

Regulating Capital Flows to Emerging Markets: An Externality View

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Identifying and Resolving Financial Crises

FDIC and Cleveland Fed

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Typical pattern of capital market liberalization:

- emerging markets enjoy an immediate spurt of growth
- many of them experience a financial crises soon thereafter

⇒ Fierce (ideological) debate on desirability of liberalization

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

Empirical Evidence: suggests a more nuanced view is warranted:

- Equity flows, in particular FDI, enhance opportunities for growth and risk sharing
- Uncontingent capital flows, esp. short-term dollar debt, raise the risk of financial crises

Research Questions (closely inter-related)

- *Why do private agents take on large amounts of risky finance?*
- *Should regulators do something about it, and if so what?*

Existing explanations:

- moral hazard
- lack of access to safer instruments

Our answer:

- macroeconomic externalities
- decentralized agents do not internalize their contribution to macroeconomic accelerator effect

Financial Accelerator Mechanism

Standard mechanism of financial crises: financial accelerator effect
in closed economy: Bernanke and Gertler (1989), Kiyotaki and
Moore (1997), ...

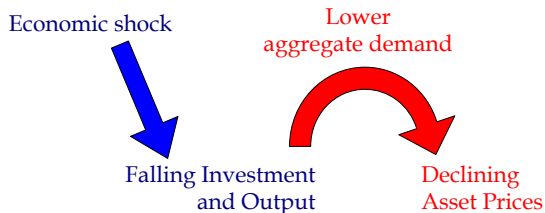
Economic shock



Falling Investment
and Output

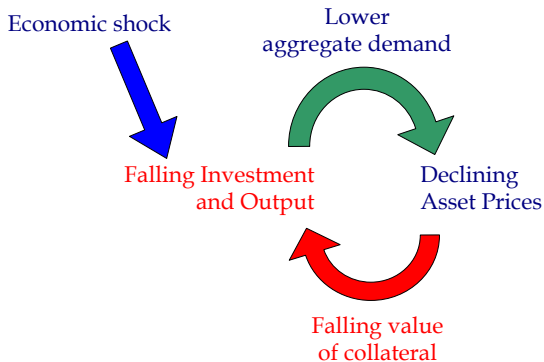
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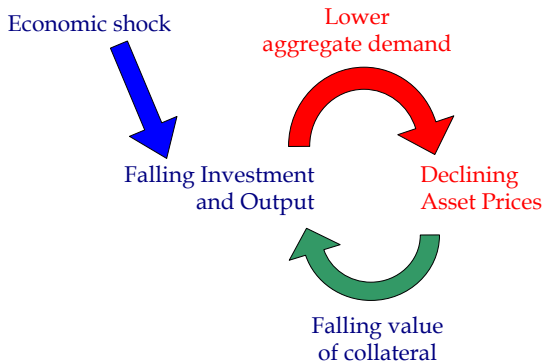
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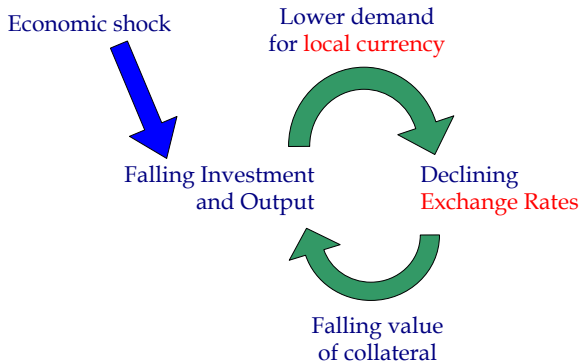


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in open economy: Krugman (1999), Mendoza (2005), ...



