Government Guarantees and Financial Stability

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Government guarantees to financial institutions are common all over the world and take different forms

- Deposit insurance or implicit guarantees for a bailout

The recent crisis has renewed the debate on their desirability:

- They help preventing the occurrence and the consequences of panics (Diamond and Dybvig (1983))
- But, they introduce moral hazard, encouraging banks to take excessive risks
- Overall effect is unclear
What we do in the paper

- We present a model to analyze the trade-off involved in the choice of the level of government guarantees.

- What is needed:
  - Endogenize the probability of a run on banks to see how it is affected by banks’ risk choices and government guarantees.
  - Endogenize banks’ risk choices to see how they are affected by government guarantees, taking into account investors’ expected run behavior.

- We put all these ingredients together and derive some surprising results on different guarantee schemes.
  - Existing models – e.g., Boot and Greenbaum (1993), Cooper and Ross (2002), and Keister (2014) – don’t have all these ingredients.
Banks provide risk sharing against early liquidity needs to depositors, thus improving investors’ welfare.

But, the deposit contracts expose banks to the risk of a run as depositors may panic out of self-fulfilling beliefs.

Deposit insurance eliminates runs and restores full efficiency.

- It solves depositors’ coordination failure without entailing any disbursement for the government.

However, reality is much more complex.

- Even with deposit insurance, runs might still occur due to a deterioration in the banks’ fundamentals.
- Given this, should the government protect depositors only against illiquidity due to coordination failures or also against bank insolvency?
Our framework

- We build on Goldstein and Pauzner (2005), where
  - depositors’ withdrawal decisions are uniquely determined using the global-game methodology
  - the run probability depends on the banking contract (i.e., amount promised to early withdrawers), and the bank decides on it taking into account its effect on the probability of a run
- We add a government to this model to study how the government’s guarantees policy interacts with the banking contract and the probability of a run
Decentralized economy

- Two period model, where banks raise deposits from risk-averse consumers and invest in risky projects.
- At the interim date, each depositor receives an imperfect signal regarding the fundamentals and decides when to withdraw.
- Runs occur when the fundamentals are below a unique threshold and can be:
  - *panic-based runs* (out of self-fulfilling beliefs), or
  - *fundamental-based runs* (when fundamentals are low enough).
- Two inefficiencies: inefficient fundamental runs and too little risk sharing to depositors.
Main scope is to reduce the probability of runs by guaranteeing depositors a minimum repayment

We consider two different guarantee schemes:

1. *Against panics only*: Depositors are guaranteed if the bank’s project is successful *irrespective* of what the other depositors do (as in DD)

2. *Against runs and bank failures*: Depositors are guaranteed *irrespective* of what the others do and *irrespective* of the bank’s available resources so that they are protected against both illiquidity and insolvency
Guarantees against panics only

- As in DD, this scheme prevents panic runs (but **not** fundamental runs) without entailing any disbursement.
- *Unlike* DD, in response banks offer a greater rate to early withdrawing depositors.
- This improves risk sharing **but** it also increases the probability of fundamental-based runs and possibly overall instability (consistent with evidence in Demirguc-Kunt and Detragiache, 1998).
- First effect dominates so that welfare is higher than in the decentralized solution, but **no** full efficiency.
Guarantees against runs and bank failures

- Probability of both types of runs is reduced but runs still occur, leading to actual disbursements for the government.

- Given this, there is now an inefficiency:
  - Banks internalize the effect of their choices on the probability of a run but not on the cost to provide the guarantee.
  - There is a wedge between the deposit rate set by banks and the one the government would like to set.

- Interestingly, banks set too high deposit rates and thus take too much risk (typical moral hazard) or too low.
  - It depends on whether the government pays more to depositors at the final date when the bank fails or when there is a run and the bank is illiquid.

- Despite this, this scheme may lead to higher welfare than previous one as it reduces runs much more.
Three date \((t = 0, 1, 2)\) economy with a continuum \([0, 1]\) of banks and consumers.

Banks raise one unit of funds from depositors in exchange for a demandable deposit contract and invest in a risky project.

The project returns 1 if liquidated at date 1 and \(\tilde{R}\) at date 2 with

\[
\tilde{R} = \begin{cases} 
R > 1 & \text{w. p. } p(\theta) \\
0 & \text{w. p. } (1 - p(\theta)) 
\end{cases}
\]

with \(\theta \sim U[0, 1]\), \(p'(\theta) > 0\) and \(E_\theta[p(\theta)]R > 1\). For simplicity, \(p(\theta) = \theta\).
The basic model II

- Consumers are risk-averse ($RRA > 1$ for any $c \geq 1$) and endowed with 1 unit each at date 0.
- At date 0 they deposit at the bank in exchange for a deposit contract $(c_1, \tilde{c}_2)$.
- Consumers are ex ante identical but each has probability $\lambda$ of suffering a liquidity shock and having to consume at date 1 (uncertainty is resolved at the beginning of date 1).
- Consumers derive utility both from consuming at date 1 or 2 and from enjoying a public good $g$:

$$U(c, g) = u(c) + v(g)$$

with $u'(c) > 0$, $v'(g) > 0$, $u''(c) < 0$, $v''(g) < 0$, $u(0) = v(0) = 0$.

