Optimal Regulation without Commitment: Reputation and Incentives

Alessandro Dovis
U Penn and NBER

Rishabh Kirpalani
Wisconsin

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This Paper

- Regulators often deviate from rules designed to provide incentives to private agents ex-ante
  - Example: Banking union in EU

  Negative reputational consequences

- **Question: How to design regulation when there is uncertainty about the type of the regulator?**

- Regulator can be either
  - Commitment type: enforce regulation
  - Optimizing type: chooses policy sequentially

- Regulation must provide incentives to
  - Private agents (banks ...)
  - Regulator (optimizing type)

More Lenient Rules to Preserve Reputation

- Uncertainty about regulator's type beneficial
  - Prevents private agents to deviate much from desired action
  - e.g. banks do not take on too much risk

- Regulation preserves uncertainty about type over time:
  - Most stringent rule that will be followed by optimizing type
  - Rules more lenient than in static setting

- Bailouts on path prevent excessive risk taking in the future

Role for Opaque Rules

- When regulator's type known: ability to easily monitor policy maker actions supports better outcomes
    - Atkeson-Chari-Kehoe (2007) and Piguillem-Schneider (2017)
- When regulator's type uncertain: opaque rules are optimal because help to preserve uncertainty
    - Want rules hard to monitor (hard to detect deviation)
    - Complicated rules contingent on irrelevant contingencies

Environment

- Private agents
- Regulator
  - Commitment type
  - Optimizing type
- Common prior of commitment type is ρ
- Regulator chooses a policy π
- x is a vector of private choices and prices
  - Predetermined wrt policy
  - Assume $x = \phi(\rho, \mathbb{E}\pi)$
- Government preferences: $w(x, \pi)$

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- x is a vector of private choices and prices
  - Predetermined wrt policy
  - Assume $x = \phi(\rho, \mathbb{E}\pi)$, $\phi_\rho \leqslant 0, \phi_{\mathbb{E}\pi} > 0$
- Government preferences: $w(x, \pi)$, $w_x < 0$

Time Inconsistency

- Let $(x_{ramsey}, \pi_{ramsey})$ be the Ramsey outcome:

$$(x_{ramsey}, \pi_{ramsey}) = \arg\max_{x,\pi} w(x, \pi) \quad \text{subject to} \quad x = \phi(1, \pi)$$

- Let $\pi^*(x)$ be gov't best response to x

$$\pi^*(x) = \arg\max_{\pi} w(x, \pi)$$

- Ex-post not optimal to follow Ramsey policy:

$$\pi_{ramsey} \neq \pi^*(x_{ramsey})$$

Example 1: Barro-Gordon

- π: inflation rate

- x: wage inflation set by unions as

$$x = \phi(\rho, \mathbb{E}\pi) = \mathbb{E}\pi$$

- Preferences

$$w(x, \pi) = -\frac{1}{2}\left[(\psi + x - \pi)^2 + \pi^2\right]$$

with inflation bias $\psi > 0$

Example 2: Bank Bailout

- Private agents: bank, lenders, tax payers
- Bank:
  - Raise 1 to finance an investment opportunity
  - Promises to repay R but there is limited liability
  - Chooses riskiness of the project $a \in \{\underline{a}, \bar{a}\}$
- Returns are
  - with probability p_H: $\theta_H(a) = 1 + a\Delta\frac{p_L}{p_H}$ with $\Delta \in (0, 1]$
  - with probability p_L: $\theta_L(a) = 1 - a$
- Regulator can avoid defaults w/ transfer to bank/lenders
  - $\pi(a) \in [\theta_L(a)/R, 1]$: recovery rate after a bad realization
- Social cost of default given by $\psi(b - \pi)$

Example 2: Bank Bailout, cont.

