Lecture 3: Currency Crises, Sudden Stops, and Sovereign Risk

PSE – APE Masters Year 1 (M1) – Macro 3

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April 1, 2026

Introduction

What is a balance-of-payments crisis?

A balance-of-payments crisis occurs when a country can no longer service its foreign obligations or sustain its exchange rate regime.

Three main types, which often occur together:

- *Currency crisis*: large sudden depreciation or collapse of a fixed peg
- *Banking crisis*: bank runs, widespread insolvency, credit crunch
- *Sovereign debt crisis*: failure to meet external debt obligations

Today's focus: currency crises through three generations of theory, plus the basics of sovereign default.

Road map

Three generations of currency crisis models:

- Gen I – Krugman (1979): fiscal deficit + peg = inevitable speculative attack
- Gen II – Obstfeld (1994): government's dilemma; self-fulfilling attacks on countries with sound fundamentals
- Gen III – Asian crisis: capital account liberalisation + balance-sheet amplification

Sovereign risk: brief empirical overview and theory intuition

Project papers: identifying capital flow surges:

- Forbes and Warnock (2012) – gross flow episodes: surges, stops, flight, retrenchment
- Ghosh et al. (2014) – net flow surges to emerging markets

Generation I: The Krugman (1979) Model

Setup: the fundamental inconsistency

A government creates a fundamental inconsistency when it simultaneously:

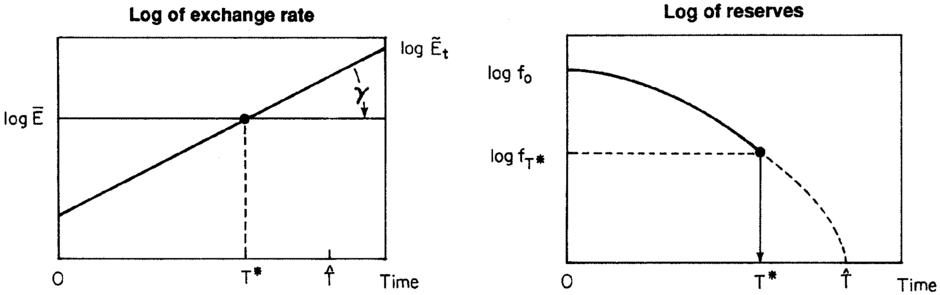
- runs a persistent fiscal deficit ($G > T$), financed partly by printing money (**seigniorage** = the real revenue earned by creating money)
- pegs the exchange rate

Why they are inconsistent:

- Under a peg, the money supply is endogenous. Printing money to cover deficits raises the price level $\rightarrow$ the central bank must sell foreign reserves to keep the exchange rate fixed
- Reserves therefore *decline steadily* as long as the deficit persists
- This process cannot continue forever

Historical example: Mexico 1982 – fiscal monetisation $\rightarrow$ reserve drain $\rightarrow$ speculative attack

The mechanism: reserves fall, shadow rate rises



Obstfeld (1994)

The **shadow exchange rate** is the rate that would prevail if the peg were abandoned today. As reserves fall, the shadow rate rises. Rational investors attack the moment the shadow rate first reaches the fixed rate — *before* reserves are actually exhausted.

Note: In the model, government deficit requires financing by money supply growth (or reserve depletion) at rate $\gamma > 0$.

The speculative attack: timing is endogenous but predictable

The attack occurs before reserves hit zero:

- If investors wait until reserves $= 0$, they hold domestic currency through the collapse $\rightarrow$ capital loss
- Rational investors therefore attack at the moment the shadow rate first equals the fixed rate

Why a discrete jump in reserves at T^*:

- At T^* the exchange rate is continuous (shadow rate $=$ fixed rate), but switching to a float immediately raises the nominal interest rate from i^* to $i^* + \gamma$ via UIP
- Higher $i \rightarrow$ money demand falls discontinuously $\rightarrow$ the money supply must fall by the same amount *instantaneously*
- The only way to shrink M instantly is a sudden reserve loss — speculators collectively buy all remaining reserves at the fixed rate in an instant

Key properties:

- Crisis is *predictable* from fundamentals; appears *abrupt* even though deterioration was gradual. Not irrational panic, unique equilibrium. ▸ Model sketch

Limitation: fundamentals were fine in many famous crises

Generation I cannot explain:

- **ERM crisis, September 1992:** UK had sound fiscal position with no systematic monetisation. The UK was forced off the ERM despite adequate reserves.
- **Asian crisis, 1997–98:** Thailand, Korea, Indonesia had no fiscal monetisation and no obvious reserve drain before the crisis

The *timing* of attacks is also hard to pin down from fundamentals alone – the same fundamentals can persist for years before a crisis.

