsilon}^{\theta^*(x^*)} [e^* - f(\theta)] \mathrm{d}\theta - t = 0.$$

Theorem (Morris and Shin). There exists a unique level of fundamentals θ^* such that the government abandons the peg under speculative pressure if and only if $\theta \leq \theta^*$.

Atkeson's Question

Conspicuously absent from this model are *prices* – for example, forward rates, derivatives prices, interest rates.

But we know (from work of Grossman and Stiglitz in the 1970s) that in some contexts, aset prices can aggregate private information.

Intuition: Suppose people see equilibrium prices and demands are linear functions of private signals. In equilibrium, prices depend on summed demands and the private signals cancel, revealing the true state of fundamentals. Common knowledge is restored.

We don’t believe this is true in practice.

Extended model: Add unobserved shifts in asset supply, say, so that price becomes a noisy signal of private information. But this last is a systemic and not idiosyncratic noise.

So we have private signals as in Morris-Shin (1998) and price, which is a public signal.

Angeletos and Werning: When individuals observe fundamentals with small enough idiosyncratic noise, there is mutiplicity.

Intuition: Suppose both signals are exogenous. Then individuals act on the one that is more precise. Thus, even if we have very little idiosyncratic noise we get uniqueness – discontinuity result.

But with endogenous public information (extracted from prices), the more precise is the private information, the more precise is the public signal, and people will therefore tend to act on that.

“Multiplicity cannot be obtained as a small perturbation around common knowledge.”

6. Empirical analysis of crisis episodes

The paper by Kaminsky and Reinhart (1999) is an example of the event-study approach to the empirical analysis of crises.

A more recent essay in this literature is the paper by Gourinchas and Obstfeld, "Stories of the Twentieth century for the Twenty-First" (forthcoming, *American Economic Journal: Macroeconomics*, January 2012).

The title alludes to an essay by the great Cuban economist and historian, Carlos Diaz-Alejandro.

Financial Crises: Post-floating vs. Post-millennium

Before 2007, financial crises seemed mainly to afflict developing countries. Not really true:

- "Big Five" systemic banking crises.(Finland, Japan, Norway, Spain, Sweden)
- ERM currency crisis (1992-93)
- 1982 LDC debt crisis was a "near miss" for money-center banks.
- LTCM crisis was a near miss too.

But effects generally less devastating than in developing world. Until 2007....

Crisis Frequency in Advanced Countries vs. EMEs (through 2006) – Why the Difference?

	Currency	Banking	Default	# countries
Advanced	43	5	0	22
Emerging	84	57	74	57
Total	127	62	74	79

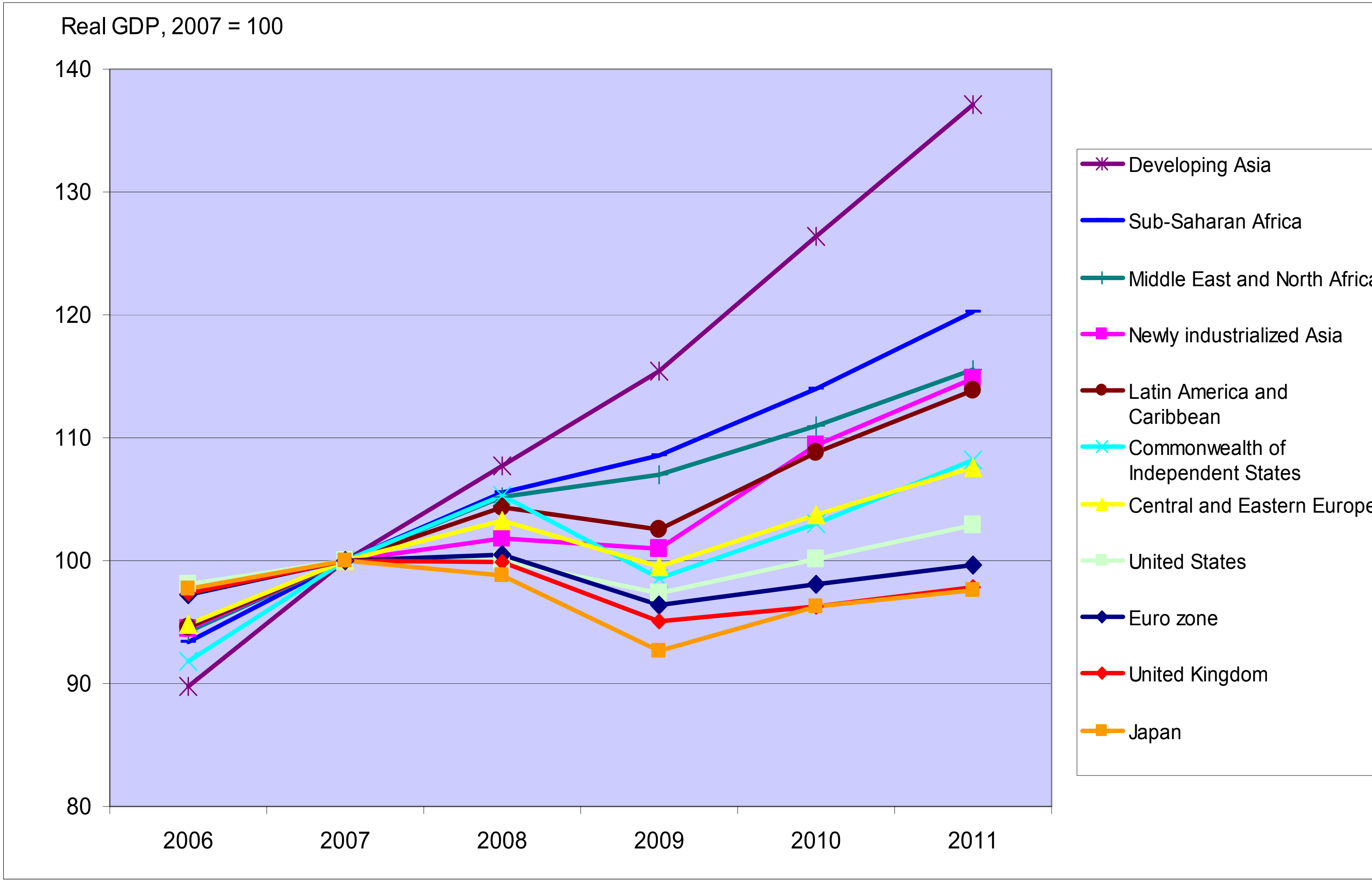
Structural Vulnerabilities of EMEs

- Political/economic instability (Acemoglu & al (2005), Kaminsky & al (2005), Rajan & Tokatlidis (2005))
- Undeveloped/unstable financial markets (Stulz (2005), Demirgüc-Kunt & Detragiache (2000), Honohan & Klingebiel (2003))
- Dollarization/original sin/currency mismatch (Eichengreen & al (2003), Nicolo & al (2005))
- Fear of floating (Calvo & Reinhart (2002), Hausman & al (2001))
- Sudden stops/debt intolerance (Calvo & Reinhart (2000), Forbes & Warnock (2011), Reinhart & al (2003))
- Other nonfinancial rigidities

The 2007-2009 Crisis: Several Surprises

- Came after a long period of seeming calm, in EMEs too.
- Originated in advanced financial markets, then spread.
- On average, EMEs were less affected, had faster recoveries.
- As a result of the crisis, some advanced countries now face government default fears.
- Unprecedented since interwar period (which also featured global imbalances, fixed exchange rates, unstable finance).

