Lecture 6: Labour Economics and Wage-Setting Theory

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Literature: Soskice-Iversen

Topics

- **Wages and the degree of coordination: The Calmfors-Driffill hump-shape hypothesis**

- **Interaction between large trade unions and the central bank: wage setting and monetary policy**

<u>Different degrees of co-ordination</u>

Employment is determined by the product real wage w_p

$w_p = \frac{W}{P}$

W = Nominal wage

P = Output price

$\therefore L = L(w_p)$,

where L = Employment

The union maximises expected utility for a representitive member:

$U = \frac{L}{M} w_c + (1 - \frac{L}{M})\, b,$

where M = number of union members

$w_c = \frac{W}{P_c}$ = Consumption real wage

P_c = CPI

b = Real unemployment benefit

Maximisation of the union utility function

We assume a monopoly union:

$$\max_{w_c} \; U = \frac{L}{M} w_c + \left(1 - \frac{L}{M}\right) b$$

given:

$L = L\,(w_p)$

$w_p = \frac{W}{P_c} \cdot \frac{P_c}{P} = \frac{W}{P_c} \Big/ \frac{P}{P_c} = \frac{w_c}{\tilde{p}}$,

where $\tilde{p} = \frac{P}{P_c}$ = The relative output price in the bargaining area

FOC:

$$1 + \frac{\partial L}{\partial w_p} \cdot \frac{w_p}{L} \; \left[1 - \frac{\partial \tilde{p}}{\partial w_c} \cdot \frac{w_c}{\tilde{p}}\right] \left[1 - \frac{b}{w_c}\right] = 0$$

$-\frac{\partial L}{\partial w_p} \cdot \frac{w_p}{L} = \varepsilon$ = The elasticity of employment w.r.t. the product real wage

$\frac{\partial \tilde{p}}{\partial w_c} \cdot \frac{w_c}{\tilde{p}} = \eta$ = The elasticity of the relative output price w.r.t. the consumption real wage

$$1 - \varepsilon\,[1 - \eta]\,\left[1 - \frac{b}{w_c}\right] = 0$$

$$w_c = \frac{\varepsilon\,(1-\eta)}{\varepsilon\,(1-\eta) - 1}\, b$$

Effects of different degrees of co-ordination

$$w_c = \frac{\varepsilon\,(1-\eta)}{\varepsilon\,(1-\eta)-1}\,b$$

1. Firm-level wage setting

With perfect competition in the goods market and homogeneous goods, the wage in the firm does not affect the relative output price $\tilde{p}$.

$$\eta = 0 \Rightarrow w_c = \frac{\varepsilon}{\varepsilon-1}\,b$$

2. Complete national co-ordination (same wage in all firms) in a closed economy

The wage cannot affect the relative output price in a representative firm (since all wages are the same).

$$\eta = 0 \Rightarrow w_c = \frac{\varepsilon}{\varepsilon-1}\,b$$

3. Industry-level wage setting (the same wage for all firms in an industry)

$$\eta > 0 \Rightarrow w_c = \frac{\varepsilon(1-\eta)}{\varepsilon(1-\eta)-1}\,b = \frac{1}{1-1/\varepsilon(1-\eta)}\,b > \frac{\varepsilon}{\varepsilon-1}\,b = \frac{1}{1-1/\varepsilon}\,b$$

4. Small open economy

If domestic and foreign goods are perfect substitutes:

$\eta = 0 \Rightarrow w_c = \frac{\varepsilon}{\varepsilon-1}\,b$ for all degrees of co-ordination.

