Inertia of Forward-Looking Expectations

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Rationalizing Macroeconomic Persistence

- Signal Extraction (Lucas (1973), Phelps (1970))
- Sticky Information (Mankiw and Reis (2002))
- Rational Inattention (Sims (2003))

Our approach: variation on signal extraction, but with implications for sticky information and rational inattention.

Higher order beliefs: Townsend (1983), Phelps (1983), Sargent (1991), Morris and Shin (2002), Woodford (2003), Allen, Morris and Shin (2002), Adam (2003), Bacchetta and Van Wincoop (2002), Ui (2002), Hellwig (2002), Angeletos and Pavan (2004), Amato and Shin (2006), Nimark (2005)...

Themes

With differential information, events in the distant past are “more common knowledge”.

The more concerned you are about beliefs of others in the far future, the more you need to rely on events in the distant past.

$\Rightarrow$ Looks like adaptive expectations.

Discontinuity: small incidence of sticky information or rational inattention can generate large amounts of persistence.

Decision Rule

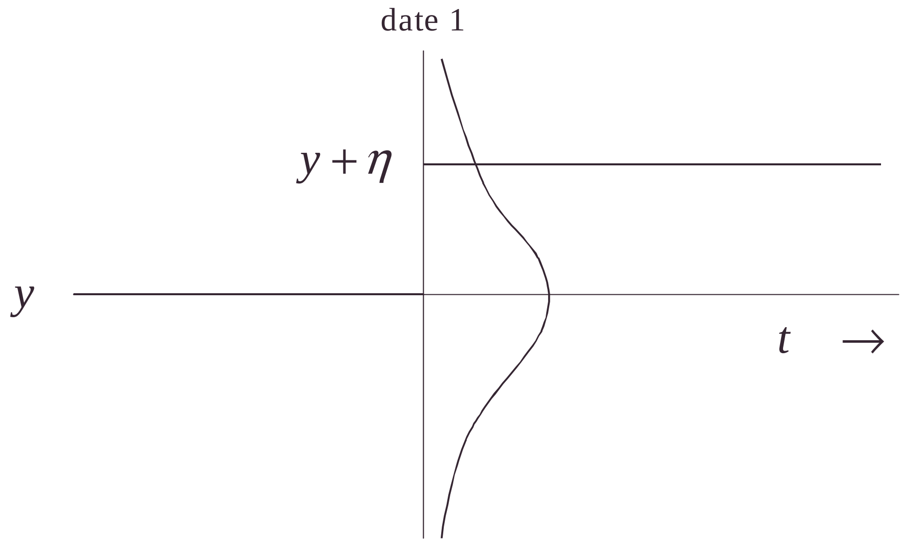
$$a_{it} = \gamma E_{it}(\theta_t) + \beta E_{it}(a_{t+1})$$

a_{it} is i's action at t, a_t is average action, $E_{it}(.)$ is i's expectation at t, $\bar{E}_t(.)$ is average expectation, θ_t is "fundamental" (example: investment with spillovers, New Keynesian Phillips curve)

$$\begin{aligned} a_t &= \gamma \bar{E}_t(\theta_t) + \beta \bar{E}_t(a_{t+1}) \\ &= \gamma \sum_{j=0}^{\infty} \beta^j \bar{E}_t \bar{E}_{t+1} \cdots \bar{E}_{t+j}(\theta_{t+j}) \\ &\neq \gamma \bar{E}_t \left(\sum_{j=0}^{\infty} \beta^j \theta_{t+j} \right) \end{aligned}$$

Fundamentals

$$\theta_t = \begin{cases} y & \text{for } t \leq 0 \\ y + \eta & \text{for } t \geq 1 \end{cases}$$



Information

At $t \geq 1$, proportion μ_t know true value of θ_t.

$\mu_t \to 1$, μ_1 close to 1.

$$E_{it}\begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix}$$

$[i$ informed$]$

$$E_{it}\begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix}$$

$[i$ uninformed$]$

Average expectation:

$$\bar{E}_t\begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1-\mu_t & \mu_t \end{bmatrix}\begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix}$$

Markov Chain

$$\begin{aligned}
\bar{E}_{t-1}\bar{E}_t \begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix} &= \bar{E}_{t-1} \begin{bmatrix} 1 & 0 \\ 1-\mu_t & \mu_t \end{bmatrix} \begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix} \\
&= \begin{bmatrix} 1 & 0 \\ 1-\mu_t & \mu_t \end{bmatrix} \bar{E}_{t-1} \begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix} \\
&= \begin{bmatrix} 1 & 0 \\ 1-\mu_t & \mu_t \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 1-\mu_{t-1} & \mu_{t-1} \end{bmatrix} \begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix} \\
&= \begin{bmatrix} 1 & 0 \\ 1-\mu_{t-1}\mu_t & \mu_{t-1}\mu_t \end{bmatrix} \begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix}
\end{aligned}$$

$$\bar{E}_1\bar{E}_2\cdots\bar{E}_t \begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1-\prod_{s=1}^{t}\mu_s & \prod_{s=1}^{t}\mu_s \end{bmatrix} \begin{bmatrix} y \\ \theta_{t+h} \end{bmatrix}$$

Example

$$\mu_s = \alpha^{-\frac{1}{s}}, \quad \alpha > 1, \quad \alpha \text{ close to } 1.$$

$$\begin{aligned} \ln \prod_{s=1}^{t} \mu_s &= -\ln \alpha \cdot \sum_{s=1}^{t} \frac{1}{s} \to -\infty \\ \prod_{s=1}^{t} \mu_s &\to 0 \end{aligned}$$

θ is a transient state in the Markov chain.

$$\bar{E}_1 \bar{E}_2 \cdots \bar{E}_t \left(\theta_{t+h}\right) \to y \quad \text{as } t \to \infty.$$

Inertia

Set $\gamma = 1 - \beta$, $y = 0$, denote $\mu(t, t+j) \equiv \prod_{s=t}^{t+j} \mu_s$.

$$\begin{aligned} a_t &= (1-\beta) \sum_{j=0}^{\infty} \beta^j \bar{E}_t \bar{E}_{t+1} \cdots \bar{E}_{t+j} (\theta_{t+j}) \\ &= (1-\beta) \sum_{j=0}^{\infty} \beta^j \mu(t, t+j) \cdot \eta \end{aligned}$$

If $\mu_1 = \mu_2 = \cdots = 1$, immediate adjustment:

$$\begin{aligned} a_t &= (1-\beta) \sum_{j=0}^{\infty} \beta^j \eta \\ &= \eta \end{aligned}$$

If $\mu(t, t+j) \to 0$ as $j \to \infty$, then total inertia in limit:

$$a_t \to 0 \quad \text{as } \beta \to 1$$

Discontinuity

What is the incidence of “backward-looking behavior” necessary to account for observed persistence? (Gali and Gertler (1999), Fuhrer (1997),...)

Our message: a small incidence of rational inattention or sticky information can generate large amounts of persistence when embedded in a differential information framework.