- π: recovery rate
- $x = (a, R)$ where ϕ is characterized by
  - Interest rate R satisfies

$$1 = Rp_H + p_L \left[\rho\pi_c(a) + (1-\rho)\pi_o(a)\right] R$$

  - Bank's incentive compatibility constraint

$$p_H \left(\left(1 + a\Delta \frac{p_L}{p_H} \right) - R \right) \geqslant \underline{U}(\rho)$$

where

$$\underline{U}(\rho) = \max_{a,R} p_H \left(\left(1 + a\Delta \frac{p_L}{p_H} \right) - R \right) \text{ s.t. } \frac{1}{R} = \frac{p_H + p_L(1-\rho)}{1 - p_L \rho (1-a)}$$

- Regulator's preferences:
  - value of lenders + tax-payers net of default costs

$$w(x, \pi) = -1 + p_H R + p_L(1-a) - p_L \psi R \max\{1-\pi, 0\}$$

Static Problem

The optimal regulation solves

$$W_0(\rho) = \max_{\pi_c, \pi_o, x} \rho w(x, \pi_c) + (1-\rho) w(x, \pi_o)$$

subject to

$$\begin{aligned} x &= \phi(\rho, \rho\pi_c + (1-\rho)\pi_o) \\ \pi_o &= \pi^*(x) \end{aligned}$$

Static Problem

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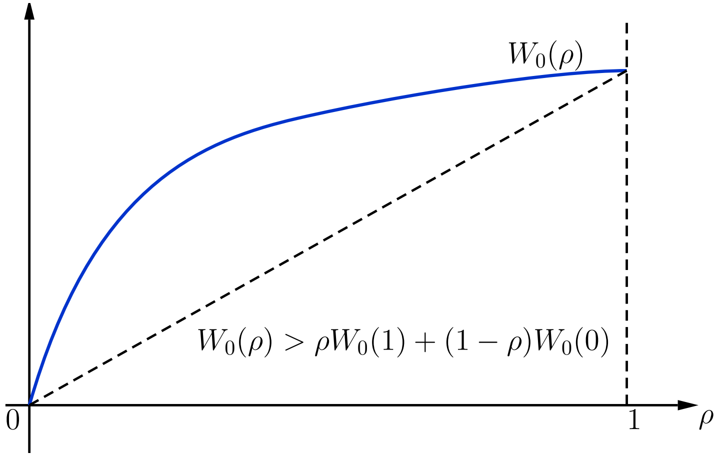
subject to

$$x = \phi(\rho, \rho\pi_c + (1-\rho)\pi_o)$$
$$\pi_o = \pi^*(x)$$

Value for the optimizing type:

$$V_0(\rho) = w(x_0(\rho), \pi^*(x_0(\rho))).$$

Uncertainty Beneficial



Twice Repeated

The optimal regulation solves

$$W(\rho) = \max_{x,\pi_c,\pi_o} \rho\left[(1-\beta)\, w(x,\pi_c) + \beta W_0\left(\rho_c'\right)\right] \\ + (1-\rho)\left[(1-\beta)\, w(x,\pi_o) + \beta W_0\left(\rho_o'\right)\right]$$

subject to

$$x = \phi\left(\rho, \rho\pi_c + (1-\rho)\,\pi_o\right),$$

the incentive compatibility constraint for the optimizing type,

$$(1-\beta_o)\, w(x,\pi_c) + \beta_o V\left(\rho_o'\right) \geqslant (1-\beta_o)\, w(x,\pi^*) + \beta_o V(0),$$

and the law of motion for beliefs,

$$\rho_c' = \begin{cases} 1 & \text{if } \pi_o \neq \pi_c \\ \rho & \text{o/w} \end{cases}, \quad \rho_o' = \begin{cases} 0 & \text{if } \pi_o \neq \pi_c \\ \rho & \text{o/w} \end{cases}.$$

Main Result

Suppose β_o is small enough

- IC for the optimizing type is binding for all ρ

Proposition

- *For ρ close to one there is separation, $\pi_c \neq \pi_o = \pi^*(x)$*
  - *Same outcome as in static setting, $\pi_c = \pi_0$*

- *If β is high enough then it is optimal to pool for some ρ*
  - *Rule is less stringent than in static setting, $\pi_c < \pi_0$*
  - *Most stringent rule consistent with IC for optimizing type*