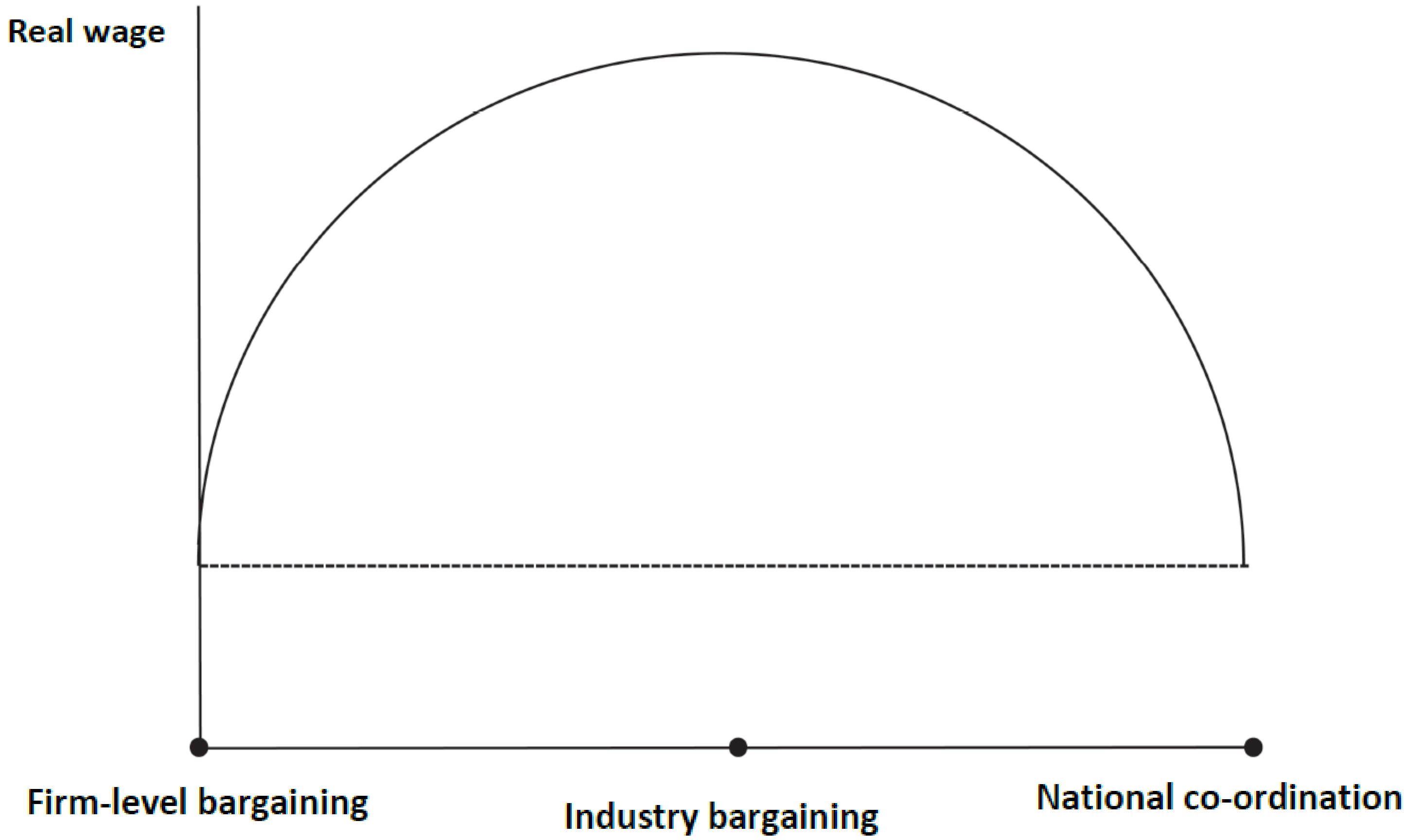
If domestic and foreign goods are imperfect substitutes, we have also with complete co-ordination:

$$\eta > 0 \Rightarrow w_c = \frac{\varepsilon(1-\eta)}{\varepsilon(1-\eta)-1}\,b > \frac{\varepsilon}{\varepsilon-1}\,b$$

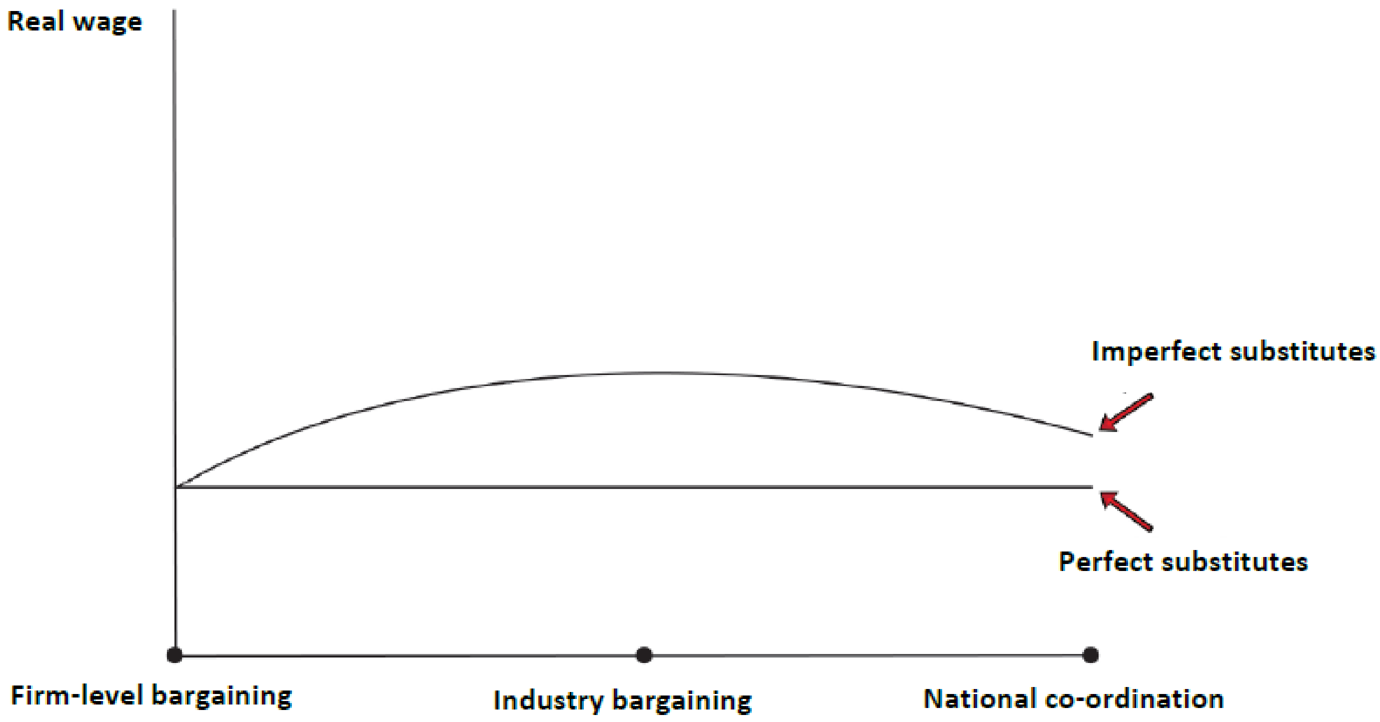
Conclusions on co-ordination and real wages

