Macroprudential Regulation Versus Mopping Up After the Crash

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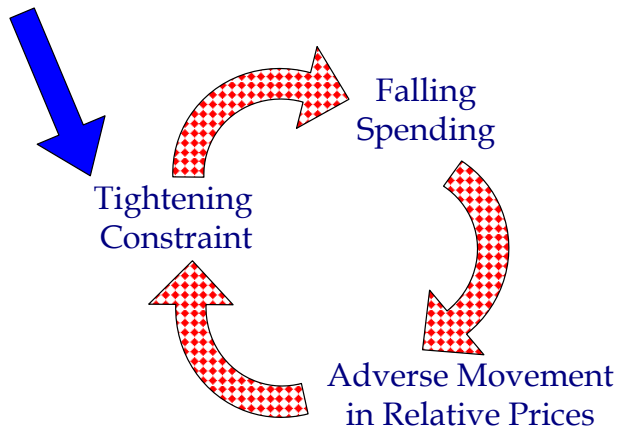**Growing literature on financial amplification in crises:**

Economic shock

Falling
Spending

Tightening
Constraint

Adverse Movement
in Relative Prices

Figure: Financial amplification/financial accelerator/leverage cycle/...

Growing literature on financial amplification in crises:

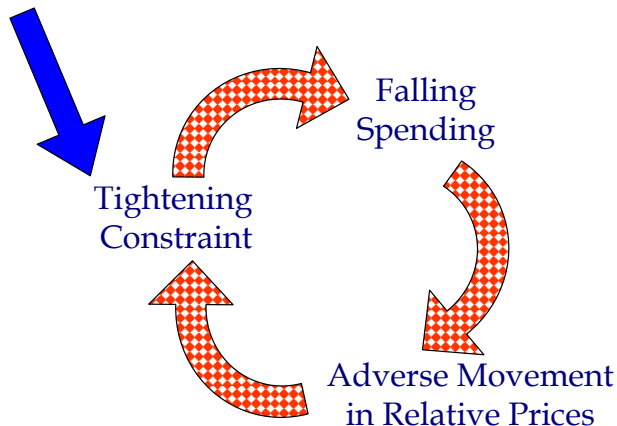Figure: Financial amplification/financial accelerator/leverage cycle/...

Motivation

1) Pecuniary/fire-sale externalities provide new rationale for macroprudential regulation as Pigouvian taxation

(unrelated to traditional argument about safety nets)

2) Financial amplification can also be mitigated ex-post
by relaxing binding constraints

- via formal safety nets
- or discretionary intervention

$\rightarrow$ bailouts/mopping up measures

Key Question

What is the optimal balance between ex-ante/ex-post policies?

Related policy debate: how should policy respond to crisis risk?

- **Ex-post view:** exemplified by "Greenspan doctrine:"
  ex-ante policy too costly and blunt
  (e.g. Greenspan, 2002, Blinder and Reis, 2005)
  $\rightarrow$ focus on "mopping up" after the crash

- **"Ex-ante view:"** macro-prudential policy:
  financial imbalances build up before crises
  (e.g. Borio, 2003)
  $\rightarrow$ focus on "macro-*prudential*" policies

Contribution

Contribution of this paper:

- study the relationship between ex-ante/ex-post intervention to respond to financial amplification
- characterize optimal policy mix

Key Features

Model Setup:

- 3-period macro model with entrepreneurs and workers

- Entrepreneurs use capital as collateral

- Adverse shock in period 1 can lead to amplification

Two Policies:

1. Ex-ante (period 0): macro-prudential tax on borrowing
2. Ex-post (period 1): bailout transfer financed by labor taxation

Key Findings

Key Findings:

- Optimal policy mix involves use of both
  - macroprudential regulation does not obviate need for bailouts
  - bailouts have benefit of being more state-contingent

- Macroprudential regulation has two distinct roles:
  - addresses pecuniary externality and
  - simultaneously solves time inconsistency of bailouts

  (there is in fact no tension between these two objectives)

- Macroprudential regulation reduces need for bailouts

- Bailouts do not necessarily imply that macroprudential regulation should be more aggressive

