# Bailouts and Financial Fragility

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# Bailouts

Bailouts have two effects:

- Moral hazard problem: Banks choose to be more illiquid.
- Stabilize the economy: Decrease the probability of bank runs.

$\Longrightarrow$Bailouts can increase or decrease *ex ante* welfare.

# The Model

- 3 periods $t = 0, 1, 2$
- 2 goods: 1 private good 1 public good
- Continuum of depositors $i \in [0, 1]$ with preferences

$$u\left(c_1, c_2, d; \theta_i\right) = \frac{\left(c_1 + \theta_i c_2\right)^{1-\gamma}}{1-\gamma} + \delta \frac{d^{1-\gamma}}{1-\gamma}$$

  - i.i.d. $\theta_i \in \Theta = \{0, 1\}$ and $\Pr\left(\theta_i = 0\right) = \pi$ for all $i$,
  - $\gamma > 1$, $\delta > 0$
- Competitive banks
- Benevolent government

# Endowment and Technology

- Consumers are endowed with 1 unit of the private good in period 0.
- Banking technology: transforms period 0 private good to period $t$ private good

| $t=0$ | $t=1$ | | $t=1$ |
|---|---|---|---|
| $-1$ | $1$ | or | $R>0$ |

# Government

- In period 1 it can transform 1 unit of the private good into 1 into of public good.
- Government taxes endowments in period 0 and provides public good or bailouts in period 1.

$$d = \tau - (1 - \pi)\, b$$

# Withdrawal Strategy

- "Sunspot" random variable $s \in \{s_1, s_2\}$ realized in period 1. $\Pr(s = s_2) = q$
- $s$ only observed by consumers.
- $\theta_i$ is realized in period 1 in order and remains private information.
- Withdrawal decisions are sequential after $\theta_i$ is observed.
- We can define a withdrawal strategy for depositor $i$ as

$$y_i(\theta_i, S) = \begin{cases} 0 & \text{if withdraws in period 1} \\ 1 & \text{if withdraws in period 2} \end{cases}$$

# Banking Policy

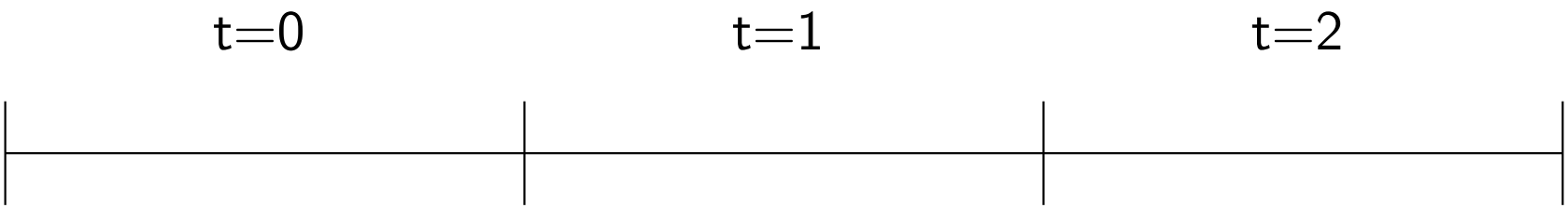
A **banking policy** is a function $x : [0,1] \to \mathbb{R}_+$ where $x(\mu)$ is the amount received by an agent who withdraws in the $\mu th$ position in period 1.

- Feasibility implies

$$\int_0^1 x(\mu)\, d\mu \leq 1 - d$$

- Sequential service in period 1
- Equal treatment in period 2

# Timing




- Taxes and deposits
- Banking policy

- $S$ is realized
- Depositors discover $\theta_i$ and decide to withdraw or not in order
- Bailout/Renegotiation

Late withdrawals,

# Constrained efficient allocation

Planner doesn't realize $s = s_2$ until $\pi$ agent withdraw.

$$\max_{\{c_1, c_2, d, c_{1P}, c_{2P}, d_P\}} (1-q)\left[\pi \frac{c_1^{1-\gamma}}{1-\gamma} + (1-\pi)\frac{c_2^{1-\gamma}}{1-\gamma} + \delta \frac{d^{1-\gamma}}{1-\gamma}\right]$$
$$+q\left[\pi \frac{c_1^{1-\gamma}}{1-\gamma} + (1-\pi)\left[\pi \frac{c_{1P}^{1-\gamma}}{1-\gamma} + (1-\pi)\frac{c_{2P}^{1-\gamma}}{1-\gamma}\right] + \delta \frac{d_P^{1-\gamma}}{1-\gamma}\right]$$

s.t.

$$\begin{aligned} \pi c_1 + d + (1-\pi)\frac{c_2}{R} &= 1 \\ (1-\pi)\left(\pi c_{1P} + (1-\pi)\frac{c_{2P}}{R}\right) + d_P &\leq 1 - \pi c_1 \end{aligned}$$

$\Longrightarrow c_1^*, c_2^*, c_{1P}^*, c_{2P}^*, d^* > 0, d_P^* < d^*$

- The constrained efficient allocation involves bailouts.