The Comparative Resilience of EMEs



Source: WEO April 2011 database; 2011 numbers are (ex post, overoptimistic) IMF projections.

Our Focus: Is This Time Different?

No and yes!

- 20th-century financial crises show build-up and response patterns that are quantitatively similar across advanced and EMEs.
- A main factor: increases in foreign and especially domestic leverage.
- For advanced economies, prologue to recent 21st-century crisis no different from the past.

Performance of EMEs

- EMEs (except perhaps emerging Europe) avoided credit booms.
- Entered crisis with stronger fundamentals–perhaps aided by earlier global boom:
  - High commodity prices.
  - Low real interest rates.
  - External surpluses; reserves.
  - Institutional and policy reforms.
  - Greater intra-EME trade; engine of China.
- "Undeveloped financial markets" may have been a blessing in this context.

Ireland

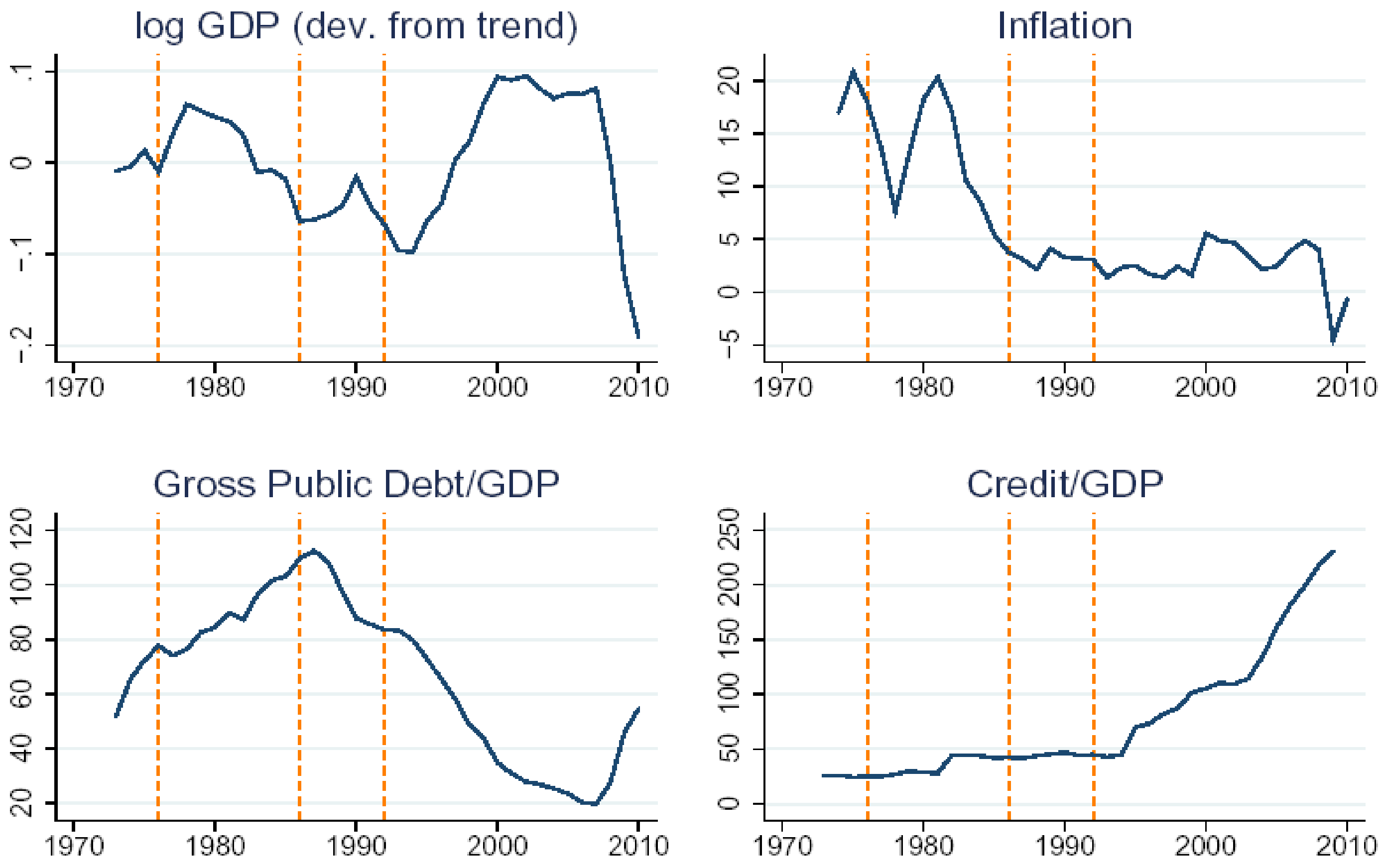


Figure: Macroeconomics Indicators

lines indicate different crisis: currency (- -), defaults (– –), banking (—),

Credit-boom Theme is a Familiar One

- Minsky, Kindleberger, Diaz-Alejandro, McKinnon
- Unheeded warnings in early 2000s from BIS (Borio and Lowe 2002, Borio and White 2004)
- More recent contributions (Schularick and Taylor 2009, Hume and Sentance 2009)
- A related literature empirically ties the depths of individual countries' recent slowdowns to economic preconditions …

Key Factors in this Literature

A few variables seem to stand out:

- Growth in credit.
- Short-term foreign debt.
- Current account surplus.
- Prior housing boom.
- Strenth of financial regulation.

Rose-Spiegel critique; diversity of experience; collinearity.