Pooling vs. Separation

- If there is separation:
  - Current outcome solves static problem and $\pi_c = \pi_0$ and $\pi_o = \pi^* (a_0)$
  - Expected continuation value is $\rho W_0 (1) + (1 - \rho) W_0 (0)$

- If there is pooling:
  - $\pi_o = \pi_c = \pi_{ico} (\rho)$ most stringent rule consistent with IC for optimizing type

$$w (x_{ico}, \pi_{ico}) + \frac{\beta_o}{1 - \beta_o} V (\rho) = w (x_{ico}, \pi^* (x_{ico})) + \frac{\beta_o}{1 - \beta_o} V (0)$$

    where $x_{ico} (\rho) = \phi (\rho, \pi_{ico} (\rho))$
  - Expected continuation value is $W_0 (\rho)$

Pooling vs. Separation

Optimal to pool iff

$$\Delta\omega(\rho) + \frac{\beta}{1-\beta}\Delta\Omega(\rho) \geqslant 0$$

- Dynamic benefits of pooling

$$\Delta\Omega(\rho) \equiv W_0(\rho) - [\rho W_0(1) + (1-\rho) W_0(0)]$$

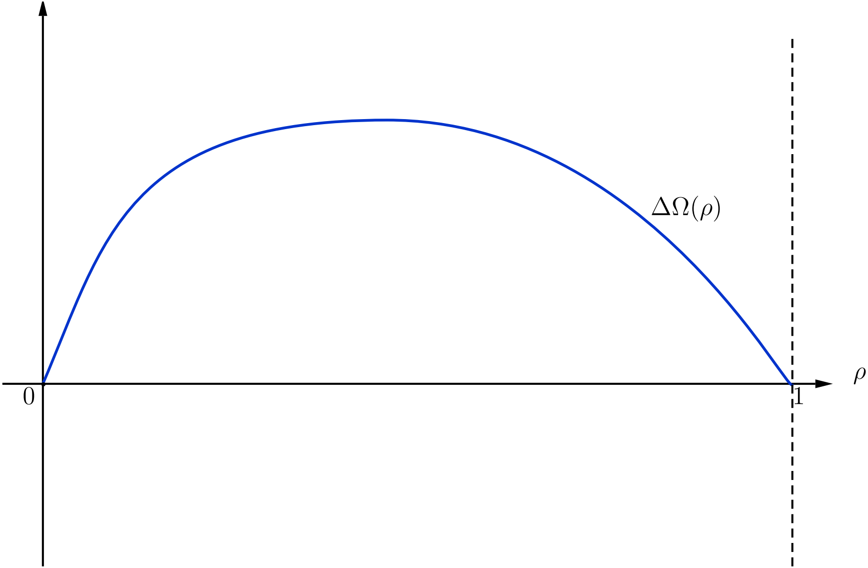
  - Always positive as uncertainty beneficial

- Static benefits of pooling

$$\Delta\omega(\rho) \equiv w(x_{ico}(\rho), \pi_{ico}(\rho)) - W_0(\rho)$$

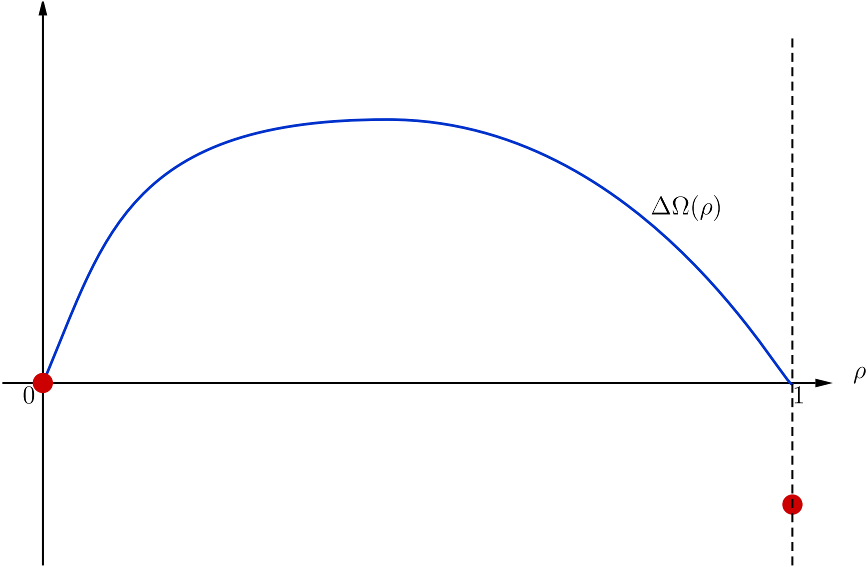
  - Pro: Optimizing type tougher policy
  - Con: Commitment type more lenient policy