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Three time periods: $t = 0, 1, 2$

Two (representative) sets of agents:

1. Entrepreneurs: combine capital and labor to produce output
   $U^e = c_0 + c_1 + c_2$

2. Workers: provide capital and labor
   $U^w = c_0 + c_1 + c_2 - \omega \ell_1 - \omega \ell_2$

Debt is the only financial contract

Entrepreneurs

Optimization problem of entrepreneurs:

- Periods 1 and 2: $\pi_t = \max_{\ell_t} (A_t k_t)^\alpha \ell_t^{1-\alpha} - \omega \ell_t = \kappa A_t k_t$

- Intertemporal problem:

$$\max E\left[c_0 + c_1 + c_2\right] \qquad \text{s.t.} \qquad \begin{aligned} c_0 + I(k) &= d_0 \\ c_1 + xk + d_0 &= \kappa A_1 k + d_1 \\ c_2 + d_1 &= \kappa A(x) k \\ d_t &\leq \phi \min p_{t+1} k \end{aligned}$$

- Period 0: invest in capital at convex cost $I(k)$
- Period 1: experience productivity shock A_1
            make complementary investment x per unit of capital
- Period 2: enjoy productivity $A_2 = A(x)$
            $\rightarrow$ this determines asset price p_2

Households

Optimization problem of households:

$$\max E\left[c_0 + c_1 + c_2 - \omega\ell_1 - \omega\ell_2\right] \qquad \text{s.t.} \qquad \begin{aligned} c_0 + b_0 &= y_0 \\ c_1 + b_1 &= \omega\ell_1 + b_0 \\ c_2 &= \omega\ell_2 + b_1 \end{aligned}$$

- provide labor ℓ_t at marginal disutility ω
- provide credit b_t at gross interest rate 1
  $\rightarrow$ household utility is constant

First-Best Solution

First-Best Solution: in absence of financial imperfections:

$$\text{Period 0:} \quad I'(k^{FB}) = E\left[\kappa\left(A_1 + A_2\right) - x^{FB}\right]$$
$$\text{Period 1:} \quad \kappa A'(x^{FB}) = 1$$

Proposition (First-Best Equilibrium)

The first-best equilibrium can be replicated if a planner has the power to do any of the following:

- *engage in lump-sum transfers to circumvent the constraint*
- *subsidize asset prices without introducing tax distortions*

Otherwise: the economy exhibits binding constraints for low A_1

Laissez-Faire

Solution of Laissez-Faire Equilibrium:

$$\max_k E[v(k, I(k))]$$
$$\text{where } v(k, d_0) = \max \left(\kappa A_1 - x \right) k + \kappa A(x) k - d_0 + $$
$$+ \lambda \left\{ (\kappa A_1 - x) k + \phi p_2 k - d_0 \right\}$$

First-order conditions:

$$\kappa A'(x) = 1 + \lambda$$
$$E[v_k] + I'(k) E[v_d] = 0$$

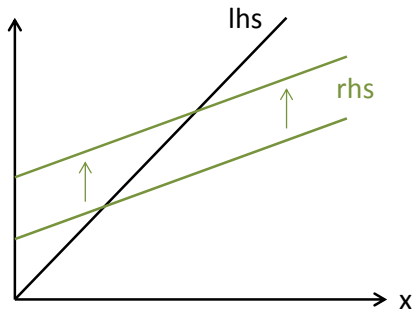Note: $k^{LF} < k^{FB}$ if there are states with binding constraint

Equilibrium and Financial Amplification

In general equilibrium, asset price $p_2 = \kappa A(x)$

$$x \leq \kappa A_1 + \phi \overbrace{\kappa A(x)} - d_0/k$$

Note: assume $\phi \kappa A'(x) < 1$ to guarantee unique solution

Shock dA_1 leads to amplified response $\dfrac{dx}{dA_1} = \dfrac{\kappa}{1 - \phi \kappa A'(x)}$

Introduce a constrained planner:

- subject to the same constraints as private agents
- she internalizes that investment x affects $p_2 = \kappa A(x)$

