Regulating Capital Flows to Emerging Markets: An Externality View

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Motivation

Emerging market economies characterized by recurring crises:

- details differ
- one element stays the same: *pro-cyclicality* of capital markets

$\Rightarrow$ **Fierce debate on desirability of capital account liberalization:**

- opponents: e.g. Rodrik (1998), Stiglitz (2000, 2002)
- proponents: e.g. Fischer (1998), etc.

Empirical Evidence: more nuanced (e.g. Mauro et al., 2007):

- Equity flows, in particular FDI, enhance opportunities for growth and risk sharing
- Debt flows, esp. short-term dollar debt, raise crisis risk, don't support growth

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Key Contribution

This suggests a role for regulatory intervention

BUT: should be based on a clearly identified market imperfection

Key Insights

This paper shows:

1. *Pro-cyclicality in capital markets creates a systemic externality*
2. *This induces market participants to take on excessive risk*
3. *There are ways to estimate the size of the externality*
4. *We can design regulations to correct the distortion*

Financial Accelerator Effects

Standard mechanism of procyclicality: financial accelerator effects

in closed economy: Bernanke and Gertler (1989), Kiyotaki and Moore (1997), ...

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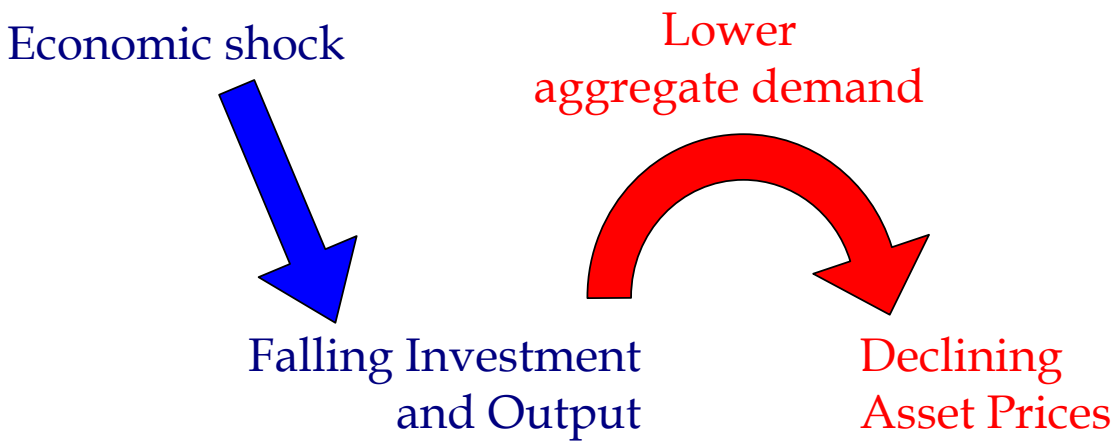

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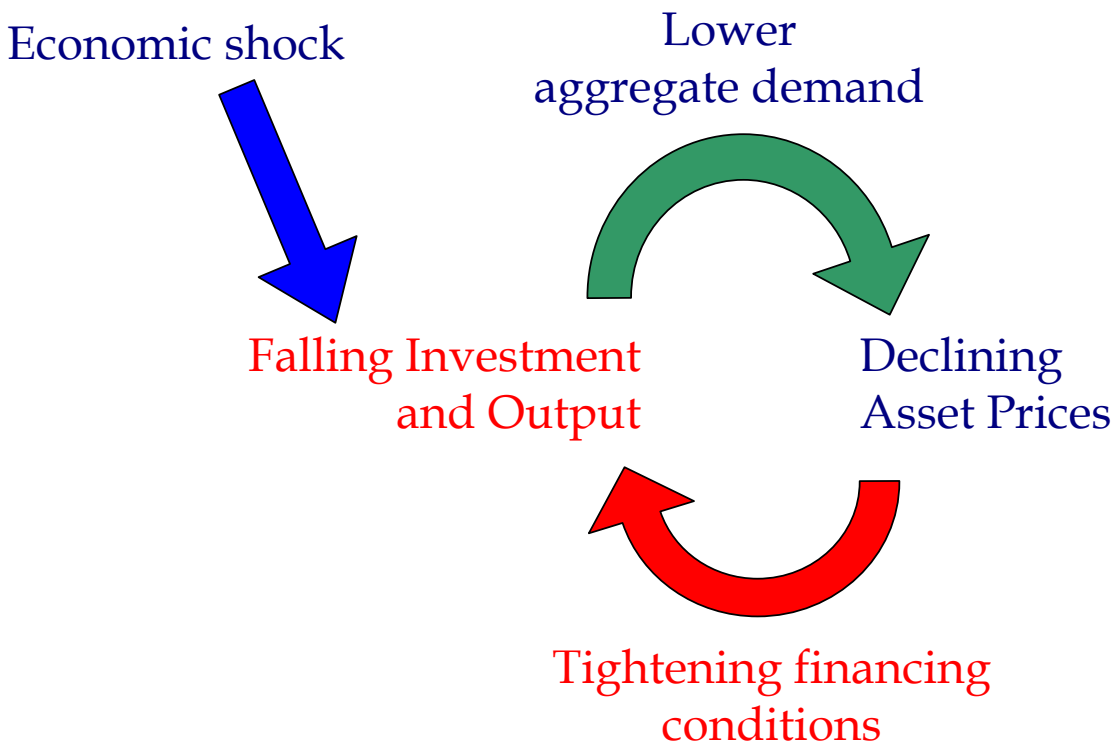

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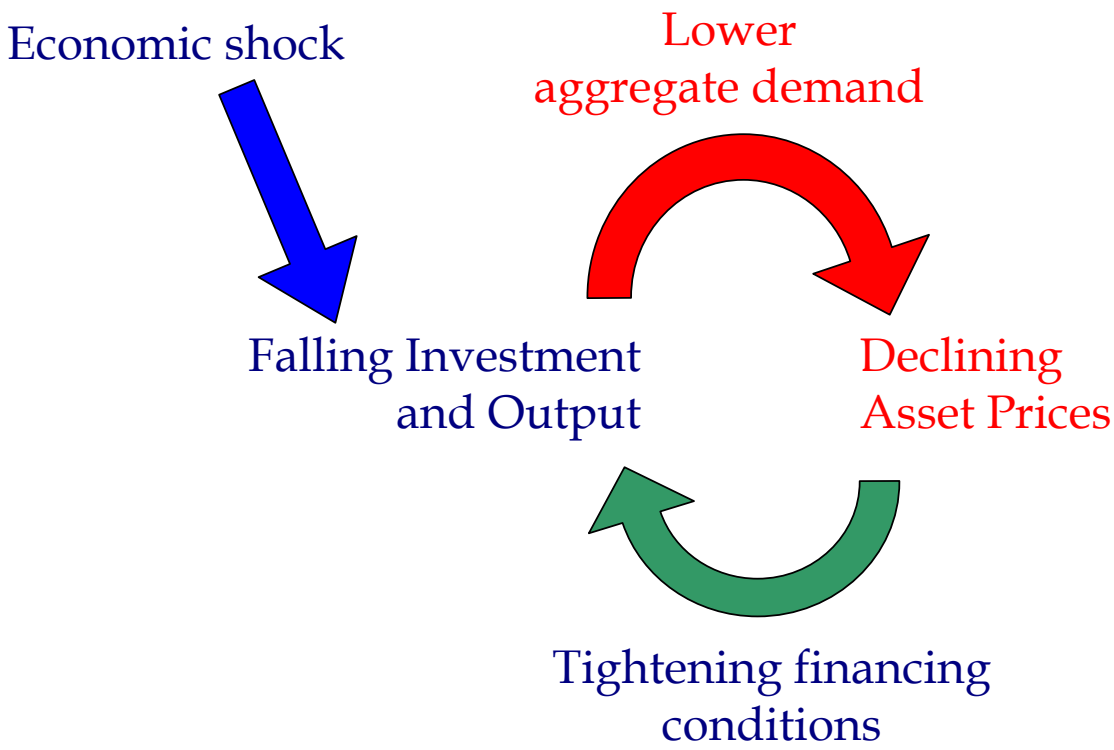