Our Empirical Approach

- In the spirit of ealier event-studies (Eichengreen et al 1995, Kaminsky & Reinhart 1999)
- Estimate conditional expectation of various macro & financial variables as a function of temporal distance from different types of crisis (treatment):
  - defaults (external and domestic) (Reinhart & Rogoff 2009)
  - systemic banking crisis (Laeven & Valencia 2010)
  - currency crisis (Frankel & Rose 1996, Bordo et al 2001)
  - 2008 global financial crisis
- Ask two main questions:
  - Is the 2007-09 crisis different from previous ones?
  - Are EME crises different from advanced economy crises?

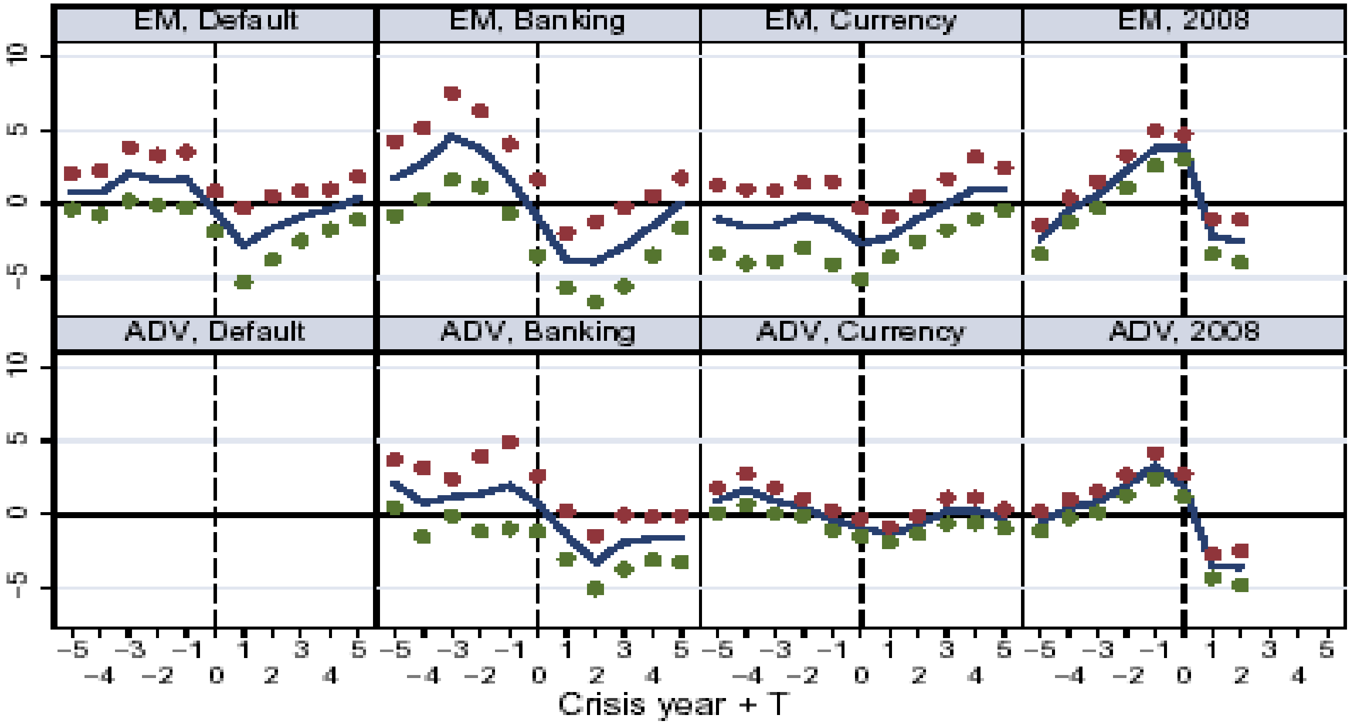
Our Empirical Approach

- Estimate panel fixed-effect model:

$$y_{it} = \alpha_i + \beta_{ds}\delta_{ds} + \beta_{bs}\delta_{bs} + \beta_{cs}\delta_{cs} + \beta_{gs}\delta_{gs} + \epsilon_{it}$$

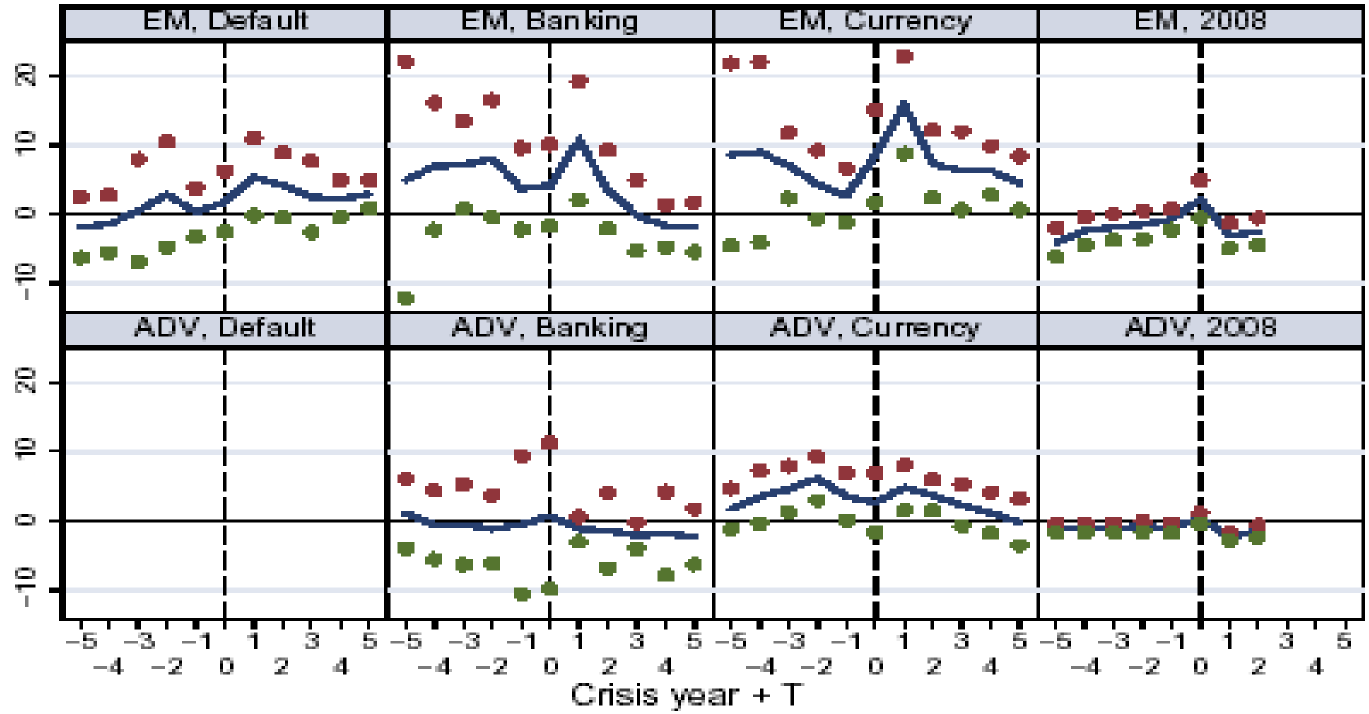
- $\delta_{js} = 1$ when country i is s periods away from crisis of type j
- Event window: 11 years, allowing for slow adjustment after financial crisis.
- Observe:
  - All treatments β_{js} relative to a common tranquil time baseline.
  - Additive approach handles simply multiple or repeat crises.
  - Estimate separately for advanced economies and EMEs, to allow for different dynamics.

