Rules versus Disclosure:
Prudential Regulation and Market Discipline

William Fuchs, Satoshi Fukuda, and Daniel Neuhann
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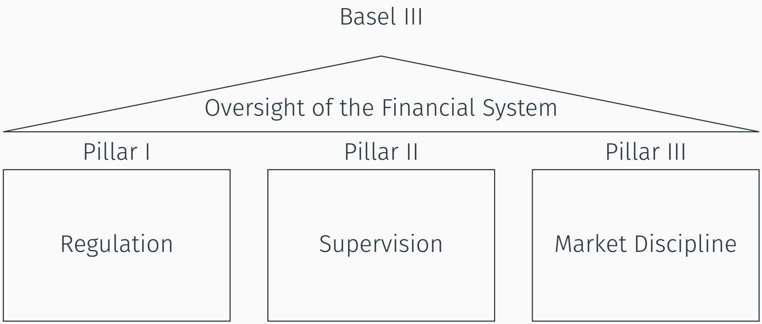
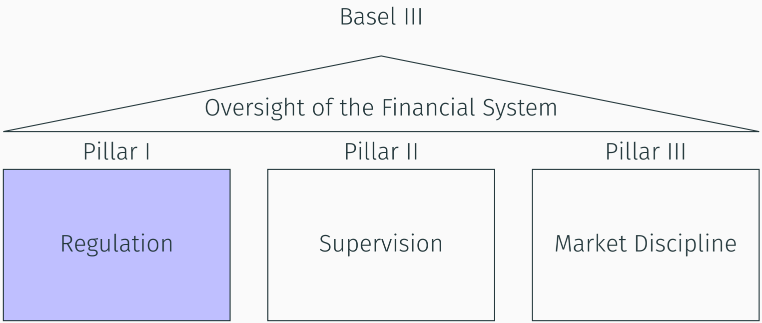
Introduction

Motivation


Basel III
Oversight of the Financial System
Pillar I
Pillar II
Pillar III
Regulation
Supervision
Market Discipline

Motivation



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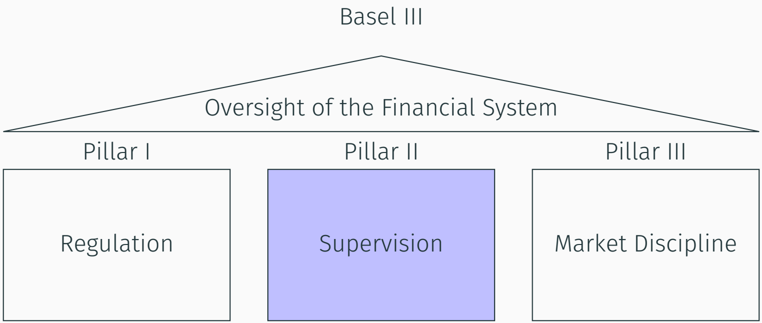

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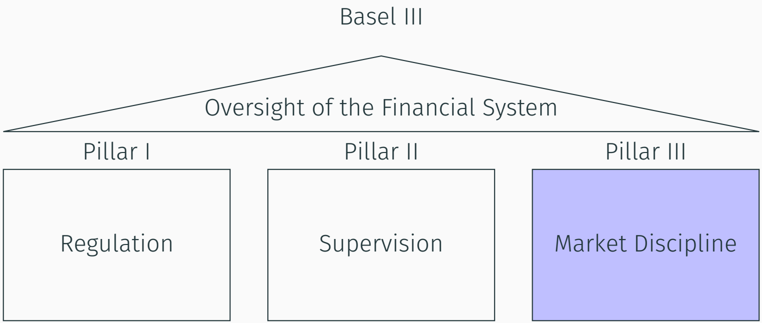

1. **Regulation**: ex-ante rules regarding operations, incl. risk management.
2. **Supervision** aims to induce sound governance and risk management.
3. **Market Discipline**: disclosure of information to other market participants.

- Limited disclosure may induce moral hazard that requires regulation.

- Effective regulation may allow the regulator to disclose less.

Overview

We ask three main questions:

1. What is the optimal disclosure policy if banks can adjust asset quality?
   - Trade-off between ex-post insurance and ex-ante incentives.
2. What is the optimal *joint* design of regulation and disclosure.
   - Rules ensure incentives, but may have excessive "red tape."
3. To what extent do banks and regulators agree about optimal policy?

