Monetary Stabilization of a Multi-Sector Economy: Adding Words to Action ?

Antoine Camous[1] Dmitry Matveev[2]

[1]Banque de France

[2]Bank of Canada

July 11, 2025

Disclaimer

The views expressed in this paper are solely those of the authors, and no responsibility for them should be attributed to the Bank of Canada, the Banque de France or the Eurosystem.

This project

1. **Monetary stabilization with sectoral shocks**
   - e.g. lockdowns, networks, supply chain disruptions, energy, etc.
   - Multi-sector NK environment, scope for monetary stabilization ...
     (e.g. *divine coincidence*)
     ... but outcome not *first best* because of sectoral price dispersion

2. **Communication as an additional instrument?**
   - Coordination with policy instrument?
   - Optimal communication and incentives to misreport ?
   - Interplay credibility and reputation?

⇒ **Can a CB leverage private information to improve economic stabilization ?**

Key messages

Benefits to strategically (mis)report information?

1. **Optimal communication** under commitment...

   ... report aggregate (and sectoral shocks) truthfully

2. **Sequential incentives to misreport** sectoral shocks ...

   ... to improve economic stabilization

   ... but complex control of beliefs with Bayesian agents

3. **Reputation as a capital stock** ...

   ... provides incentives for effective strategic communication

   ... at the cost of long-run degraded stabilization

Literature

1. **Monetary stabilization with sectoral shocks**
   - Woodford (2003), Aoki (2001), Benigno (2004)
   - Afrouzi and Bhattarai (2023), Guerrieri, Lorenzoni, Straub, and Werning (2021), LaO and Tahbaz-Salehi (2022), Rubbo (2023)
2. **Central bank communication**
   - Social value of public information: Morris and Shin (2002)
   - Transparency, e.g., Ou, Zhang, and Zhang (2022)
   - Bayesian Persuasion, e.g., Tamura (2016,2018), Gati (2022), Herbert (2022)
3. **Adverse selection and reputation**

   Kreps and Wilson (1982), Backus and Driffill (1985), Benabou and Laroque (1992), Amador and Phelan (2021), Bocola, Dovis, Jrgensen, Kirpalani (2025)

$\Rightarrow$ Discretionary incentives to (mis)report information and effective economic stabilization

Roadmap

1. Environment

- Model and price sytem
- Log-linearized competitive equilibrium
- Timing: asymmetric information and price rigidities
- Monetary Policy as an information control problem

1. Model (static)

Households

$$U(C, L) = \log C - L$$

s.t. $PC = WL + \Pi + T$

Production

- Consumption good is CES of sectoral goods $j \in \{1, 2\}$ elast $\eta \geq 1$
- Sectoral good j is CES of differentiated goods $i \in (0, \frac{1}{2})$ elast $\theta \geq \eta$
- Differentiated good: $Y_{ij} = A_j L_{ij}$ Price setters

Monetary Policy

$$Q = PY$$

1. Price system

- Consumption good and sectoral bundles $\qquad \theta \geq \eta$

$$P = \left[\frac{1}{2}P_1^{1-\eta} + \frac{1}{2}P_2^{1-\eta}\right]^{\frac{1}{1-\eta}} \qquad P_j = \left[\left(\frac{1}{2}\right)^{-1}\int_0^{\frac{1}{2}} P_{ij}^{1-\theta}di\right]^{\frac{1}{1-\theta}}$$

- Differentiated good i in sector j, set price P_{ij}

$$P_{ij}\mathbb{E}_{ij}\left\{\left(\frac{1}{P_j}\right)^{-\theta}\left(\frac{P_j}{P}\right)^{-\eta}\right\} = \mathcal{M}(1-\tau)\mathbb{E}_{ij}\left\{\left(\frac{1}{P_j}\right)^{-\theta-1}\left(\frac{P_j}{P}\right)^{-\eta-1}\frac{Y}{A_j}\right\}$$

where $1-\tau$ offsets firms' mark up $\mathcal{M} = \frac{\theta}{\theta-1}$.