Benchmark model:

- Small open economy with two types of agents:
 - representative domestic borrower (consumer-producer)
 - large international investors lending at gross rate R
- Two goods:
 - tradable good T with price $p_{T,t}^\omega \equiv 1$
 - non-tradable good N with price $p_{N,t}^\omega$
- Model of exchange rate: real exchange rate $p_{N,t}^\omega$
- Two time periods: $t = 1, 2$
- State of productivity in the economy is indexed by ω

Behavior of domestic agents:

- Utility from tradable and non-tradable consumption:

$$U = u(C_{T,1}^\sigma C_{N,1}^{1-\sigma}) + \beta u(C_{T,2}^\sigma C_{N,2}^{1-\sigma})$$

- Born with wealth W_1
- Investment of \bar{I} units of tradables required in period 1

- Output in periods 1 and 2: $(Y_{T,t}^\omega, \bar{Y}_N)$

- $Y_{T,1}^\omega$ depends positively on state of productivity ω
- $Y_{T,2} = \bar{Y}_T$ and \bar{Y}_N fixed

- Sell bond B_1^ω to international investors at price $\frac{1}{R}$
subject to a borrowing constraint: $B_1^\omega \leq K^\omega = \kappa \left(Y_{T,1}^\omega + p_{N,1}^\omega \bar{Y}_N \right)$
financial crises = when borrowing constraints are binding

Domestic Agents' Strategy

$$\max_{\{C_{T,t}^\omega, C_{N,t}, B_1^\omega\}} u(C_{T,1}^\sigma C_{N,1}^{1-\sigma}) + \beta u(C_{T,2}^\sigma C_{N,2}^{1-\sigma})$$

$$\text{s.t. } \bar{I} + C_{T,1}^\omega + p_{N,1}^\omega C_{N,1}^\omega = Y_{T,1}^\omega + p_{N,1}^\omega \bar{Y}_N + W_1 + \frac{B_1^\omega}{R}$$

$$C_{T,2}^\omega + p_{N,2}^\omega C_{N,2}^\omega = \bar{Y}_T + p_{N,2}^\omega \bar{Y}_N - B_1^\omega$$

$$B_1^\omega \leq \kappa(Y_{T,1}^\omega + p_{N,1}^\omega \bar{Y}_N)$$

Equilibrium in emerging market economy for a given ω :

- an allocation $(C_{T,t}^\omega, C_{N,t}^\omega, B_1^\omega)$ and
- a price $p_{N,t}^\omega$ for $t = 1, 2$
- which maximize agents' utility
- which clear markets for all both time periods:
 - for non-tradable goods: $C_{N,t}^\omega = \bar{Y}_N$
 - for tradable goods: ensured by agent's budget constraints

Determination of Exchange Rate

Analytical determination of exchange rate:

$$\text{First-order condition on } C_{N,t}^\omega : p_{N,t}^\omega = MRS = \frac{1 - \sigma}{\sigma} \frac{C_{T,t}^\omega}{C_{N,t}^\omega} = \frac{1 - \sigma}{\sigma \bar{Y}_N} \cdot C_{T,t}^\omega$$

Lower aggregate demand depreciates the exchange rate

= **pecuniary externality**

= mechanism by which market reaches equilibrium

⇒ typically has no welfare implications

BUT: exchange rate depreciation reduces value of collateral

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

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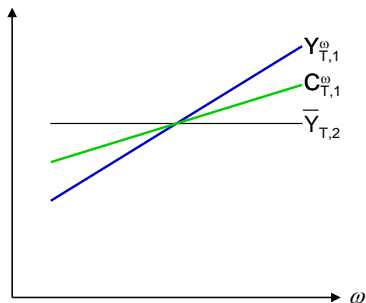
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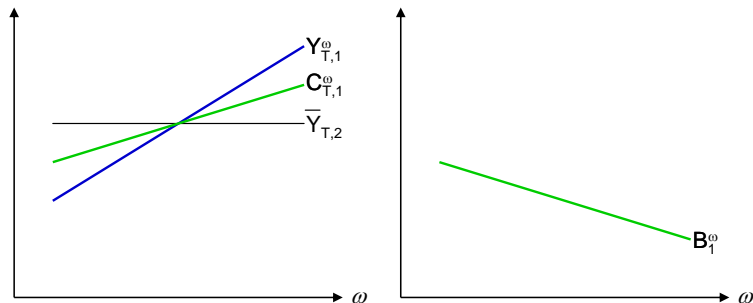
Consumption as a function of the state of productivity ω :



