# Materials 12 - tinkering around with policy and expectation formation

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### Overview

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### 1 Model summary

$$x_{t} = -\sigma i_{t} + \hat{\mathbb{E}}_{t} \sum_{T=t}^{\infty} \beta^{T-t} \left( (1-\beta) x_{T+1} - \sigma(\beta i_{T+1} - \pi_{T+1}) + \sigma r_{T}^{n} \right)$$
 (1)

$$\pi_t = \kappa x_t + \hat{\mathbb{E}}_t \sum_{T=t}^{\infty} (\alpha \beta)^{T-t} \left( \kappa \alpha \beta x_{T+1} + (1-\alpha) \beta \pi_{T+1} + u_T \right)$$
 (2)

$$i_t = \psi_\pi \pi_t + \psi_x x_t + \rho i_{t-1} + \bar{i}_t \tag{3}$$

$$\hat{\mathbb{E}}_t z_{t+h} = \begin{bmatrix} \overline{\pi}_{t-1} \\ 0 \\ 0 \end{bmatrix} + b h_x^{h-1} s_t \quad \forall h \ge 1 \qquad b = g_x \ h_x \qquad \text{PLM}$$
(4)

$$\bar{\pi}_t = \bar{\pi}_{t-1} + k_t^{-1} \underbrace{\left(\pi_t - (\bar{\pi}_{t-1} + b_1 s_{t-1})\right)}_{\text{fcst error using (4)}} \qquad (b_1 \text{ is the first row of } b)$$
 (5)

$$k_t = \begin{cases} k_{t-1} + 1 & \text{for decreasing gain learning} \\ \bar{g}^{-1} & \text{for constant gain learning.} \end{cases}$$
 (6)

# 2 Changes

- 1. To policy
  - (a)  $\mathbb{E}(\pi)$  instead of  $\pi$  in TR
- 2. To expectation formation
  - (a) Curiosity: check IRFs from Euler equation learning
  - (b) IRFs from vector learning (meaning learn all observables)
  - (c) Different implications from Bayesian learning?

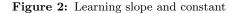
#### Some reasoning why:

- Townsend (1983) investigates "forecasting the forecasts of others" and finds damped oscillations
   → do higher-order beliefs play a role for causing oscillations in learning? If so, EE learning IRFs
   should exhibit no oscillations (and indeed they do not!)
- 2. Vector learning: are model implications different when agents learn the LOM of not only inflation but also of the other variables?  $\rightarrow$  No. (Note: I'm using the same gain for all variables.)
- 3. Does learning both slope and constant make a difference?  $\rightarrow$  Not for decreasing gain learning, but for constant gain learning yes.

## 3 IRFs from vector learning: EE and LH, T = 400, N = 100

EE, shock imposed at t=25 LH, shock imposed at t=25 Inflation **Output gap** Int. rate Inflation **Output gap** Int. rate 0.15 -0.2 -0.5 -0.2 -0.5 0.1 0.1 -0.4 -1 -0.4 0.05 0.05 -0.6 -0.6 -1.5 5 5 10 10 0 10 0 5 10 10 5 -Learning -Learning Learning —Learning —Learning —Learning ····RE ····RE ····RE ····RE ···RE ····RE (a) EE, dgain (b) LH, dgain EE, shock imposed at t=25 LH, shock imposed at t=25 Output gap Inflation Inflation **Output gap** Int. rate Int. rate 0 0.2 0.3 0.15 0.5 -0.2 -0.5 0.2 -0.2 0.1 0 -0.5 -0.4 0.05 -0.4 0.1 0 -0.6 -0.6 -1.5 0 0 5 10 5 10 0 5 10 5 10 5 10 0 -Learning -Learning —Learning -Learning -Learning -Learning ····RE ····RE ····RE

Figure 1: Learning constant only



(d) LH, cgain

(c) EE, cgain

