Heterogeneous Expectations, Learning and European Inflation Dynamics, by Anke Weber

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This Paper:

Addresses question: how do households and professional forecasters in Europe forecast inflation?

This Paper:

Forecasting model:

$$\pi_t = a_{t-1} + b'_{t-1} X_t + \varepsilon_t$$

Q: How are a_t, b_t determined?

This Paper:

Adaptive learning: let $\theta' = (a, b)$

$$\begin{aligned} \theta_t &= \theta_{t-1} + \gamma_t R_t^{-1} X_t \left(\pi_t - \theta'_{t-1} X_t \right) \\ R_t &= R_{t-1} + \gamma_t \left(X_t X'_t - R_{t-1} \right) \end{aligned}$$

where R is sample-second moment matrix of regressors.

Recursive least squares: $\gamma_t = 1/t$

Constant gain (discount l.s.): $\gamma_t = \gamma,\ 0 < \gamma < 1$.

This Paper:

Out-of-sample forecasting exercise (e.g. Stock and Watson (1996), Branch and Evans (2006)):

1. initialization period, for a_0, b_0, R
2. in-sample period: find best constant gain γ.
3. out-of-sample period: generate forecasts and compute squared forecast errors.
4. find constant gain that best explains survey data.

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- Evidence that learning is converging, but slowly.

Outline of Discussion

1. Why are results important/interesting?
2. Interpreting the results?

Learning is important:

- Stability of REE: Bray and Savin (1986), Marcet and Sargent (1989), Evans and Honkapohja (2001)
- Stability and Monetary Policy: Bullard and Mitra (2002), Evans and Honkapohja (2003)
- Constant gain learning and economy: Marcet and Nicolini (2003), Orphanides and Williams (2003), Milani (2007)
- Constant gain learning and large deviations: Sargent (1999), Cho, Williams, and Sargent (2003), Branch and Evans (2010).

and, this paper provides evidence in favor of learning.

Interpreting the results:

Simple model (e.g. Branch (2010)):

$$
\begin{aligned}
i_t &= E_t\left(\pi_{t+1} - \bar{\pi}\right) + r_t \\
i_t &= \alpha\left(\pi_t - \bar{\pi}\right)
\end{aligned}
$$

or,

$$
\pi_t = \frac{(\alpha - 1)}{\alpha}\bar{\pi} + \alpha^{-1} E_t \pi_{t+1} + \alpha^{-1} r_t
$$

Adaptive learning:

Forecast model: $\pi_t = a + \varepsilon_t \Leftrightarrow E_t \pi_{t+1} = a_{t-1}$.

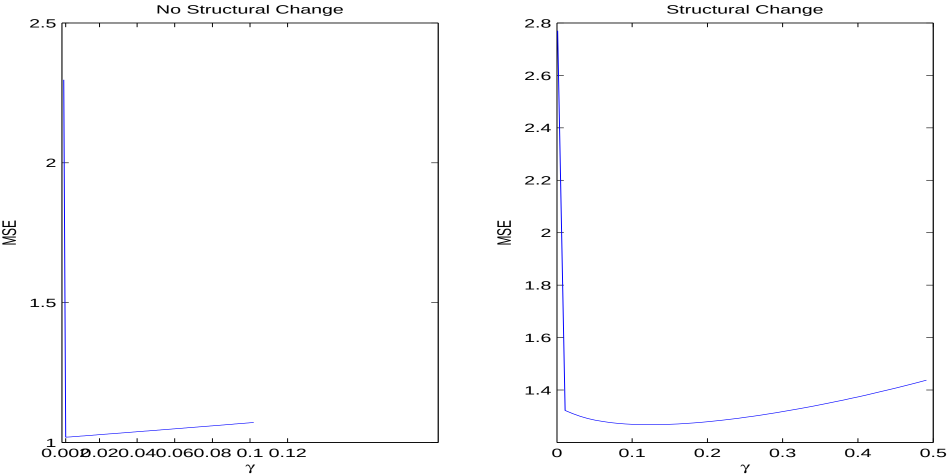
Recursive least squares:

$$a_t = a_{t-1} + t^{-1} \left(\pi_t - a_{t-1} \right)$$

Constant gain:

$$a_t = a_{t-1} + \gamma \left(\pi_t - a_{t-1} \right)$$

Why opt $\gamma >$ Survey γ?