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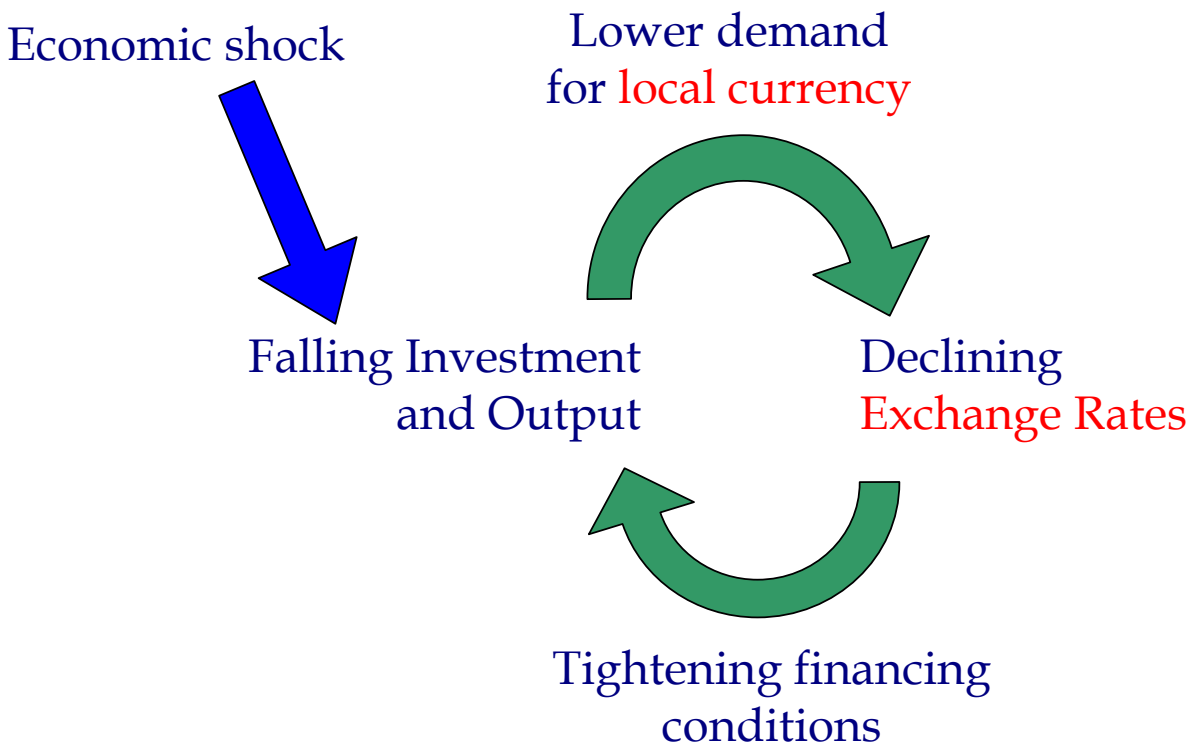
in open economy: Krugman (1999), Mendoza (2005), ...



Benchmark Model of Financial Accelerator

Benchmark model:

- Model of an emerging market economy:
  - representative domestic borrower
  - large international investors
- Exchange rates are countercyclical
  (i.e. depreciation when demand falls)
- Two time periods: 1, 2
- Shock occurs in period 1

Domestic Agents

Behavior of domestic agents:

- Initial debt B_0 (later: endogenous financing decision at $t = 0$)
- Output shock Y_T^ω hits in periods 1, returns to trend $\bar{Y}_T$ in period 2
- Domestic borrower can issue bond B_1^ω at interest rate R
- Borrowing is subject to a *procyclical* constraint:
  $B_1^\omega \leq \kappa\left(Y_{T,1}^\omega + p_{N,1}^\omega \bar{Y}_N\right)$
  financial crises = when borrowing constraints are binding
- Remainder $C_{T,1}^\omega$ is consumed
- Period 2: output received, loan B_1^ω repaid, rest consumed

Domestic Agents' Strategy

$$\max_{\{C^{\omega}_{T,t}, C_{N,t}, B^{\omega}_1\}} u(C^{\sigma}_{T,1} C^{1-\sigma}_{N,1}) + \beta u(C^{\sigma}_{T,2} C^{1-\sigma}_{N,2})$$

$$\begin{aligned}
\text{s.t.} \quad \bar{l} + C^{\omega}_{T,1} + p^{\omega}_{N,1} C^{\omega}_{N,1} &= Y^{\omega}_{T,1} + p^{\omega}_{N,1} \bar{Y}_N + W_1 + \frac{B^{\omega}_1}{R} \\
C^{\omega}_{T,2} + p^{\omega}_{N,2} C^{\omega}_{N,2} &= \bar{Y}_T \quad + p^{\omega}_{N,2} \bar{Y}_N - B^{\omega}_1 \\
B^{\omega}_1 &\leq \kappa \left(Y^{\omega}_{T,1} + p^{\omega}_{N,1} \bar{Y}_N \right)
\end{aligned}$$

Definition of Equilibrium

Equilibrium in emerging market economy for a given ω:

- an allocation $(C^{\omega}_{T,t}, C^{\omega}_{N,t}, B^{\omega}_{1})$ and
- a price $p^{\omega}_{N,t}$ for $t = 1, 2$
- which maximize agents' utility
- which clear markets for all time periods:
  - for non-tradable goods: $C^{\omega}_{N,t} = \bar{Y}_N$
  - for tradable goods: ensured by agent's budget constraints

Determination of Exchange Rate

Determination of exchange rate:

$$p^{\omega}_{N,t} = MRS = \psi \cdot C^{\omega}_{T,t}$$

Lower aggregate demand depreciates the exchange rate

$=$ **pecuniary externality**

$=$ mechanism by which market reaches equilibrium

$\Rightarrow$ typically has no welfare implications

BUT: exchange rate depreciation reduces value of collateral

$=$ **real externality** when borrowing constraints are binding

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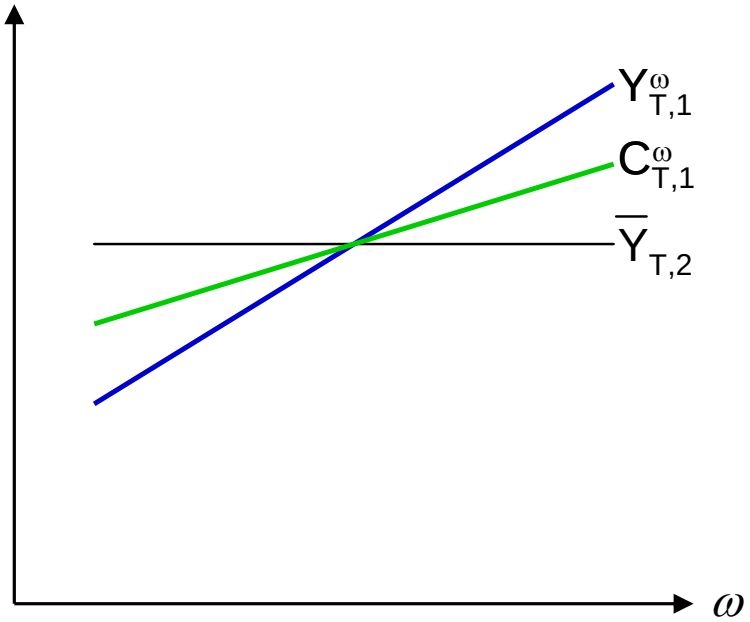
Determination of Consumption

Consumption as a function of the state of productivity ω:



When borrowing constraints are loose, consumption is smoothed...