1. Log-linearized comp eqm

Price setting

$$\hat{p}_{ij} = \mathbb{E}_{ij}(\hat{q} - \hat{a}_j)$$

Natural level of output and relative price

$$\hat{y}^n = \frac{\hat{a}_1 + \hat{a}_2}{2} \qquad \hat{p}_R^n = \hat{a}_1 - \hat{a}_2$$

Welfare

$$U \approx -\frac{1}{2}\left[(\hat{y} - \hat{y}^n)^2 + \frac{\eta}{4}(\hat{p}_R - \hat{p}_R^n)^2 + \frac{\theta}{2}\sum_{j\in\{1,2\}} \mathrm{var}_i^j \hat{p}_{ij}\right] + \mathrm{t.i.p.}$$

1. Timing

Nature, **P**rivate **F**irms, and a **M**onetary **A**uthority:

- All **PF** in sector $j \in \{1, 2\}$ *preset* prices $\hat{p}_j^p = 0$, given prior μ.
- **N** draws $\hat{v}^n = (\hat{y}^n, \hat{p}_R^n)$, only observable to **MA**.
- **MA** sends a message m associated to $\hat{v}^n = (\hat{y}^n, \hat{p}_R^n)$, and sets policy instrument $\hat{q}$.
- A share $1 - \alpha_j$ of **PF** in sector $j \in \{1, 2\}$ *resets* prices $\hat{p}_j^r$, given posterior beliefs $\tilde{\mu} = \mu | m, \hat{q}$.
- Production, aggregation and output $\hat{y}$ are realized.

NB: (i) rigidity α_j (ii) information, communication m and beliefs $\tilde{\mu}$

An information control problem

1. Express **prices and welfare** as a function of **beliefs** $\tilde{\mu}$ **and policy** $\hat{q}$, e.g.

$$\hat{p}_j^r = \hat{q} - \mathbb{E}_{\tilde{\mu}} \hat{y}^n \pm \frac{1}{2} \mathbb{E}_{\tilde{\mu}} \hat{p}_R^n$$

2. Set **policy** $\hat{q}$ **optimally** as a function of **posterior beliefs** $\tilde{\mu}$

$$\hat{q}(\tilde{\mu}) = \text{argmax } \mathbb{E}_{\tilde{\mu}} U(\hat{v}^n, \hat{q}, \mathbb{E}_{\tilde{\mu}} \hat{v}^n)$$

   (benevolent, time consistent, without loss of generality*)

$\Rightarrow$ Study the **optimal control of information**, i.e., posterior beliefs $\tilde{\mu}$

1. Economic Environment GoTo

2. **Optimal Communication Policy** GoTo

   - A Bayesian persuasion problem, i.e, commitment
   - Incentives to deviate, i.e., credibility?

3. Discretionary Communication with Reputation GoTo

2. Optimal Communication - Commitment

A Bayesian Persuasion Problem

The **optimal provision of information** $\varphi : \mathbb{R}^2 \to \Delta(M)$ solves

$$\max_{\varphi} \ \mathbb{E}U(\hat{v}^n, \hat{q}, \mathbb{E}_{\tilde{\mu}}\hat{v}^n)$$

subject to:

- firms update beliefs $\hat{\mu}$ rationally upon receiving m

$$\mathbb{E}_{\tilde{\mu}}\hat{v}^n = \mathbb{E}_{\varphi}\left(\hat{v}^n | m\right)$$

- the instrument $\hat{q}$ is set optimally according to $\tilde{\mu}$

$$\hat{q} = \hat{q}\left(\mathbb{E}_{\tilde{\mu}}\hat{v}^n\right)$$

2. Optimal Communication

Proposition

There is $\Gamma \in \mathbb{R}$ - function of (η, θ) and (α_1, α_2) - such that the optimal provision of information satisfies:

