Managing Expectations: Instruments versus Targets

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Motivation: How to Offer Forward Guidance

- To manage expectations, can talk about...
  - **Instruments:** “will maintain 0% interest rates”
  - **Targets:** “will do whatever it takes for 4% unemployment”

- Reason to prefer one *type* of forward guidance over the other?
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- **NO** in the benchmark with
  1. Full credibility
  2. No future shocks (or policy contingent on them)
  3. Rational Expectations + Common Knowledge

“Ramsey world”
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  - (iii) Rational Expectations + Common Knowledge

Our focus

Relax (iii) and explore role of bounded rationality
Set Up

- Formalize question in simple “beauty contest” game
  - stylizes NK at ZLB (and more)

- Add “bounded rationality”
  - belief inertia (lack of CK, level-k thinking)
  - other forms (belief over-reaction, animal spirits)
Main Lesson: What to do and why

**What to do**

- Instrument communication when GE feedback is weak
- Target communication when GE feedback is strong

Stop talking about $R$ and start talking about $Y$ or $U$ when

- ✓ long ZLB  
- ✓ steep Keynesian cross  
- ✓ strong financial accelerator
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Why

- Minimize agents’ need to “reason about the economy”
  (i.e., about the behavior of others/equilibrium effects)
Literature

- **Instruments vs Targets**
  Poole (1970), Weitzman (1974)

- **Micro-foundations of Beauty Contests**

- **Forward Guidance, GE Attenuation and Myopia**
  Farhi & Werning (2018), Garcia-Schmidt & Woodford (2018): Level k
  Gabaix (2018): cognitive discounting

- **Communication in Beauty Contests, Information Design**
Model
Notation and Behavior

\[ K = \int_i k_i \, di = \text{average action today} \]
\[ Y = \text{outcome (target) in the future} \]
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**Story (microfoundation in paper)**

ZLB today, but not tomorrow

\[ K = \text{spending today}; \ Y = \text{income today plus tomorrow} \]

\[ \tau = \text{(negative of) interest rate tomorrow} \]

Forward guidance via substitution (PE) or income (GE) effect
Final outcome depends on realized behavior and policy

\[ Y = (1 - \alpha)\tau + \alpha K \]

\(\alpha \in (0, 1)\) parameterizes direct policy effect
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\[ Y = (1 - \alpha)\tau + \alpha K \]

\( \alpha \in (0, 1) \) parameterizes direct policy effect

**Story (microfoundation in paper)**

Loose policy tomorrow \( \rightarrow \) higher output tomorrow
The Key Equations, and the Key Issue

\[ k_i = (1 - \gamma)E_i[\tau] + \gamma E_i[Y] \]  \hspace{1cm} (1)
\[ Y = (1 - \alpha)\tau + \alpha K \]  \hspace{1cm} (2)

- **No guidance**: Agents have to forecast both \( \tau \) and \( Y \)
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- No guidance: Agents have to forecast both \( \tau \) and \( Y \)
- Instrument communication: know \( \tau \), have to think about \( Y \)
- Target communication: know \( Y \), have to think about \( \tau \)
Timing

\( t = 0 \) (FOMC meeting): PM sees \( \theta \), announces \( \tau = \hat{\tau} \) or \( Y = \hat{Y} \)

\( t = 1 \) (liquidity trap): Agents form beliefs and choose \( k_i \)

\( t = 2 \) (exit): \( K, \tau \) and \( Y \) are realized
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$t = 1$ (liquidity trap): Agents form beliefs and choose $k_i$

$t = 2$ (exit): $K, \tau$ and $Y$ are realized

The Policy Problem

$$\min_{\theta \mapsto \{\text{message}, (\tau, Y)\}} \mathbb{E}[(1 - \chi)(\tau - \theta)^2 + \chi(Y - \theta)^2]$$

s.t. $(\tau, Y)$ is implementable in equil given

eq. (1)-(2) and message $\tau = \hat{\tau}$ or $Y = \hat{Y}$
Benchmarks \equiv \text{representative, rational and attentive agent} \\
(CK of both announcement and rationality) \\
\rightarrow \text{no error in predicting behavior of others:} \\
\mathbb{E}_i[K] = K
Frictionless, REE Benchmark

Benchmark ≡ representative, rational and attentive agent
(CK of both announcement and rationality)

⇒ no error in predicting behavior of others:

\[ \mathbb{E}_i[K] = K \]

⇒ any equilibrium satisfies

\[ k_i = K = Y = \tau \]

⇒ irrelevant whether PM announces \( \tau \) or \( Y \)

(equivalence of primal and dual problems)
Friction: Lack of CK / Anchored Beliefs

- Assumption: Lack of CK of announcement

Let $X \in \{\tau, Y\}$ be the announcement. Agents are rational and attentive but think only fraction $\lambda \in [0, 1]$ of others is attentive:

$$E_i[X] = X \quad E_i[\bar{E}[X]] = \lambda E_i[X]$$

- Mimics role of HOB in incomplete-info settings
Friction: Lack of CK / Anchored Beliefs