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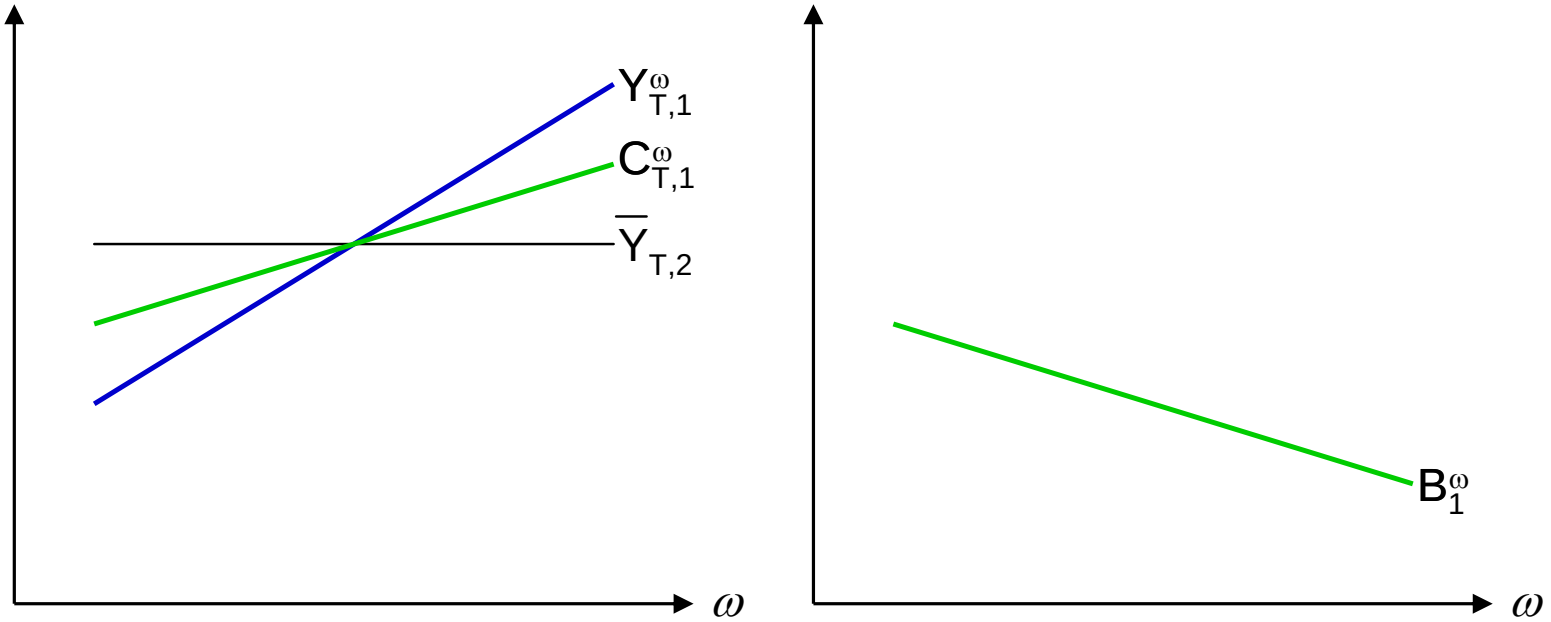

...and borrowing is an decreasing function of the output shock

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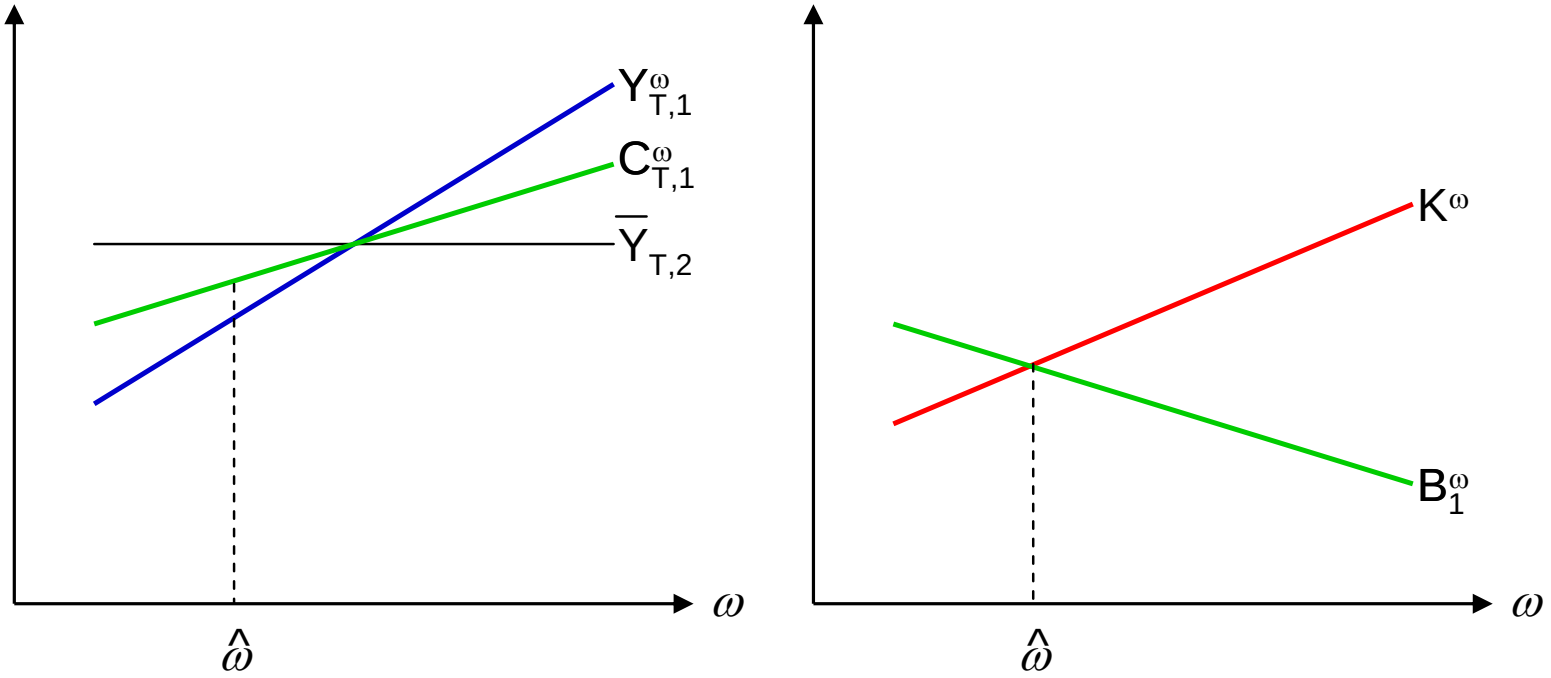

Binding borrowing constraints limit the amount of bonds issued...

