# Macroeconomics A
# Problem Set 8

Johannes Boehm

Geneva Graduate Institute — Fall 2024

## The New Keynesian model and Optimal Monetary Policy

1. Consider a monopolistically competitive firm with real unit cost of $z_t$ per unit sold at time $t$ (marginal cost is constant at the firm level). The firm (firm $i$) sells output at price $p_t(i)$ and faces the following demand function for its output $y_t(i)$:

$$y_t(i) = \left(\frac{p_t(i)}{p_t}\right)^{-\epsilon_t} y_t$$

where $p_t$ is the general price level, $y_t$ is aggregate output, and $\epsilon_t$ is the price elasticity of demand. The firm's price $p_t(i)$ implies a (gross) markup of $\mu_t(i) = p_t(i)/(p_t z_t)$ on marginal cost. Profits (in real terms) made by the firm at time $t$ are therefore given by

$$\text{Profits}_{i,t} = z_t^{1-\epsilon_t} y_t \left(\mu_t(i)^{1-\epsilon_t} - \mu_t(i)^{-\epsilon_t}\right)$$

(a) [5 points] Show that the profit-maximizing markup for a firm with flexible prices is

$$\mu_t^* = \frac{\epsilon_t}{\epsilon_t - 1}.$$

The firm hires labor in a perfectly competitive market at wage $w_t$ and each unit of labor has productivity $a_t$. Thus $z_t = w_t/a_t$. The wage is determined by the household labor supply condition

$$w_t = \frac{\nu'(l_t)}{u'(c_t)}$$

where $l_t$ is labor supply and $c_t$ is consumption.

(b) [5 points] Assume that $u(c_t) = 1 - c_t^{-1}$ and $\nu(l_t) = l_t$. Show that the natural level of output $y_t^*$ is

$$y_t^* = \sqrt{\frac{a_t}{\mu_t^*}}$$

and explain why this means that the efficient level of output is $\hat{y}_t = \sqrt{a_t}$.

When firms can adjust their prices at random staggered intervals (Calvo pricing), inflation is determined by the New Keynesian Phillips curve,

$$\widetilde{\pi}_t = \beta \mathbb{E}_t \widetilde{\pi}_{t+1} + \kappa \widetilde{x}_t + \gamma \widetilde{\mu}_t^* \tag{1}$$

where $\widetilde{\pi}_t$ is inflation and $\widetilde{x}_t$ is the output gap (defined relative to efficient output). The notation $\widetilde{x}_t$ indicates the percentage deviation of $x_t$ from its steady-state value.

(c) [5 points] In this environment, should monetary policy aim to stabilize the output gap $\widetilde{x}_t$ completely following an unexpected temporary decrease in $a_t$? Why or why not?

Now suppose that markets become more competitive when output is higher (perhaps because of more competition for new customers). In particular, assume that $\epsilon_t = 1 + \frac{1}{2}y_t$. Price adjustment is staggered according to the Calvo model.

(d) [5 points] Derive an expression for the desired flexible-price markup $\mu_t^*$ in terms of the output gap $x_t \equiv y_t/\hat{y}_t$ and productivity $a_t$. (Hint: the efficient level of output is still $\hat{y}_t = \sqrt{a_t}$.) Find a log-linear approximation of this equation in terms of $\widetilde{\mu}_t^*$, $\widetilde{a}_t$, and $\widetilde{x}_t$, and interpret it.

(e) [4 points] In this environment, should monetary policy aim to stabilize the output gap $\widetilde{x}_t$ completely following an unexpected temporary decrease in $a_t$? Why or why not?

(f) [6 points] Compare the size of the response of inflation $\widetilde{\pi}_t$ to the output gap $\widetilde{x}_t$ in the two cases where the price elasticity $\epsilon_t$ is exogenous and where it depends positively on output $y_t$. Assuming the central bank is minimizing the same standard loss function in both cases, what implications does the dependence of $\epsilon_t$ on $y_t$ have for the optimal balance between stabilizing inflation and stabilizing the output gap (when shocks shift the New Keynesian Phillips curve)? Why?

## Short Questions

2. [10 points] Explain the channel system of conducting monetary policy, and illustrate its advantages and disadvantages.

3. [10 points] Discuss whether (and in which way) optimal monetary policy with commitment is preferable over discretionary optimal monetary policy. Which assumption(s) of the New Keynesian model generate the dynamic externality that drives the differences between discretion and commitment?