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

Determination of Consumption

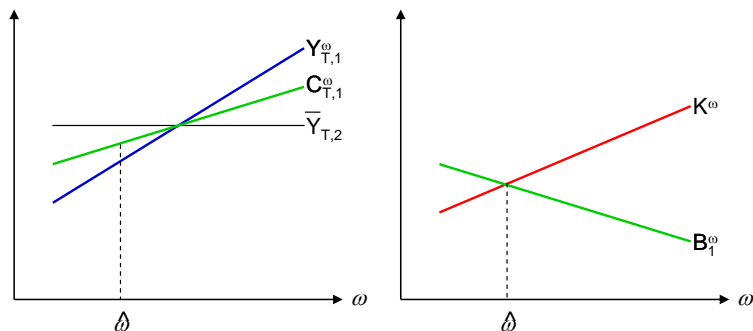
Consumption as a function of the state of productivity ω :



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

Determination of Consumption

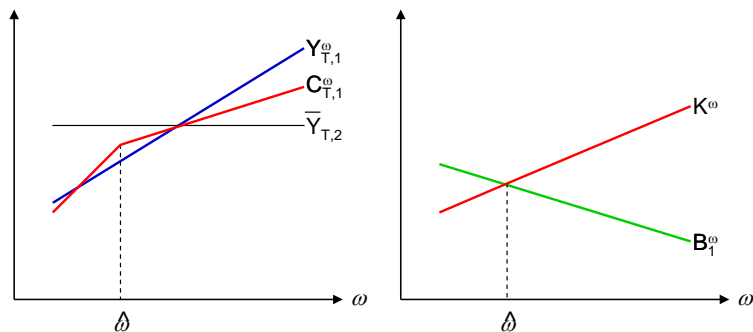
Consumption as a function of the state of productivity ω :



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

Determination of Consumption

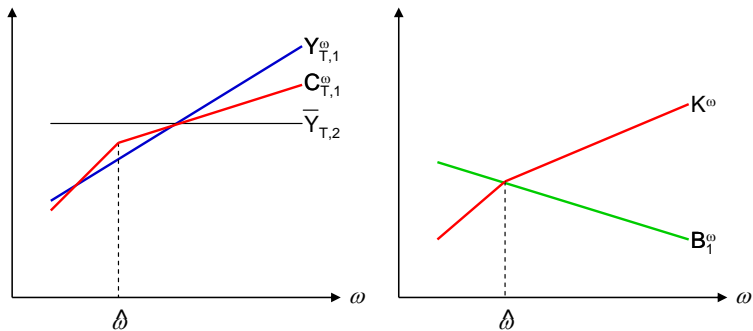
Consumption as a function of the state of productivity ω :



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

Determination of Consumption

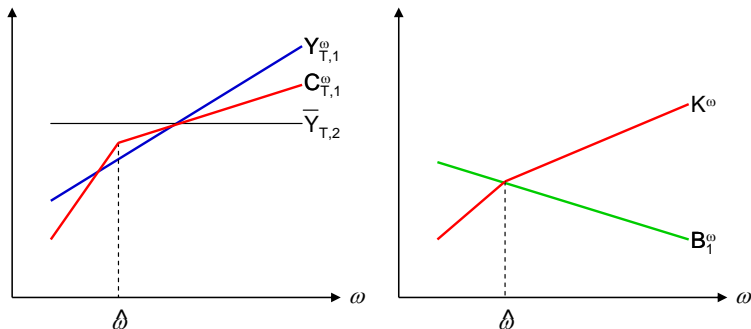
Consumption as a function of the state of productivity ω :