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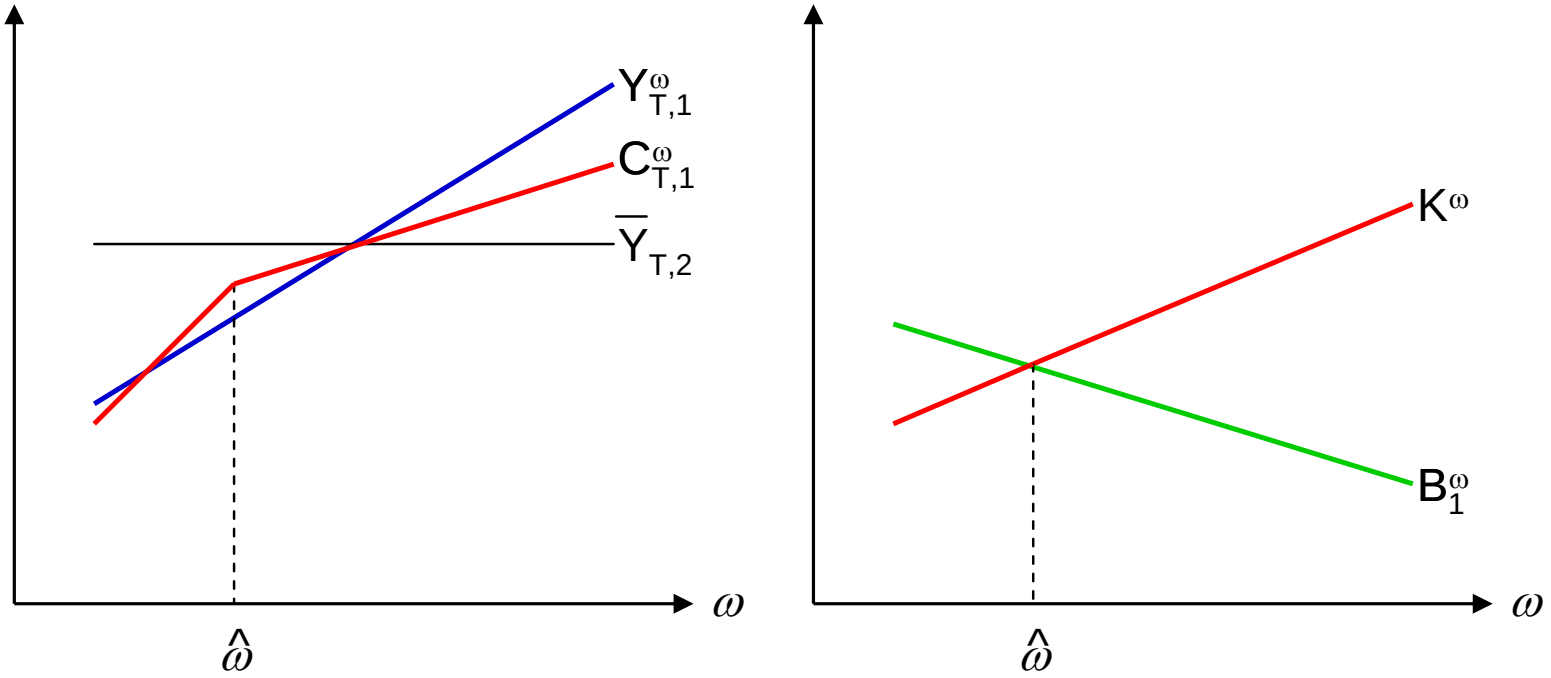

...which necessitates a decline in aggregate spending...

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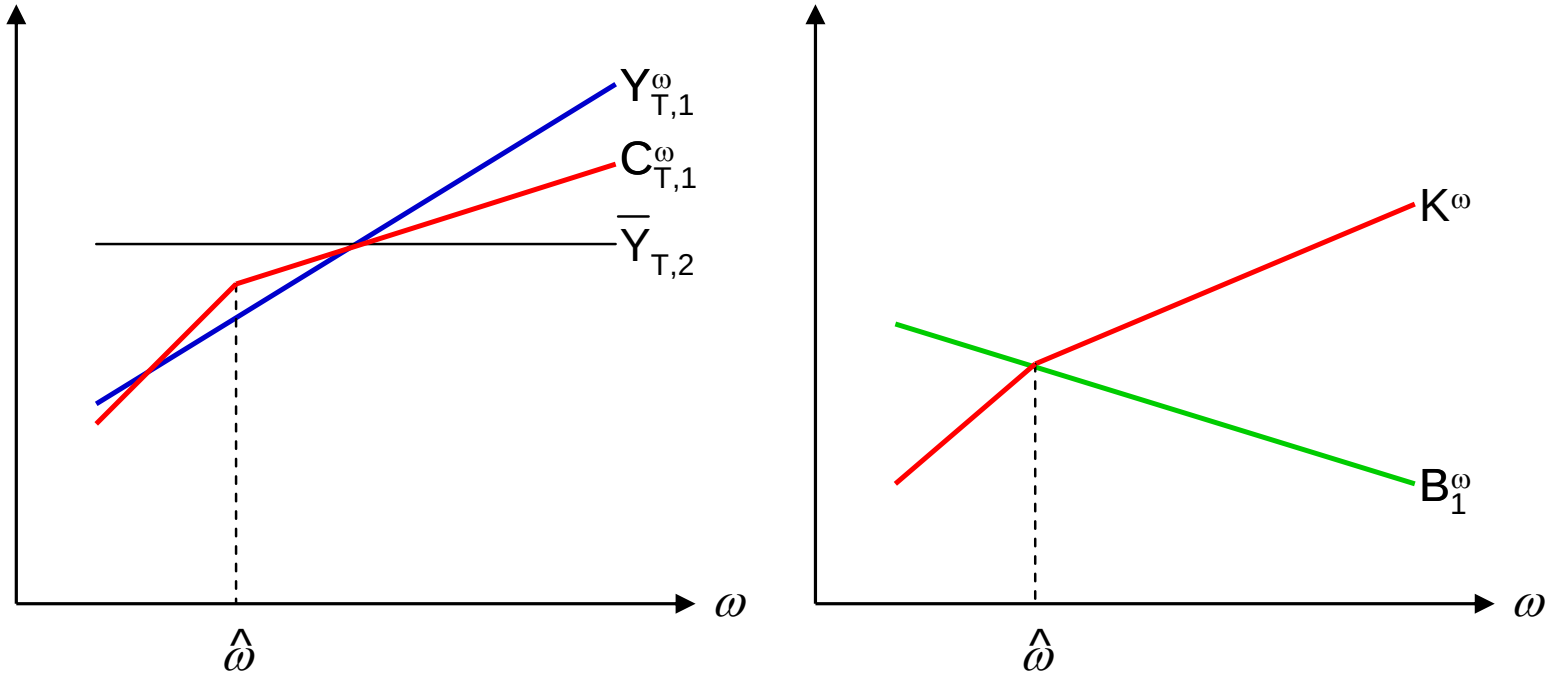

...the resulting depreciation tightens collateral constraints

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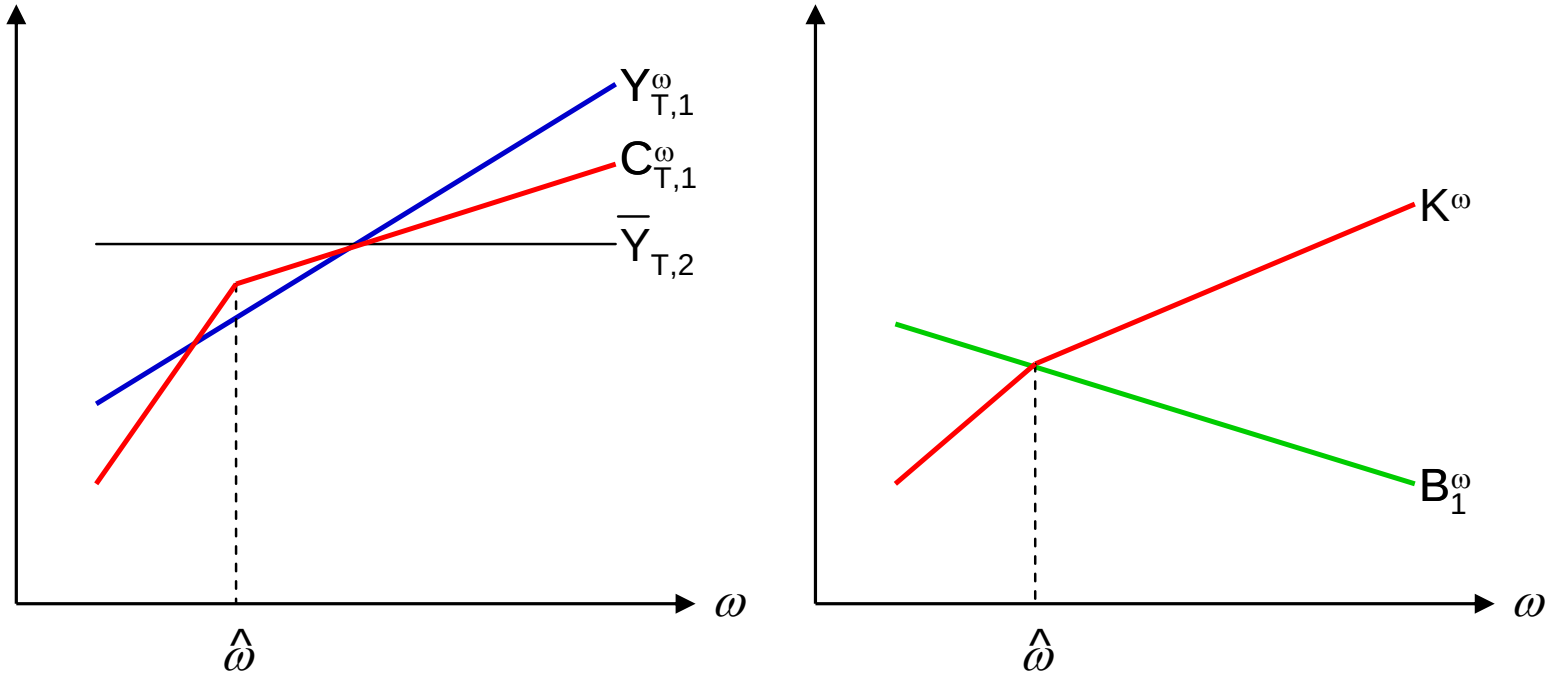

