Menu costs and Real Rigidities: Goods and Labour Market Interaction

Source: Romer Chapter 6 [note in Romer $\nu=1/\gamma-1$]

Let the economy be made up of a number of individuals, each of whom owns a firm producing a good, but where this firm hires workers. Assume that the demand for each good is log-linear:

$$Q_i = Y(P_i / P)^{-\eta} \quad \eta > 1 \qquad (1)$$

where Y, aggregate demand, is simply M/P. Each firm/seller has market power, so price>marginal cost. As a result, if prices cannot be raised when demand increases, firms are willing to raise output.

1. Competitive Labour Market

Each individual's utility is given by

$$U_i = C_i - L_i^{\gamma} / \gamma \qquad \gamma > 1 \qquad (2)$$

Each individuals budget constraint is

$$C = [(P_i - W)Q_i + WL_i] / P \qquad (3)$$

The production function is simply Q = L. The individual chooses prices and labour supply to maximise utility. We can derive the standard monopolistic competition price setting rule

$$P_i / P = \frac{\eta}{\eta - 1} \frac{W}{P} \qquad (4)$$

and the labour supply curve

$$L_i = (W / P)^{1/(\gamma-1)} \qquad (5)$$

(As Q=L, the marginal cost of producing extra output is W, so when the elasticity of demand gets very large price tends to marginal cost.) As all individuals are alike, we can rewrite (5) as an aggregate output equation:

$$Y^{\gamma-1} = W / P \qquad (6)$$

Adding this to the price equation gives

$$P_i / P = \frac{\eta}{\eta - 1} Y^{\gamma-1} \qquad (7)$$

As all prices are identical in equilibrium, we have

$$Y = (\frac{\eta - 1}{\eta})^{1/(\gamma-1)} \qquad (8)$$

Note that as we move to goods market perfect competition, Y tends to 1.

As Y=M/P, we can also derive

$$P = M / (\frac{\eta - 1}{\eta})^{1/(\gamma-1)} \qquad (9)$$

Real profits for the individual firm are given by

$$\pi_i = Y(P_i / P)^{-\eta} (P_i / P - W / P) = (M / P)(P_i / P)^{-\eta} (P_i / P - Y^{\gamma-1})$$
$$= \frac{M}{P} (\frac{P_i}{P})^{1-\eta} - (\frac{M}{P})^{\gamma} (\frac{P_i}{P})^{-\eta} \qquad (10)$$

Now suppose M changes. If firm i does not change its price, and neither do any other firms, then

$$\pi_{FIXED} = \frac{M}{P} - (\frac{M}{P})^{\gamma} \qquad (11)$$

If firm i does change its price, but other firms do not, it uses the price setting rule (7). Substituting this into the expression for profits yields

$$\pi_{ADJ} = (\frac{1}{\eta - 1})(\frac{\eta}{\eta - 1})^{-\eta} (\frac{M}{P})^{\gamma - \eta(\gamma - 1)} \qquad (12)$$

We can check, using (9), that these two expressions are equal when prices are at their equilibrium, and that otherwise profits are higher when prices adjust. However what happens if menu costs exist – is there a sufficient incentive to adjust prices? Suppose 1/(γ-1) is small (labour supply inelastic) at 0.1. Let η=5, which implies that price is 1.25 times marginal cost (see (4). Suppose M falls by 3%. We get π_{ADJ}-π_{FIXED}=0.253 approx. Since the equilibrium value of Y is just below 1, this is a huge incentive to change price, and no plausible value for menu costs could justify keeping prices fixed. The reason is that as demand changes, inelastic labour supply means that the real wage changes substantially, allowing prices to change.

2. Imperfectly competitive labour market

Now replace the labour supply function in this model by a real wage equation

$$W / P = AY^{\beta} \tag{13}$$

This can be regarded as a wage setting relationship coming from an imperfectly competitive labour market. We can recalculate profits as

$$\pi_i = \frac{M}{P}(\frac{P_i}{P})^{1-\eta} - A(\frac{M}{P})^{1+\beta}(\frac{P_i}{P})^{-\eta} \tag{14}$$

Calculating profits if firms do not adjust or adjust gives

$$\begin{aligned} \pi_{FIXED} &= \frac{M}{P} - A(\frac{M}{P})^{1+\beta} \\ \pi_{ADJ} &= A^{1-\eta}\frac{1}{\eta-1}(\frac{\eta}{\eta-1})^{-\eta}(\frac{M}{P})^{1+\beta-\beta\eta} \end{aligned} \tag{15}$$

Suppose β=0.1, which represents a substantial (but perhaps realistic) amount of real rigidity in the labour market. Set A=0.806, so that the equilibrium level of output is equal to 95% of the level with a competitive labour market. The profit gain from changing prices is now only 0.000168. The incentive to change prices is now tiny, and could easily be dominated by a menu cost.

This illustrates how real rigidity and nominal rigidity interact. The greater real rigidity, the more important nominal rigidity becomes.

3. Multiple Equilibria

In the above example, the firm calculated their profits assuming other firms kept prices fixed. This is the standard monopolistic competition assumption. We were interested in the cases where this belief proved correct i.e. the firm decided to keep its price fixed. As all firms are alike, this belief would be correct. We could describe this as a ‘no change equilibria’.

However, the assumption that firms would assume other firms kept their prices fixed makes less sense if the aggregate shock is known, and all firms know that other firms will be affected in the same way. Suppose, instead, that the firm assumed all other firms would change their price, whatever it did. Then we could get a ‘full change equilibria’ if the individual firm then decided to change its price. However this is not inevitable – menu costs could still be sufficient to prevent to individual firm from following what it expected others to do, and so of course no firms would change price, and beliefs would not be fulfilled.

Ball and Romer (1991) showed the following possibility. The parameters of the model might be such that both the ‘no change equilibria’ and the ‘full change equilibria’ were possible. (The analysis in this paper is quite tricky, but exercise 6.15 in Romer is easier and illustrates this result.) This is a case of multiple equilibria. To put the point another way, where the economy ends up depends on firms beliefs about what other firms will do, and there is not a unique position where beliefs will be fulfilled.

When we have multiple equilibria, then an obvious question is whether we could get stuck at the pareto inferior equilibria, and how we could move to the superior position. The no-price change equilibria could be pareto inferior to full price change: although we save on menu costs, the spillover costs in lost output could well be greater. This has generated a New Keynesian literature looking at ‘co-ordination failures’ – see Romer 6.14.