...the resulting depreciation tightens collateral constraints

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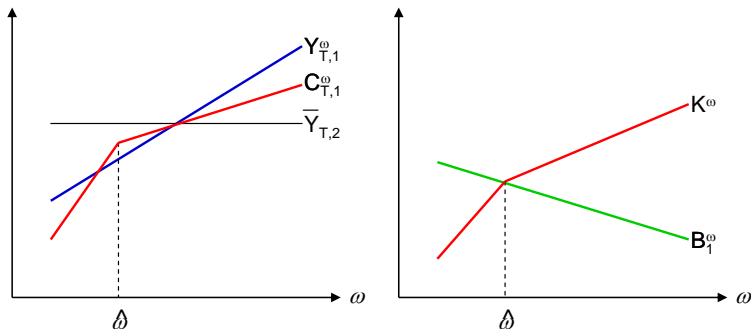


Macroeconomic accelerator: feedback cycle of

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

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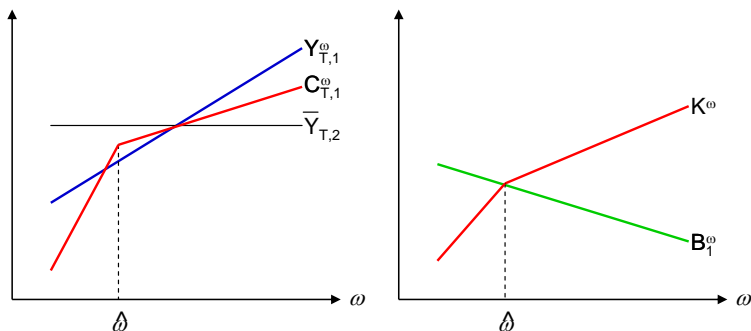


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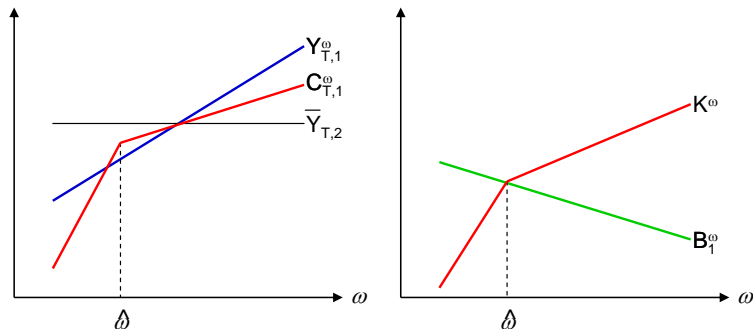


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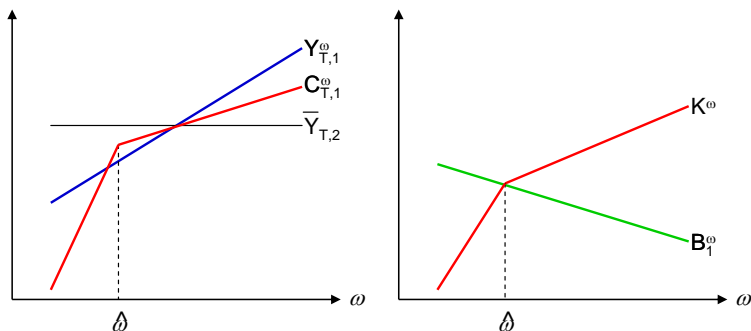


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Consumption as a function of the state of productivity ω :



Macroeconomic accelerator: feedback cycle of

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Decentralized Equilibrium Versus Social Planner