Output Performance



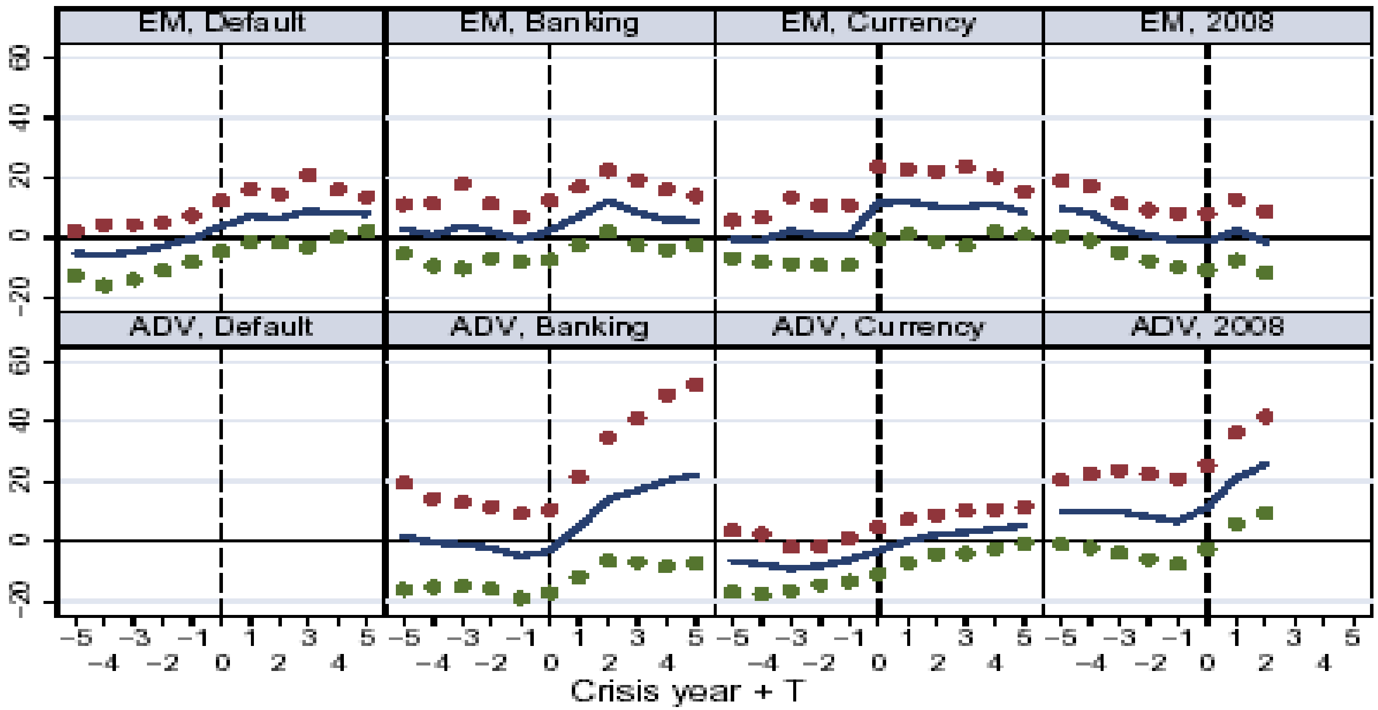
- elevated activity before banking and default crises, depressed before currency crises (EME)
- slower recovery from banking crises in advanced countries

Inflation



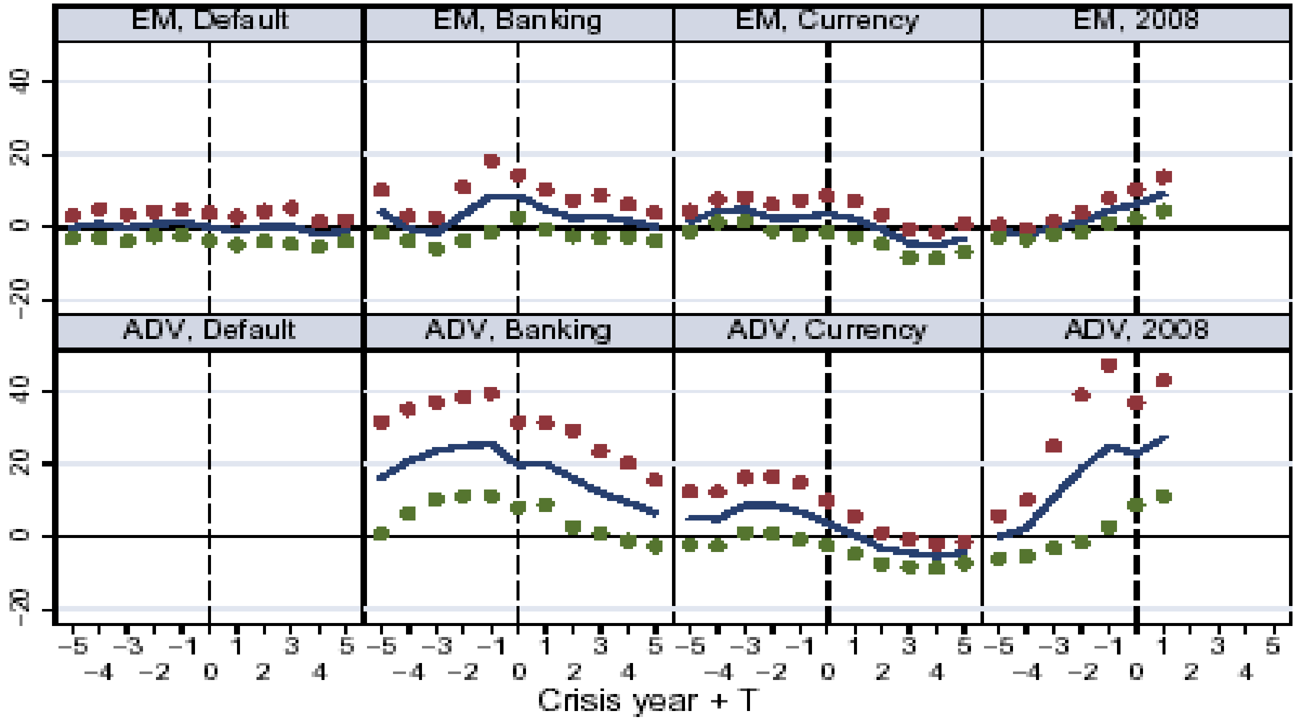
- median regression (to deal with high and hyper inflation)
- elevated for all earlier EME crises, but dramatically lower now (although rising again)