Constant gain can arise from an (approximate) Kalman Filter when perceive

$$a_t = a_{t-1} + \eta_t$$

where $Q_t = E\eta_t^2$.

- RLS: $Q_t \to 0$
- Constant gain: $Q_t \to Q$

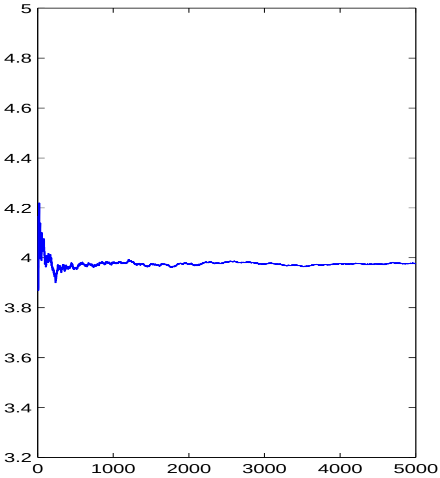
Convergence

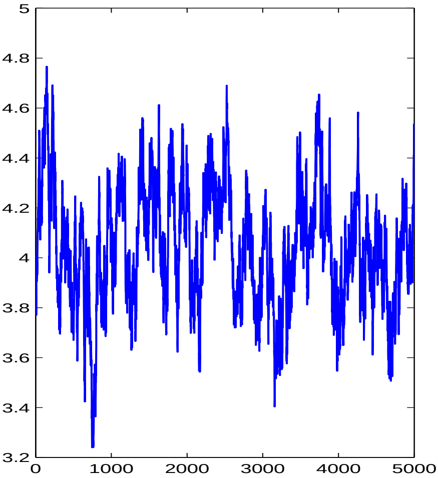
1. If RLS, $a_t \to \bar{\pi}$ with probability 1.

2. If constant gain, for *large* t and large γt,

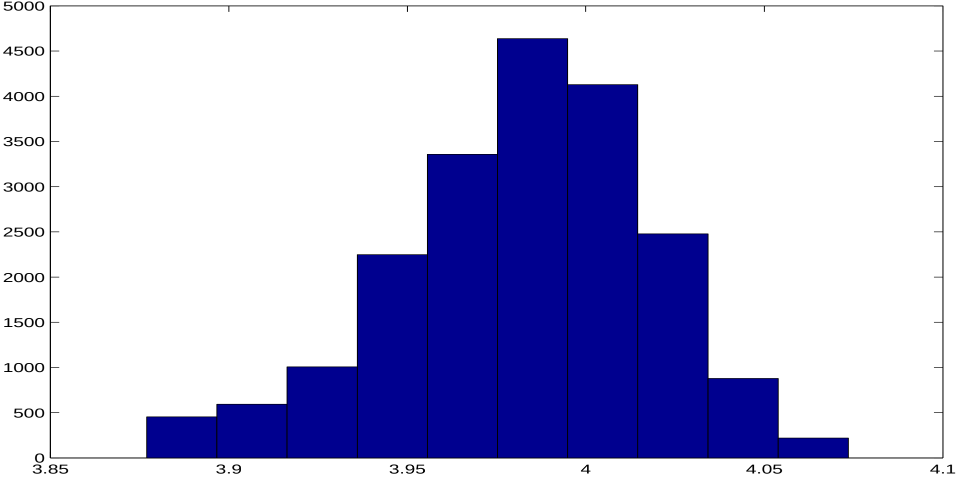
$$a_t \sim N(\bar{\pi}, \gamma C)$$

Convergence in Prob. vs. Dist.





Convergence of Constant Gain:



Testing for convergence:

Recall,

$$a_t = a_{t-1} + \eta_t \qquad E(\eta_t^2) = Q_t$$

Test $H_0 : \lambda = 1$ against $\lambda < 1$ where

$$Q_t = \lambda^2 Q_{t-1}$$

Find $\lambda < 1$, but very close to 1.