Financial accelerator: feedback cycle of

- depreciating exchange rates
- falling aggregate demand
- tightening borrowing constraints

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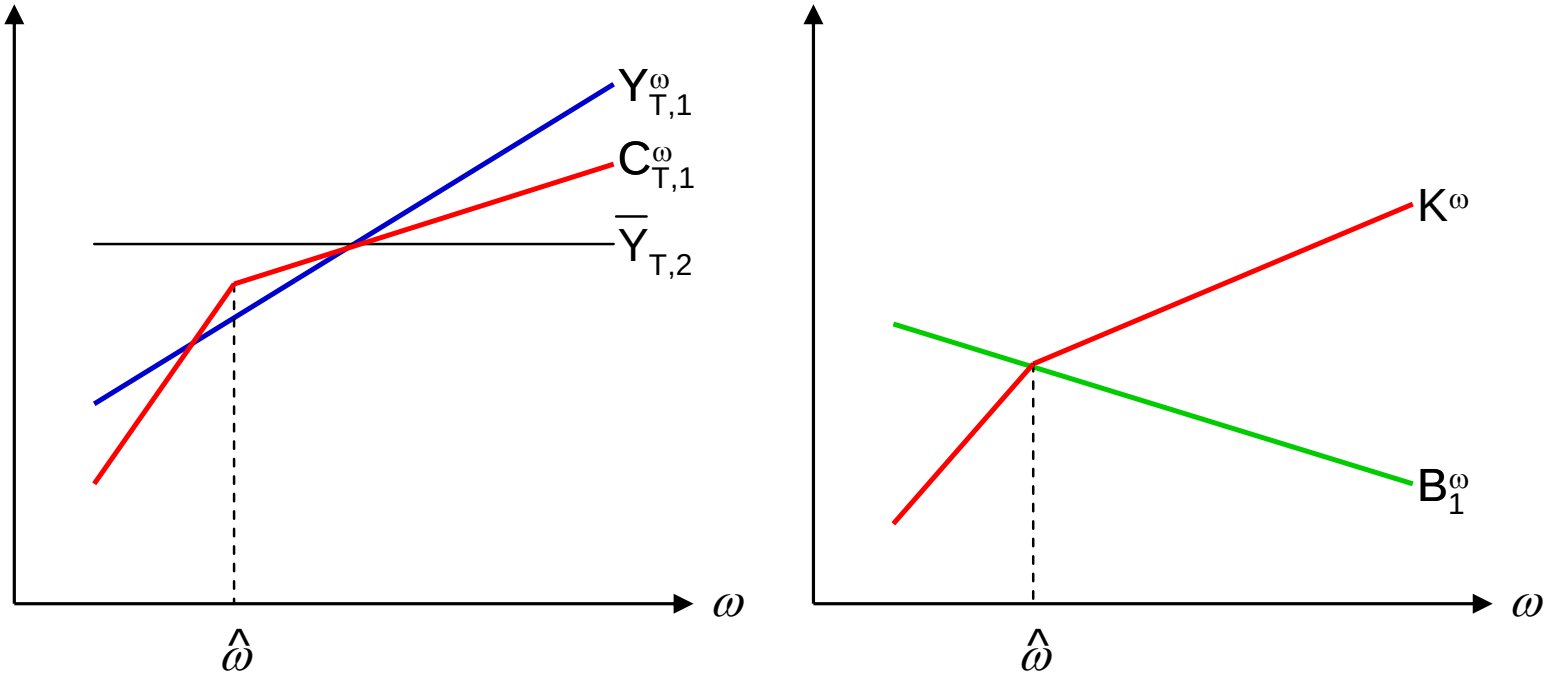

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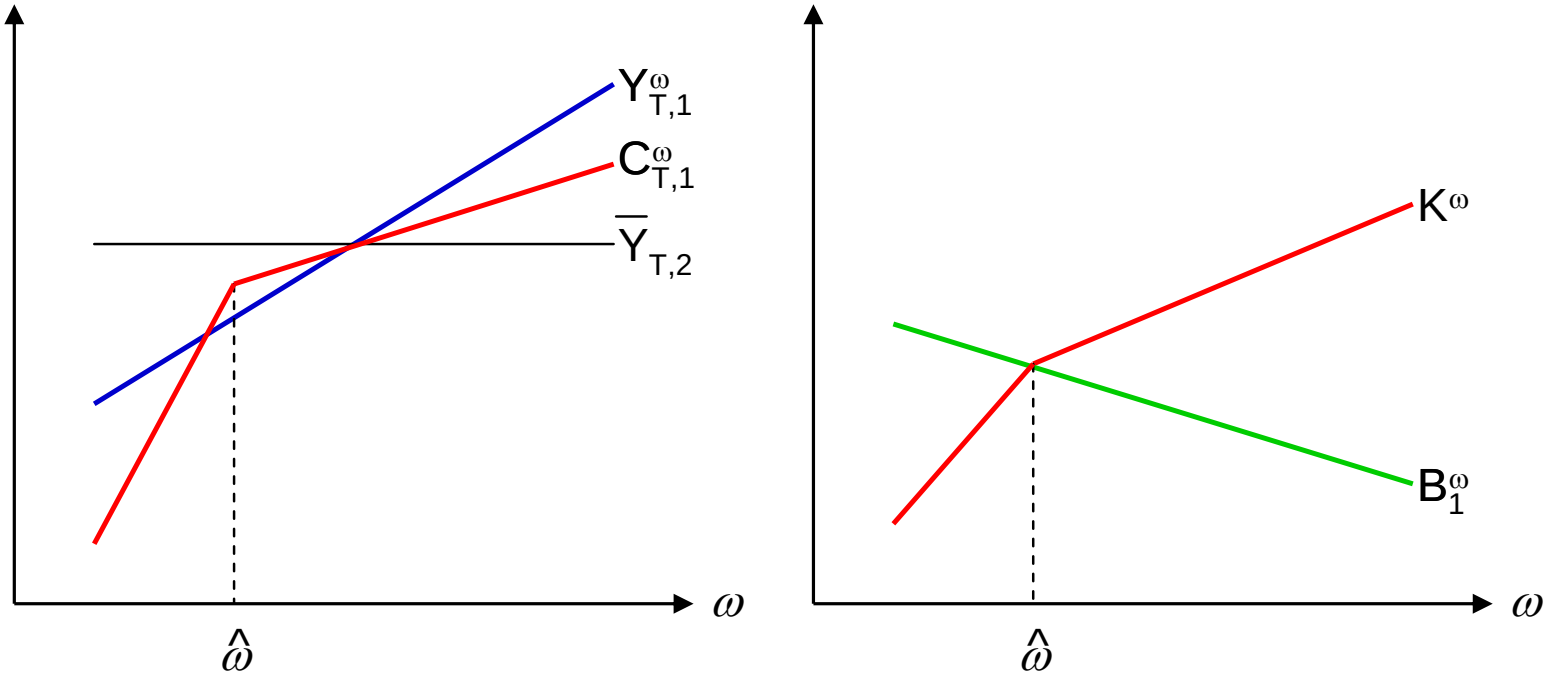

