# Problems: set 2

## Aggregate supply

1. Discuss, in economic terms, the effects of increased international globalization, and hence of an increase in the absolute value of the price elasticity of demand $\sigma$, on the natural rate of unemployment. Remember:

$$\bar{u} = 1 - \left(\frac{1-\alpha}{m^p m^w c}\right)^{1/\alpha}$$

$$m^p = \frac{\sigma}{\sigma - 1}$$

$$m^w = \frac{\eta \epsilon}{\eta \epsilon - 1} \quad \text{and} \quad \epsilon = \frac{\sigma}{1 + \alpha(\sigma - 1)}$$

2. Suppose you are asked to estimate the natural rate of unemployment for a particular country. How would you proceed?

## Explaining business cycles

1. In period 0 the economy is in a long-run equilibrium. Use the graphical representation of the AD-AS model with static expectations to illustrate the effects of a temporary positive supply shock which occurs in period 1, and only in that period. Explain the short-run effects and the dynamic adjustment of the economy. Remember:

$$y_t - \bar{y} = \alpha(\pi^* - \pi_t) + z_t \qquad \alpha = \frac{\alpha_2 h}{1 + \alpha_2 b} \; ; \; z_t = \frac{v_t + \alpha_1(g_t - \bar{g})}{1 + \alpha_2 b}$$

$$\pi_t = \pi_{t-1} + \gamma(y_t - \bar{y}) + s_t$$

2. Now assume that the supply shock lasts for 2 periods, i.e. period 1 and period 2. Discuss the effects and compare the results with the ones of the previous question.

## Stabilization policy. Why?

1. What are the arguments for avoiding employment fluctuations? What factors determine the magnitude of the welfare cost of employment fluctuations; more in particular, explain why the welfare cost is increasing in the parameters $\alpha, \theta$ and $\mu$. Remember:

$$\frac{\Delta/\bar{U}_C}{C} = \frac{(\bar{\delta} - 1)}{\bar{\delta}} \hat{y} - \left[\theta + \frac{\mu}{\bar{\delta}(1-\alpha)}\right] \frac{\hat{y}^2}{2}$$

2. Discuss why it is socially desirable to stabilize the rate of inflation around some constant and strictly positive target value.

## Stabilization policy. How?

1. Consider a model with static expectations and outside lags. The goods market equilibrium condition and the AS function are given by:

$$y_{t+1} - \overline{y} = z_{t+1} + \alpha_1 (y_t - \overline{y}) - \alpha_2 (i_t^p - \pi_t - \overline{r}^*)$$
$$\pi_{t+2} = \pi_{t+1} + \gamma (y_{t+1} - \overline{y}) + s_{t+2}$$

   (a) How can these lags be rationalized?

   (b) Suppose the central bank only cares about inflation. It was then shown that the central bank should follow a policy of inflation forecast targeting

$$\pi_{t+2,t}^e = \pi^*$$

   where $\pi^*$ is the target inflation rate.

   i. Show that, in order to attain this objective, the central bank should set the nominal interest rate as follows:

$$i_t^p = \overline{r}^* + \pi_t + h (\pi_t - \pi^*) + b (y_t - \overline{y}) \qquad \text{where } h = \frac{1}{\gamma \alpha_2} \; ; \; b = \frac{1 + \alpha_1}{\alpha_2}$$

   ii. Explain why the interest rate should react to the output gap although the central bank is only concerned with inflation.

2. Suppose the economy is in a deep recession and has fallen into a liquidity trap where the policy interest rate has hit its zero lower bound. The AD-AS model is

$$\pi = \rho - \overline{\rho} - \overline{r}^* + \frac{1}{\alpha_2} [y - \overline{y} - v - \alpha_1 (g - \overline{g}) + \widetilde{m} C_Y (\tau - \overline{\tau})]$$
$$\pi = \pi_{-1} + \frac{\alpha}{1 - \alpha} (y - \overline{y}) + s \quad \text{where} \quad s = \ln \left( \frac{m^p}{\overline{m}^p} \right) + \ln \left( \frac{m^w}{\overline{m}^w} \right) - \ln \left( \frac{1 - \tau}{1 - \overline{\tau}} \right)$$

   Carry out a graphical analysis tot discover which type of fiscal policy, an increase in public spending or a tax cut, is likely to be most effective in pulling the economy out of the recession.

## Stabilization policy with rational expectations

1. What is the Lucas critique all about? Illustrate with an example of your own.

2. Suppose the CB follows the following interest rate rule:

$$r_t = \overline{r} + h (\pi_{t,t-1}^e - \pi^*) + a_t$$

   where $a_t$ is a white noise stochastic variable reflecting the non-systematic and hence unpredictable part of monetary policy.
   The goods market equilibrium condition:

$$y_t - \overline{y} = z_t - \alpha_2 (r_t - r)$$

   The short run aggregate supply function:

$$\pi_t = \pi_{t,t-1}^e + \gamma (y_t - \overline{y}) + s_t$$

(a) Explain the assumptions behind the interest rate rule.

(b) Assume rational expectations and show that the solution of the model is

$$
\begin{aligned}
y_t &= \overline{y} + z_t - \alpha_2 a_t \\
\pi_t &= \pi^* + \gamma z_t - \gamma \alpha_2 a_t + s_t
\end{aligned}
$$

(c) Is monetary policy "effective"? Explain why or why not.

(d) Show that greater predictability of monetary policy, i.e. a smaller variance $\sigma_a^2$ of the unpredictable part $a_t$ will unambiguously raise social welfare by reducing the variance of output and inflation.

3. Announcement effects. Whe used the following model of the stock market:

$$
\begin{aligned}
V_t &= \frac{D_{t,t}^e}{1+r} + \frac{D_{t+1,t}^e}{(1+r)^2} + \frac{D_{t+2,t}^e}{(1+r)^3} + \cdots \\
d_{t+n} &= \overline{d} + \varepsilon_{t+n} \\
D_{t+n,t}^e &= (1-\tau_0)\,\overline{d}
\end{aligned}
$$

and derived the following expression for the market value of shares:

$$
V_t = \frac{(1-\tau_0)\,\overline{d}}{r}.
$$

If at time $t = t_0$ the government announces that it will permanently reduce the dividend tax rate to $\tau_1 < \tau_0$ from some future time period $t_1 > t_0$ then

$$
\begin{aligned}
V_t &= \frac{(1-\tau_0)\,\overline{d}}{1+r} + \frac{(1-\tau_0)\,\overline{d}}{(1+r)^2} + \cdots + \frac{(1-\tau_0)\,\overline{d}}{(1+r)^{t_1-t}} \\
&\quad + \frac{(1-\tau_1)\,\overline{d}}{(1+r)^{t_1+1-t}} + \frac{(1-\tau_1)\,\overline{d}}{(1+r)^{t_1+2-t}} + \cdots \qquad \Rightarrow \\
V_t &= \frac{\overline{d}}{r}\left\{\left[1 - \frac{1}{(1+r)^{t_1-t}}\right](1-\tau_0) + \left[\frac{1}{(1+r)^{t_1-t}}\right](1-\tau_1)\right\} \qquad \text{for } t_0 \le t \le t_1
\end{aligned}
$$

Now suppose that at time $\widetilde{t}$ where $t_0 < \widetilde{t} < t_1$ it becomes clear to all agents that the reduction of the dividend tax rate will be postponed to period $t_1 + 1$. Trace the dynamic effects on the market value of shares.