

Rules without Commitment: Reputation and Incentives

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This Paper

- Rules often proposed as solution to time inconsistency problem
 - Society can credibly impose rules on policy makers
- In reality substantial *uncertainty* about whether policy makers can resist temptation to deviate
- **How to design rules when there is uncertainty about the ability of policy makers to enforce the rule ex-post?**

Our Approach

- *Rule designer* chooses rules (policy recommendation)
 - EU design fin. regulation, gov't chooses central bank's mandate
 - *Policy maker* implement policy
 - Single Resolution Board/ Central banker
 - Policy maker can be one of two (hidden) types
 - Commitment type: always follows rule
 - Optimizing type: chooses policy sequentially
- Reputation = probability policy maker is commitment type
- *Private agents* make decisions given
 - Announced rule
 - Expectations about whether rule will be followed

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- *Private agents* make decisions given
 - Announced rule
 - Expectations about whether rule will be followed
 - **Study optimal rule design problem**
 - **Provide incentives to private agents and policy makers**

More Lenient Rules to Preserve Reputation

- If reputation low: preserve uncertainty over time
 - Most stringent rule that will be followed by optimizing type
 - Rules more lenient than in static setting
 - Uncertainty about policy maker's type beneficial
 - Decreasing returns to reputation
- If reputation high: separation
 - Same rule as in static setting
 - Static benefits of separation outweighs dynamic losses (uncertainty beneficial)

Role for Opaque Rules

- When policy maker's type known:
Transparent rules optimal
 - Ability to monitor policy makers supports better outcomes
 - Atkeson-Chari-Kehoe (2007) and Piguillem-Schneider (2017)
 - When policy maker's type uncertain and reputation high:
Opaque rules optimal
 - Want rules hard to monitor (hard to detect deviation)
 - Complicated rules contingent on irrelevant contingencies
- Preserve uncertainty w/out static losses associated w/ leniency

Related Literature

- Rules vs. discretion
 - Athey et al. (2007), Halac and Yared (2014, 2017, 2019), Azzimonti et al. (2016)
- Time consistent policy
 - Barro and Gordon (1983), Chari and Kehoe (1990)
- Reputation and policy
 - Barro (1986), Backus and Driffil (1985), Phelan (2006)
 - Cole et al. (1995), Lu (2013), Lu et al. (2016), Dovic and Kirpalani (2020)
- Uncertainty beneficial
 - Marinovic and Szydlowski (2019), Asriyan et al. (2019), Bond and Zheng (2019)

Policy Game

Environment

- $t = 0, 1, \dots, T$
- Rule designer
- Private agents
- Policy maker
 - Commitment type
 - Optimizing type
- Common prior of commitment type is ρ (reputation)

Timing and Actions

- State is reputation ρ
- Rule designer announces a rule
 - A rule is a policy recommendation $\pi_r \in [\underline{\pi}, \bar{\pi}]$
- Private agents take their action x
- Policy maker chooses policy π
 - Commitment type always follows recommendation: $\pi = \pi_r$
 - Optimizing type chooses its policy sequentially : $\pi \in [\underline{\pi}, \bar{\pi}]$

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- Social welfare function: $w(x, \pi)$

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Timing and Actions

- State is reputation ρ
- Rule designer announces a rule
 - A rule is a policy recommendation $\pi_r \in [\underline{\pi}, \bar{\pi}]$
- Private agents take their action $x = \phi(\mathbb{E}\pi)$, $\phi' < 0$
- Policy maker chooses policy π
 - Commitment type always follows recommendation: $\pi = \pi_r$
 - Optimizing type chooses its policy sequentially : $\pi \in [\underline{\pi}, \bar{\pi}]$
- Social welfare function: $w(x, \pi)$, $w_x > 0$, $w_{x\pi} < 0$
- $\pi < \pi' \iff \pi$ more stringent than π'

Time Inconsistency

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

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

- Normalize $\pi_{\text{ramsey}} = \underline{\pi}$
- Let $\pi^*(x)$ be best response to x

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

- Assume that the Ramsey policy is not time-consistent:

$$\pi_{\text{ramsey}} = \underline{\pi} < \pi^*(x_{\text{ramsey}})$$

Examples

- Barro-Gordon ◀ Barro-Gordon
 - $-x$: wage inflation set by unions
 - π : inflation rate

- Bank-Bailout a la Kareken-Wallace ◀ Bailout
 - x : bankers' effort
 - π : bailout to lenders

- Capital taxation ...

