Seminar 5
ECON 4330

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Problem 1: M-F model with inflation targeting

Focus of this problem is the inflation targeting note written by Rødseth (part 3). The model we consider is:

$$y - \bar{y} = -\alpha_\rho(\rho - \bar{\rho}) + \alpha_r(r - \bar{r}) + u_d \tag{1}$$
$$r = e + p_* - p \tag{2}$$
$$\rho = i - \dot{p}_e \tag{3}$$
$$i = i_* + \dot{e}_e \tag{4}$$
$$\dot{e}_e = \dot{p}_e - \dot{p}_* - \epsilon(r - \bar{r}) \tag{5}$$
$$\dot{p} = \dot{p}_e + \gamma(y - \bar{y}) + u_s \tag{6}$$

The variables and equations are the exact same as in Rødseth's note. (1) is the IS curve, (2) defines the real exchange rate, (3) defines the real interest rate, and (4) is the UIP. (5) defines what we assume about the expected rate of depreciation. It builds on the assumption that we expect PPP to hold in the long run. (6) is a Phillips curve, now augmented with expectations (in contrast to the Phillips curve in, say, the Dornbusch model).

Endogenous variables are y, ρ, r, $\dot{e}_e$, e and $\dot{p}$.[1] Exogenous variables are u_d, i_*, p_* and $\dot{p}_*$. As for expected inflation, $\dot{p}_e$, it will be assumed to be exogenously given, but we could of course have added an equation determining expectations similarly to what we did for $\dot{e}_e$. Let us also treat i as being exogenous for now.

1. First we want to discuss the effects of monetary policy on aggregate demand

[1] Note that this implies treating p as exogenous, which is correct in the *static* model, but over time it will of course change endogenously since $\dot{p} = \dot{P}/P$.

(a) Explain through what channels a change in i will affect y if $\dot{p}_e$ is held fixed.

(b) Imagine that we have a model for how $\dot{p}_e$ is determined. In what way do you expect a higher i should affect $\dot{p}_e$?

2. The function for $\dot{e}_e$ is based on the assumption that we expect PPP to hold in the long run.

   (a) What is your interpretation of the parameter ϵ? It is assumed that $0 < \epsilon < 1$.

3. It is possible to write the model more compactly, with only y, e and $\dot{p}$ as the endogenous variables:

$$y - \bar{y} = -(\alpha_\rho + \alpha_r/\epsilon)(\rho - \bar{\rho}) + u_d \tag{7}$$

$$e = \bar{r} + p - p_* - \frac{1}{\epsilon}(\rho - \bar{\rho}) \tag{8}$$

$$\dot{p} = \dot{p}_e + \gamma(y - \bar{y}) + u_s \tag{9}$$

   (To find this, just combine the equations, and then use that PPP in the long run + UIP implies $\bar{\rho} = \rho_*$)

   (a) Assume that $u_s = 0$ and $u_d > 0$. Show what interest rate the central bank must choose if it wants inflation to be on a target $\bar{\pi}$ (remember, $\rho = i - \dot{p}_e$).

   (b) How does your answer depend on expected inflation? What happens to output if $\dot{p}_e = \bar{\pi}$? What if $\dot{p}_e > \bar{\pi}$?

   (c) What is the initial impact on the exchange rate from u_d if the interest rate is unchanged?

   (d) What is the total impact on the exhange rate after the central bank has adjusted i (which changes ρ by the same amount)?

   (e) Use a diagram with ρ on the vertical and y on the horizontal axis to show how the IS curve shifts, and how equilibrium is determined, in the case where the $\dot{p}_e = \bar{\pi}$.

   (f) How would your diagram change if $\dot{p}_e > \bar{\pi}$?

4. One way to formalize the discussion on monetary policy is to assume that the nominal interest rate is set according to a Taylor rule such as (10):

$$i = \bar{\pi} + \tau(\dot{p} - \bar{\pi}) \tag{10}$$

(a) Re-write the Taylor rule to to make it a real-interest rate rule (use $\rho = i - \dot{p}_e$). Combine the Taylor rule with the IS curve to get an aggregate demand curve that relates inflation and the output gap from the demand side.

(b) Draw the demand curve together with the Phillips curve in a diagram. Analyze how changes in $\dot{p}_e$ shifts both curves, and changes the equilibrium.[2] Will output increase or decrease?

5. Assume that $\dot{p}_e = \bar{\pi}$, so the inflation target is credible (although the CB only aims to reach it in the long run).

   (a) Explain what happens to the exchange rate in the long run if $\bar{\pi} \neq \dot{p}_*$.

   (b) An increased τ will always make inflation less volatile. Use a diagram to show whether a higher value of τ makes output more or less variable when demand shocks (u_d) are dominating.

   (c) What if supply shocks (u_s) are most imporant?

   (d) Discuss informally how τ will affect exchange rate volatility, first in the short run (when p can be taken as fixed) and in the long run.

6. As a final variation, let us consider the case when the central bank targets a specific *price level* instead. For instance, we can subsitute (10) with

$$\rho = \bar{\rho} + \theta(p - \bar{p}) \tag{11}$$

   where $\bar{p}$ is the price level target. With this formulation, the central bank will try to push down output when the price level is too high, and vice versa (assuming $\theta > 0$).

   (a) Discuss informally once more how exchange rate volatility depends on how fast the central bank tries to reach its target.

   (b) (This might be a difficult question) Use a (y, p)-diagram to analyze how the short-run equilbrium is determined, and the transition towards long-run equilbirium.

[2] You should recognize that the case discussed in question 3 is when $\tau \to \infty$ (the CB wants to reach its target immediately).