- If $\Gamma > 0$, complete and truthful release of all information,i.e.,

$$\varphi(\hat{v}^n) = \hat{v}^n$$

- If $\Gamma < 0$, partial release of information, i.e.,

$$\varphi(\hat{v}^n) = \hat{y}^n$$

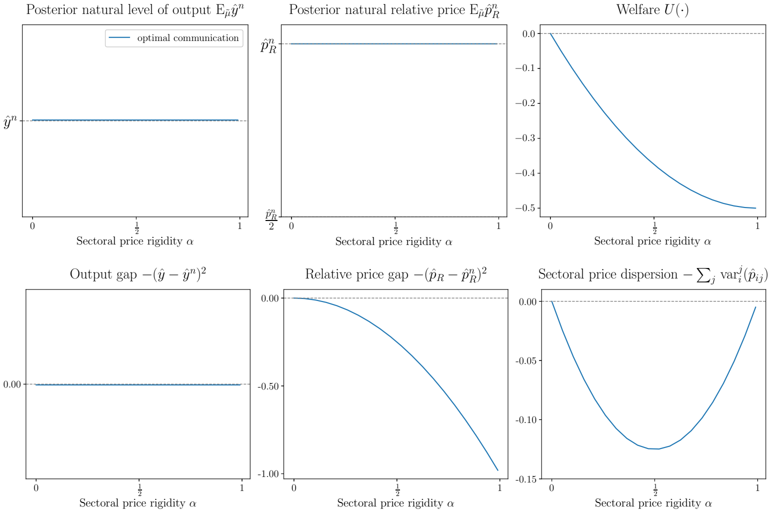
- If $\alpha_1 = \alpha_2$, then

$$\Gamma > 0 \;\Leftrightarrow\; \frac{\theta}{\eta} \leq \frac{1+\alpha}{\alpha}$$

Focus: $\Gamma > 0$ and $\alpha_1 = \alpha_2$

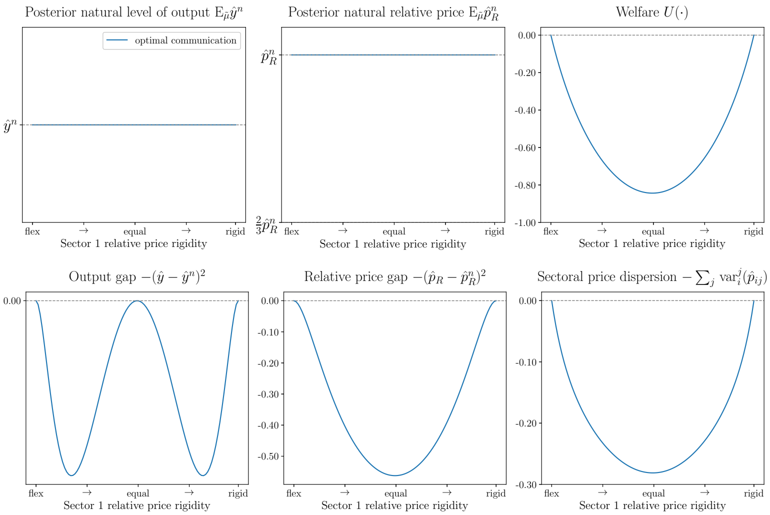
GoTo

2. Commitment with $\alpha_1 = \alpha_2$, $\Gamma > 0$



Note: $\hat{y}^n = 0$ and $\hat{p}^n_R = \hat{a}_1 - \hat{a}_2 > 0$

2. Commitment with $\alpha_1 \neq \alpha_2$, $\Gamma > 0$



Note: $\hat{y}^n > 0$ and $\hat{p}_R^n = \hat{a}_1 - \hat{a}_2 > 0$

2. Incentives to deviate

Opportunistic report of information, $\Gamma > 0$

Given $\hat{v}^n$,

$$m = \text{argmax } U\left(\hat{v}^n, \hat{q}(\tilde{\mu}), \mathbb{E}_{\tilde{\mu}}\hat{v}^n\right)$$

subject to perfect control of beliefs (credulous **PF**)

$$\mathbb{E}_{\tilde{\mu}}\hat{v}^n = m$$

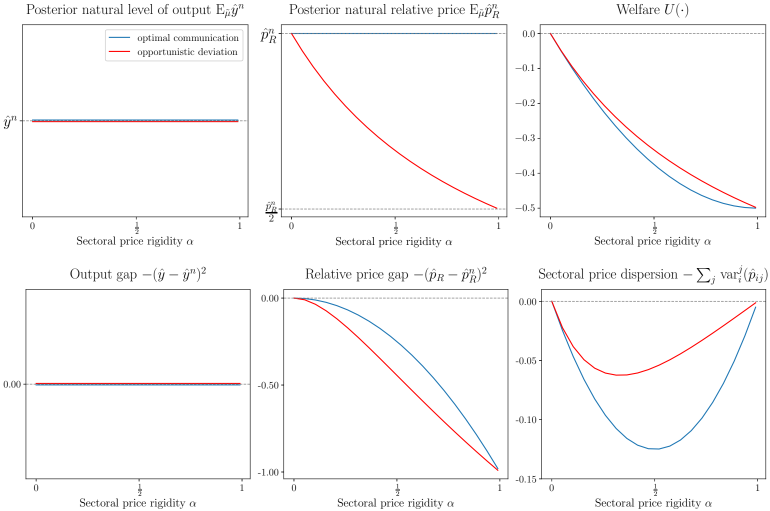
Proposition. **Opportunistic** report of information