Benefits of Lenient Rules

Statically Optimal Rule

The optimal rule solves

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

subject to

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

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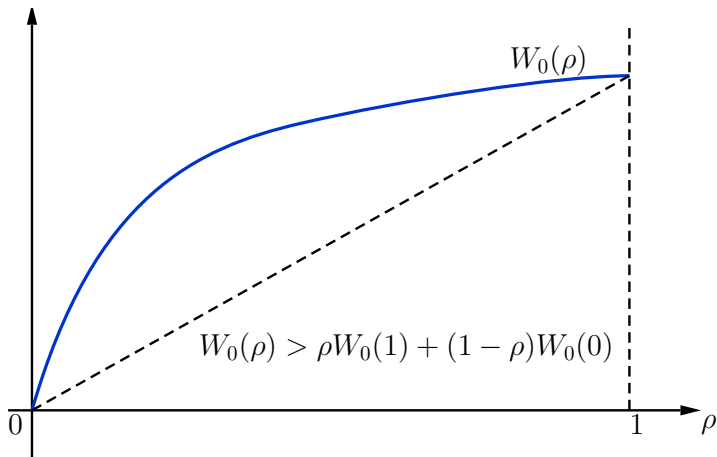
subject to

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

- Solution: $(\pi_o(\rho), x_0(\rho))$
- Assume that $\pi_o(\rho) = \underline{\pi}$ (holds in our examples)
- Value for the optimizing type:

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

Uncertainty Beneficial



Sufficient condition: $W_0(\rho)$ is concave

When is Uncertainty Beneficial?

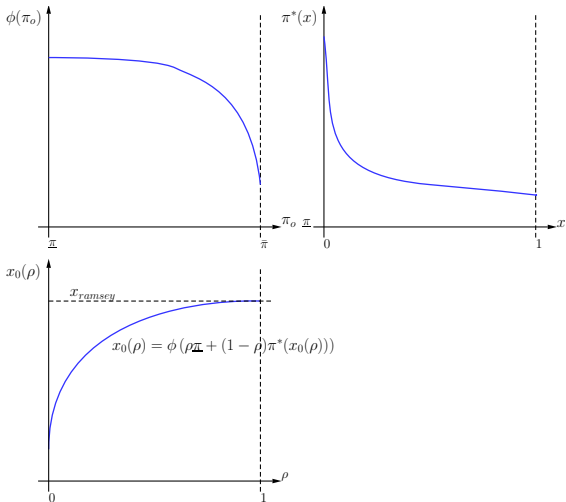
Sufficient conditions for $W_0(\rho)$ to be concave

- **Concave preferences:** $w(x, \pi)$ jointly concave
- **Strategic complementarities decreasing in reputation:**
 - $w_\pi(x, \pi)$ is convex $\Rightarrow \pi^*(x)$ is convex
 - ϕ is concave
- $1 > \pi_x^*(x)\phi'(\pi) > \underline{A}$
- $\pi_c(\rho) = \underline{\pi}$

Satisfied by a large class of economies including both examples

Intuition: Decreasing returns to reputation

- Strategic complementarities decreasing in reputation
⇒ increase in reputation increases x more when reputation is low



Intuition: Decreasing returns to reputation

- Strategic complementarities decreasing in reputation
⇒ increase in reputation increases x more when reputation is low
- Concave preferences
⇒ increase in x more valuable when away from Ramsey outcome
- Together ⇒ $w(x(\rho), \underline{\pi})$ and $w(x(\rho), \pi^*(x(\rho)))$ are concave in ρ
- Technical condition
⇒ $W_0(\rho) = \rho w(x(\rho), \underline{\pi}) + (1 - \rho)w(x(\rho), \pi^*(x(\rho)))$ is concave

Dynamically Optimal Rule (Twice Repeated)