$\rightarrow$ A second generation is needed: one where the **government's decision to defend the peg is itself endogenous**.

Generation II: Obstfeld (1994) — Multiple Equilibria

The government's dilemma

Suppose investors think a devaluation is likely. The government faces a dilemma:

To resist speculative pressure, it must **raise interest rates** to attract capital and maintain the peg. This causes a recession and unemployment, which is politically costly.

Key insight (Obstfeld, 1994): the cost of defending is *endogenous* — it rises with market expectations of devaluation.

The unemployment channel:

- Devaluation expected $\rightarrow$ workers demand higher nominal wages to protect real wages
- Higher wages $\rightarrow$ competitiveness falls $\rightarrow$ unemployment worsens
- Deeper recession $\rightarrow$ government more willing to devalue $\rightarrow$ expectation confirmed

Result: for intermediate fundamentals, *both* "defend" and "devalue" can be equilibria. Which occurs is determined by expectations, not fundamentals alone — **self-fulfilling crises are possible**.

Obstfeld (1994): his simple model

Output (log): $y = \alpha(e - w) - u$ [e = exchange rate, w = wage, u = demand shock]

Wages set one period ahead to expected exchange rate: $w = E_{t-1}[e]$

Normalising the current peg at $e_{t-1} = 0$, the **expected depreciation rate** is $\pi \equiv E_{t-1}[e] - e_{t-1} = E_{t-1}[e] = w$.

Government devalues when the output cost of defending exceeds the credibility cost c:

$$u > \bar{u}(\pi), \qquad \bar{u}(\pi) = \sqrt{\frac{2c}{\lambda}} - \alpha\pi - y^*$$

where $\lambda = \alpha^2/(\alpha^2 + \theta)$ measures the government's willingness to accommodate. $\bar{u}$ **falls** as π rises: higher expected depreciation lowers the shock needed to trigger devaluation.

Self-fulfilling loop: $\pi \uparrow \Rightarrow\ w \uparrow \Rightarrow$ competitiveness $\downarrow \Rightarrow\ \bar{u} \downarrow \Rightarrow\ P(\text{devalue}) \uparrow \Rightarrow\ \pi \uparrow$

Three zones (depending on c and fundamentals):

- **Heaven:** only low-π equilibrium exists; peg safe regardless of expectations
- **Purgatory:** both equilibria exist; a sunspot selects
- **Hell:** devaluation inevitable regardless of expectations

Limitation: still peg-centric

Generation II explains the ERM crises well: intermediate fundamentals + self-fulfilling dynamics.

Note: Purgatory crises are *not* purely irrational — a country must have sufficiently weak fundamentals to enter the zone. The sunspot selects between equilibria that fundamentals *permit*; it does not conjure crises from thin air (Obstfeld, 1994).

But the Asian crisis countries had:

- No single "defend-or-devalue" decision as the focal point
- Large short-term foreign-currency borrowing by banks and corporates (**original sin**): borrowing in USD but earning revenues in domestic currency
- When the currency fell, the *real value of FX liabilities* exploded $\rightarrow$ balance-sheet destruction even for otherwise solvent firms

$\rightarrow$ A **third generation** is needed: one centred on the balance-sheet structure of the financial sector, not on the exchange rate regime.

Generation III: Capital Accounts and Sudden Stops

What is new in Generation III?