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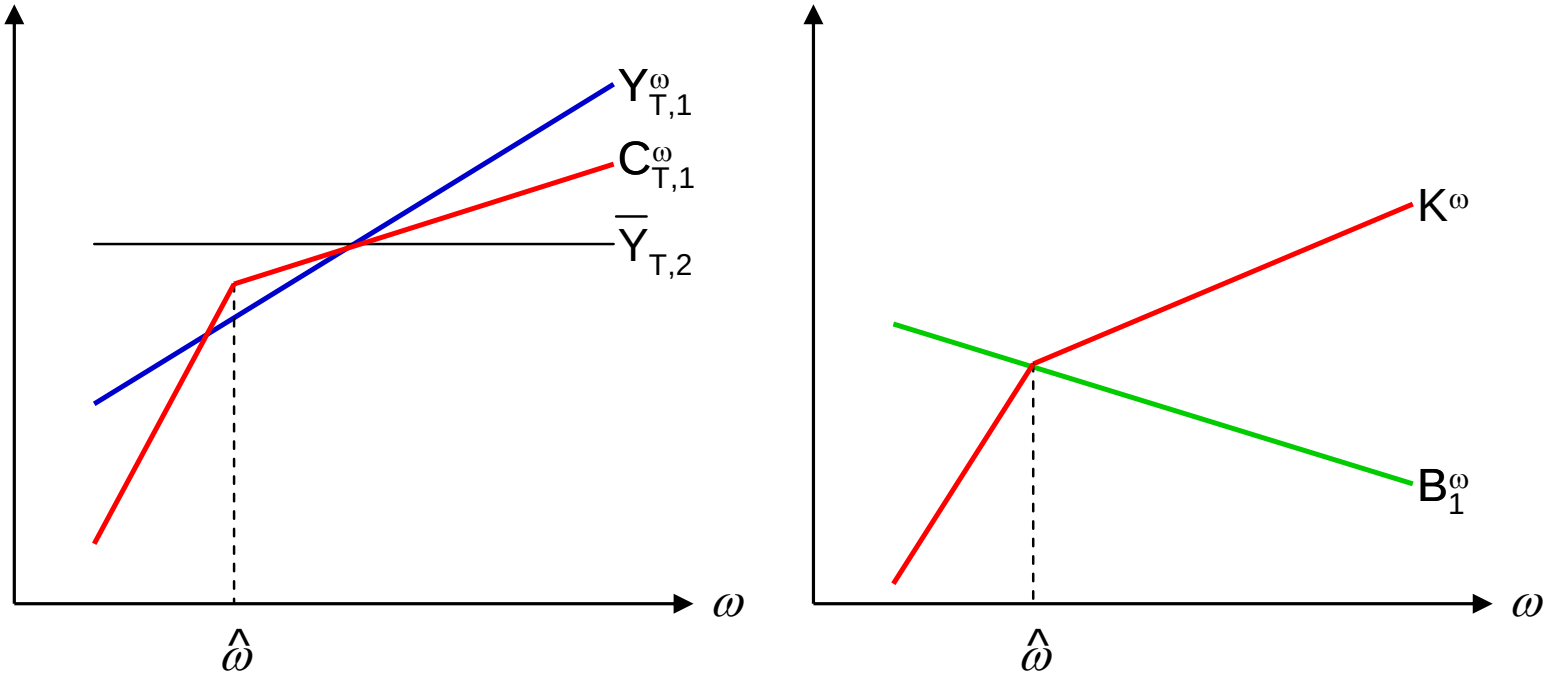

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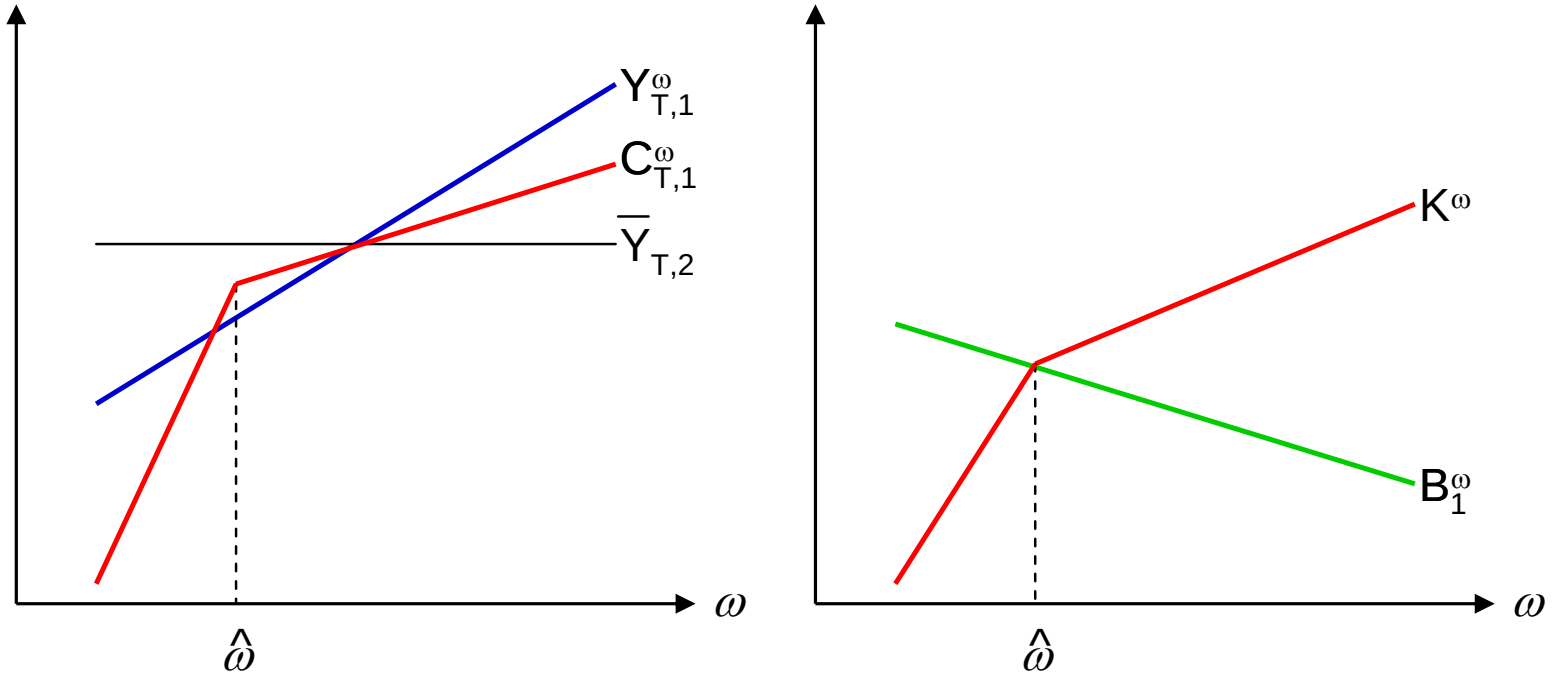

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Undervaluation of Liquidity in Crises

Valuation of liquidity μ^{ω}
= shadow value of receiving one more dollar of funds