- Calmfors-Driffill-hypothesis: wage moderation with both firm-level bargaining and complete co-ordination
  - competitive pressures with firm-level bargaining
  - internalisation of externalities (price increases for others) with co-ordination
- Highest real wage with industry-level bargaining because a given increase in the consumption real wage can be achieved with a smaller increase in the product real wage (and thus with a smaller employment loss)
- Stylised model of a closed economy gives the same real wage with firm-level bargaining and complete co-ordination
- Stylised model of an open economy gives the same real wage for all bargaining levels (perfect competition - perfect substitutes)
- If domestic and foreign goods are imperfect substitutes, then firm-level bargaining gives a lower wage than complete co-ordination
- Smaller ”hump” the more open the economy is.

<u>The degree of co-ordination and the real wage in a closed economy (the Calmfors-Driffill curve)</u>



The degree of co-ordination and the real wage in an open economy



An extended model

- More externalities can be internalised with co-ordination
  - costs for unemployment benefits paid by taxes on labour
  - lower tax base implying that taxes must be raised to pay for government expenditure
  - higher employment in a sector means fewer employment opportunities for those who lose their jobs in another sector
- Internalisation of other externalities probably imply that complete national co-ordination gives more wage moderation than firm-level bargaining

The degree of co-ordination and the real wage in reality

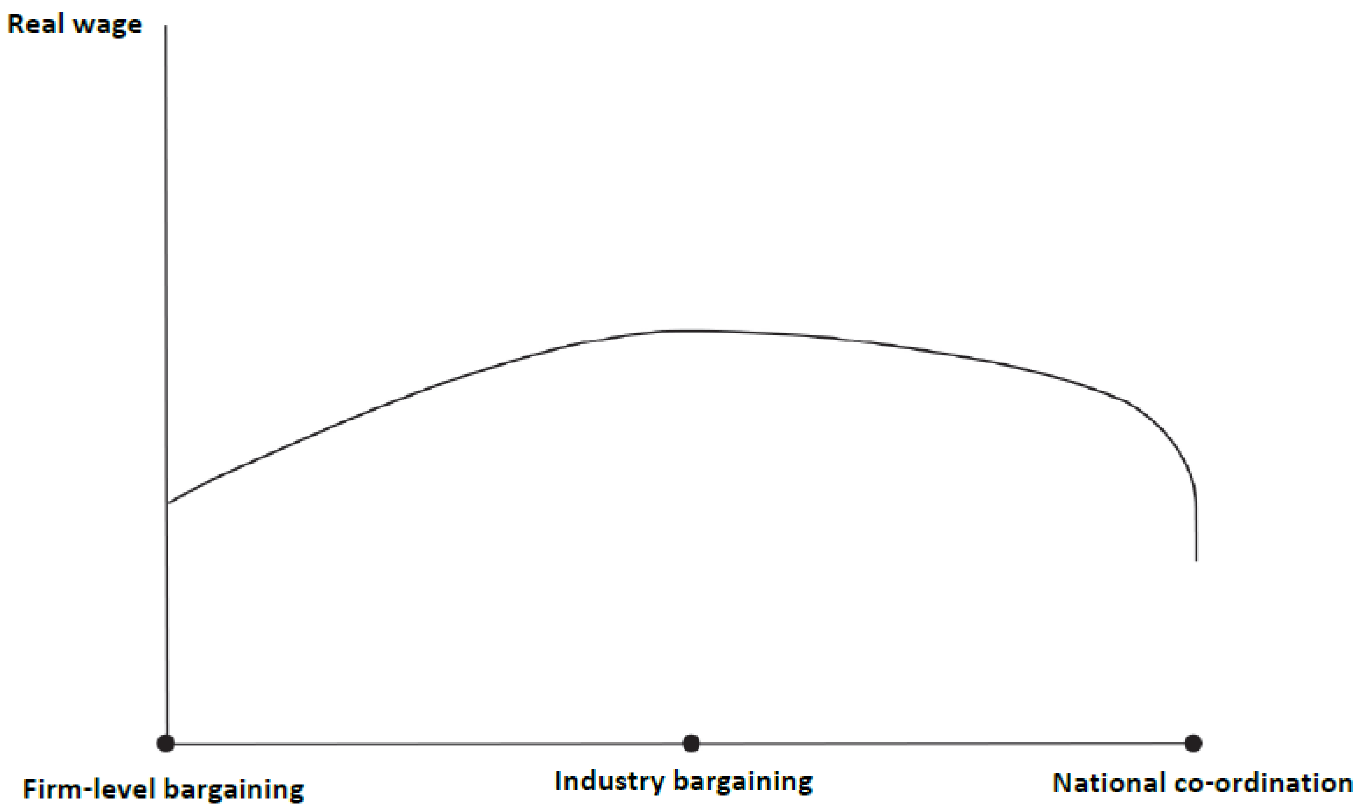


Table 3.3

Unemployment rates under various bargaining regimes (ceteris–paribus differences to decentralised systems) in various studies[a)]

A: Studies finding a hump-shaped relationship between bargaining co-ordination and unemployment

	Study	Intermediate co-ordination	High co-ordination	Measure of bargaining structure[b)]
1	Zetterberg (1995)[c)]	2.6	- 1.5	Centralisation
2	Bleaney (1996)[d)]	3.5	- 2.1	Centralisation/ co-ordination
3	Scarpetta (1996)[e)]	0.9	- 12.0	Centralisation
4	Elmeskov et al. (1998)[f)]	1.3	- 2.4	Centralisation
5	Elmeskov et al. (1998)[g)]	1.2	- 4.4	Centralisation/ co-ordination