Two key differences from Generations I and II:

1. Capital account liberalisation (early 1990s):

- Asian countries opened their capital accounts $\rightarrow$ large gross inflows, especially short-term bank borrowing from abroad
- A sudden reversal of these inflows is a **sudden stop**

2. Currency mismatch ("original sin"):

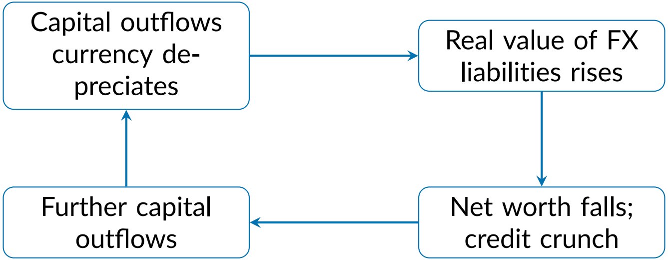
- Firms and banks borrowed in USD or other foreign currencies
- But earn revenues in domestic currency $\rightarrow$ naturally short foreign currency
- Depreciation therefore directly damages balance sheets

The crisis is *not* primarily about the exchange rate regime or fiscal deficits. It is about the **balance-sheet structure of the financial sector**.

Early references: Calvo (1998), Kaminsky and Reinhart (1999), Krugman (1999), Chang and Velasco (2001)

The balance-sheet amplification loop

A moderate trigger (reversal of inflows, rising US rates, contagion) sets off a self-reinforcing cycle:



Key problem:

$$\text{Net worth} = \text{Domestic assets} - E \times \text{FX liabilities}$$

Depreciation raises $E \rightarrow$ FX liabilities in domestic terms rise $\rightarrow$ net worth falls even if domestic assets unchanged $\rightarrow$ borrowing constraints bind $\rightarrow$ further outflows.

Three hallmarks of a sudden stop

Sudden stop: empirical concept. Abrupt reversal of capital inflows. Term coined by Calvo (1998)

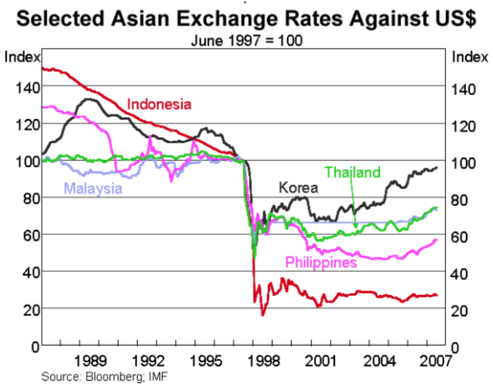
A sudden stop occurs when foreign lenders abruptly stop extending credit. Three observable signatures:

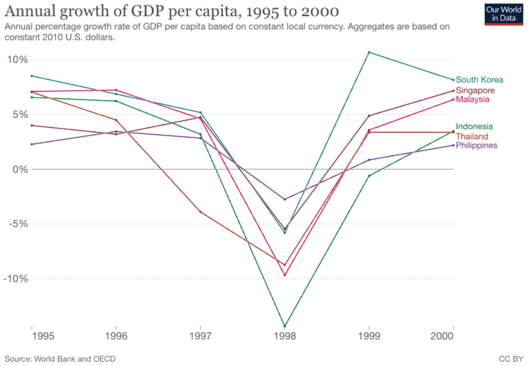
1. **Sharp current account reversal:** from deficit to surplus (or large reduction in deficit)
2. **Contraction in aggregate demand:** domestic absorption falls sharply
3. **Real exchange rate depreciation:** domestic goods become cheaper relative to foreign goods

These hallmarks appear in every severe sudden stop episode.

Sudden stops (empirical) and third generation models (theory) are very intertwined

Case study: Asian Financial Crisis

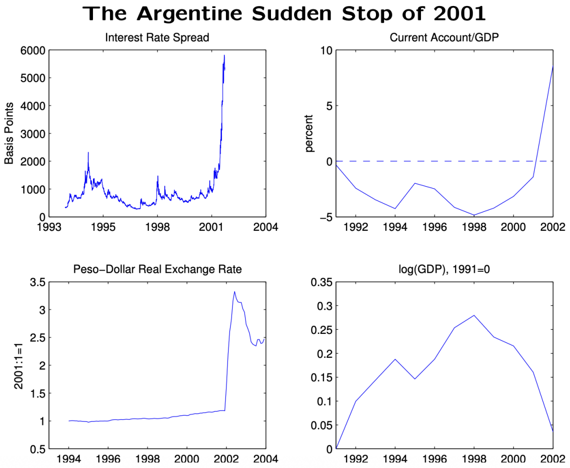




Source: Our World In Data; Reserve Bank of Australia.

Massive coordinated depreciation and output collapse across multiple fast growing Asian economies.

