

Capital Flows and Sudden Stops

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Economic Crises

- ▶ Capital flows are large and a significant source (and amplification mechanism) of macroeconomic fluctuations and crises
- ▶ Particularly for EM: Sudden Stops
- ▶ Reason to present C-K: It integrates many of the mechanisms we have discussed in this course
 - Caballero, R.J. and A. Krishnamurthy, “Bubbles and Capital Flow Volatility: Causes and Risk Management,” *Journal of Monetary Economics*, 53(1), 35-53, January 2006.
- ▶ Reason to present B-L: Pecuniary and AD externalities in **open economy**
 - Bianchi, J.. and G. Lorenzoni, “The Prudential Use of Capital Controls and Foreign Currency Reserves,” *Handbook of International Economics*, Ch 6, vol 6, 2022.
- ▶ Extensive final remarks: From EM crises to the GFC

Sudden Stop in South East Asia*



Boom and Bust in Capital Flows
(in % of GDP, last four quarters)

	Boom		Bust	
	Average 1984-88 vs peak 1998	peak 1998 vs trough 1998	peak 1998 vs trough 1998	peak 1998 vs 2002
Thailand	9,7	-22,8	-11,2	
Indonesia	2,8	-21,9	-7,0	
Korea	6,4	-14,5	-3,2	
Philippines	8,0	-10,3	-14,8	
Malaysia	6,1	-5,7	-10,9	
SEA-5	6,1	-15,0	-8,4	



*Includes Indonesia, Korea, Malaysia, Philippines and Thailand

- ▶ Emerging market economies have significant growth potential but limited financial development.
- ▶ Limited domestic financial instruments means that agents seek to store value (hoard liquidity) abroad.
- ▶ These outflows are costly – would rather grow the economy. But physical assets generate few financial assets.
- ▶ In this environment rational (real estate) bubbles are likely to arise (akin to dynamic inefficiency).
- ▶ But bubbles depend on coordination and hence are fragile. Crashes are likely to take place.
- ▶ There is a sort of “aggregate liquidity illusion.” Too much investment in real estate and too little in true international collateral. Agents undervalue the aggregate fragility that such decision brings.
 - E.g., borrowing in USD is like negative investment in international collateral⁴

- ▶ OLG
- ▶ Linear preferences and only consume when old
- ▶ Born with $\{W_t, K_t\}$
[flexible interpretation - dual liquidity/collateral]

- ▶ All plants produce RK_t
- ▶ Half of the agents have an investment opportunity a second before becoming old. Can produce Rl_{t+1} units of domestic goods for an investment of l_{t+1} units of international resources. (split between entrepreneurs and bankers)
- ▶ (benchmark) $W'_t = (1 + r^*)W_t$

Local loan market:

$$\frac{1}{2}l_{t+1} \leq \frac{1}{2}\psi \frac{RK_t}{p_{t+1}}; \quad \frac{1}{2}W'_t$$
$$1 \leq p_{t+1} \leq R.$$

Let's assume

$$\psi R < 1$$

and normalize $W = K$.

With these parameters, we have:

$$p_{t+1} = 1$$

“Dynamic inefficiency:” $g > r^*$;

$$NetOutflow_t = W_t - (1 + r^*)W_{t-1} = (g - r^*)W_{t-1} > 0.$$

- ▶ Expand the set of assets to store value
 - Stochastic bubble: crashes with probability λ .

$$\tilde{r}^b = \{g, -1\}$$

$$W' = W_t \left(1 + r^* + \alpha_t (\tilde{r}^b - r^*) \right) \left($$

$$RK_t + RW'_t + (R - \tilde{p}_{t+1}) \frac{\psi R}{\tilde{p}_{t+1}} K_t;$$

if entrepreneur.

$$RK_t + W'_t \tilde{p}_{t+1};$$

if lender.