A model with bank moral hazard and externalities

Regulator wants high effort, and can induce it using one or both tools.

- Regulation: can directly target effort, but cannot respond to shocks.
- Disclosure: state-contingent, but obfuscation creates moral hazard.

Main Findings

- It is optimal to always use both regulation and (partial) disclosure.
  - $\Rightarrow$ Rationale for key aspects of Basel III

- Absent regulation, full disclosure can be an optimal policy.
- Absent disclosure, optimal regulation entails “prudential” effort.
  - Dodd-Frank: this is stricter for “systemically important institutions.”

- Optimal disclosure is state-contingent and reduces prudential effort.

- Banks like some regulation, would prefer more disclosure.

Related Literature

- Stress Testing as an information design problem.
  - Gick & Pausch (2012), Spargoli (2012), Morrison & White (2013), Bouvard et al. (2015), Parlatore (2015), Shapiro & Skeie (2015), Dang et al. (2017), Faria-e-Castro et al. (2017), Monnet & Quintin (2017), Williams (2017), Goldstein & Leitner (2018), Leitner & Yilmaz (2019), Alvarez & Barlevy (2021), Huang (2021), Parlasca (2021), Inostroza (2023), Inostroza & Pavan (2023), Leitner & Williams (2023), Orlov et al. (2023), Parlatore & Philippon (2023), Rhee & Dogra (2024), Dai et al. (Forthcoming), Shapiro & Zeng (Forthcoming), Quigley & Walther (Forthcoming).
  - Survey: Goldtein & Sapra (2013), Goldstein & Leitner (2022)
- Interaction between Bank Supervision and Regulation
  - Bhattacharya et al. (2002), Décamps et al. (2004), Eisenbach et al. (2016), Agarwal & Goel (2022)
- Moral hazard and information design
  - Methodology: Rodina & Farragut (2018), Boleslavsky & Kim (2021)
  - Application to Grading: Dubey and Geanakoplos (2010), Boleslavsky & Cotton (2015), Zubrickas (2015)
  - Application to Certification: Albano & Lizzeri (2001), Zapechelnyuk (2022)

Outline

Outline of the Rest of Presentation

1. Model
2. Benchmarks
3. Optimal Disclosure
4. Regulation without Disclosure
5. Joint Design: Regulation + Disclosure
6. Race to the Bottom?

Model

Model

- One bank, two periods.
- Bank first originates assets of uncertain quality and may later sell them.

- The state of the economy: $\theta \sim U([1-\varepsilon, 1+\varepsilon])$.
  - ε: Uncertainty of the environment.

- Asset quality depends on bank's privately exerted effort $e \in [0, \frac{1}{2})$.
- Cost $c(e)$: increasing, convex, $c(0) = c'(0) = 0$, and $c(\frac{1}{2}) = c'(\frac{1}{2}) = \infty$.

Example Cost Functions

- The asset produced by the bank has quality $q \in \{L, H\}$ with

$$\mathrm{Prob}(q = H \mid e) = \theta e.$$

Model

- In the 2nd period, assets can be sold to a competitive fringe of buyers.
- Asset of quality $q \in \{L, H\}$ has value v_q for buyers and ρ_q for sellers.

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$$\textbf{Assumption 1:} \qquad v_H > \rho_H > \rho_L > v_L.$$

- **Externality**: Additional social value $g > 0$ of trading each asset, with

$$v_L + g > \rho_L.$$

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- **Externality**: Additional social value $g > 0$ of trading each asset, with

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- Potential rationales for this externality:
  (a) Bank better able to deal with a troubled loan, planner prefers to spread risk.
  (b) Or, induced preferences from "too big too fail."

NB: Could also modeled by assuming a richer type space and adverse selection such that low types would not trade in eq.

Policy Instruments

1. Regulation
   - The regulator can set up (before state θ is realized) a system that bounds from below the level of effort (i.e., minimum effort level).

2. Stress test/Disclosure
   - Before trades take place, the regulator can conduct a state contingent stress test that publicly reveals some information about each of the assets:

$$\pi_L, \pi_H : [1-\varepsilon, 1+\varepsilon] \to \Delta(\{\ell, h\}).$$

   - Information obfuscation ex-post $\Rightarrow$ ex-ante moral hazard: expecting obfuscation, banks are less willing to exert effort.