6	Elmeskov et al. (1998)[h)]	6.9	- 4.6	Co-ordination
7	Cukierman & Lippi (1999)[i)]	5.8	3.2	Centralisation
8	Daveri & Tabellini (2000)[j)]	5.8	- 7.2	Geographical[k)]
9	Nicoletti *et al.* (2001)[l)]	3.6	- 2.2	Centralisation/ co-ordination
	Average	**3.5**	**- 3.9**	

B: Studies finding a monotonic relationship between bargaining co-ordination and unemployment

	Study	Intermediate co-ordination	High co-ordination	Measure of bargaining structure[b)]
1	Layard et al. (1991)	- 4.7	- 10.4	Co-ordination
2	Zetterberg (1995)[m)]	- 0.4	- 2.4	Centralisation
3	Scarpetta (1996)[n)]	- 6.2	- 12.3	Co-ordination
4	Bleaney (1996)[o)]	- 2.0	- 3.9	Co-ordination
5	Elmeskov et al. (1998)[p)]	- 0.8	- 5.7	Co-ordination
6	Hall & Franzese (1998)[q)]	- 2.6	- 5.1	Co-ordination
7	Iversen (1998)[r)]	- 3.3	- 4.1	Centralisation
8	Nickell & Layard (1999)[s)]	- 4.6	- 6.0	Co-ordination
9	Blanchard & Wolfers (2000)[t)]	- 4.4	- 8.9	Centralisation
10	Belot & van Ours (2001)[u)]	- 2.6 (0)	- 5.2 (0)	Co-ordination
11	Belot & van Ours (2001)[v)]	- 1.9	- 1.9	Co-ordination
12	Nickell et al. (2003)[x)]	- 7.2	- 14.4	Co-ordination
	Average	**- 3.4**	**- 6.7**	

Co-ordinated wage bargaining and monetary policy

- **In many European countries wage bargaining is highly co-ordinated**
  - **sectoral bargaining**
  - **nation-wide bargaining**
- **Internalisation of the effects of wage setting**
- **Interaction with monetary policy**
- **A conservative central bank – aiming for price stability – can act as a deterrent to wage increases and promote employment**
- **Neutrality of money but non-neutrality of the monetary regime.**

<u>Soskice-Iversen model</u>

- ***N*** **identical sectors**
- **Bertrand competition within each sector so that *P* = *MC***
- ***n*** **workers in each sector; all are union members**
- **No labour mobility**
- **Monopoly unions**
- **Nash equilibrium**
- **CRS w.r.t. labour**
- **One union in each sector**

<u>Stages of the game</u>

(1) The central bank commits to a monetary policy rule of leaning against the wind

$$M = P^{\alpha} \qquad 0 \leq \alpha \leq 1$$

A price rise causes a reduction in real money supply M/*P* if $\alpha < 1$.

(2) Unions set wages <u>simultaneously</u> and <u>independently</u> taking all other <u>nominal</u> wages as given (Nash equilibrium).

