Athanasios Orphanides and John C. Williams, Imperfect Knowledge, Inflation Expectations, and Monetary Policy

Discussion by Lars E.O. Svensson
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- Simple model of monetary policy under perfect knowledge and imperfect knowledge with learning
- Simulation of model under perfect and imperfect knowledge
- Discussion of monetary policy under imperfect knowledge

- Perfect knowledge
  Structural model (Lucas supply function, no time-consistency problem)

$$\pi_{t+1} = \phi \pi^e_{t+1} + (1-\phi)\pi_t + \alpha y_{t+1} + e_{t+1} \quad (1)$$
$$y_{t+1} = x_t + u_{t+1} \quad (4)$$

Loss function

$$\begin{aligned}\mathcal{L} &= \omega \mathrm{Var}[\pi_t - \pi^*] + (1-\omega)\mathrm{Var}[y_t] \quad (3)\\ &= \lim_{\delta \to 1} (1-\delta)\mathrm{E}_t \sum_{\tau=0}^{\infty} \delta^\tau [\omega(\pi_{t+\tau} - \pi^*)^2 + (1-\omega) y^2_{t+\tau}]\end{aligned}$$

Rational expectations

$$\pi^e_{t+1} = \mathrm{E}_t \pi_{t+1}$$

– Optimal policy linear

$$x_t = -\theta^p(\pi_t - \pi^*) \quad (5)$$

(π_t only state variable)

$$\theta^p = \frac{\sqrt{4\left(\frac{1-\phi}{\alpha}\right)^2(1-\omega)\omega + \omega^2} - \omega}{2\frac{1-\phi}{\alpha}(1-\omega)} \quad (9)$$

$$\frac{\partial \theta^p}{\partial \left(\frac{1-\phi}{\alpha}\right)} > 0, \ \frac{\partial \theta^p}{\partial \omega} > 0$$

- Imperfect knowledge
  Least squares learning with finite memory
  Regressions in period t

$$\pi_i = c_{0,t} + c_{1,t}\pi_{i-1} + v_i, \quad i \leq t \quad (10)$$

$$c_t = \begin{bmatrix} c_{0,t} \\ c_{1,t} \end{bmatrix}, \quad X_t = \begin{bmatrix} 1 \\ \pi_{t-1} \end{bmatrix}$$

$$\pi^e_{t+1} = c'_t X_{t+1} \quad (13)$$
$$c_t = c_{t-1} + R_t^{-1} X_t(\pi_t - c'_{t-1}X_t) \quad (11)$$
$$R_t = R_{t-1} + \kappa(X'_t X_t - R_{t-1}), \quad \kappa > 0 \quad (12)$$

  – Infinite memory, $\kappa_t = \frac{1}{t} \to 0$, convergence to RE
  – Nonlinear model, nonlinear optimal-control problem
  – State variables: π_t, c_t, R_t
  – Optimal policy nonlinear

$$x_t = f(\pi_t - \pi^*, c_t, R_t)$$

  (Bellman equation, no time-consistency problem)

- Results
  – Imperfect knowledge and learning implies particular nonlinear updating of inflation expectations
  – Inflation becomes more persistent
  – Performance of simple policy

$$x_t = -\theta(\pi_t - \pi^*)$$

  ∗ Optimal simple policy higher θ, stabilizes inflation more

- Comments
  – Optimal nonlinear policy different from optimal policy under RE, takes learning into account
  – Calculate optimal nonlinear policy
  – Inflation-forecast targeting, constructing alternative inflation and output-gap forecasts, selecting those that "look best," come close to optimal nonlinear policy?
    ∗ Never use simple mechanical policy rule?
  – Problems with asymmetric information assumption
    ∗ Central bank knows all, private sector primitive learning
    ∗ Transparent informed central bank would inform the private sector about model and inflation forecasts (cf. *Inflation Reports* in NZ, UK, Sweden)
    ∗ Real world, closer to symmetry