# Final Exam - Spring 2000, Problem 16

For this question, you are given that:

$$\begin{aligned} \pi_t^w &= \pi_{t-1}^w - \lambda\left(u_t - u_o\right), \text{ where } \lambda > 0 \text{ and constant.} \\ P_t &= \mu\left(MC\right)_t, \text{ where } \mu > 0 \text{ and constant.} \\ Y &= F\left(K, L\right). \end{aligned}$$

Let $g$ be the growth rate of output-per-person hour. This means that $g = \ln\left(F_L\right)_t - \ln\left(F_L\right)_{t-1}$. Assume that $g$ rises permanently from $g_0$ to $g_1$, where $g_1 > g_0$.

If labor markets are perfectly competitive, we know that:

$$w_t = MRP_L,$$

where $w$ is the nominal wage and $MRP_L$ is the marginal revenue product of labor. With the assumption that prices are a fixed markup, the labor market equilibrium condition becomes:

$$\begin{aligned} w_t &= \mu\left(MC\right)_t\left(F_L\right)_t \\ &= P_t\left(F_L\right)_t \Rightarrow \\ \ln w_t &= \ln P_t + \ln\left(F_L\right)_t \Rightarrow \\ \ln w_t - \ln w_{t-1} &= \ln P_t - \ln P_{t-1} + \ln\left(F_L\right)_t - \ln\left(F_L\right)_{t-1} \\ \pi_t^w &= \pi_t^P + g \Rightarrow \\ \pi_t^P &= \pi_t^w - g. \end{aligned}$$

Recall that even when there are real wage rigidities in the market (such as efficiency wages), workers are still paid their marginal revenue products (just as the above equilibrium condition states). We now have a relationship between wage inflation and price inflation.

Under the assumption about the time path of wage inflation, price inflation then becomes:

$$\pi_t^P = \pi_{t-1}^w - \lambda\left(u_t - u_o\right) - g.$$

How does a rise in productivity affect price inflation? The direct effect of the productivity rise is negative; the productivity rise decreases price inflation (through $g$). There is also an indirect effect of productivity growth on price inflation. The rise in productivity growth will have a tendency to decrease the natural rate of unemployment ($u_o$ falls as $g$ rises). Since $\lambda > 0$, this means that productivity increases also tend to decrease the rate of price inflation (through decreases in wage inflation). Hence, there is both a favorable inflation shock and a favorable supply shock as a consequence of the productivity growth rise. At the natural rate of unemployment, price and wage inflation are stable.

Now, suppose that wage inflation is determined instead by the following equation:

$$\pi_t^w = \pi_{t-1}^P - \lambda\left(u_t - u_o\right).$$

In this case, we can see that path of price inflation is described by:

$$\begin{aligned} \pi_t^P &= \pi_{t-1}^P - \lambda\left(u_t - u_o\right) - g \Rightarrow \\ \pi_t^P - \pi_{t-1}^P &= -\lambda\left(u_t - u_o\right) - g. \end{aligned}$$

Again, the productivity rise acts as both a favorable inflation shock and a favorable supply shock. In this case though, wage and price inflation never settle down. Even at the natural rate of unemployment, they are both falling, since $g$ shows up negatively in the linear difference equation for price inflation.