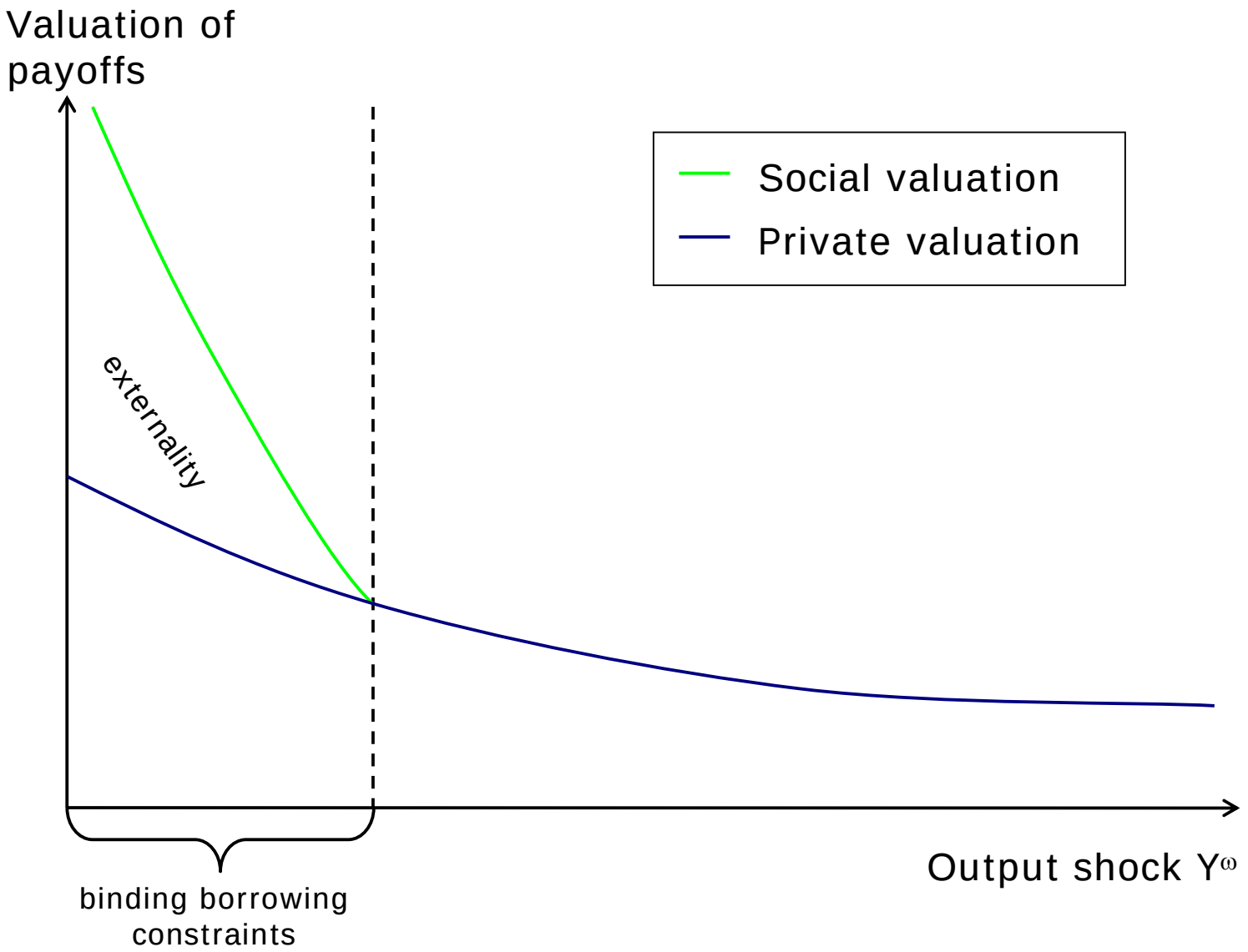
Proposition (Central result)

Undervaluation of Liquidity in Crises: *During crises a social planner values liquidity more highly than decentralized agents* ($\mu^{\omega}_{SP} > \mu^{\omega}_{DE}$)*, since he internalizes financial feedback effect*

Effects on all intertemporal stochastic tradeoffs:

- quantity and riskiness of financing
- quantity and riskiness of investment

Private and Social Pricing Kernel



Implications for financing decisions

Implications for Financing Decisions:

- assume entrepreneurs need to finance investment in period 0
- borrow in a full market of Arrow securities B_0^ω in period 0
- aggregate risk $Y_{T,1}^\omega$ materializes in period 1
- state-contingent repayment made
- if constraint binding: financial accelerator is triggered
  $\Rightarrow$ externality arises

Equilibrium with Period 0 Financing

Optimization problem with period 0 financing:

$$\underset{B_0^\omega, C_{T,1}^\omega, B_1^\omega}{\mathcal{L}} = E\left\{ u(C_{T,1}^\omega) + \beta u(Y_{T,2}^\omega - B_1^\omega) - \nu\left[\bar{I} - W_0 - M_0^\omega B_0^\omega\right] \right.$$
$$- \mu^\omega \left[C_{T,1}^\omega + \bar{I} + B_0^\omega - Y_{T,1}^\omega - \frac{B_1^\omega}{R} \right] -$$
$$\left. - \lambda^\omega \left[B_1^\omega - \kappa \left(Y_{T,1}^\omega + p_{N,1}^\omega \bar{Y}_N \right) \right] \right\}$$

First-order condition on B_0^ω: $\mu^\omega = M_0^\omega \cdot \nu$ or $\dfrac{\beta \mu^\omega}{E[\mu^\omega]} = M_0^\omega$

Decentralized agents: $\mu^\omega = u_T'(C_{T,1}^\omega)$

Social planner: $\mu^\omega = u_T'(C_{T,1}^\omega) + \lambda^\omega \kappa \cdot \frac{\sigma}{1-\sigma}$

$\Rightarrow$ Social optimum entails lower $u_T'(C_{T,1}^\omega)$ in crisis states

$\Rightarrow$ issue fewer bonds (buy more insurance) contingent on crisis

Period 0 Financing with Risk-Neutral Investors

If international capital markets are risk-neutral:

- insurance is cost-less
- both decentralized agent and social planner insure fully
- decentralized equilibrium is socially efficient = normal world

Period 0 Financing with Risk-Averse Capital Markets

If international investors are averse to emerging market risk:

- insurance decision is a risk/return trade-off
- in some states: insurance is very expensive
  $\Rightarrow$ privately optimal to repay so much that constraints bind
- financial accelerator mechanism triggered
- externality arises: decentralized agents undervalue liquidity
- excessive systemic risk

Period 0 Financing Decisions with Contagion

Contagion occurs in states when international risk aversion is high for reasons unrelated to the emerging market economy:

- decentralized agents agree to large repayments
  = optimal risk sharing
- borrowing constraints binding
- financial accelerator triggered
- externality arises: decentralized agents undervalue liquidity
- socially excessive exposure to contagion

NOTE: this suggests an “insurance view” of contagion

Implications for Investment Behavior

Determination of risky investment decisions at $t = 0$:

- in crisis states decentralized agents undervalue liquidity
- therefore they undervalue the social cost of capital
  $\Rightarrow$ they invest too much overall: speculative bubbles
- therefore they undervalue the social benefit of payoffs
  $\Rightarrow$ they invest in excessively cyclical projects:

$\Rightarrow$ investment exhibits too much exposure to systemic risk

Importance of Rational Expectations

Our model: set in rational expectations framework
Real world: crises are often "unexpectedly" severe

Cost of expectational errors:

- in normal times (loose borrowing constraints):
  - "unexpected" shocks can be smoothed over time
    $\Rightarrow$ low welfare costs of expectational errors
- in crisis states (binding borrowing constraints):
  - "unexpected" shocks cannot be smoothed
  - impact is amplified by financial accelerator
    $\Rightarrow$ welfare costs by an order of magnitude larger

Policy Measures

Externality stems from financial accelerator mechanism

First-best policy measures: break financial accelerator

- address borrowing constraints: better investor protection, ...
- stabilize exchange rate: reserve accumulation, ...