(3) Producers decide employment E_i and price P_i <u>simultaneously</u> and <u>independently</u> (Nash equilibrium).

(4) The central bank sets *M* contingent on *P* according to its policy rule.

Solve model by backward induction

Stage 4

$$M = P^{\alpha}$$

Stage 3

Bertrand competition: $P_i = W_i$

Stage 2

Union utility function:

$$U_i = w_i E_i - (d/\beta)E_i^{\beta} + m/N$$

$$w_i = \frac{W_i}{P} = \text{real consumption wage}$$

$$m = \frac{M}{P} = \text{real money supply}$$

$$E_i = \text{hours worked}$$

$$P = \left[\frac{1}{N}\sum_{N} P_i^{1-\eta}\right]^{\frac{1}{1-\eta}} = \text{price index}$$

Derivation of union utility function

Direct utility function of consumer *s* in sector *i*:

$$U_{is} = \left(\frac{C_{is}}{g}\right)^{g}\left(\frac{M_{is}/P}{1-g}\right)^{1-g} - \frac{d'}{\beta}\left(\frac{E_i}{n}\right)^{\beta} \qquad \text{(A1)}$$

$$C_{is} = N^{1/(1-\eta)}\left[\sum_{j}^{N} C_{jis}{}^{(\eta-1)/\eta}\right]^{\eta/(\eta-1)}$$

Budget constraint

$$\sum_{j}^{N} P_j C_{jis} + M_{is} = W_i \frac{E_i}{n} + \overline{M}_{is} = I_{is}$$

Optimisation on the part of the consumers

$$C_{jis} = \left(\frac{P_j}{P}\right)^{-\eta} \cdot \frac{g}{N} \cdot \frac{I_{is}}{P}$$

$$P = \left[\frac{1}{N}\sum_i P_i^{1-\eta}\right]^{\frac{1}{1-\eta}}$$

$$\frac{C_{is}}{g} = \frac{M_{is}/P}{1-g} = \frac{I_{is}}{P} \qquad \text{(A2)}$$

Substitute (A2) into (A1)

$$U_{is} = \left(\frac{I_{is}}{P}\right)^{g}\left(\frac{I_{is}}{P}\right)^{1-g} - \frac{d'}{\beta}\left(\frac{E_i}{n}\right)^{\beta}$$

$$U_{is} = \left(\frac{I_{is}}{P}\right) - \frac{d'}{\beta}\left(\frac{E_i}{n}\right)^{\beta} = \frac{w_i E_i}{n} + \frac{\bar{M}_{is}}{P} - \frac{d'}{\beta}\left(\frac{E_i}{\beta}\right)^{\beta}$$

Multiply by *n* and use that $M = \overline{M} = nN\overline{M}_{is}$

Define $d = d'/n^{\beta-1}$

Hence $U_i = w_i E_i + m/N - \dfrac{d}{\beta} E_i^{\beta}$

<u>Goods demand</u>

$$C_{jis} = \left(\frac{P_j}{P}\right)^{-\eta} \cdot \frac{I_{is}}{P} \cdot \frac{g}{N} = \left(\frac{P_j}{P}\right)^{-\eta} \cdot \frac{g}{N} \cdot \frac{M_{is}}{P} \cdot \frac{1}{1-g}$$

$$= \left(p_j\right)^{-\eta} \cdot \frac{m_{is}}{N} \cdot \frac{g}{1-g}$$

Normalise *g*/(1-*g*) to unity and aggregate over all consumers:

$$C_j = \left(m/N\right)\left(p_j\right)^{-\eta}$$

$$p_j = \frac{P_j}{P}$$

<u>Trade union optimisation (continued)</u>

<u>Goods demand</u>:

$$Q_i = (m/N)p_i^{-\eta}$$

$$p_i = \frac{P_i}{P}$$

<u>CRS</u>

$$p_i = w_i$$

<u>Labour demand</u>

$$E_i = Q_i = (m/N)w_i^{-\eta} \qquad (2)$$

$$\max_{w_i} \quad U_i = w_i E_i - (d/\beta)E_i^{\beta} + m/N$$

$$\text{s.t.} \quad E_i = (m/N)w_i^{-\eta}$$

$$p_i = w_i$$

$$m = f(w_i \ldots\ldots)$$

Use that the equilibrium is symmetric, i.e. impose $p_i = w_i = 1$ **after differentiation.**

$$E^* = \text{sectoral employment}$$

$$E^* = \left[\frac{\eta - 1 - 2\partial \ell nm / \partial \ell nw_i}{d\eta - d\partial \ell nm / \partial \ell nw_i} \right]^{\frac{1}{\beta - 1}} \tag{3}$$

Compute $\partial \ell nm / \partial \ell nw_i$

Use that:

$$\frac{\partial \ell nm}{\partial \ell nw_i} = \frac{\partial \ell nm}{\partial \ell np_i} = \frac{\partial \ell nm}{\partial \ell nP} \cdot \frac{\partial \ell nP}{\partial \ell nP_i} \cdot \frac{\partial \ell nP_i}{\partial \ell np_i} \tag{4}$$