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- **Mimics role of HOB in incomplete-info settings**

- **Implication:** Anchored Beliefs
  
  $$\bar{E}[K] = \lambda K$$
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- **Mimics role of HOB in incomplete-info settings**

- **Implication:** Anchored Beliefs

  \[ \bar{E}[K] = \lambda K \]

- **Level-K Thinking:**
  - similar flavor: relaxing CK of rationality
  - identical results except for one “bug”

- **Cognitive discounting:** same, minus PE
Main Results
Game after Announcing $\tau$

\[ K = (1 - \gamma) \bar{E}[\tau] + \gamma \bar{E}[Y] \]
Game after Announcing $\tau$

$$K = (1 - \gamma)\bar{E}[\tau] + \gamma\bar{E}[Y]$$

$= \tau \ (\text{fixed by FG})$
Game after Announcing $\tau$

$$K = (1 - \gamma)\bar{E}[\tau] + \gamma\bar{E}[Y]$$

(reasoned by agents)

$$= (1 - \alpha)\bar{E}[\tau] + \alpha\bar{E}[K]$$

$$= \tau \text{ (fixed by FG)}$$

"I expect less spending and income, so I spend less"

Friction reduces effectiveness of FG

Game after Announcing $\tau$

$K = (1 - \gamma) \bar{E}[\tau] + \gamma \bar{E}[Y]$

(Reasoned by agents)

$= (1 - \alpha) \bar{E}[\tau] + \alpha \bar{E}[K]$}

$= \tau$ (fixed by FG)

$K = (1 - \delta_\tau) \tau + \delta_\tau \bar{E}[K]$}

\[\alpha \gamma \in (0, 1)\]
Game after Announcing $\tau$

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(reasoned by agents)

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$$= \tau \quad \text{(fixed by FG)}$$

$$K = (1 - \delta_\tau)\tau + \delta_\tau\bar{E}[K]$$

$\alpha \gamma \in (0, 1)$

- Game of **complements**
  
  “I expect less spending and income, so I spend less”

- Friction **reduces** effectiveness of FG

Game after Announcing \( Y \)

\[
K = (1 - \gamma)\bar{E}[\tau] + \gamma\bar{E}[Y]
\]
Game after Announcing $Y$

$$K = (1 - \gamma)\bar{E}[\tau] + \gamma\bar{E}[Y]$$

(reasoned by agents)

$$= \frac{1}{1-\alpha}\bar{E}[Y] - \frac{\alpha}{1-\alpha}\bar{E}[K]$$

$$= Y \text{ (fixed by FG)}$$
Game after Announcing $Y$

$$K = (1 - \gamma)\bar{E}[\tau] + \gamma\bar{E}[Y]$$

( reasoned by agents )

$$= \frac{1}{1-\alpha} \bar{E}[Y] - \frac{\alpha}{1-\alpha} \bar{E}[K]$$

$$= Y \text{ (fixed by FG)}$$

$$K = (1 - \delta_Y)Y + \delta_Y\bar{E}[K]$$

$$- \frac{(1-\gamma)\alpha}{1-\alpha} \leq 0$$
Game after Announcing $Y$

$$K = (1 - \gamma)\bar{E}[\tau] + \gamma\bar{E}[Y]$$

(reasoned by agents)
$$= \frac{1}{1-\alpha}\bar{E}[Y] - \frac{\alpha}{1-\alpha}\bar{E}[K]$$

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$$K = (1 - \delta_Y)Y + \delta_Y\bar{E}[K]$$

$$- \frac{(1-\gamma)\alpha}{1-\alpha} \leq 0$$

- Game of **substitutes**
  
  “I expect less spending, so I expect looser policy and spend *more*”

- Friction **increases** effectiveness of FG
  
  Turns FG literature upside down
Proposition: implementable sets

The implementable sets of \((\tau, Y)\) pairs for each strategy are

\[
\{(\tau, Y) : \tau = \mu_\tau(\gamma, \lambda) Y\} \quad \text{Instrument communication}
\]

\[
\{(\tau, Y) : \tau = \mu_Y(\gamma, \lambda) Y\} \quad \text{Target communication}
\]

For any \(\gamma \in (0, 1)\) and \(\lambda \in (0, 1)\),

\[
\mu_\tau(\gamma, \lambda) > 1 > \mu_Y(\gamma, \lambda)
\]

Remarks

▶ Friction \(\neq \) “everything is dampened”

▶ TC keeps powder dry: what about forward guidance puzzle?
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Instrument communication \hspace{2cm} Target communication

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Instrument communication

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Target communication

For any $\gamma \in (0,1)$ and $\lambda \in (0,1)$,

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attenuation $\leftarrow$ amplification

Remarks

$\text{▶ Friction} \neq \text{"everything is dampened"}$

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- Friction \(\neq\) “everything is dampened”
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Distortion and GE Feedback

**Proposition**

\[ \frac{\partial \mu_\tau}{\partial \gamma} > 0 \]
\[ \frac{\partial \mu_Y}{\partial \gamma} > 0 \]

Quick intuition: Distortion from reasoning about what is not announced. High \( \gamma \) is very important to figure out \( Y \), not so much \( \tau \).