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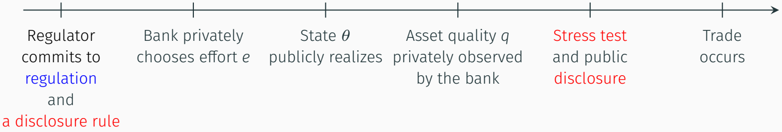

Benchmarks

No Information (Laissez Faire)

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$$\underbrace{(c')^{-1}(\rho_H - \rho_L)}_{\text{bank effort under no trade}} > \underbrace{\frac{\rho_H - v_L}{v_H - v_L}\frac{1}{1+\varepsilon}}_{\substack{\text{cutoff effort s.t.} \\ \text{average quality} \leq \rho_H \\ \text{for all } \theta}} .$$

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⏩ Details

3. Assume this holds, so that trade occurs for some θ but not for others.

No Information (Laissez Faire)

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$$\theta^*(e)ev_H + (1 - \theta^*(e)e)v_L = \rho_H.$$

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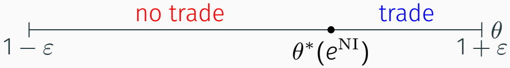

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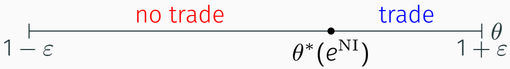


2. e^* is the effort at which the *unconditional* buyer value is equal to ρ_H,

$$e^* = \frac{\rho_H - v_L}{v_H - v_L}.$$

No Information Equilibrium (Laissez Faire)

The bank's decision problem is:

$$\max_{e\in[0,\frac{1}{2})} \frac{1}{2\varepsilon}\int_{1-\varepsilon}^{\theta^*(e)} \left(\underbrace{\theta e \rho_H + (1-\theta e)\rho_L}_{\substack{\text{asset quality} \\ \text{under no trade}}} \right) d\theta + \frac{1}{2\varepsilon}\int_{\theta^*(e)}^{1+\varepsilon} \left(\underbrace{\theta e v_H + (1-\theta e^{\mathrm{NI}})v_L}_{\text{price}} \right) d\theta - c(e).$$

The unique solution e^{NI} is

$$\underbrace{\frac{\rho_H-\rho_L}{4\varepsilon}\left(\left(\frac{e^*}{e^{\mathrm{NI}}}\right)^2 - (1-\varepsilon)^2\right)}_{\substack{\text{marginal benefit} \\ \text{prob. no trade } \times \text{ expected marginal increase in asset quality}}} = \underbrace{c'(e^{\mathrm{NI}})}_{\text{marginal cost}}.$$

1. With full information, there is trade at H and no trade at L. Bank solves:

$$\max_{e\in[0,\frac{1}{2})} \mathbb{E}_\theta \left[\theta e \underbrace{v_H}_{\text{price}} + (1-\theta e)\rho_L \right] - c(e).$$

2. The solution is

$$e^{\mathrm{FI}} = (c')^{-1}(v_H - \rho_L).$$

- $e^{\mathrm{NI}} < e^{\mathrm{FI}}$: full information provides incentives to exert higher effort.
- $e^{\mathrm{FI}} < (c')^{-1}(v_H - v_L)$: Bad assets do not trade, which is socially inefficient.

Optimal Disclosure

It is optimal to consider policies of the following form:

- After H, the policy reports h with probability 1;
- After L, the policy reports h with probability $\beta(\theta)$.

Hence, $\beta(\theta) = 1$ means no disclosure while $\beta(\theta) = 0$ means full disclosure.