Public Debt



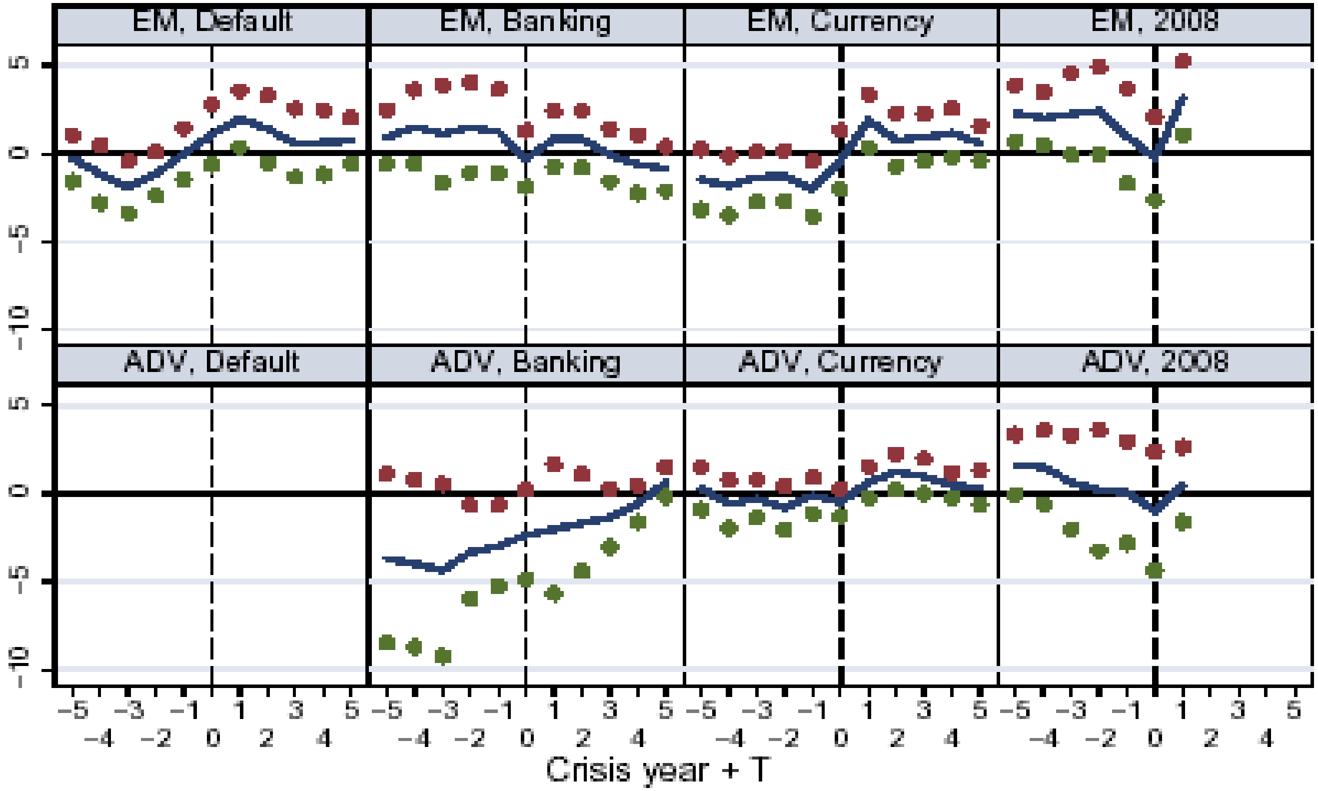
- fiscal position worsens after all crises, especially for advanced economy banking crises
- many channels: bailout costs, automatic stabilizers and (for EMEs) foreign currency denominated debt
- significant fiscal consolidation in EMEs before the 2008 crisis. The opposite appears to be true for advanced economies.

Domestic Leverage



- past banking crises preceded by credit booms (25% of GDP for advanced)
- global crisis also preceded by large credit boom for advanced countries (22%), but increase in EMEs almost entirely in Eastern European countries (related to the process of European integration?)

Current Account



- CA deficits prior to currency crises consistent with higher inflation, loss of external competitiveness and depressed output