Decentralized agents' optimization problem:

$$\begin{aligned} \mathcal{L}_{C_{T,1}^\omega, B_1^\omega}^{DE} = & u(C_{T,1}^\omega) + \beta u(Y_{T,2}^\omega - B_1^\omega) - \mu^\omega \left[C_{T,1}^\omega + \bar{I} - Y_{T,1}^\omega - W_1 - \frac{B_1^\omega}{R} \right] - \\ & - \lambda^\omega \left[B_1^\omega - \kappa (Y_{T,1}^\omega + p_{N,1}^\omega \bar{Y}_N) \right] \end{aligned}$$

Social planner's optimization: internalizes exchange rate effects

$$\begin{aligned} \mathcal{L}_{C_{T,1}^\omega, B_1^\omega}^{SP} = & u(C_{T,1}^\omega) + \beta u(Y_{T,2}^\omega - B_1^\omega) - \mu^\omega \left[C_{T,1}^\omega + \bar{I} - Y_{T,1}^\omega - W_1 - \frac{B_1^\omega}{R} \right] - \\ & - \lambda^\omega \left[B_1^\omega - \kappa \left(Y_{T,1}^\omega + \frac{1 - \sigma}{\sigma} \cdot C_{T,1}^\omega \right) \right] \end{aligned}$$

Undervaluation of Liquidity in Crises

Decentralized agents' first order conditions:

$$\text{FOC}(C_{T,1}^\omega) : \mu^\omega = u'(C_{T,1}^\omega)$$

$$\text{FOC}(B_1^\omega) : \mu^\omega = \beta R u'(C_{T,2}^\omega) + \lambda^\omega$$

Social planner's optimization: internalizes exchange rate effects

$$\text{FOC}(C_{T,1}^\omega) : \mu^\omega = u'(C_{T,1}^\omega) + \lambda^\omega \kappa \frac{1 - \sigma}{\sigma}$$

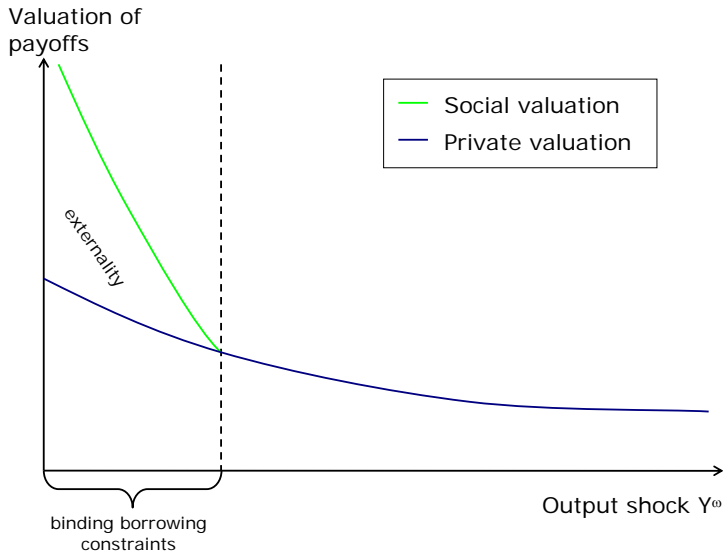
$$\text{FOC}(B_1^\omega) : \mu^\omega = \beta R u'(C_{T,2}^\omega) + \lambda^\omega$$

NOTE: μ^ω represents the shadow price of liquidity

Proposition (Undervaluation of Liquidity in Crises)

During crises (when borrowing constraints are binding), the social planner values liquidity more highly than decentralized agents, since he internalizes the macroeconomic accelerator effect

Private and Social Pricing Kernel



Implications for decentralized financing decisions

In the previous model, private and social valuations of payoffs differ, but there is no inefficiency (yet)

Q: What are the implications of this mis-valuation for ex ante financing decisions?