The optimal rule solves

$$W(\rho) = \max_{x, \pi_c, \pi_o} \rho [w(x, \pi_c) + \beta W_0(\rho'_c)] \\ + (1 - \rho) [w(x, \pi_o) + \beta W_0(\rho'_o)]$$

subject to

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

the incentive compatibility constraint for the optimizing type,

$$w(x, \pi_o) + \beta_o V_0(\rho'_o) \geq w(x, \pi^*(x)) + \beta_o V_0(0),$$

and the law of motion for beliefs,

$$\rho'_c = \begin{cases} 1 & \text{if } \pi_o \neq \pi_c \\ \rho & \text{if } \pi_o = \pi_c \end{cases}, \quad \rho'_o = \begin{cases} 0 & \text{if } \pi_o \neq \pi_c \\ \rho & \text{if } \pi_o = \pi_c \end{cases}.$$

Optimizing Type Never Randomizes

- Suppose optimizing type mixes between rule and best response
- This is welfare dominated by case in which it follows rule for sure
- Two reasons
 - Introduces volatility in posterior without affecting its mean
 - Lowers continuation value since uncertainty beneficial
 - Tightens the optimizing type's incentive constraint
 - Since w is concave in π and V_0 is concave in ρ

Main Result

Suppose β_o is small enough

- Ramsey outcome is not IC for the optimizing type for all ρ

Proposition

Under conditions for which uncertainty is beneficial:

- *For ρ close to 1, it is optimal to separate, $\pi_c \neq \pi_o = \pi^*(x)$*
 - *Same outcome as in static setting, $\pi_c = \underline{\pi}$*
- *For ρ close to 0, it is optimal to pool*
 - *Rule is less stringent than in static setting, $\pi_c = \pi_o > \underline{\pi}$*
 - *Most stringent rule consistent with IC for optimizing type*

Pooling vs. Separation

- If there is separation:
 - First period outcome solves static problem:
 - $\pi_c = \pi_o = \underline{\pi}$ and $\pi_o = \pi^*(x_o)$
 - Expected continuation value is $\rho W_o(1) + (1 - \rho) W_o(0)$
- If there is pooling:
 - $\pi_o = \pi_c = \pi_{ico}(\rho)$ most stringent rule consistent with IC for optimizing type

$$w(x_{ico}, \pi_{ico}) + \beta_o V_o(\rho) = w(x_{ico}, \pi^*(x_{ico})) + \beta_o V_o(0)$$

where $x_{ico}(\rho) = \phi(\pi_{ico}(\rho))$

- Expected continuation value is $W_o(\rho)$

Pooling vs. Separation

Define

- Dynamic benefits of pooling

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

- Always positive since uncertainty is beneficial

- Static benefits of pooling

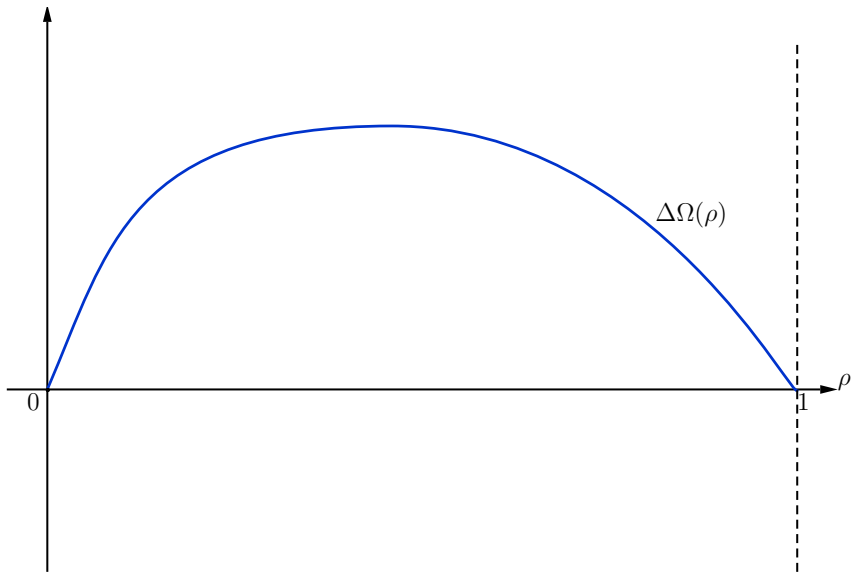
$$\Delta\omega(\rho) \equiv w(x_{ico}(\rho), \pi_{ico}(\rho)) - W_0(\rho)$$

