ECON 815

A Basic New Keynesian Model I

Winter 2014

Overview

We will make now two changes to the classical monetary model.

1. Monopolistic competition $\Longrightarrow$ demand determined equilibrium
2. Price rigidities $\Longrightarrow$ some firms cannot (do not want to) adjust prices

The first one leads to mark-ups (profits) relative to perfectly competitive markets.

The second one leads to fluctuations in these mark-ups in response to shocks.

Monetary policy cannot do anything about the first one, but can alleviate the second one.

Households

There are now many goods indexed by $i \in [0,1]$.

Households value only aggregate consumption which is assumed to be given by

$$C_t = \left(\int_0^1 C_t(i)^{1-\frac{1}{\epsilon}} di \right)^{\frac{\epsilon}{\epsilon-1}}$$

with $\epsilon > 1$.

Problem:

$$\max_{C(i)_t, N_t, B_t} E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{C_t^{1-\sigma}}{1-\sigma} + \frac{(1-N_t)^{1-\eta}}{1-\eta} \right)$$

subject to

$$\int_0^1 P_t(i) C_t(i) di + Q_t B_t \leq B_{t-1} + W_t N_t - T_t \text{ for all } t$$

Demand for individual goods

How do we choose $C_t(i)$ to achieve the maximum aggregate consumption, holding fixed the total expenditure at some level Z_t?

$$\max_{C_t(i)} C_t$$

subject to

$$\int_0^1 P_t(i) C_t(i) = Z_t$$

FOC:

$$\frac{C_t(i)}{C_t(j)} = \left(\frac{P_t(i)}{P_t(j)}\right)^{-\epsilon}$$

Define the aggregate price index by

$$P_t = \left(\int_0^1 P_t(i)^{1-\epsilon} di \right)^{\frac{1}{1-\epsilon}}$$

Then, we get from the expenditure constraint that

$$C_t(j) P_t(j)^{\epsilon} \int_0^1 P_t(i)^{1-\epsilon} di = Z_t$$

$$C_t(j) = \frac{Z_t}{P_t} \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon}$$

From the the definition of P_t this implies that $Z_t = P_t C_t$ and

$$C_t(j) = \left(\frac{P_t(j)}{P_t} \right)^{-\epsilon} C_t$$

The demand for good j is proportional to aggregate consumption.

We still have

$$\frac{C_t^{\sigma}}{(1-N_t)^{\eta}} = \frac{W_t}{P_t}$$

$$1 = \beta E_t\left[\left(\frac{C_t}{C_{t+1}}\right)^{\sigma}(1+i_t)\frac{P_t}{P_{t+1}}\right]$$

and possibly a money demand equation in the background.

The household problem remains unchanged and only aggregate demand matters for the "IS" equation provided we define the aggregate price index correctly.

Firms – Real Marginal Costs

Consider minimizing the costs of satisfying demand given by $Y_t(i)$:

$$\min_{N_t} W_t N_t$$
$$\text{subject to}$$
$$Y_t(i) \leq A_t N_t(i)^\alpha$$

Solution:

$$\varphi_t(i) = W_t \frac{1}{\alpha A N_t(i)^{\alpha-1}}$$

which is the **nominal marginal costs** of production.

Why? Objective function can be written as

$$W_t f^{-1}(Y_t(i)).$$

Firms – Optimal Price Setting

Firms sets prices as a monopolist to maximize profits:

$$\max_{P_t(i)} P_t(i)Y_t(i) - W_t(i)f^{-1}(Y_t(i))$$

subject to

$$Y_t(i) = \left(\frac{P_t(i)}{P_t}\right)^{-\epsilon} C_t$$

FOC:

$$Y_t(i) - P_t(i)\epsilon\left(\frac{1}{P_t}\right)^{-\epsilon} P_t(i)^{-\epsilon-1}C_t$$
$$+ W_t(i)\frac{1}{f'(f^{-1}(Y_t(i)))}\epsilon\left(\frac{1}{P_t}\right)^{-\epsilon} P_t(i)^{-\epsilon-1}C_t = 0$$

Mark-ups

This yields a **mark-up** condition

$$P_t(i) = \left(\frac{\epsilon}{\epsilon - 1}\right) \varphi_t(i) \equiv \mu\varphi_t(i).$$

The mark-up μ measures the difference between prices and (nominal) marginal costs and thus measures the inefficiency from monopolistic competition.

It depends on how easily goods can be substituted:

- price elasticity of demand is given by $-\epsilon$
- if $\epsilon = \infty$, we get perfect competition
- if $\epsilon \to 1$, market power increases

All prices are identical across firms. Hence, inflation depends 1-1 on the price setting behaviour of firms.