Computation of $\partial \ell nm / \partial \ell nP$

$$M = P^{\alpha}$$

$$\frac{M}{P} = P^{\alpha - 1}$$

$$m = P^{\alpha - 1}$$

$$\frac{\partial \ell nm}{\partial \ell nP} = \alpha - 1$$

Computation of $\partial \ell n P / \partial \ell n P_i$

$$P = \left[\frac{1}{N} \sum_N P_i^{1-\eta} \right]^{1/(1-\eta)}$$

$$\frac{dP}{dP_i} = \frac{1}{N} \cdot P \left[\frac{1}{N} \sum_N P_i^{1-\eta} \right]^{-1} P_i^{-\eta}$$

$$\frac{d \ell n P}{d \ell n P_i} = \frac{dP}{dP_i} \cdot \frac{P_i}{P} = \frac{1}{N} \cdot \frac{P_i^{1-\eta}}{\frac{1}{N} \sum_N P_i^{1-\eta}}$$

But as:

$$P = \left[\frac{1}{N} \sum P_i^{1-\eta} \right]^{1/(1-\eta)} \quad \text{we get}$$

$$\frac{1}{N} \sum_N P_i^{1-\eta} = P^{1-\eta}$$

Hence:

$$\frac{\partial \ell n P}{\partial \ell n P_i} = \frac{1}{N} \cdot \frac{P_i^{1-\eta}}{P^{1-\eta}}$$

In a symmetric equilibrium:

$P_i = \overline{P}$ for all *i*

$$P = \left[\frac{1}{N}\sum_N P_i^{1-\eta}\right]^{\frac{1}{1-\eta}} = \left[\frac{1}{N}\cdot N\overline{P}^{1-\eta}\right]^{\frac{1}{1-\eta}} = \overline{P} = P_i$$

Hence:

$$\frac{\partial \ell n P}{\partial \ell n P_i} = \frac{1}{N}$$

Computation of $\partial \ell n P_i / \partial \ell n p_i$

$$\frac{\partial \ell n p_i}{\partial \ell n P_i} = \frac{\partial \ell n\left[P_i - P\right]}{\partial \ell n P_i} = \frac{\partial \ell n P_i}{\partial \ell n P_i} - \frac{\partial \ell n P}{\partial \ell n P_i} =$$

$$= 1 - \frac{1}{N} = \frac{N-1}{N}$$

Hence:

$$\frac{\partial \ell n P_i}{\partial \ell n p_i} = \frac{N}{N-1}$$

Thus:

$$\frac{\partial \ell n m}{\partial \ell n w_i} = \frac{\partial \ell n m}{\partial \ell n P} \cdot \frac{\partial \ell n P}{\partial \ell n P_i} \cdot \frac{\partial \ell n P_i}{\partial \ell n p_i} =$$

$$= (\alpha - 1) \cdot \frac{1}{N} \cdot \frac{N}{N-1} = \frac{\alpha - 1}{N-1} < 0 \qquad (5)$$

- **A rise in the real consumption wage of union *i* reduces the real money supply if α < 1 (because it requires a nominal wage and a nominal price rise).**
- **Insert (5) into (3)!**

$$E^* = \left[\frac{\eta - 1 + 2(1-\alpha)/(N-1)}{d\eta + d(1-\alpha)/(N-1)}\right]^{\frac{1}{\beta-1}} \qquad (6)$$

- **Straightforward to show that** $dE^*/d\alpha < 0$
  - **a more conservative central bank is associated with higher employment**
  - **because wage restraint is induced through fear of larger employment reduction if wages are raised**

Fully accommodating central bank : α = 1

$$E^* = \left[\frac{\eta - 1}{d\eta}\right]^{\frac{1}{\beta-1}} \qquad (6a)$$

- **Real money supply is held constant**

$$m = \frac{M}{P} = P^{\alpha-1} = P^0 = 1$$

- **The only disincentive to a wage rise is product demand substitution**
- **No aggregate demand effect**

Compare employment with full accommodation, E_F^***, with employment with only partial accommodation,** E_P^***.**

$$E_F^* = \left[\frac{\eta - 1}{d\eta}\right]^{\frac{1}{\beta-1}}$$

$$E_P^* = \left[\frac{\eta - 1 + 2(1-\alpha)/(N-1)}{d\eta + d(1-\alpha)/(N-1)}\right]^{\frac{1}{\beta-1}}$$

$$E_P^* > E_F^* \quad \text{if} \quad \frac{\eta - 1 + 2(1-\alpha)/(N-1)}{d\eta + d(1-\alpha)/(N-1)} > \frac{\eta - 1}{d\eta}$$

This can be shown to hold.

