THE NEW ECONOMIC SCHOOL
Macroeconomics 6

Problem Set 2
Year 2004-2005

1 Calvo price setting with endogenous rate of price adjustment

Consider the Calvo(1983) model in continous time. Specifically, suppose that each firm is minimizing

$$\int_0^\infty e^{-\alpha s}(b_t - p^*_{t+s})^2 ds + F,$$

where α is the stochastic rate of price adjustment, b_t is the reset price, and F is the fixed cost of adjusting the price. Also suppose that

$$p^*_t = p_t + \beta(y_t - \bar{y}),$$

where p_t is the aggregate price level, y_t is total output, and $\bar{y}$ is its natural level.

a) Solve for the optimal reset price b_t. Interpret. Suppose that the economy is at a steady state with no inflation and output at its potential. What are the private losses of a firm from price stickiness?

b) Now suppose there is monotone steady-state price inflation at the rate of μ: $\dot{p} = \mu$, so that $p_t = \mu t$. At the same time, output remains at potential. Again, solve for the reset price in this case. How does the reset price depend on the inflation rate?

c) Solve for losses in the case of trend inflation. Suppose the firm can choose once and for all, for given parameters, how frequently to adjust its price. What is the optimal rate of price adjustment and how does it depend on the inflation rate?

d) Given your findings, how do you think price stickiness would differ in high inflation versus low inflation countries?

2 Monetary policy rules

Consider the following model:

$$\pi_{t+1} = \pi_t + \alpha x_t + \varepsilon_{t+1}, \tag{1}$$

$$x_{t+1} = \beta_x x_t - \beta_r (i_t - E_t(\pi_{t+1})) + \eta_{t+1}, \tag{2}$$

$$m_{t+1} - p_{t+1} = y_t - \gamma i_t + \theta_{t+1}, \tag{3}$$

$$x_t \equiv y_t - \bar{y}, \tag{4}$$

where $\pi_t \equiv p_t - p_{t-1}$ is inflation, p_t is the log price level, y_t is log output, i_t is the nominal interest rate (the Central Bank's policy instrument), m_t is money supply, $\varepsilon_t, \eta_t, \theta_t$ are all zero-mean iid shocks. All coefficients are positive.

a) Interpret the equations. How is the Phillips curve presented here different from the standard New Keynesian Phillips curve? Do you expect this difference to influence the optimal monetary policy?

Now suppose the Central bank can commit to any policy and solves the minimization problem:

$$\min (1-\delta) E_t \sum_{s=t}^{\infty} \delta^{s-t} L_s. \tag{5}$$

In each of the targeting rules (b)-(d) below, find the optimal behavior of the Central bank (first-order conditions with respect to the targeted variable), and derive the policy rule (response of the interest rate i_t to time t variables). Minimize the whole sum in (5), not just the current loss as we did in class. Interpret the results!

b) Strict inflation targeting rule

$$L_s = \frac{1}{2}(\pi_s - \pi^*)^2.$$

c) Strict output-gap targeting rule

$$L_s = \frac{1}{2}x_s^2.$$

d) Strict money growth targeting

$$L_s = \frac{1}{2}(m_s - m_{s-1} - g^*)^2.$$

e) Nominal GDP growth targeting

$$L_s = \frac{1}{2}(\pi_s + y_s - y_{s-1} - g^*)^2.$$