Real Exchange Rate

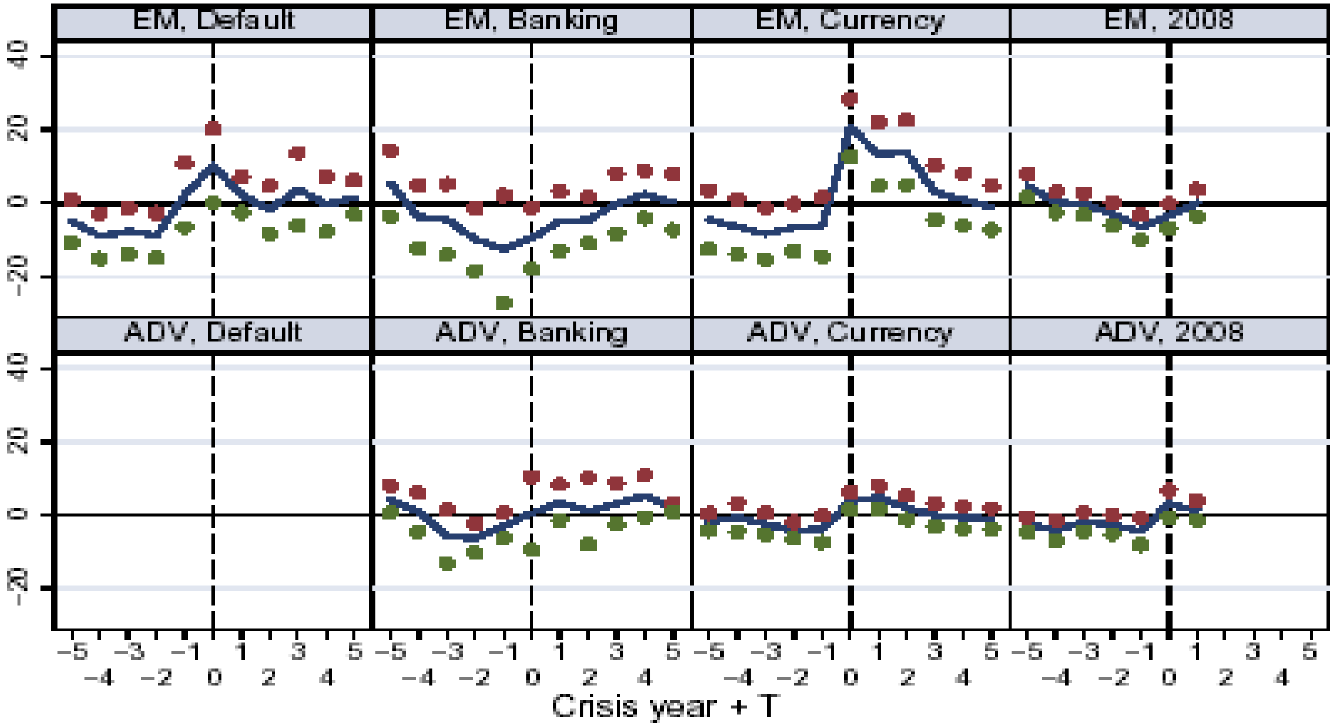


Figure: Real Exchange Rate (% log deviation from trend percent)

- Against a 'canonical' central currency
- EME currency crisis associated with large depreciations of the RER.

Foreign Exchange Reserves

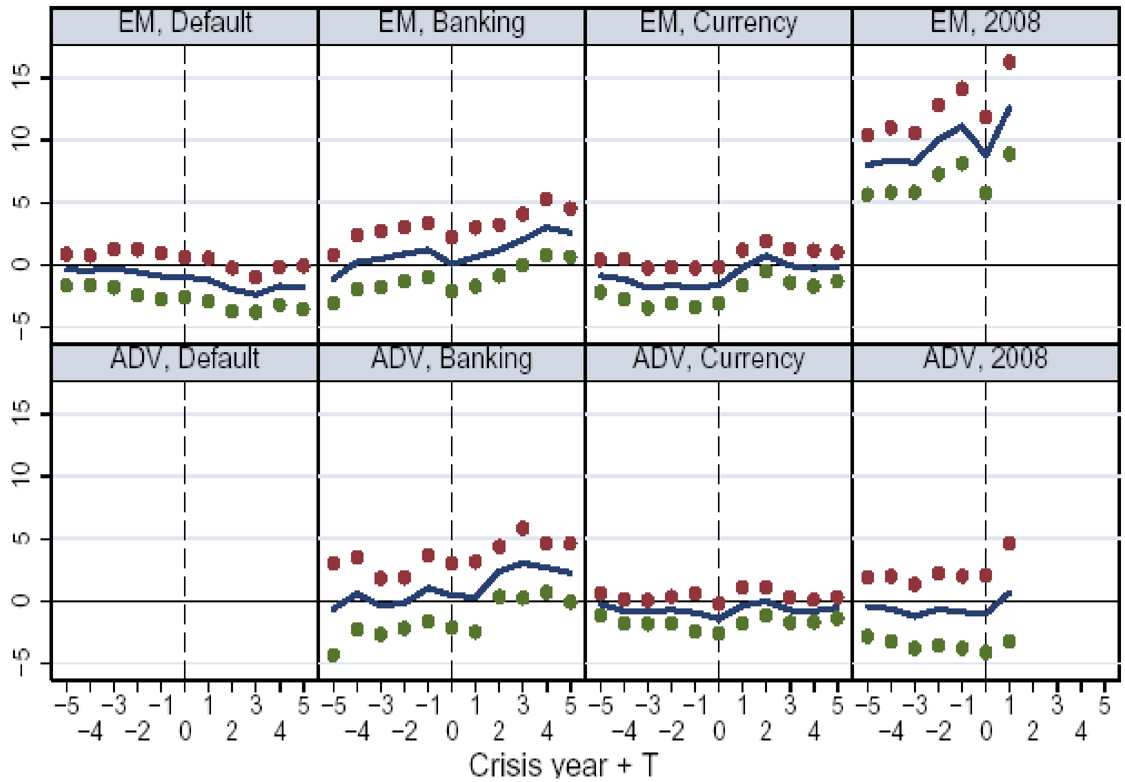


Figure: Foreign Reserves (percent of GDP)

- Striking difference between 2008 and earlier crisis.

Short-Term External Debt

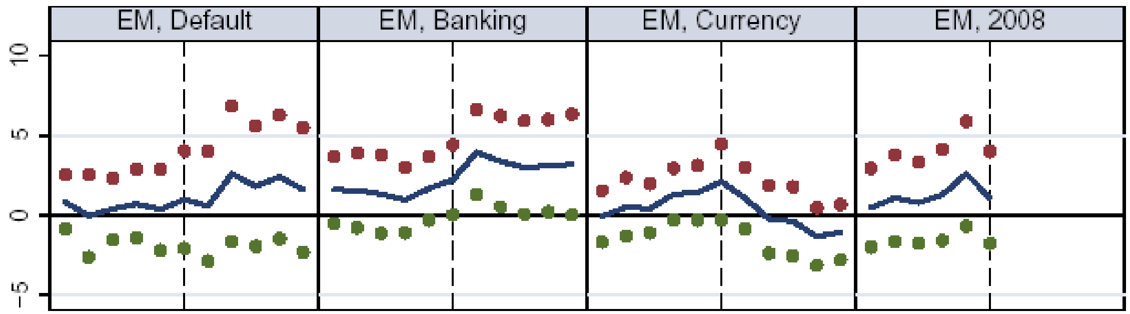
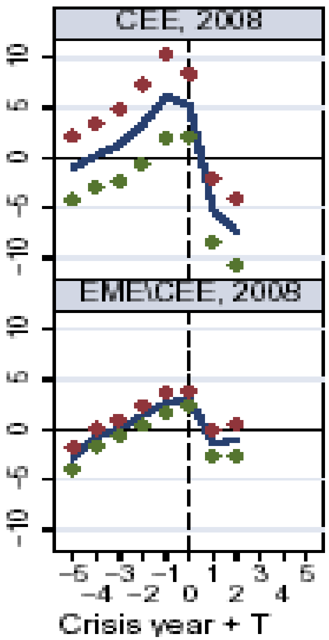