Can prove these slopes up, and never cross.

Recall: \( \mu = \frac{\partial \tau}{\partial Y} \) as \( \gamma \) (GE) increases.

\[ \begin{align*}
\text{distortion under IC increases} \\
\text{distortion under TC decreases}
\end{align*} \]
**Distortion and GE Feedback**

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Recall: \( \mu = \frac{\partial \tau}{\partial Y} \)

as \( \gamma \) (GE) increases \( \Rightarrow \) \{ distortion under IC increases \}
\[ \text{distortion under TC decreases} \]
**Main Result**

**Theorem: optimal communication**

There exists a $\hat{\gamma} \in (0, 1)$ ("critical GE feedback") such that:
- $\gamma < \hat{\gamma}$: optimal to communicate instrument
- $\gamma \geq \hat{\gamma}$: optimal to communicate target

Additional results in paper:
- Precise values of optimal message and attained $(\tau, Y)$
- Variant with Level-k Thinking
Main Result

Theorem: optimal communication

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Additional results in paper:

precise values of optimal message and attained $(\tau, Y)$

variant with Level-k Thinking
Application: Forward Guidance at the Zero Lower Bound
Forward Guidance at ZLB

- Angeletos & Lian (AER, 2018)
  - lack of CK attenuates GE effects of FG
  - longer horizon $\Rightarrow$ longer GE chains $\Rightarrow$ more distortion
Forward Guidance at ZLB

- **Angeletos & Lian (AER, 2018)**
  - lack of CK attenuates GE effects of FG
  - longer horizon ⇒ longer GE chains ⇒ more distortion

- **Farhi & Werning (2018)**
  - similar point replacing lack of CK with Level-k Thinking
  - inco markets ⇒ steeper Keynesian cross ⇒ more distortion

Forward Guidance at ZLB

- **Our paper**: bypass friction with **target communication**
  - “stop talking about $R$, start talking about $Y$ or $U$”
  - preferable when **longer ZLB** or **steeper Keynesian cross**

- **Reminiscent of Mario Draghi’s “do whatever it takes”**
  - relies on strong GE feedback but not multiple equilibria
  - common logic: alleviate concerns about behavior of others
Broader Scope
Generalized Form of Incorrect Reasoning

Assumption: generalized form of incorrect reasoning

Let $\epsilon$ be noise orthogonal to $\theta$.

$$\bar{E}[K] = \lambda K + \sigma \epsilon \quad \lambda, \sigma > 0$$

nests: under-reaction ($\lambda < 1$), over-reaction ($\lambda > 1$), and noise or animal spirits ($\sigma > 0$)

- Optimal policy result goes through
- Intuition: all about limiting the role of $\bar{E}[K]$
  - i.e., the “more thinking = more distortion” result extends
Policy Rules

Announce a linear policy rule: $\tau = A - BY$

Optimal $(A, B)$ indeterminate in RE benchmark
Policy Rules

Announce a linear policy rule: \( \tau = A - BY \)

Optimal \((A, B)\) indeterminate in RE benchmark

<table>
<thead>
<tr>
<th>Proposition: optimal linear policy with distorted beliefs</th>
</tr>
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<tbody>
<tr>
<td>For each ( \gamma ), there exists ((A^<em>(\gamma), B^</em>(\gamma))) that uniquely solves the policy problem for all ((\lambda, \sigma)). (B^*(\gamma)) increases in (\gamma).</td>
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- High \( \gamma \rightarrow \) tilt toward TC (“smoothed result”)
- New perspective on policy rules
  - Optimal \( = \) reduces bite of bounded rationality
  - Uniqueness in tiny deviations from frictionless case
Conclusion
Managing (Distorted) Expectations

- Goal: policy with frictional coordination or bounded rationality
- Lesson: ease the burden of reasoning about the economy
- More in the paper: unobserved shocks; relation to Poole/Weitzman; more policy options; other settings
Supplementary Material
Level-$k$: Similar but Less Sharp

- **Instrument comm** (games of complements): the same
  - others are less rational $\approx$ others are less attentive

- **Target comm** (games of substitutes): a bug
  - distortion changes sign between even and odd $k$

- Our preferred formulation avoids the bug

- Cognitive discounting avoids it too (but confounds PE-GE)
FG: Three GE Feedbacks

1. Within Dynamic IS: Keynesian cross
2. Within NKPC: dynamic pricing complementarity
3. Across: inflation-spending feedback

- All three: intensify with length of ZLB / horizon of FG
Textbook NK model, with modest friction ($\lambda = .75$)

- Attenuation by 90% when ZLB last 5 years
- Plus, discontinuity at infinite horizons