- + Optimizing type follows tougher policy (closer to Ramsey)
- - Commitment type follows lenient policy (further from Ramsey)

Optimal to pool iff

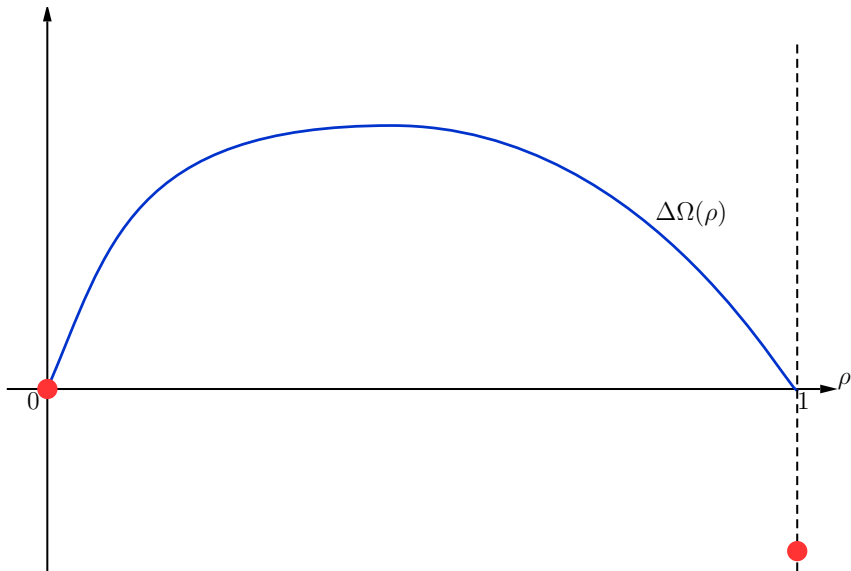
$$\Delta\omega(\rho) + \beta\Delta\Omega(\rho) \geq 0$$

Dynamic Benefits



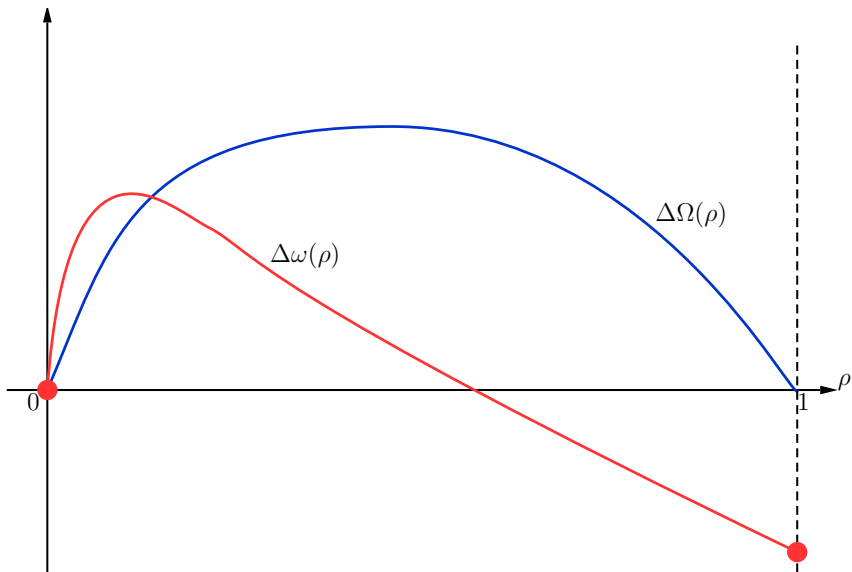
- $\Delta\Omega(\rho) \geq 0$ with $\Delta\Omega(0) = \Delta\Omega(1) = 0$