$$m = \begin{pmatrix} m_1 \\ m_2 \end{pmatrix} = \begin{pmatrix} 1 & \kappa_1 \\ 0 & \kappa_2 \end{pmatrix} \begin{pmatrix} \hat{y}^n \\ \hat{p}_R^n \end{pmatrix} = \kappa \hat{v}^n$$

where $\eta = \theta \Leftrightarrow \kappa = \mathbb{I}$

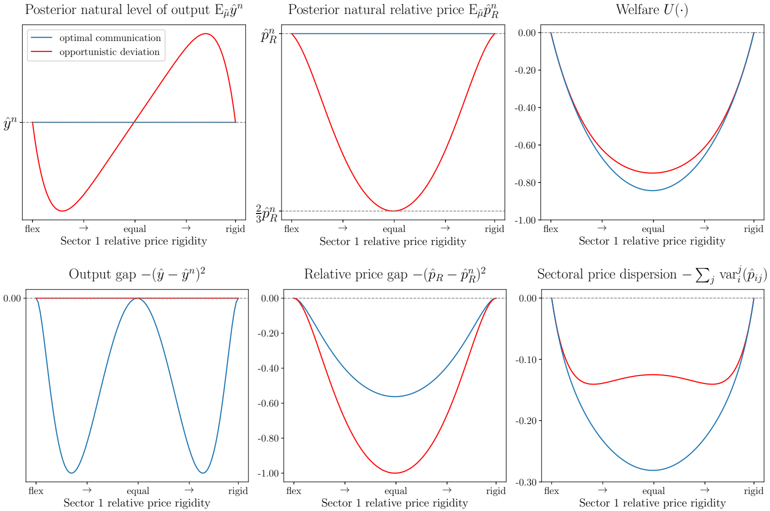
Details

2. Symmetric $\alpha_1 = \alpha_2$, $\Gamma > 0$



Note: $\hat{y}^n = 0$ and $\hat{p}^n_R = \hat{a}_1 - \hat{a}_2 > 0$

2. Asymmetric $\alpha_1 \neq \alpha_2$, $\Gamma > 0$



Note: $\hat{y}^n > 0$ and $\hat{p}_R^n = \hat{a}_1 - \hat{a}_2 > 0$

2. Takeaways ($\alpha_1 = \alpha_2$)

- Optimal communication? with $\Gamma > 0$, **truthful** and complete report of information
  - i.e., instrument stabilization under symmetric information
  - with "divine coincidence": $\hat{y} = \hat{y}^n$ and $\hat{p} = 0$
  - but not first best, because inefficient across and within sector price dispersion

- Credibiliy? **opportunistic** report of information
  - report correctly $\hat{y}^n$ and underreport $\hat{p}_R^n$ **iff** $\eta < \theta$
  - welfare gains from reduction in within-sector dispersion
  - welfare costs from deviation of $\hat{p}_R$ from $\hat{p}_R^n$

$\Rightarrow$ **Discretionary communication? Interplay with reputation?**

3. Dynamic Game with Reputation

Monetary Authorities, Strategies and Reputation

Two types of **MA** $\delta \in \{tt, st\}$, observe $s = \hat{v}^n + \varepsilon$

- a *truthteller* **MA** always reports $\tilde{v}^n = \mathbb{E}(\hat{v}^n | s)$ truthfully
- a *strategic* **MA**
  - either truthful report: $m = \tilde{v}^n$ w.p. p
  - or opportunistic report: $m = \kappa \tilde{v}^n$ w.p. $1 - p$

$\Rightarrow$ $p(\cdot)$ **is the communication policy**

MA type is unobservable, ...