Dynamic Benefits



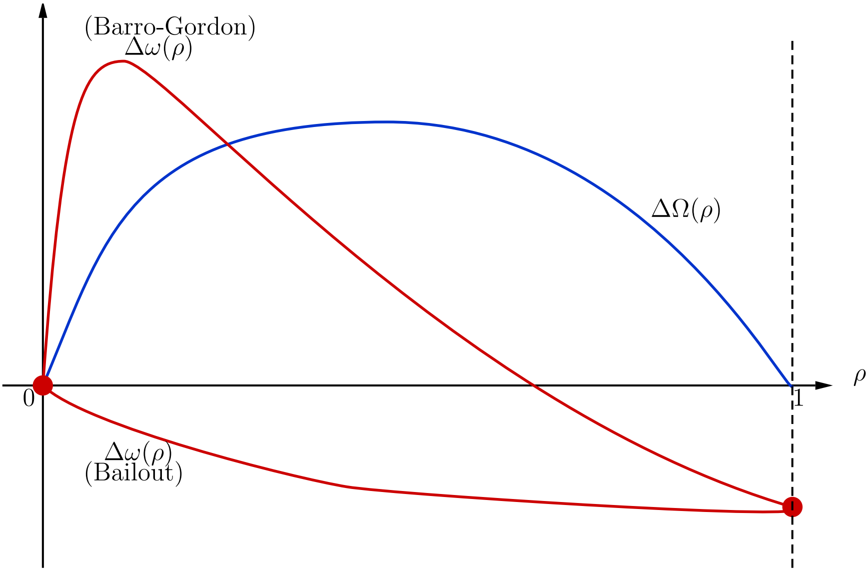
- $\Delta\Omega(\rho) \geqslant 0$ with $\Delta\Omega(0) = \Delta\Omega(1) = 0$

Static Benefits



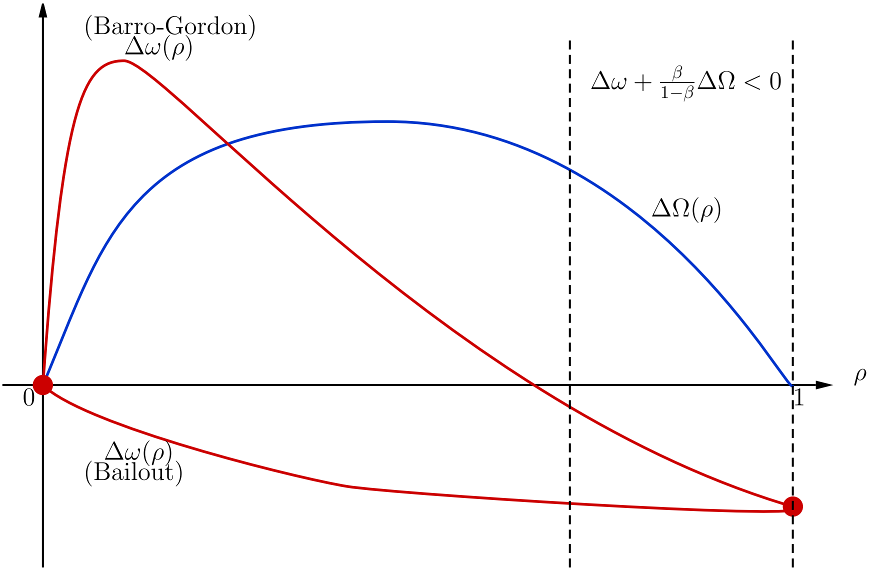
- $\Delta\omega\,(0) = 0$ and $\Delta\omega\,(1) < 0$