$$\max_{e,\beta} \frac{1}{2\varepsilon} \int_{1-\varepsilon}^{1+\varepsilon} \left(\underbrace{\theta e}_{H} \cdot \underbrace{(v_H + g)}_{\text{trade}} + \underbrace{(1-\theta e)}_{L} \left(\beta(\theta) \underbrace{(v_L + g)}_{\text{trade}} + (1-\beta(\theta)) \underbrace{\rho_L}_{\text{no trade}} \right) \right) d\theta - c(e)$$

$$\text{s.t. } \underbrace{p(\theta \mid e, \beta)}_{\text{Price given } h} := \frac{\theta e \cdot v_H + (1-\theta e)\beta(\theta) v_L}{\theta e + (1-\theta e)\beta(\theta)} \geq \rho_H \text{ for each } \theta$$

$$e \in \underset{\hat{e}\in[0,\frac{1}{2})}{\operatorname{argmax}} \frac{1}{2\varepsilon} \int_{1-\varepsilon}^{1+\varepsilon} \left(\underbrace{(\theta\hat{e} + (1-\theta\hat{e})\beta(\theta))}_{\text{prob. receiving } h} p(\theta \mid e, \beta) + \underbrace{(1-\theta\hat{e})(1-\beta(\theta))}_{\text{prob. receiving } \ell} \rho_L \right) d\theta - c(\hat{e}).$$

IC Constraint

Information Disclosure without Regulation

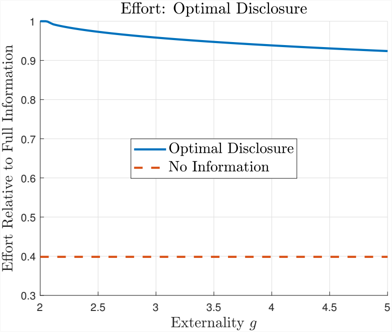
Optimal policy trades off ex-post insurance and ex-ante moral hazard.

Key properties:

- No disclosure ($\beta = 1$) is never optimal.
- When externality g is low, full disclosure is optimal.
- When externality g is high, partial obfuscation is optimal.
- Disclosure is non-monotone in state θ.

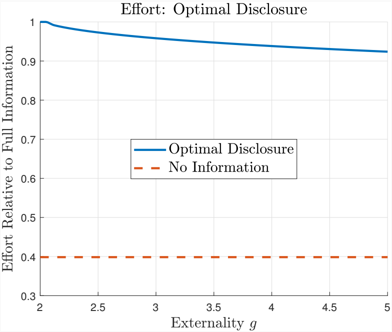
Proposition

1. There is a $\underline{g}$ such that if $g < \underline{g}$ then full information $(e^{\mathrm{FI}}, \beta = 0)$ is optimal.
2. If instead $g > \overline{g}$ then some information obfuscation is optimal: $e^{\mathrm{D}} < e^{\mathrm{FI}}$ and $\beta^{\mathrm{D}}(\theta) > 0$ for some θ.



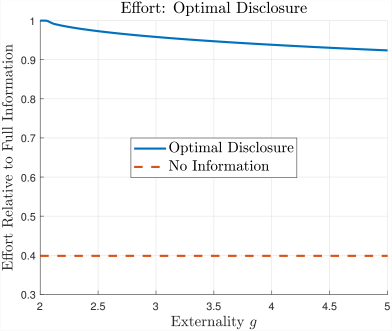
Intuition: Low g

- Cost of moral hazard > Welfare gain from selling bad assets



Intuition: High g

- Welfare gain from trading bad quality assets increases.
- To ensure trade, engage in more information obfuscation: $\beta \uparrow$.
- To respect incentive compatibility, effort e goes down.



Information Disclosure without Regulation

Intuition: High g

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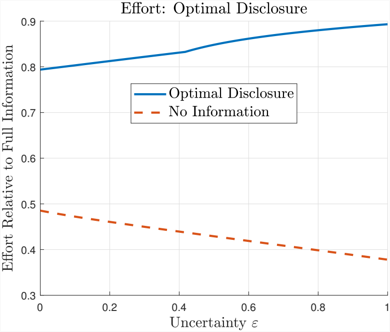
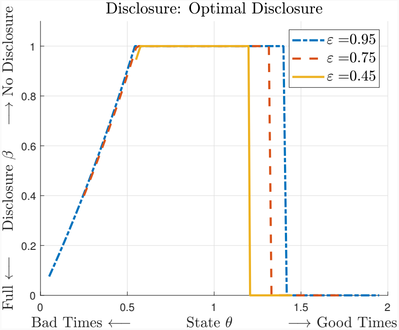
High $g \approx$ systemically important financial institutions

- The planner is more opaque about the assets of large institutions.
- As a result, their quality is relatively low.

$\Rightarrow$ **If** regulation can induce effort, then SIFIs should be regulated more tightly.

