

The Macroeconomics of Imperfect Capital Markets

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Lecture 8: Macroprudential Regulation Versus Mopping Up After the Crash

Growing literature on financial amplification in crises:

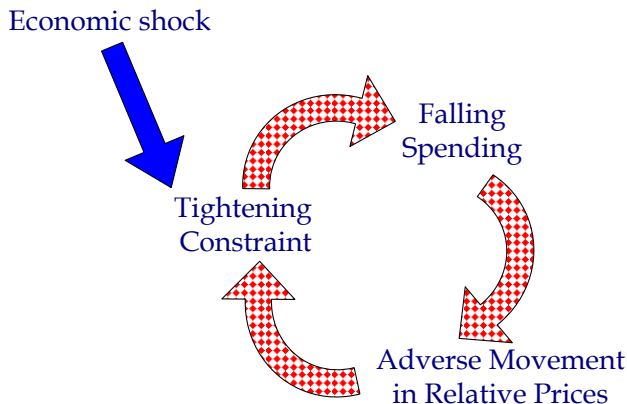


Figure: Financial amplification/financial accelerator/leverage cycle/...

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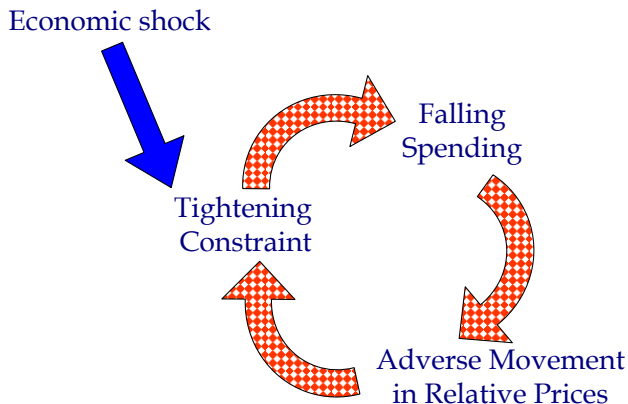


Figure: Financial amplification/financial accelerator/leverage cycle/...

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

→ 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)
→ focus on “mopping up” after the crash
- **“Ex-ante view:”** macro-prudential policy:
financial imbalances build up before crises
(e.g. Borio, 2003)
→ focus on “macro-*prudential*” policies

Existing literature on policy response to financial amplification:

- Ex-ante interventions to curb leverage, investment, risk-taking
see e.g. Caballero and Krishnamurthy, Lorenzoni, Korinek, Jeanne and Korinek, Bianchi and Mendoza, Stein, ...
→ macroprudential regulations
- Ex-post interventions to relax constraints
see e.g. Aghion et al., Benigno et al. ...
→ bailouts
- Literature on ex-ante/ex-post intervention without financial amplification: see e.g. Dewatripont and Tirole, Farhi and Tirole, ...

Contribution of this paper:

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

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:

- Optimal policy mix involves use of both instruments:
 - 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

$$U^w = c_0 + c_1 + c_2 - \omega l_1 - \omega l_2$$

Debt is the only financial contract

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:

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

- 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 $A_2 = A(x)$
→ this determines asset price p_2

Optimization problem of households:

$$\begin{aligned} \max E [c_0 + c_1 + c_2 - \omega l_1 - \omega l_2] \quad \text{s.t.} \quad & c_0 + b_0 = y_0 \\ & c_1 + b_1 = \omega l_1 + b_0 \\ & c_2 = \omega l_2 + b_1 \end{aligned}$$

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

First-Best Solution: in absence of financial imperfections:

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

$$\text{Period 1: } \kappa A'(x^{FB}) = 1$$

Proposition (First-Best Equilibrium)

The first-best equilibrium can be replicated if a planner can:

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

Otherwise: the economy exhibits binding constraints for low A_1

Solution of Laissez-Faire Equilibrium:

$$\max_k E[v(k, I(k))]$$

$$\text{where } v(k, d_0) = \max(\kappa A_1 - x)k + \kappa A(x)k - d_0 + \\ + \lambda \{(\kappa A_1 - x)k + \phi p_2 k - d_0\}$$

First-order conditions:

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

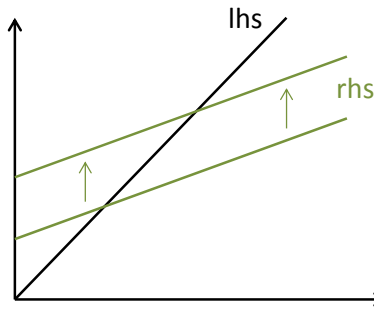
Note: $k^{LF} < k^{FB}$ if there are states with binding constraint

Equilibrium and Financial Amplification

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

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

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



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

Constrained Planner's Problem

Introduce a constrained planner:

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

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

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

→ constrained planner takes on less debt in period 0
= macroprudential regulation

Proposition (Macroprudential Regulation)

If there is a positive probability that the economy experiences binding constraints,

- 1 the planner lowers borrowing and investment below the laissez-faire level, $k^{MP} < k^{LF}$,*
- 2 this policy can be implemented via a Pigouvian tax $\tau_0^{MP} > 0$,*
- 3 the planner mitigates the binding constraints but does not fully alleviate them.*

Macroprudential Regulation as Second-Best Policy

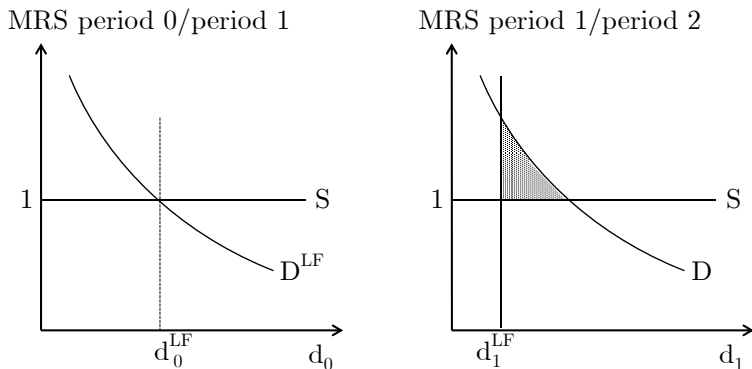


Figure: Macroprudential Regulation as a Second-Best Intervention

Macroprudential Regulation as Second-Best Policy

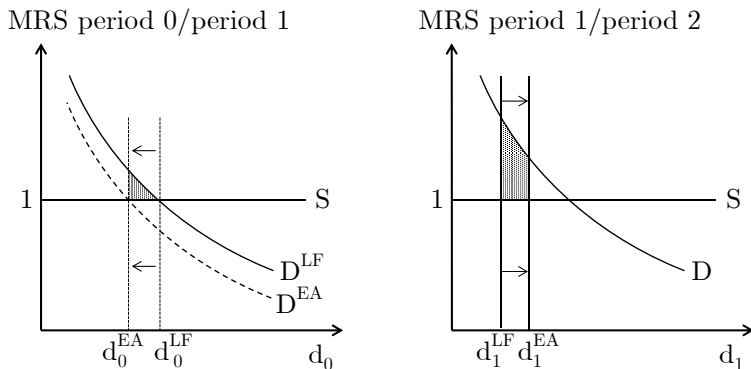


Figure: Macroprudential Regulation as a Second-Best Intervention

Lessons from the general theory of the 2nd best

(Lipsey and Lancaster, 1956)

- First-order benefit weighed against second-order cost
- small intervention is always desirable
- it is not desirable to fully undo a distortion
- employ all policy instruments that target a distortion:
 - macroprudential regulation (reduce borrowing in good times)
 - distortionary asset price support (relax constraint directly)
 - distortionary crisis lending (circumvent constraint)
 - ...

“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
- we focus on generic 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 (for later):
 - investment tax credits
 - tax-financed lump-sum transfers
 - interest rate cuts
 - crisis lending
 - ...

