Lectures on Monetary Policy, Inflation and the Business Cycle
Chapter 7-9 Solutions
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3. Monetary Policy and Real Wage Rigidities

a) efficiency requires $MRS_t = MPN_t$ thus implying

$$n_t^* = a_t$$

(b).under perfectly competitive labor markets

$$\begin{aligned} w_t - p_t &= mrs_t \\ &= n_t \end{aligned}$$

whereas under the alternative wage schedule

$$w_t - p_t = \frac{1}{1+\delta} n_t$$

Under the latter real wages are less sensitive to variations in employment, in that sense they are more "rigid".

(c)

$$\begin{aligned} \mu &= p_t - (w_t - a_t) \\ &= -\frac{1}{1+\delta}\overline{n}_t + a_t \end{aligned}$$

thus implying

$$\overline{n}_t = (1+\delta)(a_t - \mu)$$

(d) independently of the degree of price stickiness we have

$$\begin{aligned} mc_t &= (w_t - p_t) - a_t \\ &= \frac{1}{1+\delta} n_t - a_t \end{aligned}$$

whereas under flexible prices

$$mc = -\mu = \frac{1}{1+\delta}\overline{n}_t - a_t$$

Subtracting the latter from the former we obtain:

$$\widehat{mc}_t = \frac{1}{1+\delta}\widetilde{n}_t$$

(e) notice that we can write the the inflation equation in terms of the output gap as

$$\pi_t = \beta\ E_t\{\pi_{t+1}\} + \frac{\lambda}{1+\delta}\widetilde{n}_t$$

Using the fact that

$$\begin{aligned}
\widetilde{n}_t &= (n_t - n_t^*) + (n_t^* - \overline{n}_t) \\
&= (n_t - n_t^*) + \delta a_t + \mu(1+\delta) \\
&\simeq (n_t - n_t^*) + \delta a_t
\end{aligned}$$

we can rewrite the inflation equation as a function of the welfare-relevant employment gap $n_t - n_t^*$:

$$\pi_t = \beta\ E_t\{\pi_{t+1}\} + \frac{\lambda}{1+\delta}(n_t - n_t^*) + \lambda\mu + \frac{\delta\lambda}{1+\delta}a_t$$

Hence, the presence of real wage rigidities ($\delta > 0$) generates a trade-off in response to technology shocks.

(f) taking $E_t\{\pi_{t+1}\}$ as given, the foc is given by

$$n_t - n_t^* = -\ \frac{\lambda}{\alpha(1+\delta)}\ \pi_t$$

Plug into inflation equation and solve for π_t...

4. A Small Open Economy Model

a) Profit maximization requires $a_t = w_t - p_{H,t}$. Combined with the labor supply and $s_t = y_t - y_t^*$ yields:

$$y_t = \frac{1+\varphi}{\sigma+\varphi+\alpha(1-\sigma)}\ a_t + \frac{\alpha(1-\sigma)}{\sigma+\varphi+\alpha(1-\sigma)}\ y_t^*$$

$$\begin{aligned}
s_t &= y_t - y_t^* \\
&= \frac{1+\varphi}{\sigma+\varphi+\alpha(1-\sigma)}\ a_t - \frac{\sigma+\varphi}{\sigma+\varphi+\alpha(1-\sigma)}\ y_t^*
\end{aligned}$$

$$\begin{aligned}
c_t &= y_t + p_{H,t} - p_t \\
&= y_t - \alpha\ s_t \\
&= \frac{(1+\varphi)(1-\alpha)}{\sigma+\varphi+\alpha(1-\sigma)}\ a_t + \frac{\alpha(1+\varphi)}{\sigma+\varphi+\alpha(1-\sigma)}\ y_t^*
\end{aligned}$$

$$
\begin{aligned}
p_{H,t} &= m_t - y_t \\
&= m_t - \frac{1+\varphi}{\sigma+\varphi+\alpha(1-\sigma)}\, a_t - \frac{\alpha(1-\sigma)}{\sigma+\varphi+\alpha(1-\sigma)}\, y_t^*
\end{aligned}
$$

$$
\begin{aligned}
e_t &= p_{H,t} + s_t \\
&= p_{H,t} + y_t - y_t^* \\
&= m_t - y_t^*
\end{aligned}
$$

In the particular case of $\sigma = 1$ foreign output will have no influence on domestic output.

b) in the absence of nominal rigidities, the choice of exchange or monetary policy regime should not affect the equilibrium level of any real variable. Nominal variables, however, will be affected. Hence, normalizing $e_t = 0$ all t we would have in particular:

$$
\begin{aligned}
p_{H,t} &= -s_t \\
&= a_t - y_t^*
\end{aligned}
$$

Money supply would be endogenous and given by:

$$
m_t = y_t^*
$$

c) the derivation of the equilibrium values for real variables in (a) would no longer go through since, in general, $a_t \neq w_t - p_{H,t}$ because the markup will change as a result of the lack of continuous price adjustment. An immediate consequence would be that real variables will be affected by the monetary policy regime in place. In particular, a policy regime that fully stabilizes domestic prices (say, making $p_{H,t} = 0$ all t) will replicate the flexible price equilibrium. But in that case nominal exchange rates will have to be allowed to fluctuate one-for-one with the terms of trade, i.e.

$$
\begin{aligned}
e_t &= s_t \\
&= a_t - y_t^*
\end{aligned}
$$

while the money supply will have to accommodate domestic technology shocks:

$$
\begin{aligned}
m_t &= y_t^* + e_t \\
&= a_t
\end{aligned}
$$

Any attempt to stabilize the nominal exchange rate or the money supply will thus lead to a deviation from the flex price equilibrium allocation...