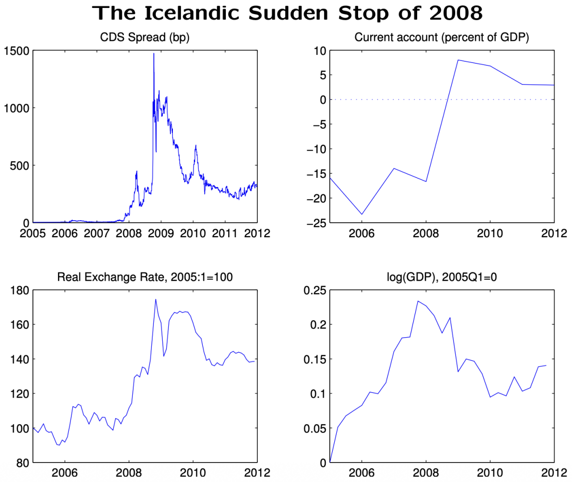
Case study: Argentina 2001



Source: Schmitt-Grohé, Uribe & Woodford (2022), Ch. 10.

All three hallmarks visible: spread explosion $\rightarrow$ CA reversal to $+8\%$ of GDP $\rightarrow$ **154% real depreciation** (nominal: 1 $\rightarrow$ 3.5 pesos/USD; Argentine CPI $+41\%$, US CPI $+2.5\%$) $\rightarrow$ GDP -12.5%

Case study: Iceland 2008

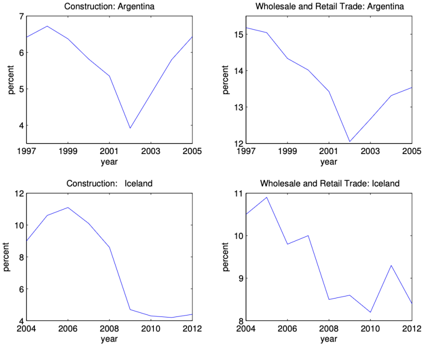


Source: Schmitt-Grohé, Uribe & Woodford (2022), Ch. 10.

Bank balance sheets $= 10\times$ GDP on eve of crisis. CA reversal: -17% to $+8\%$ of GDP; real depreciation 45%; GDP -6%.

Sectoral reallocation during sudden stops

GDP Shares in Construction and Wholesale and Retail Trade During the Sudden Stops in Argentina 2001 and Iceland 2008



Construction and wholesale and retail trade are large, labor intensive, nontradable sectors. Their combined share in GDP fell from an average of 20 percent to less than 16 percent during the Argentine sudden stop of 2001 and from an average of 20 percent to less than 15 percent during the Icelandic sudden stop of 2008. This pattern of sectoral reallocation of production away from nontradable sectors conforms with the predictions of the TNT model.

Source: Schmitt-Grohé, Uribe & Woodford (2022), Ch. 10.

Resources must shift from nontradable sectors (construction, retail) toward tradable sectors to generate the current account reversal. This reallocation is costly and slow $\Rightarrow \downarrow$ output

Sovereign Default (empirics)

What is sovereign debt — and why is it different?

Sovereign debt: borrowing by a national government from foreign creditors (other governments, international institutions, private bondholders).

Unlike corporate debt:

- No collateral, no bankruptcy court, no supranational enforcement authority
- Repayment must be *self-enforcing* — there is no legal mechanism to compel it

Why do countries repay?

- *Economic sanctions:* trade reductions, seizure of foreign assets, exclusion from capital markets
- *Reputation:* maintaining future access to international credit

Note: "gunboat diplomacy" gradually declined with the Drago Doctrine (1902). Today's framework is entirely about *incentives*, not legal compulsion.

Empirical regularities on sovereign default

Country	Defaults (1824–2014)	P(def): all years	P(def): not in default	Avg. years per episode
Argentina	5	2.6%	3.5%	10
Brazil	7	3.7%	4.7%	6
Chile	3	1.6%	2.0%	14
Colombia	7	3.7%	5.8%	10
Egypt	2	1.0%	1.2%	11
Mexico	8	4.2%	5.2%	6
Philippines	1	0.5%	0.6%	32
Turkey	6	3.1%	3.7%	5
Venezuela	10	5.2%	7.9%	6
Mean	**5.4**	**2.9%**	**3.9%**	**11**

Source: Uribe and Schmitt-Grohé (2017). The sample includes only emerging countries with at least one external-debt default or restructuring episode between 1824 and 1999.

