Models of Wage-setting..

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1 Models of Wage-setting.

- Importance of Unions in wage-bargaining: more important in EU than US.

- Several Models.

- In a unionised labour market, are likely to get "Involuntary Unemployment"

Involuntary Unemployment

- Union sets wage above MRS consumption leisure. Acts just like monopolist: restricts labour supply to raise wage above competitive level.

1.1 Types of Wage setting models.

- The main features
  - How wages and employment are chosen.
  - The mobility of labour
  - how many unions per firm.

- Employment: in most models, it is assumed that the firm chooses employment given the wage. This is the "right to manage" (RTM) model. It means that employment is determined by the labour demand curve of the firm:

- The labour demand equation equates the marginal revenue product of labour to the nominal wage:

$$\begin{aligned} MRP &= W \\ P\left(1-\frac{1}{\theta}\right)F_L &= W \\ \frac{W}{P} &= \frac{\theta-1}{\theta}F_L \end{aligned}$$

  where θ is the demand in the *product* market. If you have perfect competition then $\theta = \infty$, and we have the simple rule that employment is chosen to equate MPL with the real wage.

- Alternative: the union and the firm bargain over the level of employment. This can be done simultaneously with the wage-setting decision: this results in the "efficient bargaining model" (the firm and union will choose a Pareto Optimal wage-employment combination). It can also be done sequentially (employment bargained over after the wage rate has been determined).

- How are wages set/determined?
  - monopoly union: the union (household) chooses the real wage unilaterally. Unrealistic but simple!
  - Bargain: the union and firm bargain over the wage.
  - monopsony: the firm sets the wage. An example of this is the efficiency wage model. This is realistic for low-skilled "Mc Jobs".
- Why do some economists like these models? Otherwise the labour market is competitive and the household is always on the labour supply curve.
  - Employment can only fluctuate with the real wage, and since empirical estimates of the labour supply elasticity are low, one would expect less variation in employment than appears to be the case.

– If real wage exceeds the MRS labour/consumption, then the labour supply is infinitely elastic at the current real wage. Output and employment can increase even if the real wage falls a little bit!

2 Basic Wage-setting model.

- Ascari (2000) took basic Taylor model and put it in a DGSE setting. It is a right to mange model: the union sets the (nominal) wage given that the firm chooses employment. We will assume that the wage is fixed over the period of the contract.

- One firm per union-household. When the union sets the wage, it takes aggregate output, profits and prices as constant. Only effect of varying the wage is to affect its labour income and leisure.

2.1 One Period Model.

- Keep life simple. One period first!

$$\max\ U(C) + V(1 - L)$$

- labour demand. First note that:

$$Y_f = \frac{1}{\nu} L_f^{\nu}$$

this yields labour demand and corresponding output supply as functions of the own-product real wage:

$$
\begin{aligned}
L_f &= \left(\frac{W_f}{p_f}\right)^{\frac{1}{1-\nu}} \\
y_f &= \frac{1}{\nu}\left(\frac{W_f}{p_f}\right)^{-\frac{\nu}{1-\nu}}
\end{aligned}
$$

- Second, to solve for the price we equate demand y_f^d equal to supply given

(W, P, Y)

$$
\begin{aligned}
y_f^d &= \left(\frac{P_f}{P}\right)^{-\theta} Y \\
\frac{1}{\nu}\left(\frac{p_f}{W_f}\right)^{\frac{\nu}{1-\nu}} &= \left(\frac{P_{ft}}{P_t}\right)^{-\theta} Y_t \\
p_f^{\theta+\frac{\nu}{1-\nu}} &= p_f^{-\theta} W^{\frac{\nu}{1-\nu}} \left[\nu P^{\theta} Y\right] \\
p_f^{\frac{\nu+\theta(1-\nu)}{1-\nu}} &= W^{\frac{\nu}{1-\nu}} \left[\nu P^{\theta} Y\right] \\
p_f &= W^{\frac{\nu}{\nu+\theta(1-\nu)}} \left[\nu P^{\theta} Y\right]^{\frac{1-\nu}{\nu+\theta(1-\nu)}}
\end{aligned}
$$

- This gives us the demand for output and labour as a function of $\left(W_f, P, Y\right)$:

$$
\begin{aligned}
y_f &= \left(\frac{W^{\frac{\nu}{\nu+\theta(1-\varpi)}} \left[\nu P^{\theta} Y\right]^{\frac{1-\nu}{\nu+\theta(1-\nu)}}}{P} \right)^{-\theta} Y \\
L_f &= \nu \left[\left(\frac{W^{\frac{\nu}{\nu+\theta(1-\nu)}} \left[\nu P^{\theta} Y\right]^{\frac{1-\nu}{\nu+\theta(1-\nu)}}}{P} \right)^{-\theta} Y \right]^{\frac{1}{\nu}}
\end{aligned}
$$

