Myopia and Anchoring

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Belief Frictions = Myopia and Anchoring

- Starting point: representative-agent model of the form

$$a_t = \varphi \xi_t + \delta \mathbb{E}_t[a_{t+1}]$$

  - nests: AP, Dynamic IS, NKPC, investment/entry in large industries
  - underneath: dynamic beauty contest

- Add: **dispersed private information or RI**
  - imperfect knowledge of, or attention to, shocks (first-order uncertainty)
  - doubts about attention and responsiveness of others (higher-order uncertainty)

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- Main result: under conditions, observational equivalence with

$$a_t = \varphi\xi_t + \omega_f\delta\mathbb{E}_t\left[a_{t+1}\right] + \omega_b a_{t-1}$$

  - $\omega_f < 1$ (myopia) and $\omega_b > 0$ (anchoring)
  - both distortions increase with strategic complementarity/GE
  - may loom at macro level but may not be easily detected in usual micro data

Framework

- Aggregate outcome satisfies

$$a_t = \overline{\mathbb{E}}_t \left[\sum_{k \geq 0} \beta^k \varphi \xi_{t+k} \right] + \gamma \overline{\mathbb{E}}_t \left[\sum_{k \geq 0} \beta^k a_{t+k+1} \right]$$

  - a_t is endogenous outcome (π_t, C_t, I_t, asset price ...)
  - ξ_t is exogenous fundamental (marginal cost, dividend ...)
  - γ controls GE feedback, or strategic complementarity

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- Same as game with continuum of long-lived players and best responses

$$a_{it} = \mathbb{E}_{it} \left[\varphi \xi_t + \beta a_{it+1} + \gamma a_{t+1} \right]$$

  - $\beta \geq 0$, $\gamma \geq 0$, $\beta + \gamma < 1$

Departure: Incomplete Information and Higher-Order Uncertainty

- Why this particular departure?
  - dispersed private information (Hayek, Lucas)
  - rational inattention and costly cognition (Sims)
  - doubts about others' awareness and response (higher-order uncertainty)
  - a form of bounded rationality consistent with REE

- Key implications:
  - expectations of future outcomes $\neq$ expectations of future fundamentals
  - outcomes depend on HOB (higher-order beliefs)
  - PE and GE play distinct roles, γ regulates relative importance of HOB

Baseline Specification

- Fundamental follows AR(1)

$$\xi_t = \rho \xi_{t-1} + \eta_t = \frac{1}{1-\rho L}\eta_t$$

where $\eta_t \sim \mathcal{N}(0,1)$ and $\rho \in (0,1)$

- Information given by history of private signals:

$$x_{it} = \xi_t + u_{it},$$

where $u_{it} \sim_{\text{iid}} \mathcal{N}(0,\sigma^2)$ and $\sigma \geq 0$ parameterizes the friction

Equivalence Result

Proposition (*Observational Equivalence*)

Incomplete-info outcome is replicated by a complete-info economy in which

$$a_t = \varphi\xi_t + \delta\omega_f\mathbb{E}_t\left[a_{t+1}\right] + \omega_b a_{t-1}$$

for a unique pair of (ω_f, ω_b) *which is such that* $\omega_f < 1$ *and* $\omega_b > 0$*.*

- myopia : $\omega_f < 1$
- anchoring : $\omega_b > 0$
- both encompass HOB

Understanding Myopia ($\omega_f < 1$)

- To illustrate: think of NKPC, fix $\xi_t = 0$ for $t \neq 1$, and let $\xi_1 \sim \mathcal{N}(0, \sigma_\xi^2)$

- Response of inflation at $t = 0$ to news about MC at $t = 1$

$$\begin{aligned}\pi_0 &= \kappa\delta\theta\, \overline{\mathbb{E}}_0[\xi_1] + \delta(1-\theta)\delta\theta\, \overline{\mathbb{E}}_0[\pi_1] \\ &= \kappa\delta\theta\, \overline{\mathbb{E}}_0[\xi_1] + \delta(1-\theta)\delta\theta\, \overline{\mathbb{E}}_0\left[\kappa\overline{\mathbb{E}}_1[\xi_1]\right]\end{aligned}$$