Effects of Volatility on Optimal Disclosure





- Higher θ: Easier to provide effort incentives through disclosure
- Low θ: Pricing constraint is binding (can't obfuscate too much).

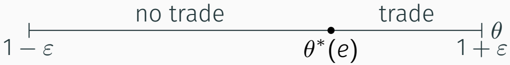
Regulation without Disclosure

Regulation without Disclosure

- **Assume:** regulator can induce minimum effort through regulation.
- This can address moral hazard but is not state contingent.

Regulation without Disclosure

- Effort e pins down the set of states for which trade occurs.
- As before, there is a cutoff state $\theta^*(e)$ at which buyer value is ρ_H.



Assume the regulation is binding. Then the planner solves:

$$\max_{e\in[0,\frac{1}{2})} \quad \frac{1}{2\varepsilon}\int_{\theta\le\theta^*(e)} \underbrace{\left(\theta e\cdot \rho_H + (1-\theta e)\,\rho_L\right)}_{\text{no trade}} d\theta$$

$$+\frac{1}{2\varepsilon}\int_{\theta\ge\theta^*(e)} \underbrace{\left(\theta e\cdot v_H + (1-\theta e)\,v_L + g\right)}_{\text{trade}} d\theta - c(e).$$

Regulation without Disclosure: Key Considerations

1. When ε is small, trade occurs for all θ at efficient effort $e = (c')^{-1}(v_H - v_L)$.

2. As ε increases, for a given effort level, there are states θ such that the realized average quality is below ρ_H.

3. Prudential regulation: costly increase in effort to induce more trade.

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3. Prudential regulation: costly increase in effort to induce more trade.

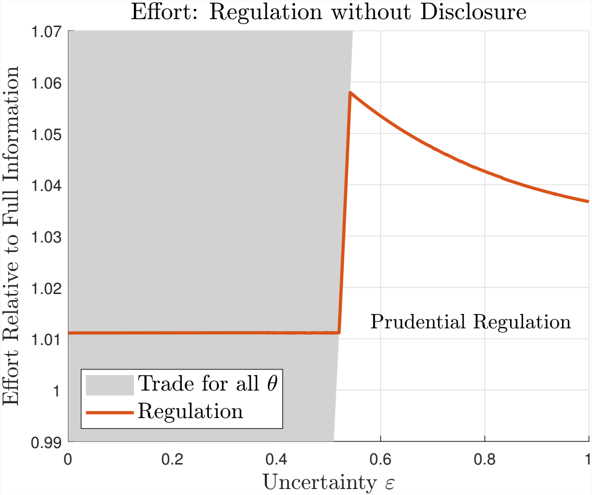
With sufficient volatility, regulator may decide to “give up” on some states.

Formal Details

Proposition

1. When ε is small, the optimal regulation is the efficient effort level.
2. When ε is intermediate, excess effort (prudential regulation) that ensures trade of all assets is optimal.
3. When ε is high, full insurance is too costly and less prudential regulation to provide partial insurance is optimal.
4. Optimal regulation is increasing in externality g.

Regulation without Disclosure: Optimal Policy



Joint Design: Regulation + Disclosure

Idea: regulation deals with the moral hazard, disclosure adapts to the state.

Planner's Problem:

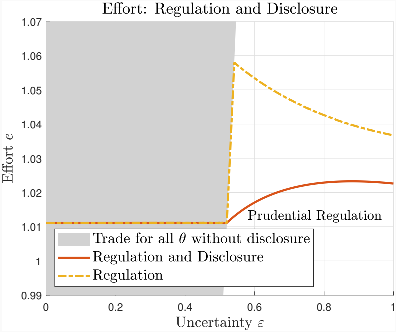
$$\max_{e,\beta} \frac{1}{2\varepsilon} \int_{1-\varepsilon}^{1+\varepsilon} \left(\underbrace{\theta e}_{H} \cdot \underbrace{(v_H + g)}_{\text{trade}} + \underbrace{(1-\theta e)}_{L} \left(\beta(\theta) \underbrace{(v_L + g)}_{\text{trade}} + (1-\beta(\theta)) \underbrace{\rho_L}_{\text{no trade}} \right) \right) d\theta - c(e)$$