Static Benefits



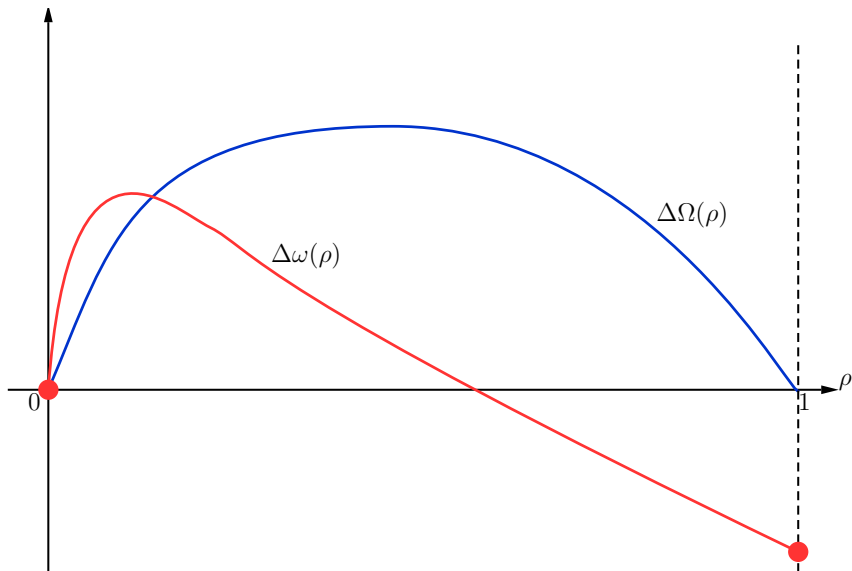
- $\Delta\omega(0) = 0$ and $\Delta\omega(1) < 0$

Static Benefits

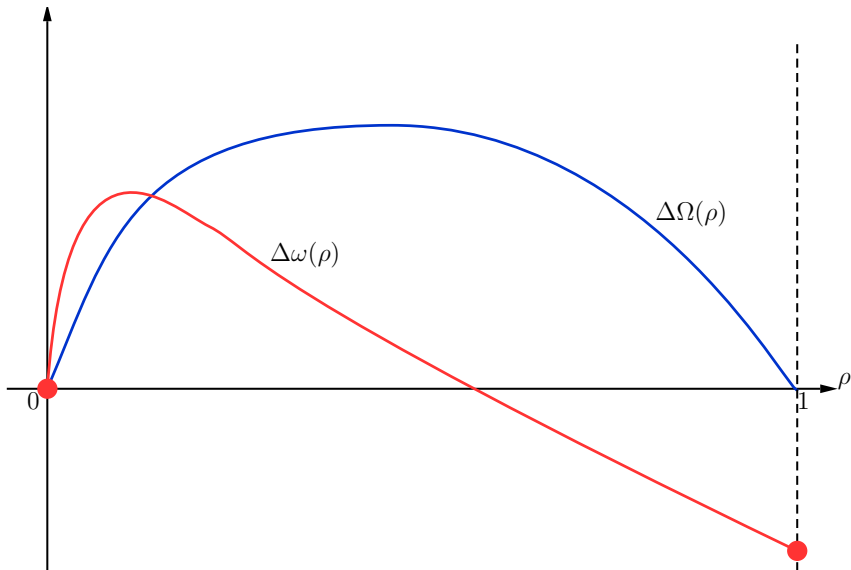


- $\Delta\omega(\rho) > 0$ for ρ close to zero

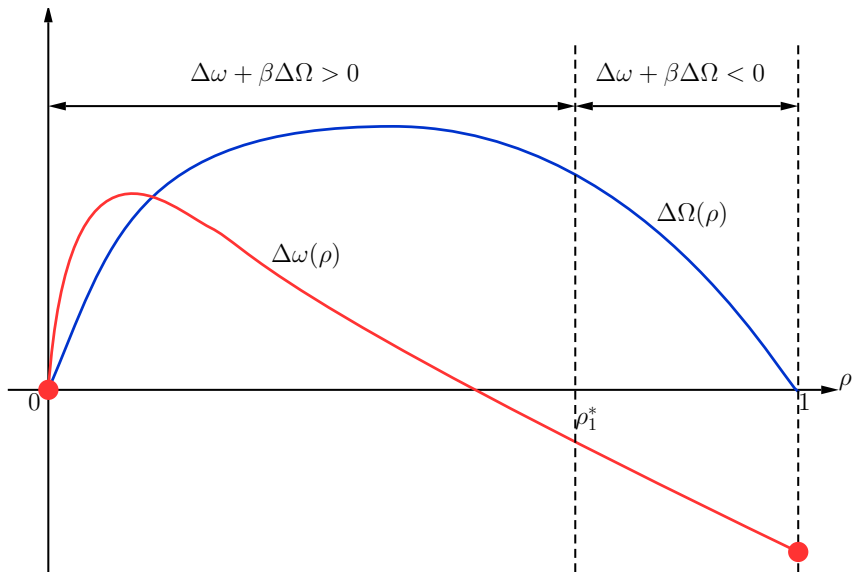
Low Reputation \Rightarrow Lenient Rule with Pooling