Assume:

- agents are born with wealth W_0 in period 0
- raise \bar{I} for investment to produce in period 1
- sell a set of Arrow-Debreu assets B_0^ω
- international investors buy these at price M_0^ω
typically M_0^ω negatively correlated with $Y_{T,1}^\omega$

Optimization problem with period 0 financing:

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

First-order condition on B_0^ω : $\mu^\omega = M_0^\omega \cdot \nu = M_0^\omega \cdot RE[\mu^\omega]$

Decentralized agents: $u'(C_{T,1}^\omega) = M_0^\omega \cdot RE[\mu^\omega]$

Social planner: $u'(C_{T,1}^\omega) + \lambda^\omega dK^\omega / dC_{T,1}^\omega = M_0^\omega \cdot RE[\mu^\omega]$

\Rightarrow Social planner would issue assets with lower repayments
(buy more insurance) in crisis states

Implications of Period 0 Financing

Period 0 financing:

Allows domestic agents and social planner to buy insurance

If international capital markets are risk-neutral:

- insurance is cost-less
- both decentralized agent and social planner insure fully
- in full insurance equilibrium, borrowing constraints are loose
- decentralized agent and social planner value liquidity equally

If international capital markets are risk-averse:

- insurance decision is risk-return trade-off
- in some states: insurance too expensive to avoid crisis
- financial accelerator mechanism triggered
- externality
- decentralized agents undervalue liquidity
- they borrow too much (buy insufficient insurance) in such states

Insight so far:

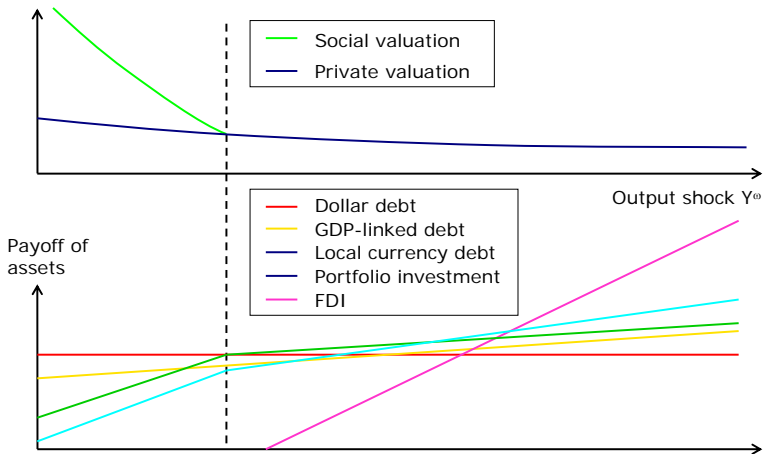
- decentralized agents borrow too much
in Arrow-Debreu assets contingent on crisis states

In real world:

- every asset is a collection of Arrow-Debreu assets
- those with highest repayments in crisis states
carry the largest externality

Implications for International Capital Flows

Valuation of payoffs



Externality stems from macroeconomic accelerator mechanism

First-best policy measures: break financial accelerator

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

What does not work: publicly insuring the private sector

⇒ creates an incentive for private agents to take on even more risk

Idea of second-best policy measures:

- tax risky assets to offset externality θ
- raise demand for safer assets
- reduce incidence and severity of borrowing constraints
- less macroeconomic volatility
- higher welfare

Varieties of policy measures:

- tax on asset payoffs in crisis states:

$$\text{externality kernel } \tau^\omega = \frac{\lambda^\omega \kappa \frac{1-\sigma}{\sigma}}{E[u'(C_{T,1}^\omega) + \lambda^\omega]}$$

optimal tax on security with payoffs X^ω is $E[\tau^\omega X^\omega]$

- equivalent measure: reserve requirements

Conclusions

- 1 Financial accelerator mechanism creates an externality
- 2 This distorts private financing and investment decisions towards excessive risk-taking (under-insurance)
- 3 Decentralized equilibrium exhibits socially excessive volatility
- 4 Policy intervention makes private agents internalize risk
⇒ increases social welfare