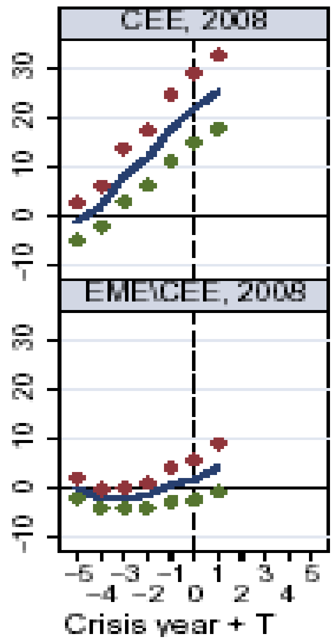
Figure: Short-Term External Debt(percent of GDP)

- Only for EMEs (World Bank data)
- Increase in ST debt after banking crisis and defaults.
- Why? Valuation effects, improvements in fundamentals or shortening of maturities

Central European Economies vs Other Emerging - I



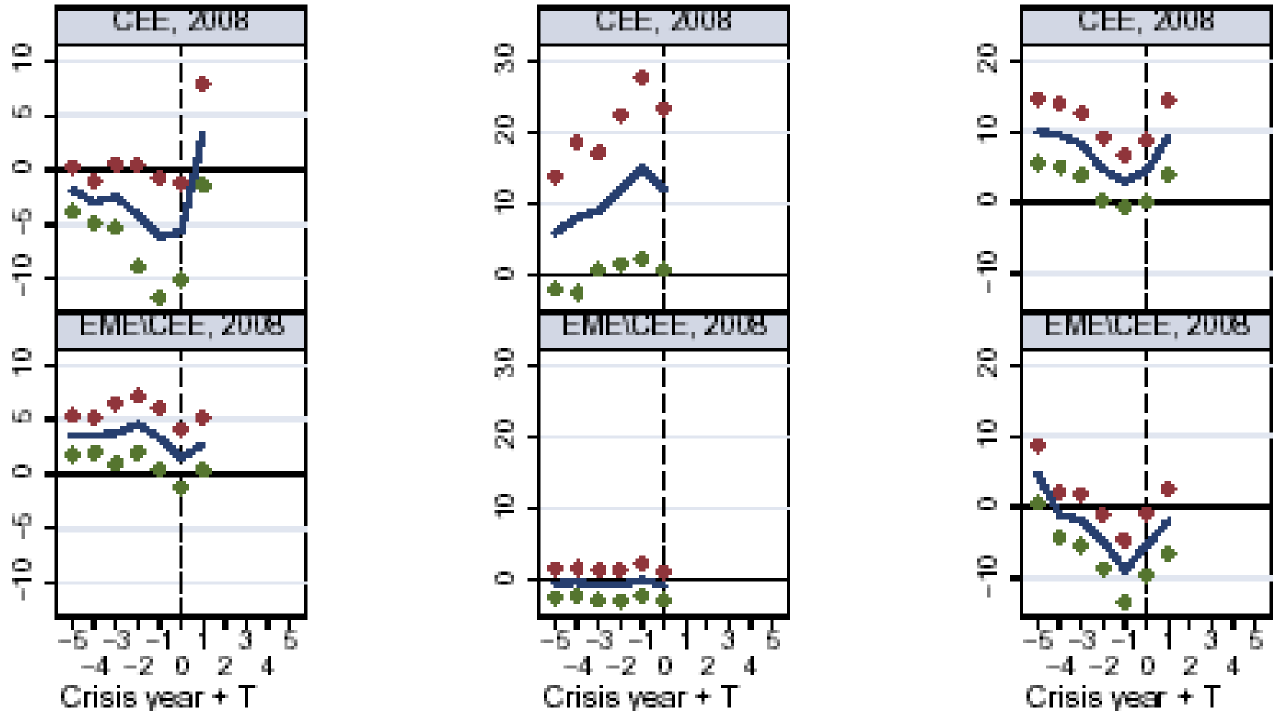
(a) Output Gap



(b) Domestic Credit

(a): % dev. from trend; (b): % of GDP

Central European Economies vs Other Emerging - II



(a) Current Account (b) Short-Term Debt (c) Real Exchange Rate

Figure: CEE vs other Emerging Market Economies

(a) and (b): % of GDP; (c): % dev. from trend

Logit analysis of crisis episodes

We see factors that precede and follow crises; but do some precede periods of no crisis? What is the probability of future crisis given the factors?

For each type of crisis j and period t, we define a forward looking indicator variable y_{jt}^{k} that takes the value 1 if a crisis (of type j) occurs between periods $t+1$ and $t+k$, and 0 otherwise. We vary k between 1 and 3 years. Our benchmark specification assumes a panel logit model with country fixed-effects, in which the crisis probability depends on a vector x of macroeconomic variables:

$$P(y_j^k = 1|x) = \frac{e^{x'\gamma_j^k}}{1 + e^{x'\gamma_j^k}}$$

We drop crisis observations as well as the post-crisis observations for four years afterward, so as to avoid post-crisis bias. Estimate over 1973–2010.

Each table reports the overall probability of crisis occurrence $p(y = 1)$ evaluated at the pre-crisis sample mean; for each explanatory variable x_i in the vector x, its standard deviation $sd.(x_i)$ over the pre-crisis sample; and the marginal effect $\partial p/\partial x_i = p(x_i)(1 - p(x_i))\gamma_i$ evaluated at the pre-crisis sample mean.

The column labeled Δp reports the change in probability resulting from a one-standard deviation increase in x, evaluated at the pre-crisis sample mean,
$\Delta p = p(x_i + sd.(x_i)) - p(x_i)$.