...but **PF** hold belief ξ that **MA** is $\delta = tt$

$\Rightarrow \xi$ **is the reputation of MA**

3. Dynamic Game: Timing

- **PF** hold belief $P(\delta = tt) = \xi$ and *preset* prices $\hat{p}_j^p = 0$ given μ
- **N** draws $\hat{v}^n = (\hat{y}^n, \hat{p}_R^n)$
- **MA** observes noisy signal $s = \hat{v}^n + \varepsilon$, infers $\tilde{v}^n = \mathbb{E}(\hat{v}^n | s)$, then sends m and sets $\hat{q}(\tilde{\mu})$
- A share $1 - \alpha_j$ of **PF** in sector $j \in (1, 2)$ *resets* prices $\hat{p}_j^r$, given posterior beliefs $\tilde{\mu} = \mu | m, \xi$
- Output $\hat{y}$ and prices are realized, **PF** observe $\hat{v}^n$ and update **MA** type

$$(\xi, m, \hat{v}^n) \to \bar{\xi}$$

- Overnight stochastic rotation of **MA**

$$\xi' = (1 - \lambda)\bar{\xi} + \lambda \rho$$

where λ is persistence and ρ long run average of $\delta = tt$

3. Dynamic Game: Timing

- **PF** hold belief $P(\delta = tt) = \xi$ and *preset* prices $\hat{p}_j^p = 0$ given μ
- **N** draws $\hat{v}^n = (\hat{y}^n, \hat{p}_R^n)$
- **MA** observes noisy signal $s = \hat{v}^n + \varepsilon$, infers $\tilde{v}^n = \mathbb{E}(\hat{v}^n|s)$, then sends m and sets $\hat{q}(\tilde{\mu})$
- A share $1 - \alpha_j$ of **PF** in sector $j \in (1, 2)$ *resets* prices $\hat{p}_j^r$, given posterior beliefs $\tilde{\mu} = \mu|m, \xi$
- Output $\hat{y}$ and prices are realized, **PF** observe $\hat{v}^n$ and update **MA** type

$$(\xi, m, \hat{v}^n) \rightarrow \bar{\xi}$$

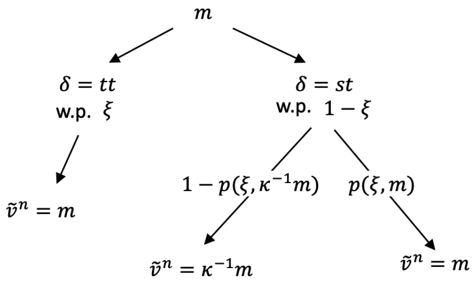
- Overnight stochastic rotation of **MA**

$$\xi' = (1 - \lambda)\bar{\xi} + \lambda\rho$$

where λ is persistence and ρ long run average of $\delta = tt$

3. Dynamic Game

Bayesian interpretation of message

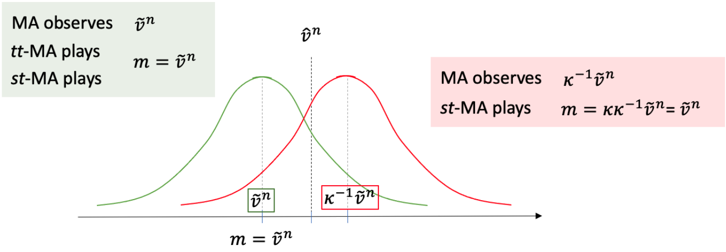


$$\mathbb{E}_{\tilde{\mu}} \hat{v}^n = \frac{m \cdot f_{tr}(m)\,[\xi + (1-\xi)p(\xi, m)] + \kappa^{-1} m \cdot f_{op}(m)(1-\xi)\left[1 - p(\xi, \kappa^{-1} m)\right]}{f_{tr}(m)\,[\xi + (1-\xi)p(\xi, m)] + f_{op}(m)(1-\xi)\,[1 - p(\xi, \kappa^{-1} m)]}$$

3. Dynamic Game

Law of motion of reputation

Given reputation ξ, message m and observed $\hat{v}^n$, $P(\delta = tt | \xi, m, \hat{v}^n)$?



$$\bar{\xi} = \frac{f_m(\hat{v}^n) f_{tr}(m) \cdot \xi}{f_m(\hat{v}^n) f_{tr}(m) \left[\xi + (1-\xi) p(\xi, m)\right] + f_{\frac{m}{\kappa}}(\hat{v}^n) f_{op}(m)(1-\xi)\left(1 - p(\xi, \kappa^{-1} m)\right)}$$