# Illiquidity

The degree of illiquidity of a bank is given by the ration of short term liabilities to short term assets.

$$\rho = \frac{c_1}{1-d}$$

If $\rho > 1$, the bank is illiquid.

- $\rho^* > 1$.

# Equilibrium withdrawing strategy

- Concentrate on the case in which only impatient investors withdraw early in state $s_1$, but all investors attempt to withdraw early in state $s_2$, i.e.,

$$y_i(\theta_i, s) = \begin{cases} 0 \text{ if } s = s_2 \\ \theta_i \text{ if } s = s_1 \end{cases}$$

- $Pr(s = s_2) = q$ is the propensity to run of late consumers.

# Fragility

## Definition

The financial sector is fragile if, for some value of $q > 0$, an individual investor has a strict incentive to run on her intermediary when all other investors are doing so in $s_2$.

# Bailouts

- Indiscriminate nature of bailouts.
- Let $\phi$ be the remaining resources in the banking system in per capita terms

$$\phi = \frac{1 - \tau - \pi c_1 d\mu}{1 - \pi}$$

- Resources are distributed such that all banks have the same per capita resources to give out, irrespectively of their remaining resources, i.e. ,

$$\phi_i + b_i = \phi_j + b_j \text{ for all } i, j$$

# Optimal Continuation Allocation

Value derived from private consumption:

$$V_0(\phi + b) = \max_{\{c_1, c_2\}} \pi \frac{c_1^{1-\gamma}}{1-\gamma} + (1-\pi) \frac{c_2^{1-\gamma}}{1-\gamma}$$

s.t.

$$(1-\pi) c_2 = R(\phi + b - \pi c_1) \text{ and } c_i \geq 0$$

# Optimal ex-post bailout

$$V_1 = \max_{0 \leq b \leq \frac{\tau}{1-\pi}} (1-\pi)\, V_0\left(\phi + b\right) + \delta \frac{d^{1-\gamma}}{1-\gamma}$$

# Competitive equilibrium with bailouts

$$\max_{\{c_1,c_2\}} (1-q)\left(\pi\frac{c_1^{1-\gamma}}{1-\gamma}+(1-\pi)\frac{c_2^{1-\gamma}}{1-\gamma}+\delta\frac{\tau^{1-\gamma}}{1-\gamma}\right) + q\left(\pi\frac{c_1^{1-\gamma}}{1-\gamma}+V_1\right)$$

$$\begin{aligned} \pi c_1+\tau+(1-\pi)\frac{c_2}{R} &= 1 \\ c_2 &\geq c_1 \end{aligned}$$

$\Longrightarrow c_1^B,\ c_2^B,\ r_1^B$

# Illiquidity

For any $q > 0$

$$\rho^B > \rho^*$$

In the equilibrium with bailouts, banks are more illiquid than in than in the first best. $\Longrightarrow$ Moral hazard problem

# Fragility

- The set of parameters such that the banking system is fragile under the efficient bailout policy is given by $\Gamma^B(\delta)$.
- This set is decreasing in $\delta$.

$$\Gamma^B(\delta') \subset \Gamma^B(\delta) \quad \delta' > \delta$$

# Competitive equilibrium with no-bailout policy

$$\max_{\{c_1,c_2\}} (1-q)\left(\pi\frac{c_1^{1-\gamma}}{1-\gamma}+(1-\pi)\frac{c_2^{1-\gamma}}{1-\gamma}\right) + q\left(\pi\frac{c_1^{1-\gamma}}{1-\gamma}+V_0\left(\frac{1-\tau-\pi c_1}{1-\pi}\right)\right)+\delta\frac{\tau^{1-\gamma}}{1-\gamma}$$

$$\begin{aligned}\pi c_1+\tau+(1-\pi)\frac{c_2}{R} &= 1\\ c_2 &\geq c_1\end{aligned}$$

$\Longrightarrow {c_1}^{NB}, c_2^{NB},$

$$\rho^{NB} < \rho^* < \rho^B$$

# Fragility

- The set of parameters such that the banking system is fragile under the no-bailout policy is given by $\Gamma^{NB} = \Gamma^{B}(0)$

$\Longrightarrow$-

$$\Gamma^{NB} \supset \Gamma^{B}(\delta)$$

$\Longrightarrow$ Stabilization effect of bailouts

# Tax on illiquidity

Tax banks according to their contibution to aggregate illiquidity.

$$fee_j = \eta \pi \rho_j \sigma_j (1 - \tau)$$

where $\sigma_j$ is the fraction of depositors who invest their after-tax endowment in bank $j$.

$$\max_{\{c_1, c_2\}} \pi \frac{c_1^{1-\gamma}}{1-\gamma} + (1-q) \left( (1-\pi) \frac{c_2^{1-\gamma}}{1-\gamma} + \delta \frac{\tau^{1-\gamma}}{1-\gamma} \right) + qV_1$$

s.t.

$$\pi c_1 + (1-\pi) \frac{c_2}{R} = 1 - \tau - fee_j + N(1-\tau)$$

By choosing $\eta$ appropriately, constrained efficiency is achieved.

# Tax on illiquidity

- Government can continue to follow the ex post efficient bailout policy
- Offsets moral hazard problem