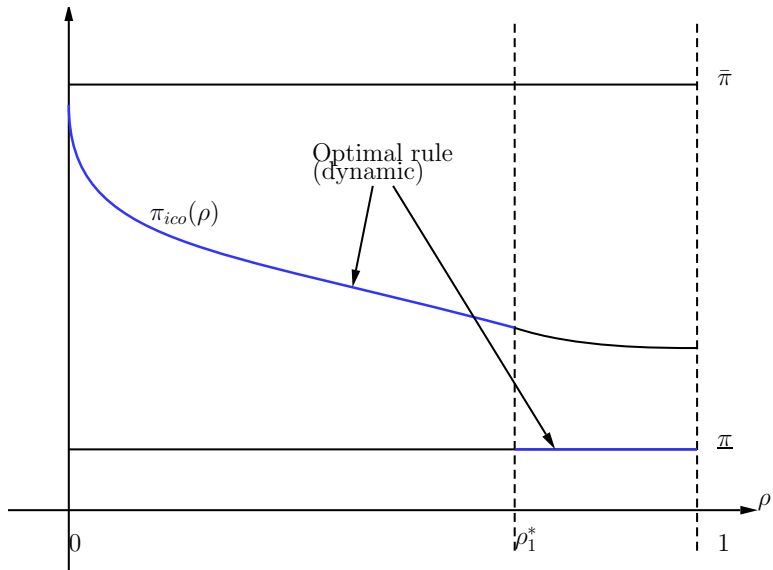
High Reputation \Rightarrow Stringent Rule with Separation



In Barro-Gordon model: Cutoff Rule



Optimal Dynamic Rule



Result in the Context of our Two Examples


In the bailout example

- $\pi_{\text{ramsey}} = \pi_0 = \underline{\pi} = 0$
 - Statically optimal rule is a strict no-bailout policy
- Proposition 1: if reputation low allow for partial bailouts
 - On path-bailouts *necessary* to discipline future risk taking

In the Barro-Gordon example

- $\pi_{\text{ramsey}} = \pi_0 = \underline{\pi} = 0$
 - Statically optimal rule is strict zero inflation target
- Proposition 1: if reputation low relaxed target is optimal

Extensions

- Insights from two period model extend to any finite horizon
 - Including the limit as $T \rightarrow \infty$ 
- We also consider an extension in which the rules are “sticky”
 - Rule can be revised with probability $\alpha < 1$
 - As $T \rightarrow \infty$ main results unchanged
- Optimal rules when rule designer can commit
 - Same outcome for sufficiently high or low levels of reputation
 - When $T > 1$, rule designer also suffers from time inconsistency problem for intermediate values of reputation
 - Rule designer in period t wants to impose stringent rules in $t + 1$
 - Rule designer in period $t + 1$ wants more lenient rules

Key Role of Private Agents

- It is because of the rule designer's desire to influence the actions of these private agents that uncertainty may be beneficial
- Without private agents
 - Uncertainty is never beneficial
 - Always want to learn type of the policy maker

Benefits of Opaque Rules

Role for Opaque Rules

A rule is

- Transparent if deviations are easy to detect
- Opaque if deviations are hard detect

When policy maker's type known:

- Transparent rules optimal because enable better monitoring
 - Provide incentives to policy-makers to not deviate
 - Avoid punishment on path

When policy makers's type uncertain and reputation high:

- Opaque rules optimal because they help preserve uncertainty
 - Want rules that are hard to monitor (hard to detect deviation)
 - Complicated rules that have irrelevant contingencies

Optimal Degree of Monitoring

- Suppose private agents cannot observe π
- Observe a signal $\tilde{\pi} = \pi + \varepsilon$ where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$
- Rule designer chooses σ_ε^2 as part of the optimal rule design
 - Rule is transparent if $\sigma_\varepsilon^2 = 0$
 - Rule is opaque if $\sigma_\varepsilon^2 > 0$