- Banking sector is competitive.
Depositors’ information

- At the beginning of date 1, each depositor receives a private signal $x_i$ regarding the fundamental of the economy $\theta$ of the form

$$x_i = \theta + \epsilon_i,$$

with $\epsilon_i \sim U[-\epsilon, +\epsilon]$ being i.i.d. across agents. Most of the time, $\epsilon$ is very close to 0.

- Based on the signal, depositors update their beliefs about the fundamental $\theta$ and the actions of the other depositors.
  - Early depositors always withdraw at date 1.
  - Late depositors withdraw at date 1 if they receive a low enough signal.

- The bank satisfies early withdrawal demands by liquidating its investments. If proceeds are not enough, depositors receive a pro-rata share.
### The decentralized solution: Depositors’ withdrawals

<table>
<thead>
<tr>
<th>Lower dominance</th>
<th>Intermediate</th>
<th>Upper dominance</th>
</tr>
</thead>
<tbody>
<tr>
<td>late</td>
<td>late</td>
<td>no late</td>
</tr>
<tr>
<td>depositors</td>
<td>depositors</td>
<td>depositor</td>
</tr>
<tr>
<td>withdraw</td>
<td>withdraw</td>
<td>withdraws</td>
</tr>
<tr>
<td>as low $\theta$</td>
<td>because of $\theta$ and $n$</td>
<td>— no runs</td>
</tr>
<tr>
<td>— fundamental runs</td>
<td>— panics</td>
<td></td>
</tr>
</tbody>
</table>

where $\theta(c_1)$ is the solution to

$$u(c_1) = p(\theta) u\left(\frac{1 - \lambda c_1}{1 - \lambda} R\right)$$

and $\theta^*(c_1)$ to

$$\int_{n=\lambda}^{1/c_1} p(\theta^*) u\left(\frac{1 - nc_1}{1 - n} R\right) = \int_{n=\lambda}^{1/c_1} u(c_1) + \int_{n=\frac{1}{c_1}}^{1} u\left(\frac{1}{n}\right)$$

- Both thresholds $\theta(c_1)$ and $\theta^*(c_1)$ increase with $c_1$, which measures bank risk taking.
The decentralized solution: The bank’s choice

- Given depositors’ withdrawal decisions, at date 0 each bank chooses $c_1$ to maximize:

$$
\int_{0}^{\theta^*(c_1)} u(1) \, d\theta + \int_{\theta^*(c_1)}^{1} \left[ \lambda u(c_1) + (1 - \lambda) \theta u \left( \frac{1 - \lambda c_1}{1 - \lambda} R \right) \right] \, d\theta 
+ v(g)
$$

- The optimal $c_1^D > 1$ trades off better risk sharing with higher probability of runs $\left( \frac{\partial \theta^*(c_1)}{c_1} > 0 \right)$

- Two inefficiencies:
  - Banks offer less risk sharing in anticipation of the run
  - Runs lead to inefficient liquidation of bank investment for $\theta \in (\theta(1), \theta^*(c_1))$
Government guarantees against panics only

- Depositors are guaranteed to receive $\overline{c} = \frac{1-\lambda c_1}{1-\lambda} R$ when the bank’s project is successful at date 2, **irrespective** of how many depositors have withdrawn at date 1.

- Panic runs are eliminated but fundamental runs remain for $\theta \in [0, \underline{\theta}(c_1)]$.

- Bank chooses $c_1$ to maximize

$$\int_0^{\underline{\theta}(c_1)} u(1) d\theta + \int_{\underline{\theta}(c_1)}^1 \left[ \lambda u(c_1) + (1 - \lambda) \theta u \left( \frac{1 - \lambda c_1}{1 - \lambda} R \right) \right] d\theta$$

$$+ \int_0^1 v(g) d\theta$$

- **Result:** $c_{1}^{DD} > c_{1}^{D}$. Thus, $\theta(c_{1}^{DD}) > \theta(c_{1}^{D})$ and possibly $\underline{\theta}(c_{1}^{DD}) > \theta^*(c_{1}^{D})$.

- **Note:** No distortion in the choice of $c_{1}^{DD}$ as the guarantee entails no disbursement for the government.
Depositors are guaranteed to receive \( \bar{c} > 1 \) whenever their bank is unable to repay them the promised repayments.

Runs occur now for \( \theta < \theta^* (c_1, \bar{c}) \), with \( \frac{\partial \theta^*(c_1, \bar{c})}{\partial c_1} > 0 \) and \( \frac{\partial \theta^*(c_1, \bar{c})}{\partial \bar{c}} < 0 \).