- Sovereign default is not uncommon
- Average haircut: $\approx$ 40% (SD $\approx$ 22%)
- Financial exclusion: partial reaccess $\approx$ 9.8 years after default

Sovereign debt on sovereign default

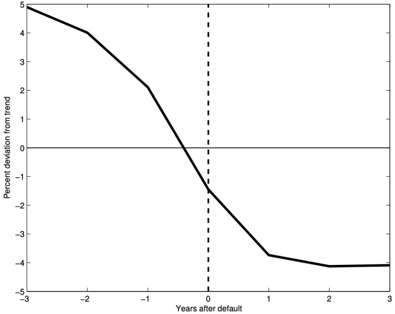
Country	Avg. debt-to-GNP ratio	Debt-to-GNP in year of default
Argentina	37.1	54.4
Brazil	30.7	50.1
Chile	58.4	63.7
Colombia	33.6	–
Egypt	70.6	112.0
Mexico	38.2	46.7
Philippines	55.2	70.6
Turkey	31.5	21.0
Venezuela	41.3	46.3
Average	**44.1**	**58.1**

Source: Uribe and Schmitt-Grohé (2017).

- Countries default with different levels of debt $\implies$ no simple debt threshold causes default for all countries
- Debt-to-GNP at default higher than country average $\implies$ default more likely when debt is higher than usual

Output costs of sovereign default

Figure 13.2 Output Around Default Episodes

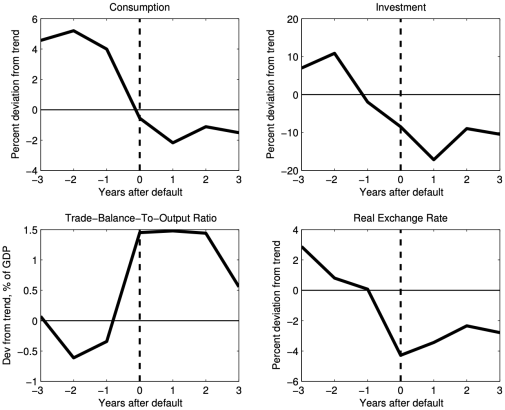


Note: Annual log-quadratically detrended real GDP per capita. The year of default is normalized to 0. Median over 105 default episodes between 1975 and 2014.

Source: Uribe and Schmitt-Grohé (2017)

Aggregates around sovereign default

Figure 13.3 Consumption, investment, the trade balance, and the real exchange rate around default episodes



Source: Uribe and Schmitt-Grohé (2017)

Sovereign default is associated with a sharp drop in investment and consumption, and a current account reversal. RER depreciates by 4% in the year of default.

Project Papers:
Identifying Sudden Stops and Surges in the Data

The gross vs. net distinction: what question does each answer?

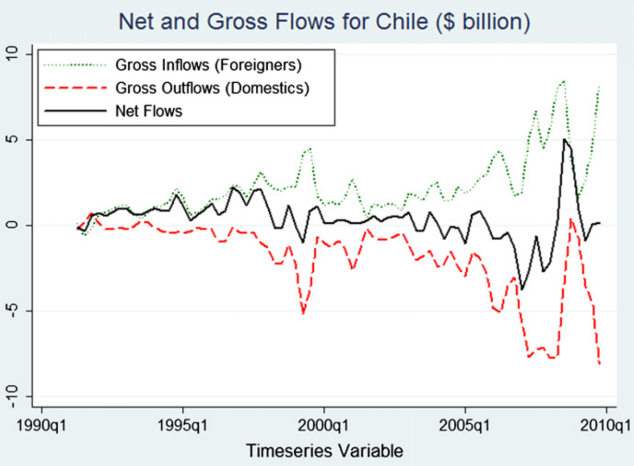
Gross flows (foreigners and residents tracked separately) = volume and direction of cross-border activity by each group.

- Forbes and Warnock (2012) use gross flows
- "... the differentiation between gross inflows and gross outflows has become more important. Foreign and domestic investors can be motivated by different factors and respond differently to various policies and shocks." (Forbes and Warnock, 2012)
- Gross flows have grown so large that foreigners and residents routinely move in opposite directions. Net can look calm when financial stress is severe.