The above inequality implies: $d + d\eta > 0$**, which always holds.**

Lower employment with <u>full accommodation</u> than with only <u>partial accommodation</u> if

$$\left[\frac{\eta - 1}{d\eta}\right]^{\frac{1}{\beta - 1}} \;<\; \left[\frac{\eta - 1 \;+\; 2(1-\alpha)/(N-1)}{d\eta \;+\; d(1-\alpha)/(N-1)}\right]^{\frac{1}{\beta - 1}}$$

$$\Leftrightarrow$$

$$(\eta - 1)d\eta \;+\; \frac{(\eta - 1)d(1-\alpha)}{N-1} \;<\; (\eta - 1)d\eta \;+\; \frac{2(1-\alpha)d\eta}{N-1}$$

$$(\eta - 1)d(1-\alpha) \;<\; 2(1-\alpha)d\eta$$

$$0 \;<\; d \;+\; d\eta$$

Non-neutrality of the monetary regime

- **Strategic wage setting**
- **Money supply rule has real implications**
- **A large trade union takes into account that a wage rise affects both the relative wage and the aggregate demand (via real money supply)**
- **Aggregate demand effect presupposes that *N* is not too large.**

Large number of unions

$$E^{*} = \left[\frac{\eta - 1 + 2(1-\alpha)/(N-1)}{d\eta + d(1-\alpha)/(N-1)}\right]^{\frac{1}{\beta - 1}}$$

$$\lim_{N\to\infty} E^{*} = \frac{\eta - 1}{d\eta}$$

- **Degree of accommodation α does not matter then.**
- **Same employment as with fully accommodating central bank (α=1).**
- **A small union perceives zero effect of its wage decision on real money supply (as if it is held constant).**

<u>Only one union (N= 1)</u>

$$U = w_i E_i - (d/\beta)E_i^{\beta} + m/N = w_i E_i - (d/\beta)E_i^{\beta} + m$$

$$w_i = \frac{W_i}{P} = 1$$

$$E_i = \left[m/N\right] w_i^{-\eta} = m = E$$

Drop subscripts:

$$U = E - (d/\beta)E^{\beta} + E = 2E - (d/\beta)E^{\beta}$$

<u>Optimisation problem</u>

$$\underset{E}{\text{Max}} \quad 2E - (d/\beta)E^{\beta}$$

$$2 - (d/\beta)\cdot \beta E^{\beta-1} = 0$$

$$E^{*}_{N=1} = \left(\frac{2}{d}\right)^{\frac{1}{\beta-1}}$$

- **Straightforward to show that employment with *N* = 1 is higher than with *N* > 1.**
- **The union fully internalises the aggregate demand effects (real money supply effects) of its wage decision.**
- **The degree of accommodation no longer matters.**

<u>Conclusion</u>

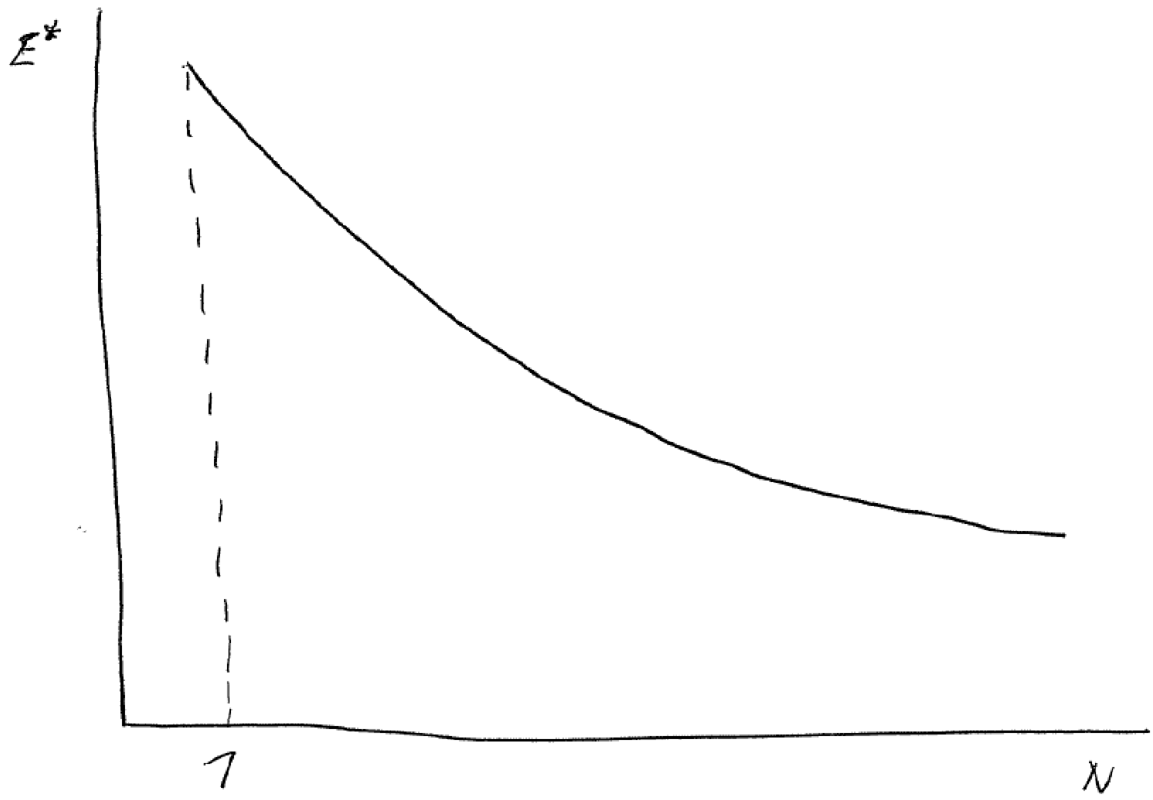
- **Higher employment with complete centralisation.**
- **Degree of central bank conservativeness does not matter with complete centralisation.**
- **Lower employment the lower is the degree of centralisation.**
- **A more conservative central bank raises employment with an intermediate degree of centralisation**

