ECON 815

Two-Period New Keynesian Model

Winter 2020

Firms

There is no capital and production is linear in labour

$$y = an$$

A monopoly firm sets prices to maximize its profits

$$\max_P Py(P) - Wn$$

subject to

$$y(P) = an$$

The first-order condition is given by

$$1 + \frac{P}{y}\frac{\partial y}{\partial P} - \frac{W}{Pa}\frac{P}{y}\frac{\partial y}{\partial P} = 1 - \epsilon + \frac{W}{Pa}\epsilon = 0$$

so that firms charge a mark-up μ over marginal costs

$$\mu = \frac{\epsilon}{\epsilon - 1} = \frac{a}{W/P} = \frac{a}{w} > 1$$

Households

Households solve the problem

$$\max_{c_1,c_2,n_1,n_2} \log c_1 + \log(1-n_1) + \beta\left(\log c_2 + \log(1-n_2)\right)$$

subject to

$$P_1 c_1 + s = W_1 n_1 + \Pi_1$$
$$P_2 c_2 = W_2 n_2 + (1+i)s + \Pi_2$$

where Π_t are the firm's profit.

This gives us the following FOC

$$n_t = 1 - \frac{P_t c_t}{W_t}$$
$$\frac{c_2}{\beta c_1} = (1+i)\frac{P_1}{P_2} = 1 + r$$

Equilibrium

Using the wage rate and $c_t = y_t$ we obtain from the FOC

$$n = 1 - \frac{an}{a}\mu \qquad \text{or} \qquad n = \frac{1}{1+\mu}$$

for the equilibrium labour supply.

The Euler equation implies that real interest rates are determined by

$$\beta(1+r) = \frac{a_2}{a_1}$$

as in a standard RBC model.

Monetary policy sets i which would determine inflation according to the Fisher equation

$$(1+\pi) = \frac{P_2}{P_1} = \frac{(1+i)}{(1+r)}$$

What is New Keynesian?

We have that the optimal monopoly mark-up μ^* reduces output.

We view this as a long-run distortion that does not change over time.

Monetary policy (think changes in i) can't do anything about it ...

... unless we introduce **sticky prices** so that nominal variables matter.

This will cause the **mark-up to move inversely with the real wage**. Mark-up changes act like **changes in labour taxes** since

$$\frac{W}{P} = \frac{1}{\mu}a = (1-\tau)a$$

Any change in demand cannot be offset through price changes by firms. Hence, the mark-up moves in response leading to short-run movements in employment and output.

Monetary Policy

Monetary policy sets a nominal interest rate i so that

$$r = i - E(\pi).$$

From the Euler equation, we have that

$$1 = E\left[\beta\left(\frac{c_1}{c_2}\right)\left(\frac{1+i}{1+\pi}\right)\right]$$

or, using a log-linear approximation

$$\log c_1 = E[\log c_2] + \bar{r} - i + E[\pi]$$

Assume that expectations are well-anchored so that $E[\pi]$.

Key Idea:

Increasing (decreasing) nominal interest rates decreases (increases) current demand and, thus, compresses (expands) mark-ups.

Example I: Demand Shock

Suppose people expect (falsely) a lower future income.

We have that c_1 will fall since prices are fixed.

$$\log \tilde{c}_1 = \tilde{E}[\log c_2] + \bar{r} - i < \log c_1$$

Hence, people demand less which increases mark-ups and leads to lower output, employment and income.

Lowering nominal interest rates in period 1 will restore same level of demand c_1

$$\log c_1 = \tilde{E}[\log c_2] + \bar{r} - \tilde{i}$$

Conclusion:

If prices are fixed, monetary policy moves real interest rates in the same direction as short-term demand shocks.

Example II: Temporary Productivity Shock

Suppose a_1 falls.

Demand is constant since prices are fixed. This compresses mark-ups.

Instead, for efficiency output should fall which can be achieved by raising i and, thus, stabilize mark-ups.

$$\log \tilde{c}_1 = E[\log c_2] + \bar{r} - \tilde{i} < \log c_1$$

Conclusion:

If prices are fixed, monetary policy moves real interest rates in the opposite direction of productivity shocks.

Example III: Permanent (Future) Productivity Shock

Suppose there is *news* that future productivity will increase; i.e., $a_2 = (1+g)a_1$.

People will increase consumption since prices are fixed and, hence their net present value of income has increased.

$$\log \tilde{c}_1 = \tilde{E}[\log c_2] + \bar{r} - i > \log c_1$$

Since current demand increases, mark-ups are compressed which is inefficient.

The central bank can stabilize mark-ups by moving the interest rate i 1-1 with productivity growth to get

$$\log c_1 = \tilde{E}[\log c_2] + \bar{r} - \tilde{i}$$

Conclusion:

If prices are fixed, monetary policy moves real interest rates in the same direction of news about future productivity.

A Rudimentary Phillips Curve

Firms would like keep their mark-up as close as possible to μ^*.

However, there are costs to adjust prices. Firms will change their prices only if there are significant and persistent changes in their desired mark-up.

Persistent mark-up compression (expansion) thus moves inflation above (below) trend.

Current inflation is fixed unless firms react to mark up changes according to

$$\pi = f(E(\mu_2)) + E(\pi)$$

where

- $f(\mu^*) = 0$
- $\frac{\partial f}{\partial E[\mu_2]} < 0$

Central Bank Credibility

Suppose a central bank wants to exploit sticky prices persistently.

Why?

- reduce monopoly power
- stimulate demand

If $E(\mu_2) < \mu^*$, firms will raise prices and $\pi > E[\pi] = 0$.

Suppose people adjust their expectations to $E[\pi] > 0$.

The central bank needs to set $i > \bar{r} + E(\pi)$ to bring actual inflation down again via expanding mark ups which lowers employment and output.

Conclusion:

If a central bank loses its credibility to deliver low inflation, it is very costly to re-establish it.