3. Dynamic Game

Strategic Monetary Authority

$$V_{st}(\xi, \tilde{v}^n) = \max_{p\in[0,1]} \mathbb{E}_{m,\hat{v}^n}\Big\{U\left(\hat{v}^n, \hat{q}, \mathbb{E}_{\tilde{\mu}}\hat{v}^n|m\right) + \beta\mathbf{V}_{st}\left(\xi'\right)\Big\}$$

subject to

$$\begin{aligned} \hat{q} &= \hat{q}(\tilde{\mu}) && \text{instrument policy} \\ \mathbb{E}_{\tilde{\mu}}\hat{v}^n &= \mathbb{E}(\hat{v}^n|\xi, m) && \text{interpretation of } m \\ \xi' &= \xi'(\xi, m, \hat{v}^n) && \text{law of motion of reputation} \end{aligned}$$

and continuation benevolent utility

$$\mathbf{V}_{st}(\xi) = (1-\lambda\rho)\cdot\mathbb{E}_{\tilde{v}^n}V_{st}(\xi, \tilde{v}^n) + \lambda\rho\cdot\mathbb{E}_{\tilde{v}^n}V_{tt}(\xi, \tilde{v}^n)$$

$\Rightarrow$ **Discretionary communication** vs. **reputation**

Strategic **MA** only

Proposition. Let $\xi = \rho = 0$, then given $\tilde{v}^n$

- **MA** systematic misreporting $m = \kappa \tilde{v}^n$

$$p(\tilde{v}^n) = 0, \ \forall \tilde{v}^n$$

- and **PF** Bayesian interpretation

$$\mathbb{E}_{\tilde{\mu}} \hat{v}^n | m = \kappa^{-1} m = \tilde{v}^n$$

$\Rightarrow$ **symmetric information** without strategic gain in equilibrium!

Systematic turnover of **MA**

Proposition. Let $\lambda = 1$ and $\rho \in (0,1)$, then

- reputation is exogenous and constant across periods

$$P(\delta = tt) = \xi = \rho$$

- a *st*-**MA** always misreport

$$\forall \hat{v}^n, \ \forall \xi, \ p(\xi, \hat{v}^n) = 0$$

- a *st*-**MA** achieves stabilization gains at the expense of *tt*-**MA**

$$W_{tt}(\rho) \leq W^{SI} \leq W_{st}(\rho)$$

- and at the expense of the long run stabilization of the economy

$$W(\rho) = \rho \cdot W_{tt}(\rho) + (1-\rho) \cdot W_{st}(\rho) \leq W^{SI}$$

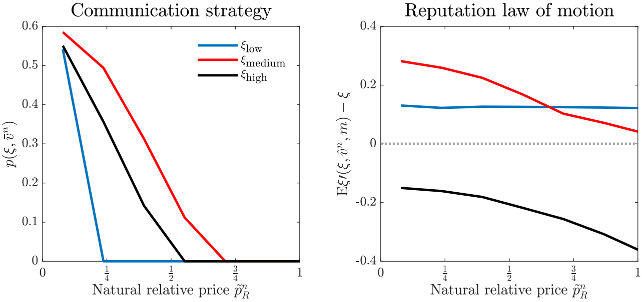
where the inequalities are strict if $0 < \rho < 1$

Numerical Values

Parameter	Symbol	Value
Discount factor	β	0.96
Elasticity across sectors	η	4
Elasticity within sector	θ	8
Price rigidity 1	α_1	0.5
Price rigidity 2	α_2	0.5
Dispersion of technology shocks	σ_a	1
Competence of monetary authorities	σ_ε	1/5
Prevalence of truth-telling type	ρ	0.5
Persistence of CB type	λ	0.2

3. Dynamic Game

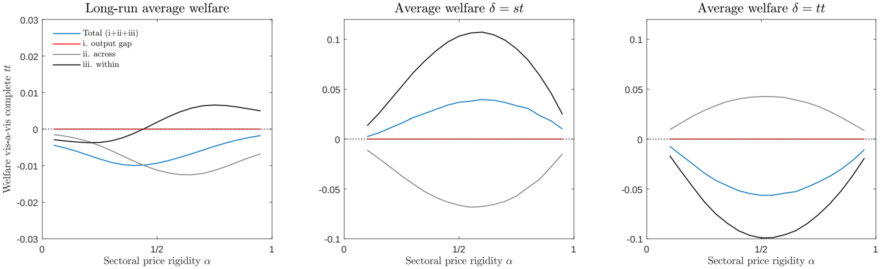
Reputation and propensity to misreport



Reputation as capital

- "Use it" at low and high ξ to (try to) stabilize the economy
- "Build it" at intermediate ξ and low shocks $\hat{p}_R^n$