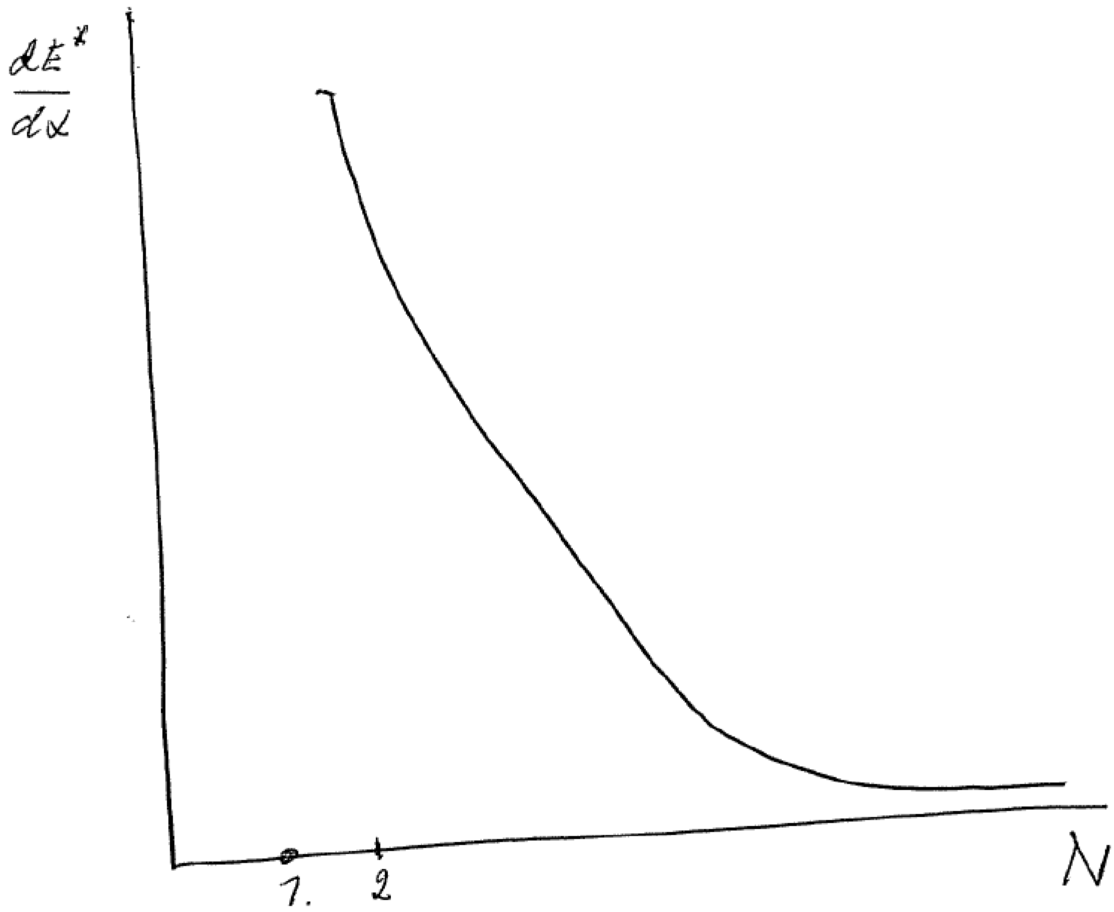
  largest effect if $N = 2$

  $$d\,\frac{\left|\frac{\partial E^*}{\partial \alpha}\right|}{dN} < 0 \quad \text{for} \quad N \geq 2$$

  zero effect with complete decentralisation ($N \to \infty$).

- **Complete centralisation and central bank conservativeness are (imperfect) substitutes when it comes to promoting wage restraint.**


E^*
1
N


$\frac{dE^x}{d\alpha}$
1.
2
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