▶ Rule Designer's problem

Opaque Rules Are Optimal for High Reputation

Proposition

- *For ρ close to zero, it is optimal to pool and set σ_ε to zero;*
- *For ρ close to 1, it is optimal to separate and set $\sigma_\varepsilon > 0$*

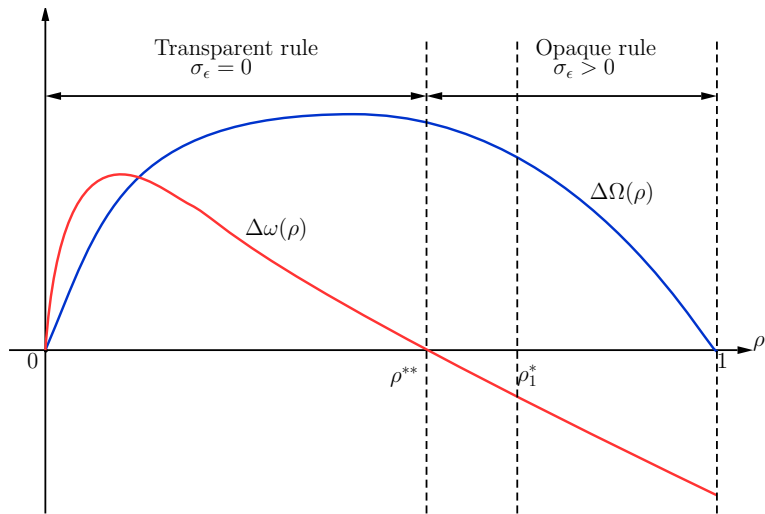
Opaque Rules Are Optimal for High Reputation

Proposition

- For ρ close to zero, it is optimal to pool and set σ_ϵ to zero;
- For ρ close to 1, it is optimal to separate and set $\sigma_\epsilon > 0$

- Low $\rho \Rightarrow$ optimal to pool:
 - $\sigma_\epsilon = 0$ to relax IC for optimizing type
 - Same logic as in ACK
- High $\rho \Rightarrow$ optimal to separate
 - Spse for contradiction $\sigma_\epsilon = 0 \Rightarrow \rho' \in \{0, 1\}$ and $\pi_o = \pi^*(x)$
 - Can support same policies by choosing $\sigma_\epsilon = \infty \Rightarrow \rho' = \rho$
 - Since $W(\rho) > \rho W(1) + (1 - \rho) W(0)$ have an improvement. Contradiction.

Opaque Rules Are Optimal for High Reputation



With opaque rules no trade-off b/w dynamic and static benefits

Optimal Tenure

- Replacing policy maker:
 - Get static benefits of separation without dynamic losses
- Equivalent to choosing a perfectly opaque rule with $\sigma_\varepsilon = \infty$
- Rule designer's problem as before w/ restriction $\sigma_\varepsilon \in \{0, \infty\}$

Proposition

*In the Barro-Gordon model, there exists $\rho^{**} < \rho_1^*$ such that:*

- *For $\rho \leq \rho^{**}$ do not terminate and pool*
- *For $\rho \geq \rho^{**}$ terminate and separate*

Random Rules are Optimal for High Reputation

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

Proposition

In our two examples:

- *For ρ close to 0, a deterministic rule is optimal*
 - $\pi_c = \pi_{ico}(\rho)$ *with probability one*
- *For ρ close to 1, it is optimal to have stochastic rules.*

Random Rules are Optimal for High Reputation, cont.

- Consider ρ close to 1
- Spse optimal to separate and no randomization
- Consider the perturbation

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

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

- Since $\lim_{\rho \rightarrow 1} \lim_{\varepsilon \rightarrow 0} \Delta\Omega'(\varepsilon) \rightarrow \infty$ while $|\Delta\omega'(\varepsilon)| < M$
 \Rightarrow the perturbation is profitable
- Key inputs
 - $W'_0 > 0$
 - $\lim_{\rho \rightarrow 1} \lim_{\varepsilon \rightarrow 0} \partial\rho'/\partial\varepsilon = \infty$

Conclusion

- Optimal design of rules when uncertain about whether policy maker follows the rule ex-post
- If reputation low optimal to design lenient rules which help preserve uncertainty
- Opaque/complicated rules desirable as they preserve reputation without the static costs of leniency