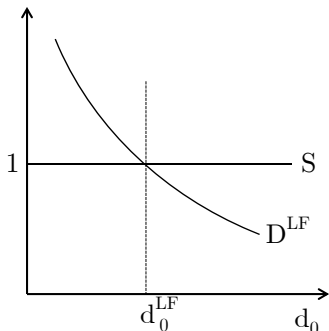$$FOC(x) : \kappa A'(x) = 1 + \lambda[1 - \underbrace{\phi \kappa A'(x)}_{\text{externality}}]$$

compare to DE : $\kappa A'(x) = 1 + \lambda$

$\rightarrow$ constrained planner takes on less debt in period 0

$\rightarrow$ can be implemented via Pigouvian tax $\tau_0 > 0$

  $=$ macroprudential regulation

Macroprudential Regulation as a Second-Best Intervention
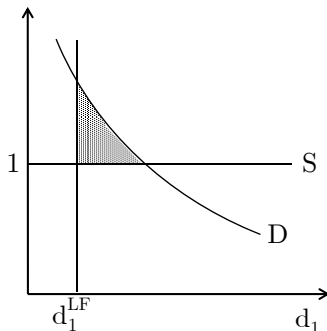

Figure: Macroprudential Regulation as a Second-Best Intervention

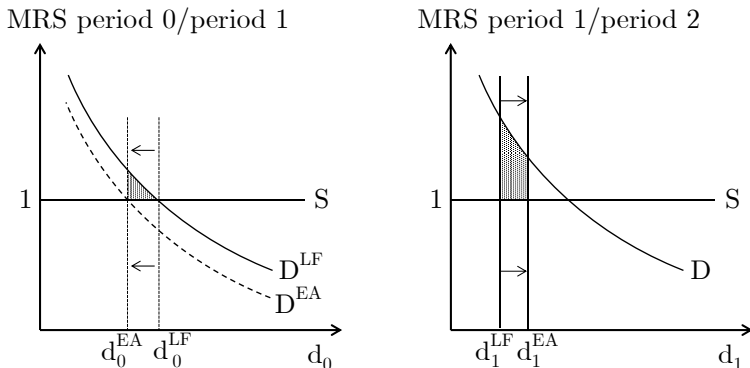# Macroprudential Regulation as a Second-Best Intervention

Figure: Macroprudential Regulation as a Second-Best Intervention

"Mopping Up" After the Crash

Focus on ex-post policy measures:

- critical property of such measures:
    1. relieve binding constraint
    2. at the cost of introducing another distortion in the economy

- generic policy that we explore: tax-financed bailouts:
    - provide a transfer *s* per unit of capital to constrained entrepreneurs
    - finance transfer via labor taxation τ_1, τ_2 in periods 1 and 2 (note: planner lends superior borrowing capacity to entrepreneurs)

- alternative policies with similar properties:
    - investment tax credits
    - tax-financed lump-sum transfers
    - interest rate cuts
    - crisis lending
    - ...

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Within-period problem: $\pi(\tau) = \max_\ell (Ak)^\alpha \ell^{1-\alpha} - (1+\tau)\omega\ell = \kappa(\tau)Ak$

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Proposition (Mopping Up)

If there are binding financial constraints, the planner provides a bailout $s > 0$ to entrepreneurs to relax their financial constraint.

The optimal tax $\tau_1 = 0$. The transfer is financed solely by issuing debt, which is repaid by taxing $\tau_2 > 0$ in period 2.
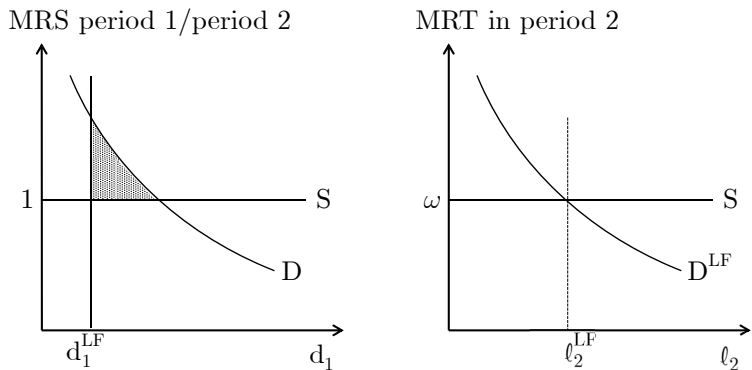
MRS period 1/period 2