Panel A: Banking Crisis		1 year		1-2 years	
	sd.(x)	$\partial p/\partial x$	Δp	$\partial p/\partial x$	Δp
Public Debt/GDP	20.59	0.006	0.26	0.028	1.28*
		(0.007)	(0.24)	(0.020)	(0.69)
Credit/GDP	19.01	0.013	1.38	0.066	7.64**
		(0.015)	(0.96)	(0.048)	(2.26)
Current Account/GDP	3.75	0.016	0.08	0.080	0.44
		(0.022)	(0.12)	(0.078)	(0.47)
Real Exchange Rate	6.78	-0.003	-0.02	-0.029	-0.16
		(0.007)	(0.04)	(0.023)	(0.13)
Output Gap	2.26	0.057	0.31	0.211	0.89
		(0.078)	(0.42)	(0.195)	(0.86)
p (percent)		0.08		0.41	
N:18; NxT: 547					

Panel B: Currency Crisis		1 year		1-3 years	
	sd.(x)	$\partial p/\partial x$	Δp	$\partial p/\partial x$	Δp
Public Debt/GDP	22.19	-0.025	-0.49	-0.140*	-2.66**
		(0.029)	(0.51)	(0.078)	(1.27)
Credit/GDP	22.75	0.031	0.85	0.119*	3.12*
		(0.021)	(0.65)	(0.062)	(1.81)
Current Account/GDP	3.86	0.100	0.42	-0.508*	-1.77*
		(0.114)	(0.53)	(0.308)	(0.98)
Real Exchange Rate	7.28	-0.414**	-1.51**	-1.138**	-5.48**
		(0.128)	(0.66)	(0.211)	(0.83)
Output Gap	2.22	-0.542*	-0.89*	-0.277	-0.60
		(0.288)	(0.47)	(0.657)	(1.37)
p (percent)		1.88		8.80	
N: 15; NxT: 373					

Note: *(**): significant at 10%(5%). The table reports estimates of a panel logit with country fixed-effects for the occurrence of crisis at horizon $t+1:t+k$ where k varies between 1 and 3. All variables in percent. Real Exchange Rate: deviation from HP-trend. Credit/GDP: deviation from linear trend. Output gap: deviation from HP-trend. p: estimated probability of crisis, evaluated at the pre-crisis sample mean. sd.(x): standard deviation of variable over tranquil periods. $\partial p/\partial x$: marginal effect (in percentage) for variable x, evaluated at tranquil sample mean. $\Delta p = p\,(x + sd.\,(x)) - p\,(x)$ evaluated at tranquil sample mean. Robust (White) standard errors evaluated by delta-method when necessary. N: number of crisis events; NxT: number of observations.

Table 3: Panel Logit Estimation: **Advanced Economies**. Sample: 1973-2010.

Panel A: Default		1 year		1-3 years	
	sd.(x)	$\partial p/\partial x$	Δp	$\partial p/\partial x$	Δp
Public Debt/GDP	18.78	-0.021	-0.37	-0.193*	-3.11**
		(0.050)	(0.86)	(0.105)	(1.49)
Credit/GDP	7.64	0.417**	4.89**	1.138**	11.49**
		(0.129)	(1.70)	(0.197)	(2.44)
Current Account/GDP	4.03	0.236	1.08	0.150	0.63
		(0.249)	(1.27)	(0.548)	(2.36)
Reserves/GDP	4.58	-0.593**	-1.93**	-1.309**	-5.15**
		(0.299)	(0.69)	(0.516)	(1.56)
Real Exchange Rate	20.60	-0.052	-0.94*	-0.257**	-4.26**
		(0.032)	(0.51)	(0.089)	(1.24)
Short Term Debt/GDP	5.42	0.255**	1.66*	1.010**	6.43**
		(0.125)	(0.94)	(0.270)	(1.99)
Output Gap	3.79	-0.248	-0.83	0.195	0.75
		(0.205)	(0.61)	(0.489)	(1.93)
p (percent)		3.68		11.82	
N: 17; NxT: 360					

Panel B: Banking Crisis		1 year		1-3 years	
	sd.(x)	$\partial p/\partial x$	Δp	$\partial p/\partial x$	Δp
Public Debt/GDP	22.27	0.017	0.41	0.152**	4.01**
		(0.023)	(0.58)	(0.055)	(1.68)
Credit/GDP	10.59	0.181**	2.70**	0.468**	6.35**
		(0.060)	(1.13)	(0.127)	(2.11)
Current Account/GDP	5.02	0.090	0.49	0.188	0.99
		(0.165)	(0.97)	(0.285)	(1.57)
Reserves/GDP	6.91	-0.323*	-1.55**	-1.099**	-5.22**
		(0.176)	(0.61)	(0.295)	(1.02)
Real Exchange Rate	19.99	-0.075**	-1.17**	-0.326**	-4.71**
		(0.028)	(0.36)	(0.073)	(0.84)
Short Term Debt/GDP	5.19	0.083	0.47	0.334*	1.89
		(0.108)	(0.65)	(0.202)	(1.24)
Output Gap	3.93	0.334	1.66	1.414**	7.34**
		(0.206)	(1.21)	(0.415)	(2.61)
p (percent)		2.81		8.94	
N:26; NxT: 571					

Panel C: Currency Crisis		1 year		1-3 years	
	sd.(x)	$\partial p/\partial x$	Δp	$\partial p/\partial x$	Δp
Public Debt/GDP	17.17	0.050	0.96	0.097	1.85
		(0.037)	(0.80)	(0.062)	(1.32)
Credit/GDP	9.58	0.329**	4.99**	0.656**	9.36**
		(0.101)	(2.29)	(0.149)	(3.07)
Current Account/GDP	4.71	0.127	0.65	0.224	1.13
		(0.158)	(0.88)	(0.359)	(1.93)
Reserves/GDP	6.89	-0.667**	-2.56**	-1.372**	-5.36**
		(0.172)	(0.68)	(0.252)	(0.94)
Real Exchange Rate	18.15	-0.023	-0.40	-0.170**	-2.53**
		(0.033)	(0.53)	(0.069)	(0.89)
Short Term Debt/GDP	4.38	0.136	0.65	0.450	2.23
		(0.163)	(0.84)	(0.300)	(1.66)
Output Gap	3.78	0.387*	1.80*	0.451	1.90
		(0.202)	(1.07)	(0.288)	(1.33)
p (percent)		3.44		7.21	
N:26; NxT: 381					

Note: *(**): significant at 10%(5%). See table 3 for definitions.

Table 4: Panel Logit Estimation: **Emerging Market Economies**. Sample: 1973-2010.

Performance of EMEs and Advanced Economies

EMEs improved performance along some key dimensions of prior vulnerabilities

- price stability
- sound fiscal position
- avoidance of credit-fueled boom (except Eastern Europe)
- reduced dependence on external debt financing
- balance sheet consolidation happened despite low world real interest rates

By contrast, advanced economies experienced

- deteriorating fiscal position
- increased internal and external leverage

Unlike the 1930s, when the decoupling of Latin American countries was at the expense of macroeconomic orthodoxy, the current resilience reflects beneficial institutional and economic reforms. Role of financial development?

Will recent capital inflows undermine EME financial stability?