Persuading Multiple Audiences:
An Information Design Approach to Banking Regulation

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Motivation

- **Stress Tests and Asset Quality Reviews**
  - Prominent after 2007-2008 financial crisis
  - Examination Process + Disclosure + Recapitalization

- **Benefits**: Discipline, Provide credible Information about Losses, etc

- **Costs**: Destroy risk sharing, over-reaction public, gaming, etc

- What’s the optimal degree of transparency if PM wants to aid a sifi under distress?

- **This paper**: Information disclosure as *regulatory tool* when public funds limited
Motivation

Complexity:

- Many **audiences**
  - Long-term Investors
  - Short-term Creditors
  - Speculators
  - Insurance companies
  - Taxpayers
  - ...

- Many **variables**
  - Asset quality (e.g., NPL)
  - Liquidity
  - Exposure to other sifi
  - ...

Motivation

Bank

Asset Quality

Liquidity

Long-term Investors

Short-term Creditors
Motivation
Findings

**Transparency**
- High-quality assets → Unique passing grade (Opaque)
- Poor-quality assets → Multiple failing grades (More Transparent)

**Recapitalizations**
- Key to effectiveness of information disclosure. Without: Disclosures may **backfire**
- Undermine effectiveness of PM’s Emergency Lending Mechanisms
Related literature


  *Multiple audiences and multi-dimensional fundamentals. Interaction: disclosure and regulatory policies.*


  *Interplay information design & security design (endogenous probability of default).*


  *Add Information Design (Ex-ante and Interim)*


  *Multiple audiences with different objectives and multi-dimensional state space.*
Plan

- Model
- Stress Testing and Recapitalizations
- Emergency Lending Mechanisms
- Conclusions
Market Participants:

- Bank
- Long-term Investors
- Short-term Creditors
- Policy maker
Model

Gradual Resolution of Uncertainty

- $t \in \{1, 2, 3\}$

- **Period 1**
  - Asset profitability $y \in \mathbb{R}_+$
    - drawn from $F^y$
    - pays at $t = 3$
  - Bank observes signal $\theta \in \{L, H\}$ about $y$
    - $F_\theta$ is posterior given $\theta$
    - $F_H \preceq_{MLRP} F_L$
  - **Bank** can sell claims on its asset to long-term investors
    - $s(y) \in [0, y], \forall y$
  - Long-term investors pay $P$ to bank


Model

- **Period 2**

  - Short-term creditors: \( i \in [0, 1] \), each owns claim of 1

  \[
  a_i = \begin{cases} 
  1 & \text{withdraw early at } t=2 \\
  0 & \text{rollover until } t=3 
  \end{cases}
  \]

  - \( A \in [0, 1] \) : fraction of early withdrawals.

  - Liquid funds \( \omega \sim F^\omega \) on \([0, 1]\)

  - Liquidity Position: \( \omega + P \)

  - **Bank defaults if**

    \[ A > \omega + P \]

  - Adversarial Selection

    \[ \mathbb{E}(u_{\text{Run}}(\omega, P, A = 1)) \geq 0 \Rightarrow A^*(P) = 1. \]
Model - Actions

Policy-maker

- At $t = 1$
  - Asset quality review $\Gamma^y = \{M^y, \pi^y\}$
    
    $$\pi^y : Y \rightarrow \Delta(M^y)$$
  - Recapitalization $R(m^y)$
    
    $$R : M^y \rightarrow \mathbb{R}_+$$

- At $t = 2$,
  - Stress Test $\Gamma^\omega = \{M^\omega, \pi^\omega\}$
    
    $$\pi^\omega : \Omega \rightarrow \Delta(M^\omega)$$
Timing

\[ AQR + Recap. \{ \Gamma y, \mathcal{R} \} \quad y, \theta \{ m^y, \mathcal{R}(m^y) \} \]

**Fund-Raising Stage:**
- Bank issues $s$
- Investors offer $P$

\[ \text{Stress Test} \quad \Gamma^\omega \quad \{ m^\omega \} \]

Creditors’ rollover decision
- Fundamentals publicly observed
- Payoffs are realized

$t=1$

$t=2$

$t=3$
Plan

- Model
- Stress Testing and Recapitalizations
- Emergency Lending Mechanisms
- Conclusions
Theorem 1. The Optimal Comprehensive Assessment $\Psi = (\Gamma^y, \mathcal{R}, \Gamma^\omega)$ has monotone partitional structure:
Each score $m^y$ induces $\mathbb{E}(y|m^y)$

$\Gamma^y = \{M^y, \pi^y\}$ induces distribution, $G$, of $\mathbb{E}(y|m^y)$

Blackwell Thm implies PM’s problem:

$$\max_G \int_0^\infty \mathbb{P}\{\text{Survival}(\tau)\} \, G(d\tau)$$

s.t: $F^y \succeq_{MPS} G$

Solution: Monotone Partitional Structure

Duality arguments

(Proof Thm 1)
Driving Forces

- Amplification mechanism with low quality assets
  - ↑ quality ⇒ ↑P ⇒ ↑P \{\text{survive}\} ⇒ ↑P ⇒ ...