Bank chooses \( c_1 \) to maximize

\[
\int_0^{\theta^*} u(\bar{c}) d\theta + \int_{\theta^*}^1 \left[ \lambda u(c_1) + (1 - \lambda) (\theta u \left( \frac{1 - \lambda c_1}{1 - \lambda} R \right) + (1 - \theta) u(\bar{c})) \right] d\theta + E [v(g, c_1^*, \bar{c})]
\]

where \( \theta^* = \theta^* (c_1, \bar{c}) \), and

\[
E[.] = \int_0^{\theta^*} v(g - \bar{c} + 1) d\theta + \int_{\theta^*}^1 \left[ \theta v(g) + (1 - \theta) v(g - (1 - \lambda) \bar{c}) \right] d\theta
\]

- **Result:** \( c_1^{IN} > c_1^D \) with \( \frac{dc_1^{IN}}{d \bar{c}} > 0 \).
Both types of runs occur still and deposit insurance entails now a disbursement, thus introducing an inefficiency

- The bank takes $E \left[ \nu \left( g, c_1^*, \bar{c} \right) \right]$ as given when choosing $c_1$, differently from what a planner would do

**Result:** $c_1^{IN} < c_1^{SP}$ if

$$[\theta^*(c_1, \bar{c})\nu(g) + (1 - \theta^*(c_1, \bar{c}))\nu(g - (1 - \lambda)\bar{c}) - \nu(g - \bar{c} + 1)] < 0$$

and $c_1^{IN} > c_1^{SP}$ otherwise

- There is **not** always moral hazard! It depends on whether it is more costly to guarantee **all** depositors in the case of runs or (only) the **late** ones against bank failure
Comparing government guarantees: An example

Consider

\[ u(c) + v(g) = \frac{(c + f)^{1-\sigma}}{1-\sigma} - \frac{(f)^{1-\sigma}}{1-\sigma} + \frac{(g + f)^{1-\sigma}}{1-\sigma} - \frac{(f)^{1-\sigma}}{1-\sigma}, \]

\( \sigma = 3; \ R = 5; \ \lambda = 0.3, \ f = 4 \) and \( g = 1.5 \)
## A numerical Example

### Table 2: $g = 1.5$

<table>
<thead>
<tr>
<th></th>
<th>$\frac{\theta}{\theta^*}$</th>
<th>$c_1$</th>
<th>$c_2$</th>
<th>$\bar{c}$</th>
<th>$E \left[ u(c_1, c_2, \bar{c}) \right]$</th>
<th>$E[\nu(g, \bar{c})]$</th>
<th>$SW(c_1, c_2, g, \bar{c})$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decentralized Economy</strong></td>
<td>0.451436</td>
<td>1.0076</td>
<td>4.98372</td>
<td>0</td>
<td>0.0139202</td>
<td>0.0147211</td>
<td>0.0286413</td>
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<tr>
<td></td>
<td>0.463162</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Guarantees against panic runs</strong></td>
<td>0.488273</td>
<td>1.1076</td>
<td>4.7694</td>
<td>$\frac{1-\lambda c_1}{1-\lambda}$ R</td>
<td>0.013945</td>
<td>0.147211</td>
<td>0.028666</td>
</tr>
<tr>
<td></td>
<td>$\frac{\theta}{\theta^*}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Guarantees against runs and bank failure</strong></td>
<td>0.0576263</td>
<td>1.15397</td>
<td>4.67006</td>
<td>1.055</td>
<td>0.0163807</td>
<td>0.023515</td>
<td>0.0287322</td>
</tr>
<tr>
<td></td>
<td>0.0790303</td>
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<tr>
<td><strong>Social Planner</strong></td>
<td>0.170141</td>
<td>1.411144</td>
<td>4.11878</td>
<td>1.12702</td>
<td>0.016183</td>
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<td>0.0293</td>
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<tr>
<td></td>
<td>0.331056</td>
<td></td>
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</tbody>
</table>
Comparing government guarantees: An example

1. Both guarantees improve upon the decentralized solution.
2. Guarantee against panics only: It removes panics but leads to more crises because $c_1^{DD} > c_1^D$.
3. Guarantee against panics and bank failure: Both runs still occur but crises are much less likely despite the higher $c_1$ ($c_1^{IN} > c_1^{DD} > c_1^D$).
4. Broader guarantee scheme achieves higher level social welfare.
Conclusions

- Government guarantees present a complicated trade-off and understanding it requires endogenizing banks’ choices and depositors’ behavior in response to government intervention.

- A scheme resembling the one in DD removes panics and does not entail any disbursement for the government, but it may increase bank instability.

- A scheme protecting against runs and bank failures is more effective in reducing the likelihood of runs and may be welfare superior.
  
  - Although it is inefficient in terms of the deposit contract and the amount of guarantee chosen by the government.

- Possible extensions: no commitment, feedback loop of government budget for financial stability, etc.