$$\max_{0 \leq \alpha \leq 1} E_t \left\{ \left(R K_t + W_t' \frac{R + \tilde{p}_{t+1}}{2} + \frac{R - \tilde{p}_{t+1}}{2} \frac{\psi R}{\tilde{p}_{t+1}} K_t \right) \left((1 - \lambda) \frac{R + p_{t+1}^B}{2} \Delta r^b - \lambda (1 + r^*) \frac{R + p_{t+1}^C}{2} \right) \right\} \quad (1)$$

$$\Delta r^b \equiv g - r^*$$

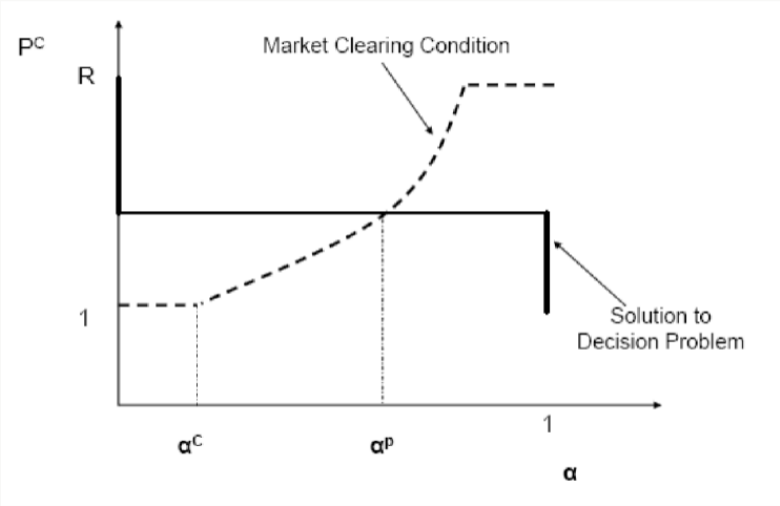
$$p^B = 1$$

and (credit crunch)

$$\tilde{p}^C = \frac{\psi R K}{(1 - \alpha) W (1 + r^*)} = \frac{\psi R}{(1 - \alpha) (1 + r^*)}$$

$$p^C = \min \{ \max \{ \tilde{p}^C, 1 \}, R \} \quad 8$$

Real Estate Bubbles



Social foc (derivative w.r.t. α):

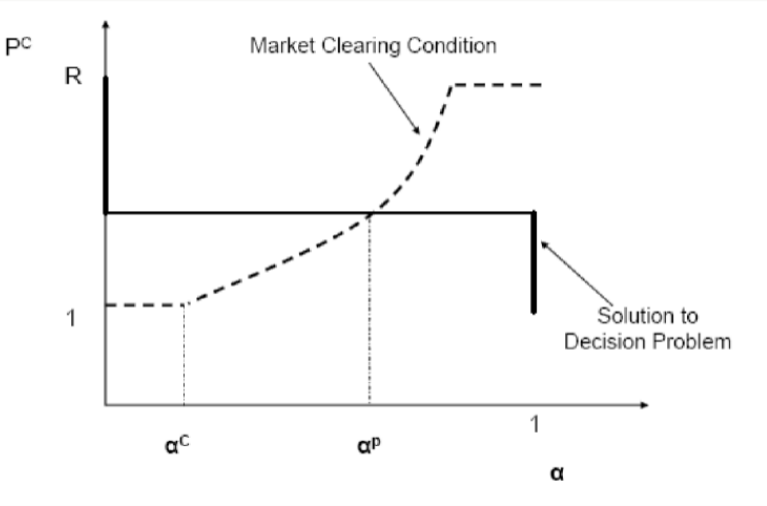
$$(1 - \lambda) \frac{R + 1}{2} \frac{\Delta r^b}{1 + r^*} - \lambda R$$

Private:

$$(1 - \lambda) \frac{R + 1}{2} \frac{\Delta r^b}{1 + r^*} - \lambda \frac{R + p_{t+1}^C}{2}$$

- ▶ $p_{t+1}^C < R$: Banker does not share equally in the marginal product R (due to *domestic* financial underdevelopment). Thus, it overinvests in bubble-asset
- ▶ Welfare maximizing choice: set α^S to the maximum value that does not lead to a credit crunch if the bubble crashes.