- Hence

$$\begin{aligned} L_f &= W^{-\frac{\theta}{\nu+\theta(1-\nu)}} \left[\left[\nu P^{\theta} Y \right]^{-\theta \frac{1-\nu}{\nu+\theta(1-\nu)}} \nu P^{\theta} Y \right] \\ &= W^{-\frac{\theta}{\nu+\theta(1-\nu)}} \left[\left[\nu P^{\theta} Y \right]^{\frac{\nu}{\nu+\theta(1-\nu)}} \right] \\ &= W^{-\varepsilon} \kappa \end{aligned}$$

Where

$$\varepsilon = \frac{\theta}{\nu + \theta (1 - \nu)}; \kappa = \left[\nu P^{\theta} Y \right]^{\frac{\nu \varepsilon}{\theta}}$$

Assume $\varepsilon > 1$. Note also that when $\nu = 1, \varepsilon = \theta$

$$Y_f = \frac{1}{\nu} W^{-\varepsilon \nu} \kappa^{\nu}$$

- We can now consider the optimization

$$\max\ U(C)+V(1-W^{-\varepsilon}\kappa)+\lambda\left[\kappa W^{1-\varepsilon}+\Pi-PC\right]$$

Note, $\kappa W^{1-\varepsilon}+\Pi=WF_L+rF_K=PF(K,L)$. FOC

$$\begin{aligned} U_C &= \lambda P \\ V_L\varepsilon\kappa W^{-(1+\varepsilon)} &= \lambda\kappa\left(\varepsilon-1\right)W^{-\varepsilon} \end{aligned}$$

Hence

$$W^{*}=\frac{\varepsilon}{\varepsilon-1}\frac{V_L}{U_C}P \tag{1}$$

this is the optimal "flex wage".

- Note that $L=W^{-\varepsilon}\kappa$ can be written as

$$L=\left(\frac{W}{P}\right)^{-\varepsilon}Y^{\frac{\varepsilon}{\theta}}\nu^{\frac{\varepsilon}{\theta}} \tag{2}$$

take logs of (1) :

$$X - P = \ln V_L\left(\left(\frac{X}{P}\right)^{-\varepsilon} Y^{\frac{\varepsilon}{\theta}}\nu^{\frac{\varepsilon}{\theta}}\right) - U_c(Y)$$

"Differentiate" wrt X, P, Y

$$x - p = -\varepsilon\eta_L(x-p) + \eta_L\frac{\varepsilon}{\theta}y - \eta_c y$$

rearranging

$$(x-p)(1+\varepsilon\eta_L) = \left(\eta_L\frac{\varepsilon}{\theta} - \eta_c\right)y \tag{3}$$

But

$$\begin{aligned}(1+\varepsilon\eta_L) &= \frac{\nu + \theta(1-\nu) + \theta\eta_L}{\nu + \theta(1-\nu)} \\ \frac{\varepsilon}{\theta} &= \frac{1}{\nu + \theta(1-\nu)}\end{aligned}$$

Hence

$$
\begin{aligned}
(x-p)\left(\frac{\nu+\theta(1-\nu)+\theta\eta_L}{\nu+\theta(1-\nu)}\right) &= \left(\eta_l\frac{1}{\nu+\theta(1-\nu)}+\eta_c\right)y \\
x-p &= \left[\frac{\eta_l+\eta_c(\nu+\theta(1-\nu))}{\nu+\theta(1-\nu)+\theta\eta_L}\right]y
\end{aligned}
$$

or the familiar

$$
\begin{aligned}
x^* &= p+\gamma y \\
\gamma &= \frac{\eta_l+\eta_c(\nu+\theta(1-\nu))}{\nu+\theta(1-\nu)+\theta\eta_L}
\end{aligned}
$$

- Two + periods:

$$
\begin{aligned}
x_t &= \frac{1}{\sum_{s=0}^{N-1} \beta^s} \left[\sum_{s=0}^{N_i-1} \beta^s \left(p_{t+s} + \gamma y_{t+s} \right) \right] \\
\gamma &= \frac{\eta_\ell + \eta_c(\nu + \theta(1-\nu))}{\nu + \theta(1-\nu) + \theta \eta_\ell}
\end{aligned}
$$

- OR

$$
x_t = \frac{1}{\sum_{s=0}^{N-1} \beta^s} \left[\sum_{s=0}^{N_i-1} \beta^s x^*_{t+s} \right]
$$

The log-linearised reset wage is the weighted average of the optimal flex-wages over the lifetime of the contract: the arithmetic average if $\beta = 1$.

3 Implications of wage setting models.

- If we compare wage and price setting models, they look similar: indeed, Ascari argues that a whole range of models can be put in the format

$$x \text{ or } p = \frac{1}{\sum_{s=0}^{N-1} \beta^s} \left[\sum_{s=0}^{N_i-1} \beta^s \left[p_{t+s} + \gamma y_{t+s} \right] \right]$$

  the differences arise because of the different γ.