Static Benefits: Examples

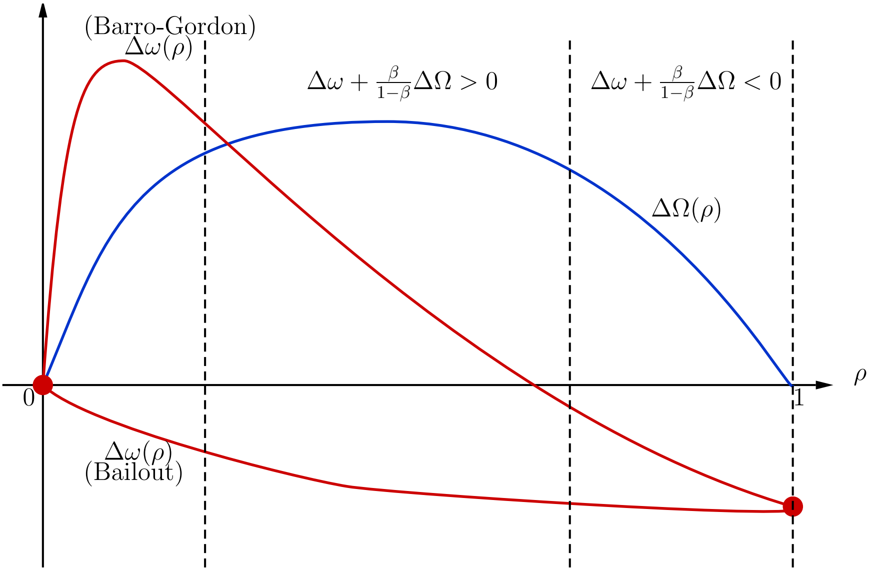


- $\Delta\omega(\rho)$ depends on details for $\rho \in (0,1)$

High Reputation ⇒ Separate w/ Strict Regulation



Intermediate Reputations ⇒ Lenient Rule w/ Pooling



In Detailed Examples

Barro-Gordon example:

- There exists $0 < \rho_1 \leqslant \rho_2 < 1$ such that
  - for $\rho \leqslant \rho_1$ it is optimal to pool
  - for $\rho > \rho_2$ it is optimal to separate
  - for $\rho \in (\rho_1, \rho_2]$ optimizing type mixes

Bailout example:

- There exists $0 < \rho_1 < \rho_2 < 1$ such that
  - for $\rho \leqslant \rho_1$ it is optimal to separate
  - for $\rho \in (\rho_1, \rho_2]$ it is optimal to pool
  - for $\rho > \rho_2$ it is optimal to separate

Role for Opaque Rules

- When regulator's type known: ability to easily monitor policy maker actions supports better outcomes
  - Provide incentives to regulators not to deviate
  - Avoid punishment on path
  - Atkeson-Chari-Kehoe (2007) and Piguillem-Schneider (2017)

- When regulator's type uncertain: opaque rules are optimal help to preserve uncertainty
  - Want rules hard to monitor (hard to detect deviation)
  - Complicated rules contingent on irrelevant contingencies

Optimal Transparency

- Suppose private agents cannot observe π
- Observe a signal $\tilde{\pi} = \pi + \varepsilon$ where $\varepsilon \sim N\left(0, \sigma_\varepsilon^2\right)$
- Planner chooses σ_ε^2 as part of the optimal rule design
- The law of motion for beliefs is

$$\rho'(\tilde{\pi}, \rho) = \frac{\rho \Pr(\tilde{\pi}|\pi_c)}{\rho \Pr(\tilde{\pi}|\pi_c) + (1-\rho)\Pr(\tilde{\pi}|\pi_o)}$$
$$= \frac{\rho g(\tilde{\pi} - \pi_c|\sigma_\varepsilon)}{\rho g(\tilde{\pi} - \pi_c|\sigma_\varepsilon) + (1-\rho) g(\tilde{\pi} - \pi_o|\sigma_\varepsilon)}$$