Welfare implications



Relative to symmetric information

- Strategic **MA** achieves aggregate stabilization gains
- ... at the expense of truthtelling **MA**
- ... and the long run stabilization of the economy

3. Sensitivity Analysis

	Average propensity to report truthfully			Average reputation			Average welfare ($.10^{-2}$)		
	$\delta = tt$	$\delta = st$	$\mathbb{E}(\delta)$	$\delta = tt$	$\delta = st$	$\mathbb{E}(\delta)$	$\delta = tt$	$\delta = st$	$\mathbb{E}(\delta)$
Baseline	1.00	0.112	0.556	0.72	0.23	0.48	−5.61	3.63	−0.99
Price rigidities									
$\alpha_1 = \alpha_2 = 0.25$	1.00	0.131	0.566	0.60	0.30	0.45	−3.35	1.65	−0.85
$\alpha_1 = \alpha_2 = 0.75$	1.00	0.103	0.552	0.77	0.20	0.49	−4.31	3.40	−0.46
$\alpha_1 = 0.25 < \alpha_2 = 0.75$	1.00	0.091	0.546	0.82	0.18	0.50	−11.49	11.40	−0.06
Elasticities									
$\eta = 3$; $\theta = 8$	1.00	0.103	0.551	0.78	0.20	0.49	−7.24	6.00	−0.62
$\eta = 5$; $\theta = 8$	1.00	0.126	0.563	0.63	0.28	0.45	−3.60	1.93	−0.83
Monetary Authorities									
competence $\sigma_\varepsilon = 1/3$	1.00	0.108	0.554	0.60	0.26	0.43	−6.23	2.90	−1.67
$\sigma_\varepsilon = 1/7$	1.00	0.125	0.563	0.77	0.21	0.49	−4.96	3.75	−0.61
prevalence $\rho = 0.4$	1.00	0.101	0.460	0.67	0.18	0.38	−7.16	3.16	−0.97
$\rho = 0.6$	1.00	0.124	0.649	0.77	0.28	0.57	−4.20	4.09	−0.88
persistence $\lambda = 0.1$	1.00	0.101	0.550	0.80	0.15	0.48	−4.05	2.53	−0.76
$\lambda = 0.3$	1.00	0.110	0.555	0.67	0.29	0.48	−6.40	4.38	−1.01

Conclusions

Adding words to action ?

- Incentives to strategically (mis)report information?
  - it is a tempting thing to do — sectoral shocks
  - it is a hard thing to do — control of beliefs
  - it is self defeating — short term gains, long term losses

- Companion projects: focus on (partial) commitment and on communication dynamics with persistent unobservable shocks

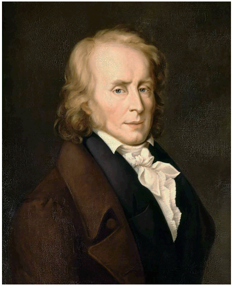
Conclusion

On a Supposed Right to Tell Lies from Benevolent Motives*

Immanuel Kant

"categorical imperative"

Benjamin Constant

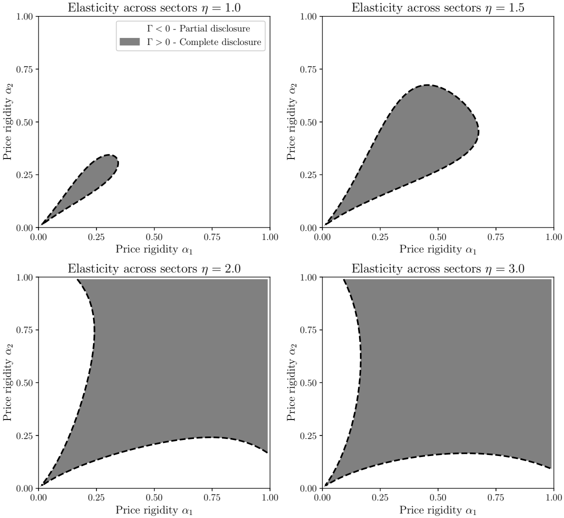


"sure, but..."

* *Uber ein vermeintes Recht aus Menschenliebe zu lugen* (1797)

Appendix

Γ as a function of (η, θ) and (α_1, α_2)



Back