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:

- Economic shock
- Tightening Constraint
- Adverse Movement in Relative Prices
- Falling Spending

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
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

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

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:

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

- Period 0: invest in capital at convex cost \( l(k) \)
- 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 \( p_2 \)

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Optimization problem of households:

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

- provide labor $l_t$ at marginal disutility $\omega$
- 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:

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

Period 1:
\[ \kappa A'(x^{FB}) = 1 \]

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 \( A_1 \)
Solution of Laissez-Faire Equilibrium:

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

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 \( p_2 = \kappa A(x) \)

\[
x \leq \kappa A_1 + \phi \kappa A(x) - d_0 / k
\]

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

Shock \( dA_1 \) leads to amplified response

\[
\frac{dx}{dA_1} = \frac{\kappa}{1 - \phi \kappa A'(x)}
\]

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Constrained Planner’s Problem

Introduce a constrained planner:

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

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

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

→ constrained planner takes on less debt in period 0

→ 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
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Figure: Macroprudential Regulation as a Second-Best Intervention
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 $\tau_1$, $\tau_2$ 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
  - ...
“Mopping Up” After the Crash

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

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

**Proposition (Mopping Up)**

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Mopping Up as a Second-Best Intervention

MRS period 1/period 2

MRT in period 2

Figure: Mopping Up as a Second-Best Intervention

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Mopping Up as a Second-Best Intervention

Figure: Mopping Up as a Second-Best Intervention
Bailouts and Time-Consistency

Under discretion: bailout policy $\tau^d_2(A_1)$

- planner chooses $\tau^d_2$ 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 $\tau^c_2(A_1)$

- planner reduces $\tau^c_2 < \tau^d_2$ 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
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 $\lambda$
$\lambda$ 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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→ kill two birds with one stone (externality + time inconsistency)
Interactions

Key distinction:

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

→ relative use depends on “likeness” of states of nature

Effects on total debt level:

- macroprudential regulation reduces borrowing
- bailouts increase borrowing

→ overall effect ambiguous
Accumulating a bailout fund:
- assume revenue from Pigovian tax $\tau_0$ 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:
- $\tau_0$ 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”