New Economic School

Macroeconomics 2

Problem set 5 answer key

Instructor: Andrei Sarychev

1. Expectations-augmented Phillips curve

   (a)

$$\begin{aligned}\pi_t - (1-\lambda)\,\pi_t - \lambda\pi_t^e &= \alpha\,(u_N - u_t)\\ \lambda\pi_t - \lambda\pi_t^e &= \alpha\,(u_N - u_t)\\ \pi_t - \pi_{t-1} &= \frac{\alpha}{\lambda}\,(u_N - u_t)\end{aligned}$$

   (b) Suppose initially the inflation and monetary growth were at 5%, and the unemployment rate was equal to u_n. If the authorities decide to reduce unemployment, say, by 1%, they engineer an increase in the rate of money growth, which drives up prices as a side effect (recall AD-AS model). The effect on unemployment is non-zero because higher inflationary expectations do not set in immediately: π_t^e is still 5%. By how much inflation has to shoot up in the immediate aftermath of the expansion depends on α and λ, 1% reduction in u requires to increase inflation by α/λ%. This implies an increase in the depreciation rate in the short run. However, the effects of the faster growth of money stock only last until π_t^e catch up with π_t.

   (c) The fact that more workers are paid in dollars, does not have an impact on the "long run" unemployment rate, which is u_N. However, as we saw in b), this makes the magnitude of the required acceleration in inflation higher (α/λ%). Thus the gains in unemployment reduction become more costly in terms of inflation. This would probably make authorities less eager to use money growth to stimulate activity. Needless to say, the trade-off is temporary, and therefore in the long run trade-off between u and π does not exist for any value of λ.

2. True model:

$$y_t = \alpha(p_t - E_{t-1}p_t) \tag{1}$$

$$p_t = \pi + p_{t-1} + \varepsilon_t \tag{2}$$

Estimated equation:

$$y_t = \beta_0 + \beta_1(p_t - p_{t-1}) = \beta_0 + \beta_1\pi_t \tag{3}$$

From equation (2):

$$E_{t-1}p_t = \pi + p_{t-1} \tag{4}$$

Substitute into (1):

$$y_t = \alpha(p_t - \pi - p_{t-1}) = -\alpha\pi + \alpha\pi_t \tag{5}$$

Therefore estimation of (3) gives $\beta_0 = -\alpha\pi$, and $\beta_1 = \alpha$.
Using π (the systematic component) to exploit the apparent trade-off leads to a shift in the intercept. Thus cannot rely on estimated (3) for policy simulations (Lucas Critique).
Analogously, if

$$p_t = \pi + (1+\gamma)p_{t-1} - \gamma p_{t-2} + \varepsilon_t \tag{6}$$

then

$$y_t = \alpha(p_t - \pi - (1+\gamma)p_{t-1} + \gamma p_{t-2}) = \alpha(\pi_t - \gamma\pi_{t-1} - \pi) = \tag{7}$$

$$= -\alpha\pi + \alpha\pi_t - \alpha\gamma\pi_{t-1} \tag{8}$$

Therefore estimation of

$$y_t = \beta_0 + \beta_1\pi_t + \beta_2\pi_{t-1} \tag{9}$$

yields $\beta_0 = -\alpha\pi$, $\beta_1 = \alpha$, and $\beta_2 = -\alpha\gamma$.
As above, trying to exploit the trade-off leads to a shift in the intercept. Thus cannot rely on estimated (9) for policy simulations.