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- Information:
  - firm i observes $x_i = \xi_1 + \epsilon_i$ at $t = 0$;
  - no learning at $t = 1$

- Implied beliefs:

$$\begin{aligned}\mathbb{E}_{i,0}[\xi_1] = \mathbb{E}_{i,1}[\xi_1] &= \lambda x_i \\ \overline{\mathbb{E}}_0[\xi_1] = \overline{\mathbb{E}}_1[\xi_1] &= \lambda \xi_1 \qquad \lambda \equiv \frac{\sigma_\xi^2}{\sigma_\xi^2 + \sigma_\epsilon^2} \\ \overline{\mathbb{E}}_0[\overline{\mathbb{E}}_1[\xi_1]] &= \lambda^2 \xi_1\end{aligned}$$

$\Rightarrow$ as if the news is discounted, more discounting with HOB

Understanding Anchoring ($\omega_b > 0$)

- Anchoring, or momentum, hinges on learning

- Basic intuition: in Kalman filter, past belief shows up as a state variable

$$\overline{\mathbb{E}}_t[\xi_t] = (1-G)\overline{\mathbb{E}}_{t-1}[\xi_t] + G\xi_t$$

- Similar logic in our setting except that
  - anchoring reinforced by higher-order uncertainty
  - relevant state variable is a_{t-1} (magic: a_{t-1} is a summary statistic of HOB)

The Role of GE Feedback

Proposition (*GE*)

Both distortions intensify ($\omega_f \downarrow$, $\omega_b \uparrow$) with stronger complementarity/GE

- Higher complementarity in price setting $\rightarrow$ more backward-looking inflation
- Larger Keynesian multiplier $\rightarrow$ more discounting and habit in Euler condition

Monetary Policy and Aggregate Demand

- Consumption function (PIH) plus market clearing $(y = c)$ give

$$c_t = -\sum_{k=0}^{\infty} \chi^k \overline{\mathbb{E}}_t[r_{t+k}] + \underbrace{(1-\chi)}_{\gamma} \sum_{k=0}^{\infty} \theta^k \overline{\mathbb{E}}_t[c_{t+k+1}]$$

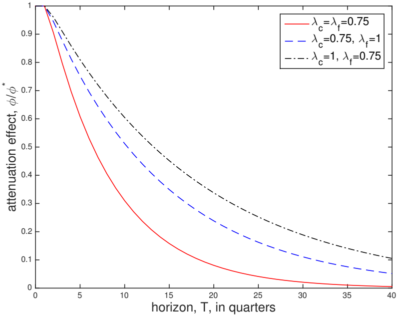
- Reduces to $c_t = -r_t + \mathbb{E}_t[c_{t+1}]$ with complete info, but not without
- Applying our result $\Rightarrow$ myopia toward future MP + habit

$$c_t = -r_t + \omega_f \mathbb{E}_t[c_{t+1}] + \omega_b c_{t-1}$$

  - both distortions increase with slope of Keynesian cross (captured by γ)
  - suggests role of expectations particularly important in HANK
  - see also Farhi and Werning (2018)

Forward Guidance (Angeletos and Lian, AER 2018)

- Application: ZLB up to $t = T - 1$, response to news about R_t at $t = T$
- Full NK model: additional feedback between AD and AS (multi-layer game)



- Even a tiny perturbation can have huge effects as $T \to \infty$
- Front-loading fiscal stimuli, paradox of flexibility, neo-Fisherian effects...