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“Mopping Up” After the Crash

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

Labor compensation per effective unit of capital: $\epsilon(\tau) = \omega\ell/Ak$

→ tax revenue $\tau \cdot \epsilon(\tau)$

→ social return on capital $\eta(\tau) = \kappa(\tau) + \tau\epsilon(\tau)$

→ fiscal revenue available for bailout $s = \tau_1\epsilon(\tau_1) + \tau_2\epsilon(\tau_2)$

Proposition (Mopping Up)

- 1 *If there are binding financial constraints, the planner provides a bailout $s > 0$ to entrepreneurs to relax their financial constraint.*
- 2 *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.*
- 3 *The bailout mitigates the constraint but does not fully alleviate it.*
- 4 *The expectation of bailouts increases period-0 investment above the laissez-faire level, $k^{BL} > k^{LF}$.*

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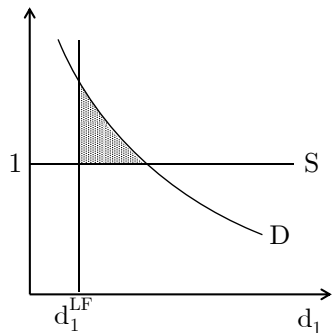
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Mopping Up as a Second-Best Intervention

MRS period 1/period 2



MRT in period 2

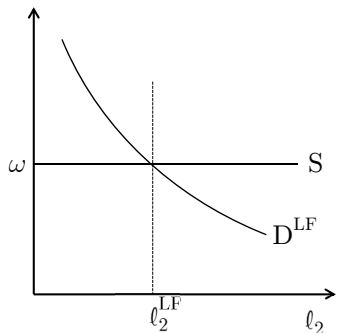


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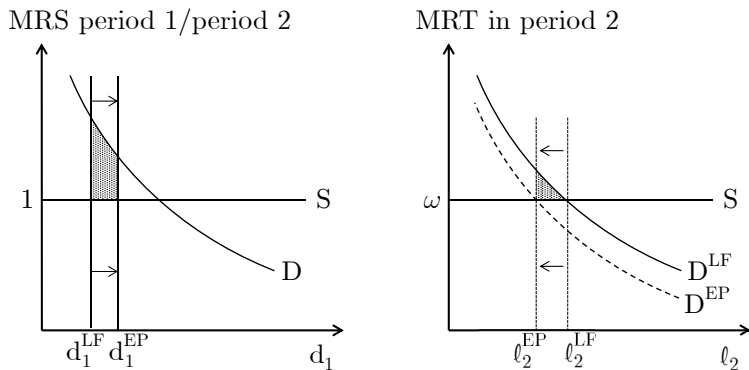


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Bailouts and Time-Consistency

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
→ 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

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 financed by $\tau_2 > 0$.*

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

Relative Merits of Policy Tools

Relative Merits:

- bailouts are perfectly targeted at a state of nature
 - macroprudential policy is blunt and untargeted
- relative use depends on “likeness” of states of nature

Example:

- assume $\text{Prob}(\text{binding constraint}) \rightarrow 0$,
but in those (rare) states, constraint is very tight
- optimal bailout policy remains large
(depends on λ)
- optimal macroprudential policy $\tau_0 \rightarrow 0$
(depends on $E[\lambda]$)

Effects on total level of capital investment and debt:

Optimal policy mix falls in between macroprudential equilibrium and bailout-only equilibrium:

$$k^{MP} < k^{MIX} < k^{BL}$$

Comparison of capital investment to laissez-faire equilibrium:

- macroprudential regulation reduces borrowing
- bailouts increase borrowing

→ overall effect ambiguous

Note: macroprudential restrictions and bailouts are substitutes

Time Consistency of Optimal Policy Mix

Proposition (Time Consistency)

Macprudential regulation solves the time consistency problem of bailouts,

$$s^{MIXc}(\cdot) = s^{MIXd}(\cdot)$$

→ kill two birds with one stone (externality + time inconsistency)

Intuition: Time consistency problems can be interpreted as arising from a lack of policy instruments

→ macroprudential regulation restores full set of instruments

Assume bailouts and macroprudential policies done by two agencies:

Proposition (Allocation of Policy Objectives)

The optimal policy mix can be implemented by giving the mandate of maximizing ex-post welfare to the bailout agency and the mandate of removing the time-inconsistency in bailouts to the macroprudential agency.

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.

→ 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

→ Role for both “leaning against the wind” and “mopping up after the crash”