ADDITIONAL SLIDES

Example 1: Barro-Gordon

- π : inflation rate
- $\tilde{\chi}$: wage inflation set by unions as

$$\tilde{\chi} = \phi(\mathbb{E}\pi) = \mathbb{E}\pi$$

and $\chi = -\tilde{\chi}$

- Preferences

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

with inflation bias $\psi > 0$

Example 2: Bank-Bailout a la Kareken-Wallace

- Private agents: bank, lenders
- Bank:
 - Raise 1 to finance an investment opportunity
 - Promises to repay R but there is limited liability
 - Chooses effort e , disutility $v(e)$ w/ $v' > 0$, $v'' > 0$
- Returns from investment are
 - R_H with probability $p(e)$ w/ $p' > 0$, $p'' < 0$
 - 0 with probability $1 - p(e)$
- Social cost of default given by $\psi(1 - \pi)$
- Policy maker can avoid defaults w/ transfer to bank/lenders
 - $\pi \in [0, 1]$: recovery rate after a bad realization
 - Taxation cost associated with transfers $c(\pi)$, $c' \geq 0$, $c'' \geq 0$

Example 2: Bank-Bailout a la Kareken-Wallace, cont.

- π : recovery rate

- $x = e$,

$$\phi(\mathbb{E}\pi) = \arg \max_e -v(e) + p(e)(R_H - R(e))$$

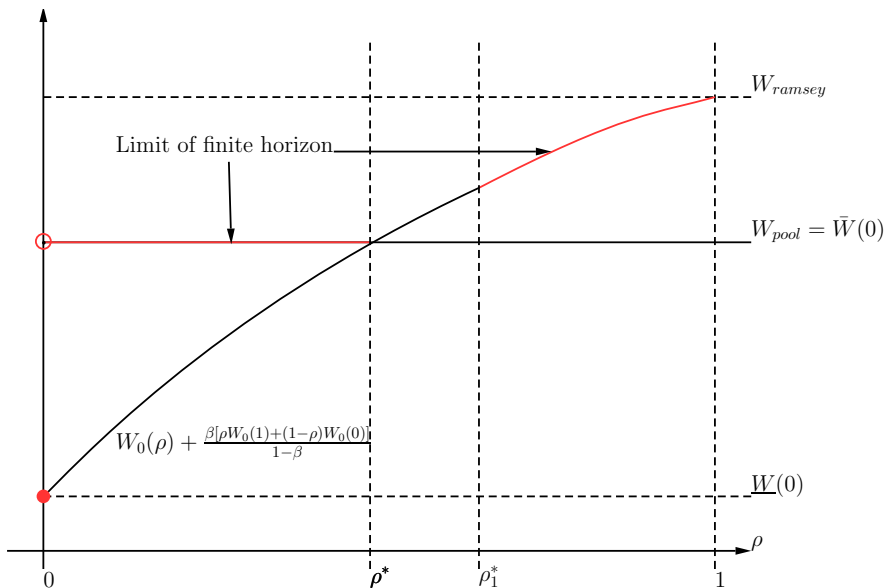
subject to

$$R(e) = \frac{1 - (1 - p(e))\mathbb{E}\pi}{p(e)}$$

- Social welfare function

$$w(x, \pi) = -v(x) + p(x)R_H + (1 - p(x))\psi(1 - \pi) - c(\pi)$$

Infinite Horizon



Rule Designer's Problem

$$\max_{x, \pi_c, \pi_o, \sigma_\varepsilon} \rho \left[w(x, \pi_c) + \beta \int W_0(\rho'(\pi_c + \varepsilon, \rho)) g(\varepsilon | \sigma_\varepsilon) d\varepsilon \right] \\ + (1 - \rho) \left[w(x, \pi_o) + \beta \int W_0(\rho'(\pi_o + \varepsilon, \rho)) g(\varepsilon | \sigma_\varepsilon) d\varepsilon \right]$$

subject to

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

$$w(x, \pi_o) + \beta_o \int V_0(\rho'(\pi_o + \varepsilon, \rho)) g(\varepsilon | \sigma_\varepsilon) d\varepsilon \geq \\ \geq w(x, \pi) + \beta_o \int V_0(\rho'(\pi + \varepsilon, \rho)) g(\varepsilon | \sigma_\varepsilon) d\varepsilon \quad \forall \pi$$

and

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