Net flows (= gross inflows − gross outflows) = the country's net external borrowing position.

- Ghosh et al. (2014) use net flows
- "While gross flows matter for some purposes, it is the net surge that matters for competitiveness, macroeconomic management, and the economy's aggregate foreign currency exposure that are of key concern to EMEs." (Ghosh et al., 2014)

Forbes & Warnock (2012): why gross flows matter — Chile



Source: Forbes and Warnock (2012), Figure 1.

49% of "surge" observations (sharp rise in gross inflows) also show simultaneous "flight" (sharp rise in gross outflows). Net flow would appear small; the net method would miss the surge.

Forbes & Warnock: four episode types and identification

Four episode types:

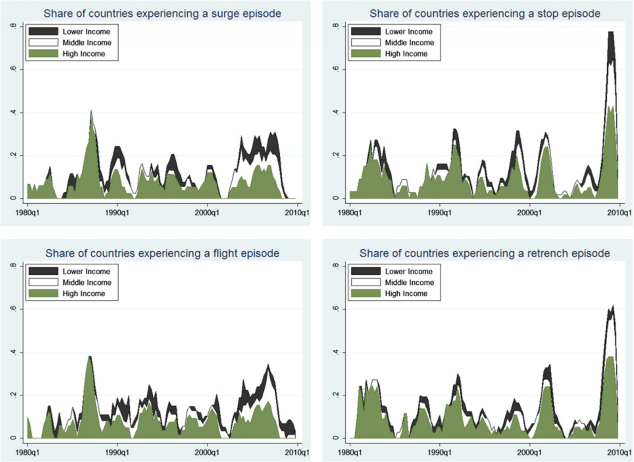
- **Surge:** sharp $\uparrow$ gross inflows (foreigners buying domestic assets)
- **Stop:** sharp $\downarrow$ gross inflows
- **Flight:** sharp $\uparrow$ gross outflows (residents sending money abroad)
- **Retrenchment:** sharp $\downarrow$ gross outflows (residents bringing money home)

Identification algorithm (illustrated for a surge):

1. Compute 4-quarter moving sum $C_t = \sum_{i=0}^{3} \text{GINFLOW}_{t-i}$
2. Compute year-over-year change $\Delta C_t = C_t - C_{t-4}$
3. Compute rolling 5-year $\bar{\mu}$, SD of ΔC_t; use these to set thresholds
4. Surge *starts* when $\Delta C_t > \bar{\mu} + 1\,\text{SD}$; must reach $> \bar{\mu} + 2\,\text{SD}$ in at least one quarter; *ends* when $\Delta C_t < \bar{\mu} + 1\,\text{SD}$; must last > 1 quarter

58 countries (emerging + advanced), quarterly data, 1980–2009.

Forbes & Warnock: episode patterns over time



Source: Forbes and Warnock (2012), Fig 3

Stops and retrenchments cluster sharply during global stress periods (1998 Russia/LTCM; 2001 Argentina; 2008–09 GFC). Surges and flights follow a different pattern

Forbes & Warnock: key results

Global risk (VXO) is the dominant driver: $\uparrow$ VXO $\rightarrow$ more stops and retrenchments, fewer surges and flights. The only variable significant across *all four* episode types. (VIX tested as robustness; correlation with VXO $= 0.992$.)

- **Global liquidity: NOT significant** for any episode type (six measures tested — all null). Contradicts the narrative that QE drives surges.
- **US interest rates:** significant only for retrenchments — not for stops or surges. (Ghosh et al. find something different)
- **Contagion matters:** stops and retrenchments associated with banking linkages and regional proximity
- **Capital controls: all six measures returned null results** — no evidence that controls protect against surges or stops

Ghosh, Qureshi, Kim & Zalduendo (2014): the net flows approach

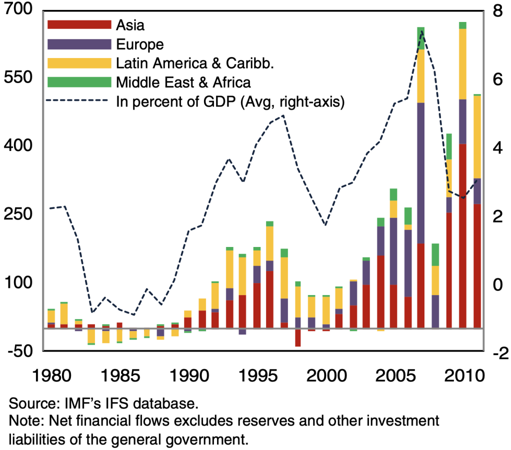


Fig. 1. Net capital flows to EMEs, 1980–2011 (in USD billions).