Need of Recapitalizations

- Banks (residual) private information \( \theta \) induces separation incentives during fund-raising stage (**Lemons Problem**)

- Absence of disclosures: threat of runs imposes discipline during fund-raising stage \( \Rightarrow \) banks raise precautionary funds

- With **Stress Tests**: \( P \{ \text{survival} \} \) goes up \( \Rightarrow \) exacerbates incentives to signal by exposing to rollover risk.

- Recapitalizations bring discipline back. PM threats with forbidding dividends if precautionary funds are not raised.
Plan

- Model
- Stress Testing and Recapitalizations
- Recapitalizations
- Emergency Lending Mechanism
- Conclusions
Conclusions

- Information Disclosure with Multiple Audiences and Multi-Dimensional Fundamentals
- Endogenous Interaction of Multiple Audiences
  - High-quality assets: (Opaque) Single passing grade
  - Low-quality assets: (More transparent) Multiple failing grades
- Recapitalizations:
  - Key to effectiveness of Disclosure Policies
  - Undermine effectiveness of PM’s Emergency Lending Programs
- Public + Private Sector Interventions: Substitutes
THANK YOU
Goal: Interplay between Info Disclosure & PM’s role as LOLR

Emphasis on Urgency of Events

- PM can’t conduct Liquidity ST in period 2

PM may use public funds but to purchase securities under a budget balance constraint (Bagehot principle)

Room for information transmission → Emergency Lending Mechanism:

- Asks bank to self-report private information $\omega$
- Provides liquidity by purchasing assets and a public disclosure
Timing

Fund-Raising Stage:
- Bank issues \( s \)
- Investors offer \( P \)

Creditors' rollover decision
- Fundamentals publicly observed
- Payoffs are realized

\[ AQR + Recap. \quad \{ \Gamma', \mathcal{R} \} \quad \gamma, \theta \quad \{ m^\gamma, \mathcal{R}(m^\gamma) \} \quad \omega \quad \text{ELP} \quad \gamma^\omega \]
Comprehensive Intervention

Designing Emergency Lending Mechanism

- Conflict: **Credibility** and **Incentive Compatibility**.

- Optimal mechanism assigns stochastic pass/fail grades. Conditional on passing, liquidity is provided.

- Liquidity types passed with **lower probability** (illiquid), are compensated with **better prices** for assets (smaller discounts).
Optimal Emergency Lending Mechanism

Figure: Optimal Emergency Lending Program
To avoid $\{\omega < 1 - P\}$ mimic: PM fails safe banks with large probability

Average liquidity passing banks deteriorates

Most illiquid banks passed with low probability.
Moreover,

- To avoid \(\{(\theta_L, \omega > 1 - P)\}\) mimic \(\{\omega < 1 - P\}\): PM cannot pledge more than \(\frac{1}{R} \mathbb{E}_L(y - s)\).
- Best Resolution Program sets \(P = 0\).
Figure: Emergency Lending Program with Observable Quality
Figure: Probability of passing $\pi^{\omega, \theta}(\text{pass} \mid \cdot)$
Bank:

\[ u^B(\omega, R, s, P, A, y) = \left( P + \frac{y - s(y)}{R} \right) \mathbb{1}\{P + \omega \geq A\} \mathbb{1}\{P \geq R\} \]

Investors

\[ u^I(s, P, A, y; \mu) = \frac{s(y)}{R} \mathbb{1}\{\omega + P \geq A\} - P \]

Short-term creditors:

- Withdraw early: 0
- Rollover:

\[ u_{\text{Rollover}}(\omega, P, A) = \begin{cases} g > 0, & \omega + P \geq A \\ b < 0, & \omega + P < A \end{cases} \]

Policy-maker

\[ u^P(\omega, P, A) = W_0(A) \times \mathbb{1}\{\omega + P > A\} \]

\[ \downarrow A \]
Emergency Lending: Screening and Persuasion

- Constraints:
  - PM cannot force bank to accept deal (Individual Rationality).
  - PM cannot pay more than faire-price of securities (Budget Balance)
  - Bank willingly discloses its private information (Incentive Compatibility)
Theorem 1

Optimal Comprehensive Policy $\Psi = (\Gamma^y, R, \Upsilon^\omega)$ follows partitional structure and features non-monotone pecking order:

1. If $y \geq y^+$: single pass grade, $m_y^{\text{pass}}$, with $E(y|m_y^{\text{pass}}) \geq K$, and $R(m_y^{\text{pass}}) = K$ [Private Sector Funding].

2. If $y^- < y < y^+$, multiple failing grades + liquidity provision, $P = 0$ [Liquidity Provision Program].

3. If $y \leq y^-$: Multiple failing grades, and bank sells whole asset
Motivation

Fed’s Approach

- Disclosures: Stress Tests (DFAST + CCAR) → Report + 3 grades
- Recapitalizations: Public Recommendations

ECB’s Approach:

- Disclosures: Asset Quality Review (ECB+ESRB)+ Stress Tests (EBA) → Report + No grades
- Recapitalizations: Private Recommendations (SREP)