Macprudential Policy



Prudential Banking Regulations (liquidity requirements)

- ▶ Each generation is forced to maintain $(1 - \alpha^S)$ in international reserves (e.g. Argentina during the convertibility plan). Thus, even if the bubble bursts there is no credit crunch.
- ▶ Problem: at $p_{t+1}^C = 1$ there is a strong incentive to cheat (as in Jacklin 1987). Agent wants to set $\alpha = 1$ (expected gain relative to investing α^S).

$$W(1 - \alpha^S)(\hat{r}^b - r^*) > 0$$

- ▶ If portfolio decisions are costly to observe, a liquidity requirement will be costly to impose. If the costs are high enough, the economy will revert to the equilibrium $\alpha = \alpha^P$.

▶ Capital Inflow Sterilization

- Less monitoring of positions but government needs to have credible taxation power.
- Sterilization: Sell bonds in exchange for capital flows [it is called sterilization for monetary reasons, which I'll omit here – no monetary friction]

Capital Inflow Sterilization

- ▶ Issue one period debt with face value G_t at interest rate r_t^G . Raise taxes τ_s on the international endowment of generation t . Revenue invested at r^* , and returned to generation t . If large enough, can solve the excess volatility problem. If taxation ability is not large enough, then the govt can't credibly raise interest rate and sterilization fails.

$$\left(\tau_s W_t + \frac{G_t}{1 + r_t^G} \right) (1 + r^*) - G_t = 0$$

$$G_t > G_t^* \equiv (1 - \alpha^P) W_t (1 + r^*)$$

Capital Inflow Sterilization

▶ If it works,

$$W' = W_t(1 - \tau_s) \left(1 + r^G + \alpha_t(\tilde{r}^b - r^G) \right) \left($$

▶ The private's foc is:

$$(1 - \lambda) \frac{R + p_{t+1}^B}{2} (g - r^G) - \lambda(1 + r^G) \frac{R + p_{t+1}^C}{2}$$

Capital Inflow Sterilization

- ▶ Evaluated at $p_{t+1}^B = p_{t+1}^C = 1$, yields

$$r_t^G = (1 - \lambda)g - \lambda = \hat{r}^b.$$

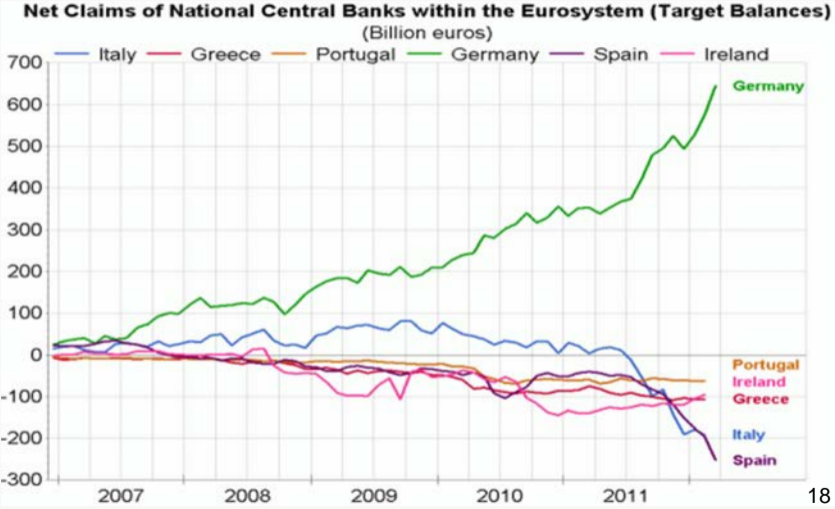
- ▶ If the government sells debt that raises $(1 - \alpha^S)W_t$ resources at t , agents purchase the debt and bubbles. Since at the margin debt crowds out the bubble, they must have the same expected return. Doing so requires to raise taxes of:

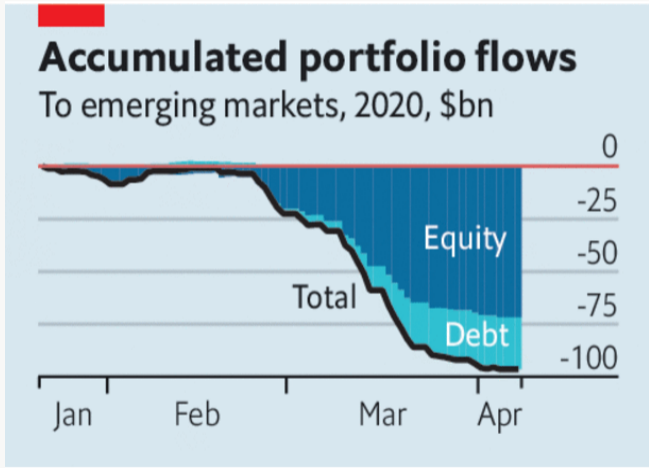
$$\tau_s = (1 - \alpha^S) \frac{\hat{r}^b - r^*}{1 + r^*}$$

- ▶ If the govt is limited in its ability to raise taxes, then it can only implement small sterilizations, which is ineffective since it just crowds out external (safe) bonds ($r_t^G = r^*$).

- ▶ There is a fundamental tension between high productivity (growth potential) of EM capital and EM's ability to produce good quality financial assets
- ▶ Natural habitat for bubbly assets
- ▶ This is worsened by low r^* (reach for yield by locals and foreigners)
- ▶ Private sector is likely to undervalue the social cost of this financial fragility

Sudden Stop within Euro Region (Euro crisis)





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The Covid-19 Sudden Stop

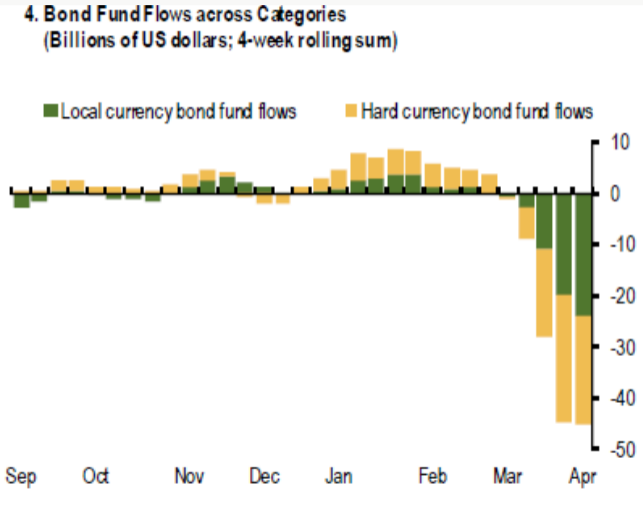
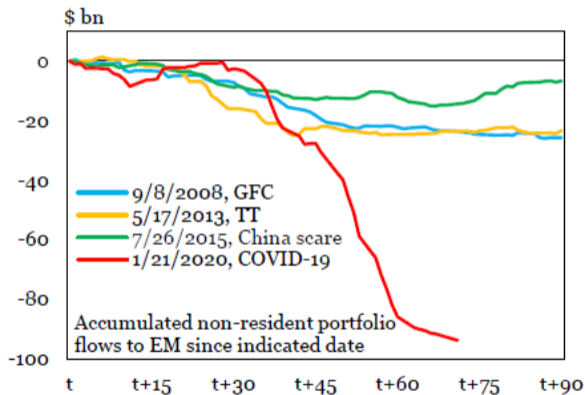
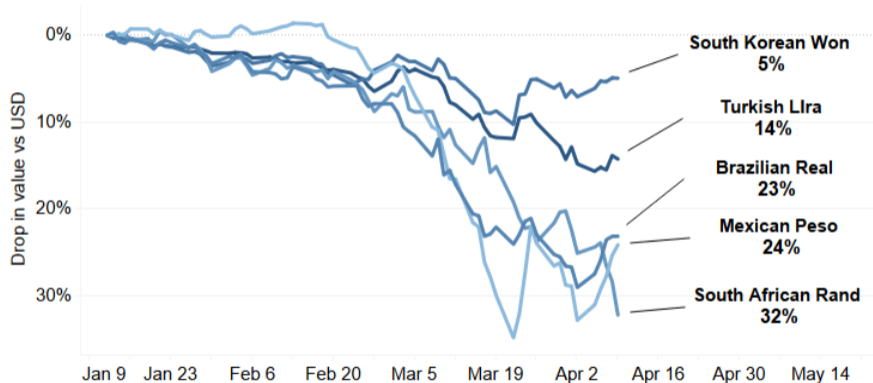