MRT in period 2

Figure: Mopping Up as a Second-Best Intervention

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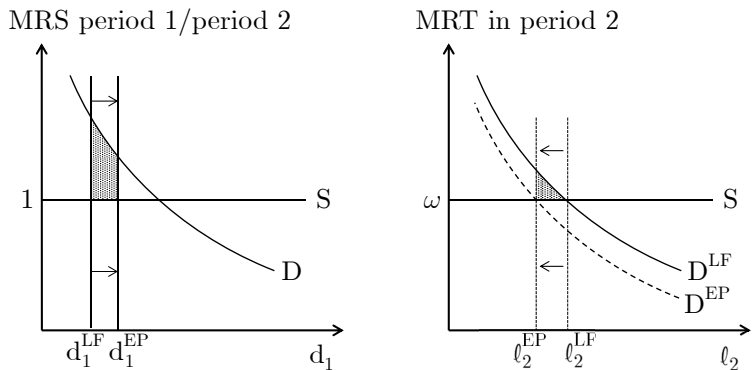

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Figure: Mopping Up as a Second-Best Intervention

Bailouts and Time-Consistency

Under discretion: bailout policy $\tau_2^d(A_1)$

- planner chooses τ_2^d while ignoring ex-ante incentive effects
- bailout *s* increases period 0 incentive to borrow and invest
  $\rightarrow$ bailouts lead to higher borrowing and investment

Under commitment: bailout policy $\tau_2^c(A_1)$

- planner reduces $\tau_2^c < \tau_2^d$ to mitigate incentive effects
  (interpretation: one instrument, two targets)
- capital investment reduced $k^{EP,c} < k^{EP,d}$

Time consistency problem:

- ex-ante, planner wants to commit to being "tough"
  to ensure that private sector holds greater precautionary savings
- ex-post, planner wants to provide bailout to relax financial
  constraint

Macroprudential Regulation Versus Mopping Up

Analyze planner who has access to both policy measures:

Proposition (Optimal Policy Mix)

If there are binding financial constraints, it is optimal for a planner to

- *use macroprudential regulation $\tau_0 > 0$ and*
- *provide a bailout $s > 0$ in period 1 and raise taxes $\tau_2 > 0$.*

Note 1: both policies increasing function of shadow price λ
λ coordinates optimal ex-ante/ex-post measures

Note 2: macroprudential regulation reduces optimal level of bailouts

Proposition (Time Consistency)

Macroprudential regulation solves the time consistency problem of bailouts.

$\rightarrow$ kill two birds with one stone (externality + time inconsistency)

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Key distinction:

- bailouts are perfectly targeted at a state of nature
- macroprudential policy is blunt and untargeted

$\rightarrow$ relative use depends on "likeness" of states of nature

Effects on total debt level:

- macroprudential regulation reduces borrowing
- bailouts increase borrowing

$\rightarrow$ overall effect ambiguous

Bailout Fund

Accumulating a bailout fund:

- assume revenue from Pigovian tax τ_0 is saved in bailout fund
- fund is rebated to entrepreneurs in period 1 to relax constraint

Proposition (Bailout Fund)

Accumulating period 0 *tax revenue in a bailout fund does not achieve any efficiency gains, but introduces greater distortions to incentives for investment.*

$\rightarrow$ killing three birds with one stone does not work

Intuition:

- τ_0 induces entrepreneurs to hold optimal level of savings
- planner has *no comparative advantage* in holding savings
- bailout fund only distorts incentives

Conclusions:

- optimal policy mix uses both instruments to address externality (theory of the second-best: use all welfare triangles you can use)

- bailouts are more state-contingent, macroprudential policy is more blunt

- macroprudential policy has a dual objective: address externality and solve time inconsistency of bailouts

$\rightarrow$ Role for both "leaning against the wind" and "mopping up after the crash"