Source: Ghosh et al. (2014)

Surge frequency rose from $\approx$ 10% of observations in the 1980s to $\approx$ 30% in the 2000s.

Ghosh et al.: surge definition and identification

Surge definition: net capital flows in the top 30th percentile of *both* the country-specific *and* the full-sample distribution. Annual data, 56 EMEs, 1980–2011. Surges classified as *liability-flow driven* (foreigners) or *asset-flow driven* (residents repatriating).

Global push ("gatekeepers"): US real interest rates and global risk (S&P 500 volatility) determine *whether* capital surges to EMEs at all.

- When US rates are low and global risk appetite is high, the aggregate tap opens

Domestic pull: external financing need, financial openness, exchange rate regime, institutional quality — determine *which* EMEs receive flows and *how large* the surge is.

Ghosh et al.: Contrast with Forbes–Warnock

Contrast with Forbes–Warnock:

- Ghosh et al.: US interest rates are significant (gatekeeper effect)
- Forbes–Warnock: US rates significant only for retrenchments — not stops or surges
- **Mechanism:** low US rates encourage *both* foreigners to invest in EMEs (liability-flow surges) *and* residents to repatriate (asset-flow surges) — Ghosh et al. find US rates significant for both types, with the effect roughly twice as large for foreigners.
- F&W miss this for surges primarily because their sample includes advanced economies: when US rates fall, surges to EMEs rise but surges to advanced economies also rise, roughly cancelling in a pooled regression (Ghosh et al., fn. 7). Restricting to EMEs only, the gatekeeper effect is unambiguous. F&W's retrenchment result (residents significant) is consistent with Ghosh's asset-flow finding.

Ghosh et al.: the asset/liability asymmetry — BRT results ▸ picture

Binary Recursive Tree (BRT) analysis reveals a finding invisible to standard probit:

- **Liability-flow surges** (foreign-investor-driven): root node = S&P 500 volatility. Global risk determines whether foreign money flows; further splits involve regional contagion and financial openness.
- **Asset-flow surges** (domestically-driven): *no global factor appears at any node.* Entirely driven by domestic conditions.

Key insight: Ghosh et al.'s liability/asset split is the net-flow version of Forbes–Warnock's gross inflow/outflow split.

- Both recover the same result: *global conditions move foreign money; domestic conditions move domestic money*
- F&W see this directly in separate gross series. Ghosh et al. decompose their net-flow surge measure into liability (foreign-driven) and asset (resident-driven) components — and the BRT rediscovers the same split
- Neither paper needs to assume this structure; both find it in the data

Comparing the two papers: same world, different lenses

	Forbes & Warnock (2012)	Ghosh et al. (2014)
Question asked	Who drives flows? Financial stability	Is the country over-borrowing? Macro risk
Flow measure	Gross (in/out separately)	Net
Episode focus	4 types	Surges only
Sample	58 countries incl. advanced	56 EMEs
Key global driver	VXO (US rates less significant)	US rates + S&P vol
Domestic factors	Mostly insignificant	Matter for allocation
Capital controls	All 6 measures null	Openness $\rightarrow$ larger surges

For a recipient-country policymaker: global factors dominate; capital controls will not reliably protect against surges or stops driven by foreign investors.

US interest rate puzzle resolved: Ghosh et al. find low US rates encourage *both* foreigners (liability flows) and residents (asset flows) to surge into EMEs — but F&W's sample pools advanced economies alongside EMEs, so the positive effect on EME surges is offset by the opposite effect on advanced-economy surges, leaving US rates insignificant for surges in their pooled regression. Ghosh's EME-only sample faces no such cancellation. F&W's significant retrenchment result (residents) is consistent with Ghosh's asset-flow finding.

What can you do with these papers?

Replication + update: Both samples end before 2012. A natural first step is extending the data to 2024 — do the same global drivers (VXO, US rates) still dominate? Does the post-GFC era of near-zero rates and then rapid tightening look different?