Exhibit 2. Stress Episodes for Capital Flows



Source: IIF daily flows tracker

Emerging Market currencies



SOURCE: Reuters



The Covid-19 Sudden Stop (Swap Lines)

- ▶ March 19, 2020: NY_Fed entered into temporary U.S. dollar liquidity arrangements (swap lines) with: Australia, Brazil, Denmark, Korea, Mexico, Norway, New Zealand, Singapore and Sweden [Add to existing lines with Canada, UK, Japan, ECB, SNB]
- ▶ March 31, 2020: Temporary repo facility. EM can repo their holding of UST (FIMA Repo Facility)
- ▶ IMF expanded and created multiple lending facilities

- ▶ Bianchi-Lorenzoni (2022)
- ▶ Pecuniary and AD externalities in open economy
- ▶ Simple model summarizing rationale for second-best use of capital controls
- ▶ Similar role of reserve accumulation

$$E \sum_{t=0}^{\infty} \beta^t U(c_t^T, c_t^N)$$

$$U(c_t^T, c_t^N) = \frac{1}{1-\rho} \left(\phi^\rho (c_t^T)^{1-\rho} + (1-\phi)^\rho (c_t^N)^{1-\rho} \right) \left($$

► Fixed tradable endowment:
 y^T

► N-technology:

$$y_t^N = n_t$$

- ▶ Full budget constraint for optimization but, in (the interesting) equilibrium,

$$a_t = a_t^* = 0.$$

- ▶ Moreover, assume $p_t^T = e_t$, to imply:

$$e_t c_t^T + p_t^N c_t^N - \frac{1}{1 + \widehat{i}_t^*} e_t b_{t+1}^* = e_t y^T + w_t n_t - e_t b_t^*$$

- ▶ Inelastic supply of labor:
 \bar{n}

- ▶ Non walrasian equilibrium (with $p_t^N = w_t$)

$$n_t \leq \bar{n}, \quad w_t \geq \underline{w}$$

with one inequality.

- ▶ Two period lived international investors
- ▶ Face quadratic cost Φ of taking dollar position in the country (upward sloping supply of funds)

Maximize

$$E_t \left[\left(b_{t+1}^* - \frac{1 + i_t^*}{1 + \widehat{i}_t^*} b_{t+1}^* \right) - \frac{1}{\omega_t} \Phi \left(\frac{b_{t+1}^*}{1 + \widehat{i}_t^*} \right) \right] \left(\frac{b_{t+1}^*}{1 + \widehat{i}_t^*} = \omega_t (\widehat{i}_t^* - i_t^*) \right)$$

- ▶ Shocks to ω_t (and possibly i_t^*)



International loan market

$$D(\hat{i}_t^*, a_t^* - b_t^*) = \omega_t (\hat{i}_t^* - i_t^*) \left($$

Domestic/international loans indifference

$$\frac{e_{t+1}}{e_t} (1 + \hat{i}_t^*) = 1 + i_t$$

Domestic demand

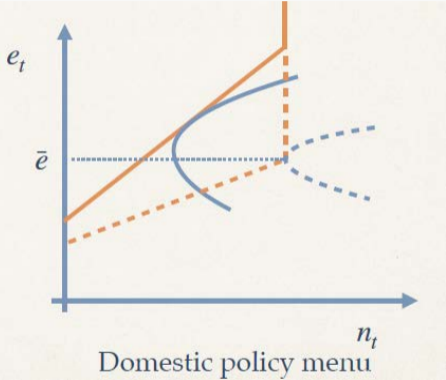
$$n_t = \frac{1 - \phi}{\phi} \left(\frac{w_t}{e_t} \right)^{-\frac{1}{\rho}} C^T(\hat{i}_t^*, a_t^* - b_t^*)$$