Macro vs Micro

- Pervasive gap between macro and micro
  - C: estimated habit much smaller in micro data (Havranek et al, 2017)
  - I: type of IAC used in DSGE inconsistent with standard Q theory as well as with literature that studies plant-level investment dynamics
  - π: menu-cost models that match price data (Golosov & Lucas etc) don't produce backward-looking feature of hybrid NKPC
  - AP: Samuelson dictum (Jung and Shiller, 2005).
- Our results help merge the gap
  - mechanism: GE and HOB
  - distinct from, but complementary to, Mackowiak & Wiederholt (2009), inattention etc
- Also: usual micro-to-macro doesn't work!
  - need to augment standard micro data (choice date) with surveys of expectations (belief data)

Evidence on Expectations

- Coibion and Gorodnichenko (2015): average forecast error

$$\pi_{t+k} - \overline{\mathbb{E}}_t[\pi_{t+k}] = K_{CG} \left(\overline{\mathbb{E}}_t[\pi_{t+k}] - \overline{\mathbb{E}}_{t-1}[\pi_{t+k}] \right) + v_{t+k,t}$$

  - $K_{CG} > 0$: correlated forecast errors, under reaction to news
  - consistent with incomplete info, level-K thinking, and cognitive discounting

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- Bordalo, Gennaioli, Ma, Shleifer (2019): individual forecast error

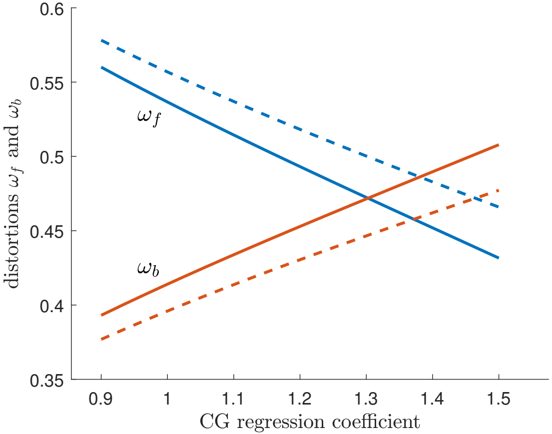
$$\pi_{t+k} - \mathbb{E}_{it}[\pi_{t+k}] = K_{BGMS}(\mathbb{E}_{it}[\pi_{t+k}] - \mathbb{E}_{it-1}[\pi_{t+k}]) + v_{i,t+k}$$

  - $K_{BGMS} < 0$: violation of rationality, over reaction to news
  - inconsistent with level-K thinking and cognitive discounting
  - consistent with incomplete information plus overconfidence

Extension: Adding Overconfidence

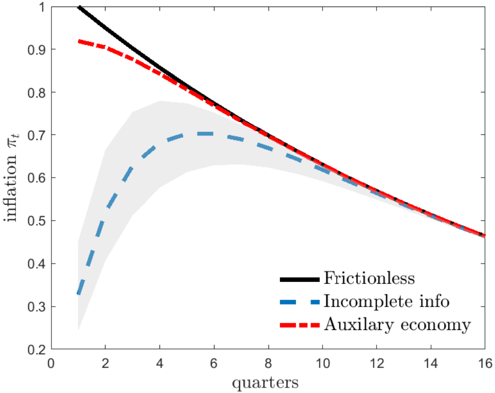
- Over- (or under-) confidence: perceived frictions $\widehat{\sigma}$ differs from actual σ
  - in line with behavioral lit on overconfidence; see also Kohlhas and Broer (2019); but here GE implications
- With $\widehat{\sigma} < \sigma$, consistent with both CG and BGMS
  - CG: informative about $\widehat{\sigma}$ and aggregate IRFs
  - BGMS: informative about σ and individual over/under-confidence, but uninformative about aggregate IRFs

Theory Meets Expectations Data (and vice versa)



Note: The distortions as functions of the proxy offered in CG (2015). The solid lines correspond to a stronger degree of strategic complementarity, or GE feedback, than the dashed one.

“Micro to Macro”



Predicted Inflation Response

→ Matches Estimated Hybrid NKPC

Auxiliary economy: incomplete-info $\mathbb{E}[\xi]$ and complete-info $\mathbb{E}[\pi]$

→ Highlights Most Effect Due to GE / HOB