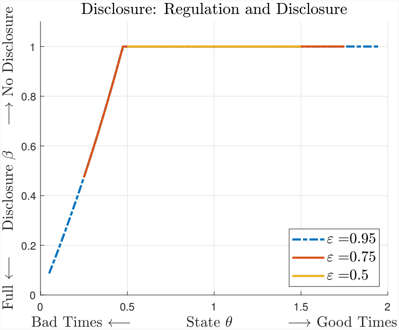
$$\text{s.t.} \quad \underbrace{p(\theta \mid e, \beta)}_{\text{Price given } h} := \frac{\theta e \cdot v_H + (1-\theta e)\beta(\theta) v_L}{\theta e + (1-\theta e)\beta(\theta)} \geq \rho_H \text{ for each } \theta$$

$$e \in \underset{\hat{e} \in [0, \frac{1}{2})}{\operatorname{argmax}} \frac{1}{2\varepsilon} \int_{1-\varepsilon}^{1+\varepsilon} \left((\theta\hat{e} + (1-\theta\hat{e})\beta(\theta)) p(\theta \mid e, \beta) + (1-\theta\hat{e})(1-\beta(\theta))\rho_L \right) d\theta - c(\hat{e}).$$

Optimal Joint Design: Key Properties

- Regulation and disclosure are substitutes.
  - For two effort levels with $e < e'$, $\beta(e, \theta) < \beta(e', \theta)$ for all θ.
- Information will never be fully disclosed: $\beta(\cdot) > 0$.
- Disclosure always reduces regulation level vis-à-vis no-disclosure.
- Optimal regulation is increasing in externality g.





⏩ Formal Result

Race to the Bottom?

How Much Regulation do Banks Want?

Basel III is a *framework* that sets minimal standards.

- Implementation is left to a variety of agencies.

This leaves open the possibility of a “race to the bottom.”

How much disclosure and regulation do banks want?

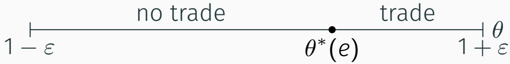
Bank-optimal Disclosure

The bank does not care about selling bad assets.

Ex-ante, it would therefore like to commit to full disclosure.
$\Rightarrow$ Obfuscation is only due to the externality.

Details

Suppose the bank could commit to some effort e. Trading probabilities are:



The bank's decision problem:

$$\max_{e\in[0,\frac{1}{2})} \frac{1}{2\varepsilon}\int_{\theta^*(e)>\theta} \underbrace{(\theta e\cdot\rho_H+(1-\theta e)\rho_L)}_{\substack{\text{average quality}\\ \text{under no trade}}} d\theta$$

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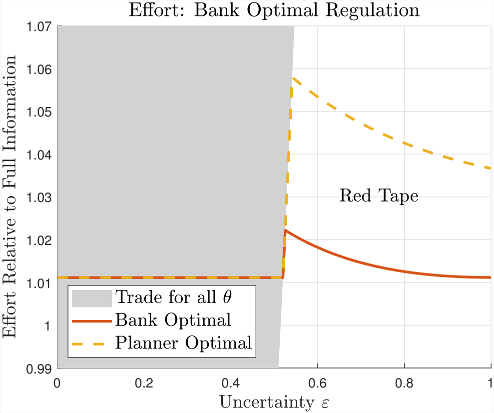

- The bank would welcome some regulation.
- “Red tape:” difference between optimal and bank-preferred regulation .

▶▶ Formal Details

Bank-Optimal Joint Design

- The bank prefers full disclosure, but the social planner doesn't.
- Under full disclosure, bank perceives no marginal benefit of regulation.

Can Banks fully disclose on their own?

- Maybe using credit ratings, but subject to limited commitment etc.
- Given the planner-optimal disclosure policy, the bank-optimal regulation $<$ the planner optimal regulation (i.e., red tape) for high uncertainty ε.

Conclusion

- It is optimal to always use both regulation and information disclosure (obfuscation), even though they are policy substitutes.
  $\Rightarrow$ Rationale for Basel III
- Full disclosure can be an optimal disclosure policy absent regulation.
- Optimal regulation entails “excess effort” (prudential regulation).
- Optimal disclosure is state-contingent and reduces excess effort.
- Stricter standards for systemically important (high g) institutions.
  $\Rightarrow$ Dodd-Frank Act

Appendix

Examples of Cost Functions

- $c(e) = -k(2e + \log(1 - 2e))$.
- $c(e) = \frac{ke^2}{1-2e}$.