- ▶ Assume policy maker's objective is

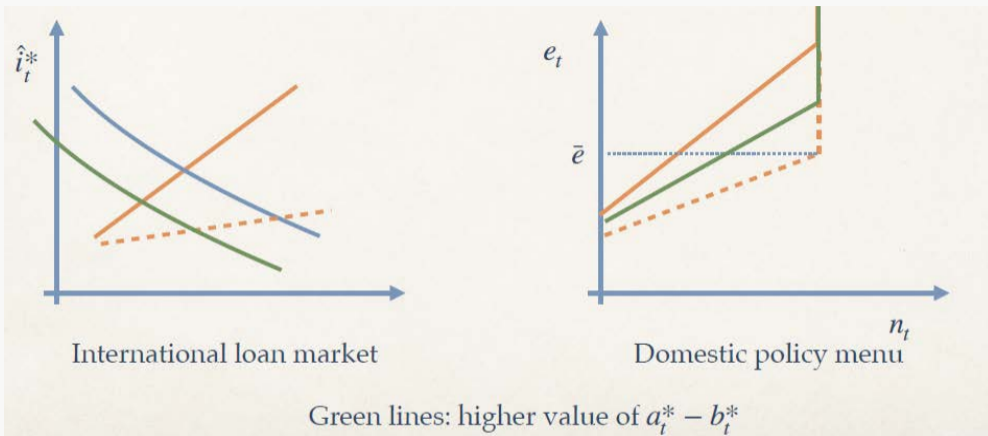
$$(1 - \beta) \left(U(c_t^T, c_t^N) - \Psi(e_t) \right) + \beta U(c_{t+1}^T, c_{t+1}^N)$$

- ▶ The term $\Psi(e_t)$ captures fear of floating

Monetary policy dilemma



Prudential policy



► Similar idea for reserve accumulation:

- Allows currency intervention and prevents large depreciation
- But there is an opportunity cost of reserves: $\hat{i}_{t-1}^* - i_{t-1}^*$

Asian/Russian crisis:

- ▶ Fundamentally changed prudence in EMEs
- ▶ Led to massive capital flows to US (Global Imbalances literature). Eventually people got it that it wasn't expansionary policy in US, but a global equilibrium phenomenon
- ▶ As such, the likelihood of a sudden stop to the US seemed remote.. still, substantial fragility built within the US financial system
 - Incentives to create and hoard pseudo-safe assets (regulatory weakness)
 - *General equilibrium leverage*
- ▶ Caballero, R.J. and A. Krishnamurthy, "*Global Imbalances and Financial Fragility*," *AER-PP* May 2009.

- ▶ During good times, external demand for AAA assets leads to:
 - An increase in the value of US **risky** assets
 - A drop in the real interest rate (CFG) **and** in the risk premium
 - A sharp rise in the leverage of US financial institutions
- ▶ Fragility with respect to negative shocks
 - Sharp rise in risk premium and drop in riskless rate
 - Sharp drop in US wealth
 - (even if AAAs are AAA)

- ▶ There is a continuum of US financial institutions, with mass one, that own assets which generate cash flows of X_t^d per unit time (payments from mortgage loans, credit card loans, auto loans, etc.), where,

$$\frac{dX_t^d}{X_t^d} = gdt + \sigma dZ_t$$

- ▶ The external demand for US assets, from foreign central banks for example, is in particular a demand for high-grade debt. They allocate an exogenous stream of funds to investments in assets produced by the US financial system

$$\frac{dX_t^f}{X_t^f} = gdt.$$

- ▶ Foreigners withdraw and accumulate riskless (AAA) debt according to:

$$c_t^f = \rho B_t^f$$

$$dB_t^f = (X_t^f - \rho B_t^f)dt + r_t B_t^f dt.$$

- ▶ The financial institutions' owners/equity-holders are local investors who maximize preferences:

$$E_t \int_t^{\infty} e^{-\rho(s-t)} \ln c_{t+s}^d ds.$$

$$W_t = V_t - B_t^f.$$

$$c_t^d = \rho W_t$$

- ▶ In equilibrium:

$$X_t^d + X_t^f = \rho W_t + \rho B_t^f = \rho V_t$$

- ▶ Which implies that the value of **risky** US asset rises with capital inflows:

$$V_t = \frac{X_t^d + X_t^f}{\rho}$$

- ▶ And so does domestic wealth early on:

$$W_t = \frac{X_t^d}{\rho} + \frac{X_t^f - \rho B_t^f}{\rho}.$$

- ▶ Define the foreign debt-to-asset ratio (leverage) and the foreign-to-total flows as:

$$b_t^f \equiv \frac{B_t^f}{V_t}, \quad x_t^f \equiv \frac{X_t^f}{X_t^d + X_t^f}$$

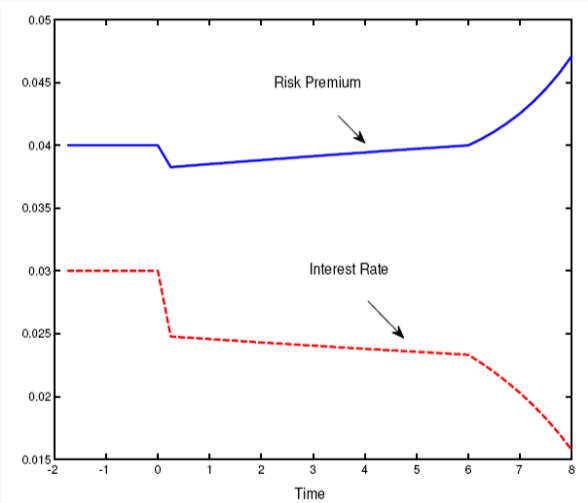
- ▶ Then:

$$\begin{aligned} r_t &= \rho + E_t[dc_t/c_t] - \text{Var}_t[dc_t/c_t] \\ &= (\rho + g - \sigma^2) \left(\rho x_t^f + \sigma^2 \left(1 - \frac{(1 - x_t^f)^2}{1 - b_t^f} \right) \right) \end{aligned}$$

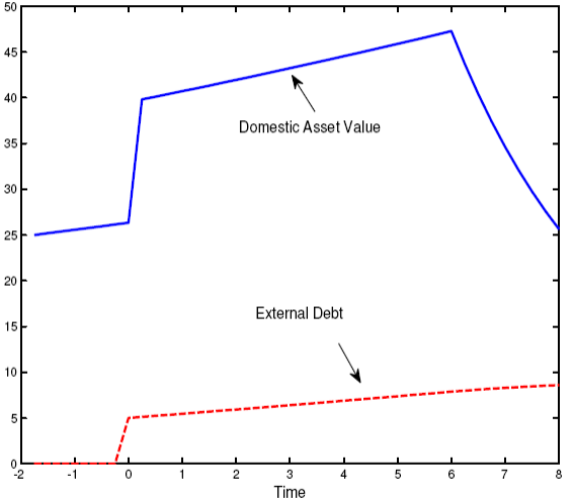
- ▶ Let us consider a hypothetical asset- i , whose return depends on innovations in the risk factor dZ_t :

$$dR_t^i = E_t[dR_t^i]dt + \sigma^i dZ_t.$$

$$\begin{aligned} E_t[dR_t^i] - r_t &= \text{Cov}_t[dR_t^i, dW_t/W_t] \\ &= \sigma^i \sigma \frac{1 - x^f}{1 - b_t} \end{aligned}$$



Fragility



- ▶ The point is **not** to argue that there were no incentive problems before the crisis, or that the severity of the crisis itself was not exacerbated by policy mistakes and agency problems...
- ▶ The argument is that the same forces that shaped global imbalances, were (and are) behind many of the developments and patterns we have seen in terms of securitization, leverage, and risk premia

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