- γ captures the effect of output on wage-setting. A higher value of γ means that an increase in output generates bigger price rises. If $\gamma = 0$, we have the classic Taylor model, where there is no effect of output on wage/price setting.

- The mechanisms underlying γ are complex: but the basic thing is that as output increases and leisure decreased, the "real cost" of the additional output increases (the MRS between leisure and consumption) and also the MC curve is upward sloping if $\nu < 1$.

- price setting: Chari, Kehoe and McGratten.

$$\gamma^{CKM} = \frac{\eta_\ell + \nu\eta_c + 1 - \nu}{1 + (1-\nu)\,\theta}$$

$$\gamma = \frac{\eta_\ell + \eta_c(\nu + \theta(1-\nu))}{\nu + \theta(1-\nu) + \theta\eta_\ell}$$

- For plausible parameter values, $\gamma^{CKM} < \gamma$. $\eta_\ell \simeq 0.2; \eta_c \simeq 1; \nu \simeq$?1?; $\theta \simeq 10$.

- This means that nominal wages are *less* responsive to increases in output than prices. $\gamma^{CKM} = 1.2; \gamma = 0.2$.

- When $\nu = 1$, the difference is due to $\theta\eta_\ell$ in the denominator. Since $\varepsilon = \theta$, the θ term reflects the competitiveness of the labour market. If the union raises wages, then firms will substitute away from this type of labour: this effect is bigger the larger θ.

- When output increases, the unions do increase wages, but are held back by the fact that other unions are not raising wages. In effect, the *markup* of real wages over the $MRS\left(C, \ell\right)$ goes down relative to its steady state value.

- This is a Nash-equilibrium/coordination phenomenon. All wages rise by the same amount in equilibrium, but each firm is treating the actions of the others as given.

- In the price setting model, this effect is absent. Product markets are competitive, so the real wage is always equal to the $MRS\,(C, \ell)$ (constant markup of 1). Real wages rise more in the price setting model, leading to (flex) prices rising by more.

4 Other unionised models.

4.1 Yeoman farmer model.

- In this the labour supplier and the firm are "one": no profits, no wages: the "farmers'" income is the revenue from sales of output. Single period problem

$$\max\ U(C) + V(1 - L)$$

subject to

$$\begin{aligned} p_f Y_f &= PC \\ p_f Y_f &= P_f^{(1-\theta)} P^{\theta} Y \\ L &= \left(\nu \left(\frac{P_{ft}}{P_t} \right)^{-\theta} Y_t \right)^{\frac{1}{\nu}} \end{aligned}$$

- Can substitute in

$$U\left(\left(\frac{P_f}{P} \right)^{1-\theta} Y \right) + V\left(1 - \left(\nu \left(\frac{P_{ft}}{P_t} \right)^{-\theta} Y_t \right)^{\frac{1}{\nu}} \right)$$

- Get the resulting γ

$$\gamma^{YF} = \frac{\eta_\ell + \eta_c \nu + (1 - \nu)}{\nu + \theta(1 - \nu) + \theta \eta_\ell}$$

If $\nu = 1$ then exactly same as the unionised γ.

4.2 Craft Unions: Blanchard and Kiyotaki (1987).

- Each household union supplies a type of labour. Every firm uses all types of labour. The firms have a CES technology for combiningthe labour with elasticity θ

- $$Y_t = \left[\int_0^1 L_f^{\frac{\theta-1}{\theta}} df\right]^{\frac{\nu\theta}{\theta-1}}$$

- The firm minimizes costs subject to the wages set by the craft unions

$$L_f = \left[\frac{W_f}{W}\right]^{-\theta} Y^{\frac{1}{\theta}}$$

- The resulting γ is same as in standard case.

5 Edge: wages and prices the same.

- Rochelle Edge (RED 2002): wages and prices the same. Depends on the assumptions about factor specificity.

- The reason: with firm specific factors (such as labour), the price of the factor is not the same across different firms: let w_{it} be the firm specific wage. The optimal price is then

$$p_{it}^{*} = mc_{it} = w_{it}$$

- hence, if the firm's wage increases whilst other firms wages do not, then this increases its marginal cost. This will cause its price to rise relative to those of other firms, thus allowing the elsticity of firm demand to enter into its decision (and yields γ^{A})

- If there is only homogeneous labour, the firms wages are constrained to be equal: an increase in wages applies to all firms, so that there is no relative price effect, and the firms elasticity of demand does not enter into the optimal price (and yields γ^{CKM}).

6 Conclusion.

- wage setting can talk a variety of forms. Typically the simple monopoly union model with the right to manage labour demand.

- nominal wage rigidity: with firm specific factors, nominal wage and price rigidity similar.

- Can choose different models. For example, Erceg, Henderson an Levine (JEDC 2003) combine wage and price rigidity. The wage-setting model uses the Blanchard and Kiyotaki model.