Back

No Information Benchmark: No Trade

- The bank's effort solves:

$$\mathbb{E}\left[\theta e \rho_H + (1-\theta e)\rho_L\right] - c(e).$$

- $\Rightarrow$ The bank's equilibrium effort:

$$(c')^{-1}(\rho_H - \rho_L).$$

- The bank would be tempted to trade if the average quality of the asset is as high as ρ_H for some θ.
- Cutoff state $\theta^*(e)$ at which the average quality is ρ_H:

$$\theta^*(e) e v_H + (1 - \theta^*(e)e)v_L = \rho_H$$

$$\Rightarrow \theta^*(e) = \frac{e^*}{e}, \text{ where } e^* = \frac{\rho_H - v_L}{v_H - v_L}.$$

- The bank would be tempted to trade for some θ if and only if

$$(c')^{-1}(\rho_H - \rho_L) > \frac{\rho_H - v_L}{v_H - v_L}\frac{1}{1+\varepsilon}.$$

▶▶ Back

Lemma
The bank's IC constraint can be replaced with its first-order condition:

$$\frac{1}{2\varepsilon}\int_{1-\varepsilon}^{1+\varepsilon}\theta(1-\beta(\theta))(p(\theta \mid e,\beta)-\rho_L)d\theta = c'(e).$$

Back

Regulation

- Given an effort level e, there exists a unique cutoff $\theta^*(e)$ such that the average quality
$$\theta e v_H + (1 - \theta e) v_L$$
is at least as high as ρ_H if and only if $\theta \geq \theta^*(e)$.
- Thus:
$$\theta^*(e) = \frac{e^*}{e}.$$
- Given a minimal effort level e (which is binding),
    - no trade occurs if $\theta < \theta^*(e)$;
    - trade occurs if $\theta \geq \theta^*(e)$.
- The planner would choose e to maximize welfare.

The planner's problem:

$$\max_{e\in[0,\frac{1}{2})} \frac{1}{2\varepsilon}\int_{1-\varepsilon}^{\mathrm{med}(1-\varepsilon,\theta^*(e),1+\varepsilon)} \left(\theta e\rho_H + (1-\theta e)\,\rho_L\right) d\theta$$
$$+\frac{1}{2\varepsilon}\int_{\mathrm{med}(1-\varepsilon,\theta^*(e),1+\varepsilon)}^{1+\varepsilon} \left(\theta e v_H + (1-\theta e)\,v_L + g\right) d\theta - c(e).$$

Proposition
The optimal process regulation is uniquely given by:

$$e^{\mathrm{R}} = \begin{cases} e^{\diamond} & \text{if } \varepsilon \leq 1 - \frac{e^*}{e^{\diamond}} \\ \min\left(e^{\dagger}, \frac{e^*}{1-\varepsilon}\right) & \text{if } \varepsilon \geq 1 - \frac{e^*}{e^{\diamond}} \end{cases},$$

where $e^{\dagger} \in (e^{\diamond}, \frac{1}{2})$ is a unique solution $e \in (0, \frac{1}{2})$ satisfying

$$\left(\frac{v_H - v_L}{2}(1+\varepsilon)^2 - \frac{\rho_H - \rho_L}{2}(1-\varepsilon)^2\right) + \left(\frac{v_H - \rho_H + \rho_L - v_L}{2} e^* + (v_L + g - \rho_L)\right)\frac{e^*}{e^2} = 2\varepsilon c'(e)$$

and

$$e^{\diamond} = (c')^{-1}(v_H - v_L).$$

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Regulation and Information Disclosure

- Information Disclosure
  - After H, the policy reports h with probability 1;
  - After L, the policy reports h with probability $\beta(\theta)$.

- The planner would choose each $\beta(\theta)$ so that:
  - the average quality is ρ_H if $\theta < \theta^*(e)$:

$$\frac{\theta e v_H + (1-\theta e)\beta(\theta) v_L}{\theta e + (1-\theta e)\beta(\theta)} = \rho_H;$$

  - $\beta(\theta) = 1$ (no disclosure) if $\theta \geq \theta^*(e)$.

