Bailouts and Financial Fragility
by Todd Keister - WP 2010

Cecilia Parlatore Siritto

March 2010
Bailouts

Bailouts have two effects:

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

→ 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

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

- i.i.d. $\theta_i \in \Theta = \{0, 1\}$ and $\Pr(\theta_i = 0) = \pi$ 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

$$t = 0 \quad t = 1 \quad t = 1$$

$$-1 \quad 1 \quad \text{or} \quad R > 0$$
Government

- In period 1 it can transform 1 unit of the private good into 1 unit 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

$$y_i(\theta_i, S) = \begin{cases} 
0 & \text{if withdraws in period 1} \\
1 & \text{if withdraws in period 2}
\end{cases}$$
A **banking policy** is a function $x : [0, 1] \rightarrow \mathbb{R}_+$ 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
- Bailout/Renegotiation

- $S$ is realized
- Depositors discover $	heta_i$ and decide to withdraw or not in order
- Late withdrawals,
Constrained efficient allocation

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

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

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

s.t.

$$\pi c_1 + d + (1 - \pi) \frac{c_2}{R} = 1$$

$$(1 - \pi) \left( \pi c_{1P} + (1 - \pi) \frac{c_{2P}}{R} \right) + d_P \leq 1 - \pi c_1$$

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

- 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.
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.

\[ (1 - \pi) c_2 = R (\phi + b - \pi c_1) \quad \text{and} \quad c_i \geq 0 \]
Optimal ex-post bailout

\[ V_1 = \max_{0 \leq b \leq \frac{\tau}{1-\pi}} (1 - \pi) V_0 (\phi + b) + \delta \frac{d^{1-\gamma}}{1 - \gamma} \]
Competitive equilibrium with bailouts

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

$$+ q \left( \pi \frac{c_1^{1-\gamma}}{1-\gamma} + V_1 \right)$$

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

$$\implies c_1^B, c_2^B, r_1^B$$
Illiquidity

For any $q > 0$

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

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

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

\[
\pi c_1 + \tau + (1 - \pi) \frac{c_2}{R} = 1 \\
c_2 \geq c_1
\]

\[\implies c_1^{NB}, \ c_2^{NB},\]

\[\rho^{NB} < \rho^* < \rho^B\]
Fragility

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

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

$\implies$ Stabilization effect of bailouts
Tax on illiquidity

Tax banks according to their contribution to aggregate illiquidity.

\[ \text{fee}_j = \eta \pi \rho_j \sigma_j (1 - \tau) \]

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

\[
\max_{\{c_1, c_2\}} \pi \frac{c_1^{1-\gamma}}{1-\gamma} + (1-q) \left( (1-\pi) \frac{c_2^{1-\gamma}}{1-\gamma} + \delta \frac{\tau^{1-\gamma}}{1-\gamma} \right) + q \pi \\
\text{s.t.} \quad \pi c_1 + (1-\pi) \frac{c_2}{R} = 1 - \tau - \text{fee}_j + N(1-\tau)
\]

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