Fiscal Policy in the NK Model

The 3-Equation System

$$\text{AD: } y_t = -(i_t - E_t\pi_{t+1} - r_t^*) + E_t y_{t+1} + g_t - E_t g_{t+1} \tag{1}$$
$$\text{AS: } \pi_t = \kappa y_t + \psi(\hat{\tau}_t - g_t) + \beta E_t \pi_{t+1} \tag{2}$$
$$\text{MP: } i_t = \max\{0, \phi_\pi \pi_t + \phi_y y_t\} \tag{3}$$

(a) Explain why g_t enters AD as $(g_t - E_t g_{t+1})$. Noting that $\kappa = \psi(1+\varphi)$, what happens to y_t, π_t and i_t if the government increases spending? Can a sudden increase in government spending be compared to which kind of shock?

(b) Explain why $\hat{\tau}_t$ enters only AS. How do inflation, output and the nominal interest rate react to a tax cut? Is a tax cut equivalent to a cost-push shock or to a demand shock?

Normal Times Equilibrium

Assume that the state of the economy is such that $r^* = \underline{r}$ and:

$$i_t = \phi_\pi \pi_t + \phi_y y_t \tag{4}$$
$$r^*_{t_0+j} = \begin{cases} \underline{r} & \text{with prob } \mu \\ 0 & \text{with prob } 1-\mu \end{cases} \tag{5}$$

Further assume that, in the long run (hence, when $r_t^* = 0$) we have constant fiscal instruments ($\hat{\tau}_t = g_t = 0$) and inflation and output are at their steady state values ($y_t = \pi_t = 0$). Denote with y_n and π_n the values of output and inflation when $r^* = \underline{r}$.

(a) Find an expression for $E_t y_{t+1}$ and $E_t \pi_{t+1}$

(b) Show that we can rewrite the AD curve as

$$\pi_n = -\frac{1}{\phi_\pi - \mu}\left[(1 - \mu + \phi_y)\, y_n - \underline{r} - (1-\mu) g\right] \tag{6}$$

(c) Show that we can rewrite the AS curve as

$$\pi_n = \frac{1}{1-\beta\mu}\left[\kappa y_n + \psi(\hat{\tau} - g)\right] \tag{7}$$

Equilibrium

(a) Solve analytically for y_n and show that we can write:

$$y_n = \frac{(1-\beta\mu)\underline{r} + \left[(1-\beta\mu)(1-\mu) + \psi\left(\phi_\pi - \mu\right)\right] g - \psi\left(\phi_\pi - \mu\right)\hat{\tau}}{(1 - \mu + \phi_y)\left(1-\beta\mu\right) + \kappa\left(\phi_\pi - \mu\right)} \tag{8}$$

(b) Is the denominator always positive or negative? Why?

Comparative Statics (Normal Times)

(a) Compute:

$$\frac{\partial y_n}{\partial g}, \quad \frac{\partial y_n}{\partial \hat{\tau}} \tag{9}$$

(b) Determine the signs and explain.

Graphical Analysis

(a) Draw the AS and AD curves in a (y, π) diagram.

(b) Show effects of:

- increasing $g : g = 0 \to g > 0$ keeping $\hat{\tau} = 0$
- reducting $\hat{\tau} : \hat{\tau} = 0 \to \hat{\tau} < 0$ keeping $g = 0$

Track AD, AS, and equilibrium.

ZLB Case

Assume now that the state of the economy is such that $r^* = \underline{r} \ll 0$ and:

$$i_t = 0 \tag{10}$$

$$r^*_{t_0+j} = \begin{cases} \underline{r} & \text{with prob } \mu \\ 0 & \text{with prob } 1-\mu \end{cases} \tag{11}$$

In the long run, variables behave like in the previous sections. Use now the suffix c when referring to values and output in crisis time (i.e. when $r^*_t = \underline{r}$).

(a) Re-derive AD curve and show it is upward sloping:

$$\pi_c = \frac{1}{\mu}\left[(1-\mu)y_c - \underline{r} - (1-\mu)g\right] \tag{12}$$

Crisis Equilibrium

Obtain an expression for y_c:

$$y_c = \frac{(1-\beta\mu)r + \mu\psi\hat{\tau} + [(1-\beta\mu)(1-\mu) - \psi\mu]g}{(1-\mu)(1-\beta\mu) - \kappa\mu} \tag{13}$$

Comparative Statics at ZLB

Assume that $(1-\mu)(1-\beta\mu) - \kappa\mu > 0$.

(a) Compute:

$$\frac{\partial y_c}{\partial \hat{\tau}}, \quad \frac{\partial y_c}{\partial g} \tag{14}$$

(b) Show that:

- Tax cuts are contractionary
- Government spending is expansionary (remember that $\kappa > \psi$ and the denominator is positive by assumption)

Graphical Analysis at ZLB

(a) Draw the AS and AD curves in a (y, π) diagram, remembering $(1-\mu)(1-\beta\mu) - \kappa\mu > 0$.

(b) Show the effects of:

- A tax cut (from $\hat{\tau} = 0$), when $g = 0$
- An increase in government spending when $\hat{\tau} = 0$

Why is the effect of a tax cut different than in normal times? Explain, stressing the role of the monetary policy authority.