Regulation and Information Disclosure

- The planner's problem is:

$$\max_{e\in[0,\frac{1}{2})} \frac{1}{2\varepsilon}\int_{1-\varepsilon}^{1+\varepsilon} \left(\theta e(v_H+g)+(1-\theta e)\left(\beta(\theta)(v_L+g)+(1-\beta(\theta))\rho_L\right)\right) d\theta - c(e).$$

- The optimal disclosure policy (given e) is:

$$\beta(\theta) = \begin{cases} \frac{v_H-\rho_H}{\rho_H-v_L}\frac{\theta e}{1-\theta e} & \text{if } \theta \leq \theta^*(e) \\ 1 & \text{if } \theta \geq \theta^*(e) \end{cases}.$$

- After algebra, the planner's problem is:

$$\max_{e\in[0,\frac{1}{2})} \frac{1}{2\varepsilon}\int_{1-\varepsilon}^{\mathrm{med}(1-\varepsilon,\theta^*(e),1+\varepsilon)} \left(\frac{e\theta}{e^*}(\rho_H+g)+\left(1-\frac{e\theta}{e^*}\right)\rho_L\right) d\theta$$
$$+\frac{1}{2\varepsilon}\int_{\mathrm{med}(1-\varepsilon,\theta^*(e),1+\varepsilon)}^{1+\varepsilon} \left(\theta e v_H+(1-\theta e)\, v_L+g\right) d\theta - c(e).$$

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Proposition
The optimal regulation (with disclosure) is uniquely given by:

$$e^{\mathrm{RD}} = \begin{cases} e^{\diamond} & \text{if } \varepsilon \leq 1 - \frac{e^*}{e^{\diamond}} \\ e^{\ddagger} & \text{if } \varepsilon \geq 1 - \frac{e^*}{e^{\diamond}} \end{cases},$$

where $e^{\ddagger} \in \left(e^{\diamond}, \frac{e^*}{1-\varepsilon}\right)$ is a unique solution $e \in (0,1)$ satisfying

$$\frac{v_H - v_L}{2}(1+\varepsilon)^2 - \frac{\rho_H - \rho_L + g}{2e^*}(1-\varepsilon)^2 + \frac{v_L + g - \rho_L}{2}\frac{e^*}{e^2} = 2\varepsilon c'(e)$$

and

$$e^{\diamond} = (c')^{-1}(v_H - v_L).$$

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Bank Optimal Disclosure

The Bank's Problem

$$\max_{e,\beta} \frac{1}{2\varepsilon} \int_{1-\varepsilon}^{1+\varepsilon} \left(\underbrace{\theta e}_{H} \cdot \underbrace{v_H}_{\text{trade}} + \underbrace{(1-\theta e)}_{L} \left(\beta(\theta) \underbrace{v_L}_{\text{trade}} + (1-\beta(\theta)) \underbrace{\rho_L}_{\text{no trade}} \right) \right) d\theta - c(e)$$

$$\text{s.t. } \underbrace{p(\theta \mid e, \beta)}_{\text{Price given } h} := \frac{\theta e \cdot v_H + (1-\theta e)\beta(\theta) v_L}{\theta e + (1-\theta e)\beta(\theta)} \geq \rho_H \text{ for each } \theta.$$

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Bank-Optimal Regulation

Proposition

A unique solution e^{BO} exists and satisfies the following:

$$e^{\mathrm{BO}} = \begin{cases} e^{\mathrm{FB}} & \text{if } \varepsilon \leq 1 - \frac{e^*}{e^{\mathrm{FB}}} \\ \min\left(e^\circ, \frac{e^*}{1-\varepsilon}\right) & \text{if } \varepsilon > 1 - \frac{e^*}{e^{\mathrm{FB}}} \end{cases},$$

where e° is a unique solution $e \in \left(\frac{e^*}{1+\varepsilon}, \frac{1}{2}\right)$ such that

$$\frac{v_H - v_L}{4\varepsilon}(1+\varepsilon)^2 - \frac{\rho_H - \rho_L}{4\varepsilon}(1-\varepsilon)^2 + \frac{1}{4\varepsilon}\frac{e^*}{e^2}\left(\frac{v_H - \rho_H}{v_H - v_L} - (\rho_L - v_L)\right) = c'(e).$$

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