Q: What is learning converging to?

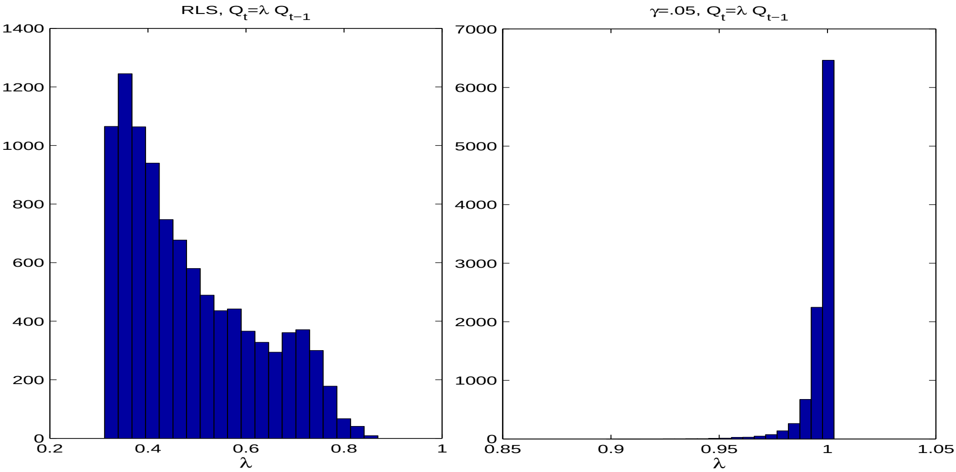
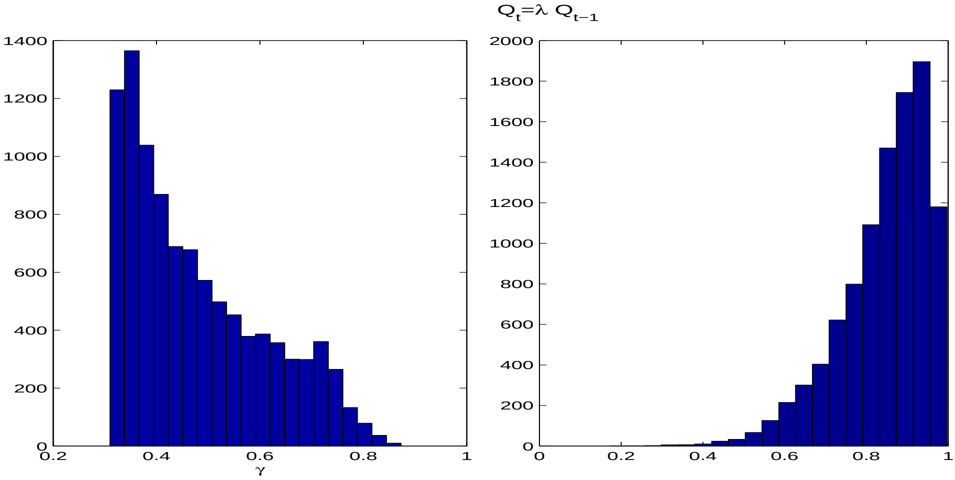

RLS, $Q_t=\lambda\ Q_{t-1}$
1400
1200
1000
800
600
400
200
0
0.2
0.4
0.6
0.8
1
λ
γ=.05, $Q_t=\lambda\ Q_{t-1}$
7000
6000
5000
4000
3000
2000
1000
0
0.85
0.9
0.95
1
1.05
λ

Figure: $Q_t - Q = \lambda^2 (Q_{t-1} - Q)$.



In a nutshell...

- Nice paper, intriguing results.
- Explaining expectations critical policy issue.
- Questions that policymakers would like to know answers to:
  1. Why are priors on structural change so different across countries, and across professionals versus households.
  2. Are beliefs converging? Does this mean the inflation target is credible?
  3. Are there ways to improve on the survey data?