Machine learning update: Ghosh et al's BRT is a simple decision-tree method. More modern ML methods (random forests, neural networks) could be applied to the same question: which factors predict surges?

Combining the two lenses: Neither paper uses both gross and net flows simultaneously. An extension could track gross and net episodes for the same country-period and ask: when do they diverge? When gross flows surge but net flows do not, is there still macro risk? This is the question the papers raise but neither answers directly.

Sensitivity to arbitrary thresholds: Both papers make discretionary choices

Reminder: What neither paper establishes: correlation, not causation. Both identify *when* and *where* episodes occur; neither identifies *why* with any causal force.

Conclusions

Summary

- Three generations of balance of payments crises models:

Generation	Designed to explain	Mechanism	Example
1. Krugman (1979)	Crises in countries with deficits + pegs	Reserve depletion → predictable attack	Mexico 1982
2. Obstfeld (1994)	Crises with pegs but no deficits	Gov. dilemma; self-fulfilling equilibria	ERM 1992
3. Various	Sudden stop. No peg, amplification by financial sector	Balance-sheet loop; sudden stop	Asia 1997

  Each generation was designed to explain what the previous could not. The distinctions have very different policy implications: fiscal adjustment vs. expectation management vs. prudential regulation of FX borrowing.

- Sovereign borrowing and default empirics

- Identifying capital flow episodes: surges, stops, flights, retrenchments. Gross vs. net flows; global vs. domestic drivers.

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Appendix: Krugman (1979) — model sketch

Setup. Money demand: $M_t = \bar{E}Ae^{-\eta i_t}$. Interest parity: $i_t = i^* + \dot{E}_t / E_t$. PPP: $P_t = E_t$. Central bank balance sheet: $M_t = C_t + \bar{E}f_t$. Government deficit requires financing by money supply growth (or reserve depletion) at rate $\gamma > 0$.

While the peg holds ($\dot{E} = 0$, so $i = i^*$): money demand is constant, so reserves fall steadily to absorb credit expansion:

$$\dot{f}_t / f_t \; = \; -\frac{1-\omega_f}{\omega_f}\gamma \; < \; 0$$

Shadow exchange rate (floating-rate that clears the money market given current C_t, if the peg were abandoned):

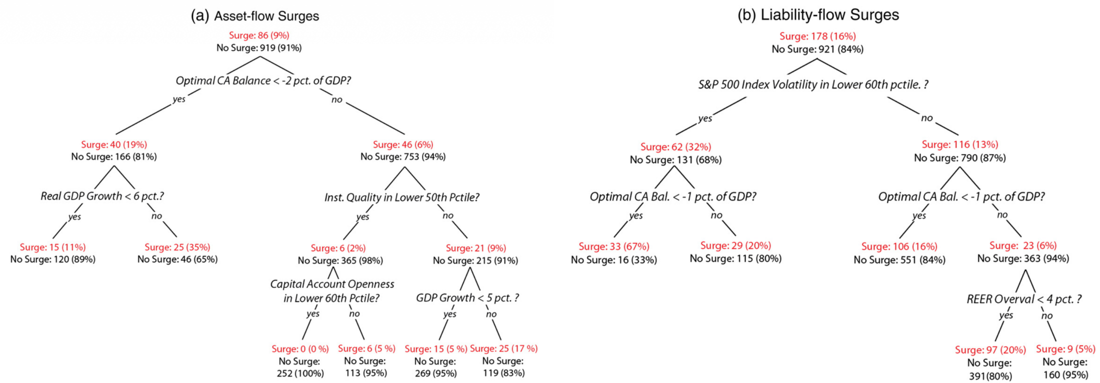
$$\log \tilde{E}_t \; = \; \eta(i^* + \gamma) + \log C_t$$

$\tilde{E}_t$ rises over time because C_t does. The gap $\eta\gamma$ above $\bar{E}$ reflects the jump in i at the moment of floating.

Attack at T^* where $\tilde{E}_{T^*} = \bar{E}$: speculators strip all remaining reserves in an instant. No capital gain or loss at T^* (exchange rate is continuous); any later and a profitable jump profit exists.

Comparative statics: attack is *earlier* when γ is higher (faster credit growth) or η is higher (more sensitive money demand).

Appendix: Ghosh et al. — BRT diagrams



Source: Ghosh et al. (2014)

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