Planner's Problem

$$\max_{x,\pi_c,\pi_o,\sigma_\varepsilon} \rho \left[w(x,\pi_c) + \frac{\beta}{1-\beta} \int W\left(\rho'(\pi_c+\varepsilon,\rho)\right) g(\varepsilon|\sigma_\varepsilon)\, d\varepsilon \right]$$
$$+ (1-\rho) \left[w(x,\pi_o) + \frac{\beta}{1-\beta} \int W\left(\rho'(\pi_o+\varepsilon,\rho)\right) g(\varepsilon|\sigma_\varepsilon)\, d\varepsilon \right]$$

subject to

$$x = \phi(\rho, \rho\pi_c + (1-\rho)\pi_o),$$

$$w(x,\pi_o) + \frac{\beta_o}{1-\beta_o} \int V\left(\rho'(\pi_o+\varepsilon,\rho)\right) g(\varepsilon|\sigma_\varepsilon)\, d\varepsilon \geqslant$$
$$\geqslant w(x,\pi) + \frac{\beta_o}{1-\beta_o} \int V\left(\rho'(\pi+\varepsilon,\rho)\right) g(\varepsilon|\sigma_\varepsilon)\, d\varepsilon \quad \forall\pi$$

and

$$\rho'(\tilde{\pi},\rho) = \frac{\rho g(\tilde{\pi}-\pi_c|\sigma_\varepsilon)}{\rho g(\tilde{\pi}-\pi_c|\sigma_\varepsilon) + (1-\rho) g(\tilde{\pi}-\pi_o|\sigma_\varepsilon)}$$

Opaque Rules Are Optimal

Proposition

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- *If it is optimal to separate then* $\sigma_\varepsilon > 0$

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- If optimal to pool: $\pi_o = \pi_c$, then $\rho' = \rho$ and choose $\sigma_\varepsilon = 0$ to relax IC for optimizing type
  - same logic as in ACK
- If optimal to separate:
  - Spse for contradiction $\sigma_\varepsilon = 0 \Rightarrow \rho' \in \{0, 1\}$ and $\pi_o = \pi^*(x)$
  - Can support same policies by choosing $\sigma_\varepsilon = \infty \Rightarrow \rho' = \rho$
  - Since $W(\rho) > \rho W(1) + (1-\rho) W(0)$ have an improvement. Contradiction.
  - (The optimal σ_ε can be interior to induce optimizing type to choose policy better than static best response.)

Random Rules are Optimal

- Allow for randomization in π_c
  - Make rules contingent on irrelevant details

Proposition

For ρ close to 1 it is optimal to mix.

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Proposition

For ρ close to 1 it is optimal to mix.

- Spse optimal to separate and no randomization. Deviation

$$\pi_c^{dev} = \begin{cases} \pi_c & \text{with pr } 1-\varepsilon \\ \pi_o & \text{with pr } \varepsilon \end{cases} \Rightarrow \rho' = \begin{cases} \frac{\rho\varepsilon}{\rho\varepsilon+(1-\rho)} > 0 & \text{if } \pi = \pi_o \\ 1 & \text{if } \pi = \pi_c \end{cases}$$

  with value $W^{dev}(\varepsilon) - W = [(1-\beta)\Delta\omega'(\varepsilon) + \beta\Delta\Omega'(\varepsilon)]\varepsilon$

- Since $\lim_{\rho\to 1}\lim_{\varepsilon\to 0}\Delta\Omega'(\varepsilon) \to \infty$ while $|\Delta\omega'(\varepsilon)| < M \Rightarrow$ deviation is profitable
- Key inputs: i) $W_0' > 0$ and ii) $\lim_{\rho\to 1}\lim_{\varepsilon\to 0}\partial\rho'/\partial\varepsilon = \infty$

Conclusion

- Study optimal regulation under uncertainty about ability of regulator to commit (resist pressure to deviate ex-post)

- If reputation not too high $\Rightarrow$ lenient rules to preserve uncertainty about regulator's type
  - Most stringent rule such that there is pooling

  Some bailout on path necessary to prevent future risk taking

- Opaque/complicated rules optimal because preserve uncertainty