What does *not* work:

Proposition (Ineffectiveness of Anticipated Transfers)

Anticipated government transfers that aim to provide insurance will be undone in the decentralized equilibrium

Idea: decentralized equilibrium = privately optimal: $\frac{\beta u_T'(C_{T,1}^{\omega})}{E[u_T'(C_{T,1}^{\omega})]} = M_0^{\omega}$

Second-Best Policy Measures and Externality Kernel

Motivation for second-best policy measures:

- tax risky assets to offset externality
- discourage risky assets
- reduce incidence of borrowing constraints
- lower volatility, higher welfare

Definition (Externality Kernel)

The externality kernel τ^ω reflects the difference between social on private costs of a payoff in state ω

$$\tau^\omega = \mu^\omega_{SP} - \mu^\omega_{DE} = \lambda^\omega \cdot \frac{dK^\omega}{dC^\omega_{T,1}}$$

Externalities of Real-World Securities

In our model: entrepreneurs can access a full set of Arrow securities

Financial assets in the real world:

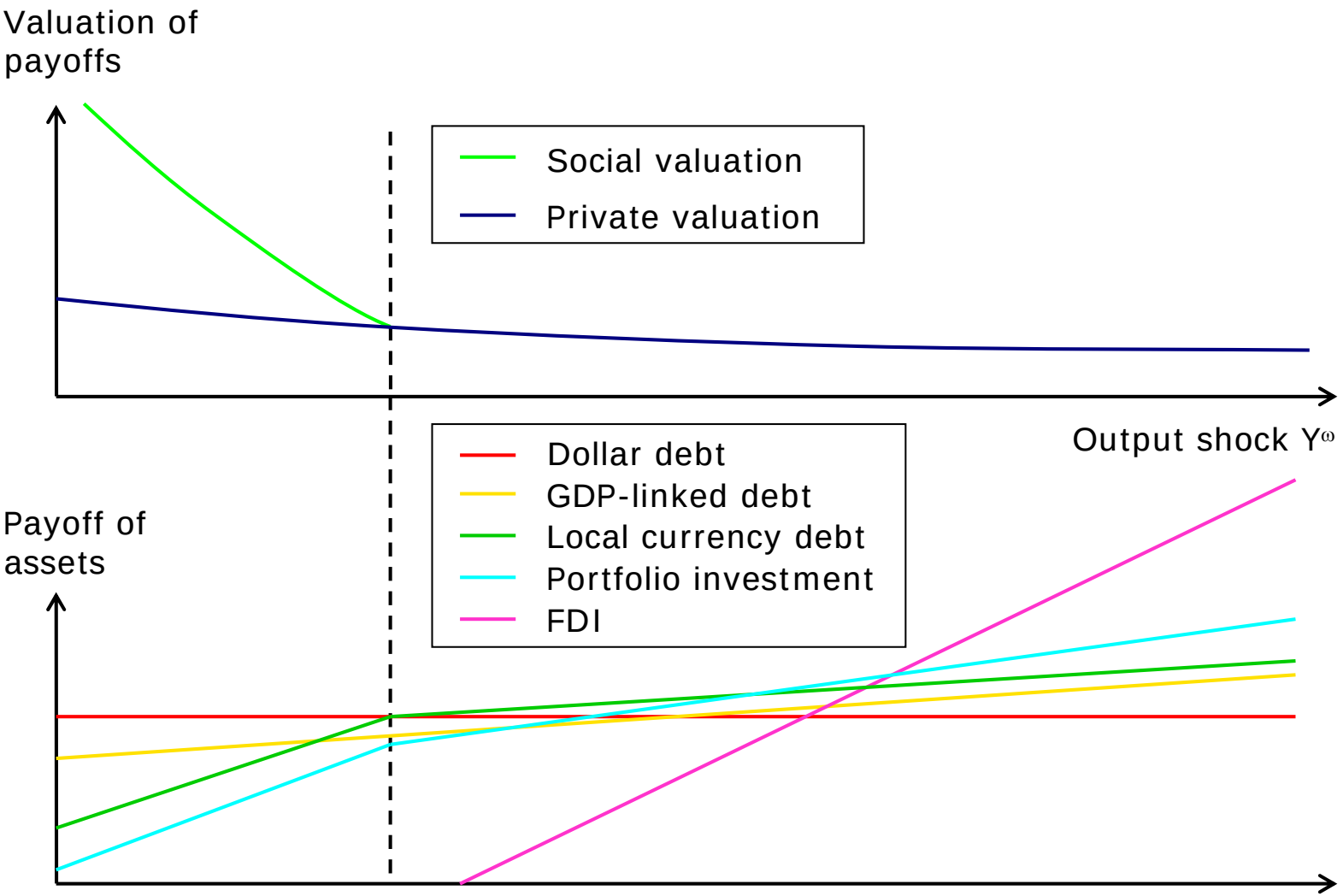
- every financial asset is a bundle of Arrow securities
- those with highest repayments in crisis states carry the largest externality

Definition (Securities)

A security i obliges the seller of one unit to make a contingent payment X_i^ω to the buyer

Optimal tax on security i with payoffs X_i^ω is $t_i^* = E[\tau^\omega X_i^\omega]$
$\Rightarrow$ precisely offsets the expected externality of security i

Externalities of Different Forms of Capital Flows



Calibrating the Magnitude of Externalities

Six steps to quantify the externalities of different capital inflows:

1. Describe probability space Ω of potential outcomes
2. Identify which states ω are subject to constraints
3. Quantify the tightness λ_{DE}^{ω} of constraints
4. Estimate the magnitude of amplification effects dK^{ω}/dY^{ω}
   $\Rightarrow \quad \tau^{\omega} = \lambda_{DE}^{\omega} \cdot dK^{\omega}/dY^{\omega}$
5. Describe contingent payoff structure X_i^{ω} of each asset category i
6. Calculate size of expected externality $t_i = E[\tau^{\omega} X_i^{\omega}]$

Magnitude of Externalities in Indonesia, 1998

Illustration: calculate externalities of various capital flows to Indonesia based on historical data 1988 – 2007:

Financial accelerator effects triggered in 1997/98
$\Rightarrow$ calibrate externality kernel $\tau^{1998} = 14.1\%$

Asset category	**Real gross return**	**Externality in 1998**	**Optimal tax**
Dollar debt	218%	30.7%	1.54%
GDP-indexed dollar debt	190%	26.8%	1.34%
CPI-indexed rupiah debt	100%	14.1%	0.71%
Rupiah debt	63%	8.9%	0.44%
Stock market index	44%	6.2%	0.31%

Implementation of Ex-Ante Policy Measures

How to impose "Pigovian" tax to offset externality:

- unremunerated reserve requirement on inflows
- banking regulations,
  e.g. based on "socially risk-neutral" probabilities

Counterpart to taxation of outflows: encouraging capital inflows

- capital inflows relax financing constraints
  $\Rightarrow$ subsidize inflows at rate τ^{ω}
- important role for IFIs

Implications for World Bank/IMF Loans

World Bank/IMF Loans:
Official loans in 'hard currency' also impose externalities
$\Rightarrow$ scope for more local currency/indexed lending, equity, etc.

Does this expose IFIs to greater risk?

- Moral hazard risk can be eliminated by indexing debt
- Indexed debt actually *reduces* risk!

It addresses a fundamental mis-match on IFIs' balance sheets:

- Business activity in developing countries
- BUT: accounting in USD, SDR
- Risk management: maintain capital in USD, SDR
  $\Rightarrow$ large *real* capital losses when dollar depreciates

Ex-Post Policy Measure: Suspension of Convertibility

Temporary suspension of convertibility:

- measure of last resort during crisis when other policy options exhausted
- suppress all capital outflows while crisis rages
- was successful e.g. in Korea and Thailand

Implementation:

- should be administered only under well-defined circumstances:
  - supervision by an international watchdog
    $\rightarrow$ reduces adverse confidence effects
  - e.g. quota on capital outflows $\rightarrow$ triggered when constraints binding
- can offset externality
- provides temporary "breathing room" for other reforms

Ex-ante effects:

- discourage risky forms of finance (e.g. short-term dollar debt)
- mitigate volatility of financial crises

Conclusions

1. Financial accelerator effects involve a systemic externality
2. This distorts private financing and investment decisions towards excessive risk-taking
3. Clear framework for policy intervention can be designed
   $\Rightarrow$ induce private agents to internalize social risk
   $\Rightarrow$ reduce volatility
   $\Rightarrow$ increase social welfare