Lecture 4: Labour Economics and Wage-Setting Theory

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Literature: Chapter 12 Cahuc-Carcillo-Zylberberg: pp 793-795.
Chapter 7 Cahuc-Carcillo-Zylberberg: pp 401-413, 413-422 (recommended), 426-435.

Topics

- **The monopsony model of wage setting and employment**
- **Collective bargaining**

The monopsony model

- **Barriers to free entry of firms**
- **Limited mobility of labour**
- **A monopsonist can hold down wages below the competitive wage**

Examples

- **Single-firm towns ("bruksorter")**
- **The labour-market for nurses**
  - **just one hospital in a region**
  - **cartel of regions ("landsting") earlier in Sweden**

The basic monopsony model

- **Labour supply $L^s(w) = G(w)$**
- **An employed person produces y**

Decision problem of a monopsonist

$$\max_{w} \quad \pi(w) = L^s(w)(y - w)$$

$$L_1^s(y - w) - L^s = 0$$

$$\frac{L_1^s}{L^s} w\left(\frac{y}{w} - 1\right) - 1 = 0$$

Define $\frac{\partial L^s}{\partial w} \cdot \frac{w}{L_s} = \eta_w^L =$ the elasticity of labour supply

Hence:

$$\eta_w^L \left[\frac{y}{w} - 1 \right] - 1 = 0$$

$$w = \frac{\eta_w^L}{\eta_w^L + 1} y$$

$\frac{\eta_w^L}{\eta_w^L + 1} < 1$ implies that $w < y$, i.e. that the monopsonist

sets a lower wage than the competitive wage

The monopsonistic wage coincides with the competitive wage only if $\eta_w^L \to \infty$ in which case

$$w = \frac{\eta_w^L}{\eta_w^L + 1} \, y = \frac{1}{1 + \frac{1}{\eta_w^L}} \, y \to y$$

- **Otherwise the monopsonist gains by lowering the wage below the competitive wage**
- **This reduces the labour supply and hence output and employment. But the loss from this is outweighed by the savings on the wage bill.**

<u>Isoprofit curve</u>

$$\pi = L(y - w) = \overline{\pi}$$

$$dL(y - w) - Ldw = 0$$

$$\frac{dL}{dw} = \frac{L}{y - w} \qquad \frac{dL}{dw} > 0 \text{ for } y > w$$

Profit maximisation at the tangency point between an isoprofit curve and the labour supply schedule

- **A minimum wage - if it is not too high – raises both the wage and employment in a monopsonistic market**
- **Non-monotonic relationship between minimum wage and employment in a monopsonistic market**

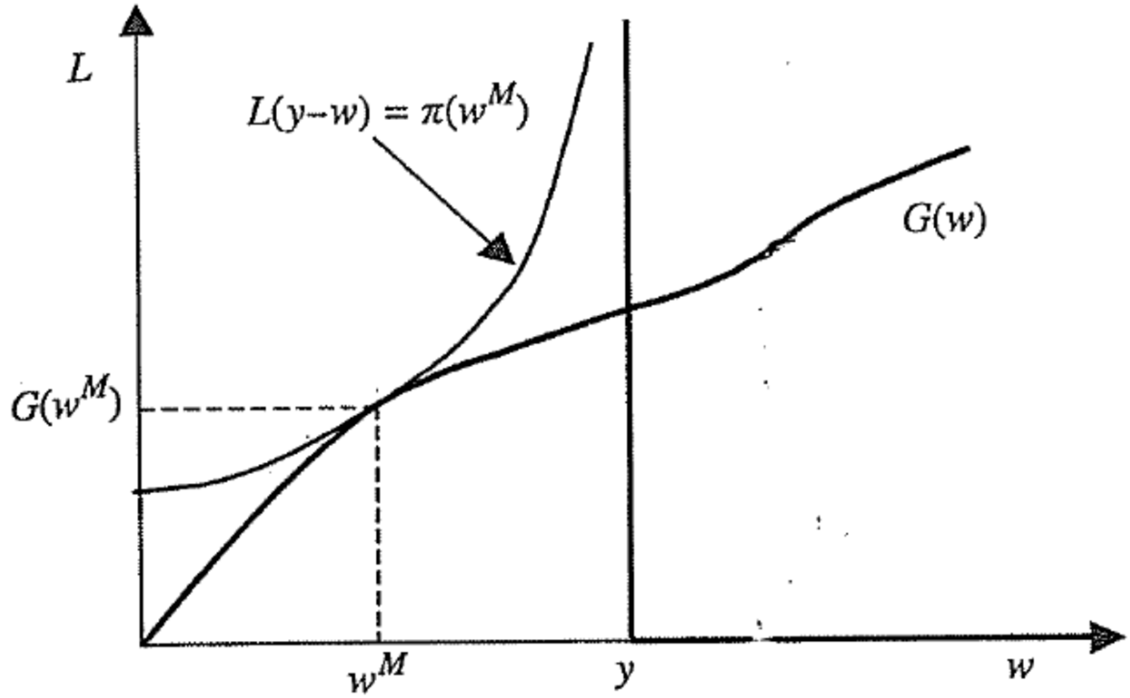


FIGURE 5.4
The monopsony model.

<u>Monopsony model with decreasing returns to scale (concave production function *F(L)*)</u>

Firm's profit:

$\pi(w) = F[L^S(w)] - wL^S(w)$

Profit maximization w.r.t. *w*:

$$\partial \pi(w) / \partial w = F' L^{S\prime} - w L^{S\prime} - L^S = 0$$

$$F' - w - L^S/L^{S\prime} = 0$$

$$F' = w[1 + L^S/(L^{S\prime} w)]$$

$$F' = w[1 + 1/\eta_w^L]$$

$\eta_w^L = L^{S\prime}w/ L^S = (\partial L^S / \partial w)(w/L^S) =$ *Elasticity of labour supply*

Labour is paid less than its marginal product

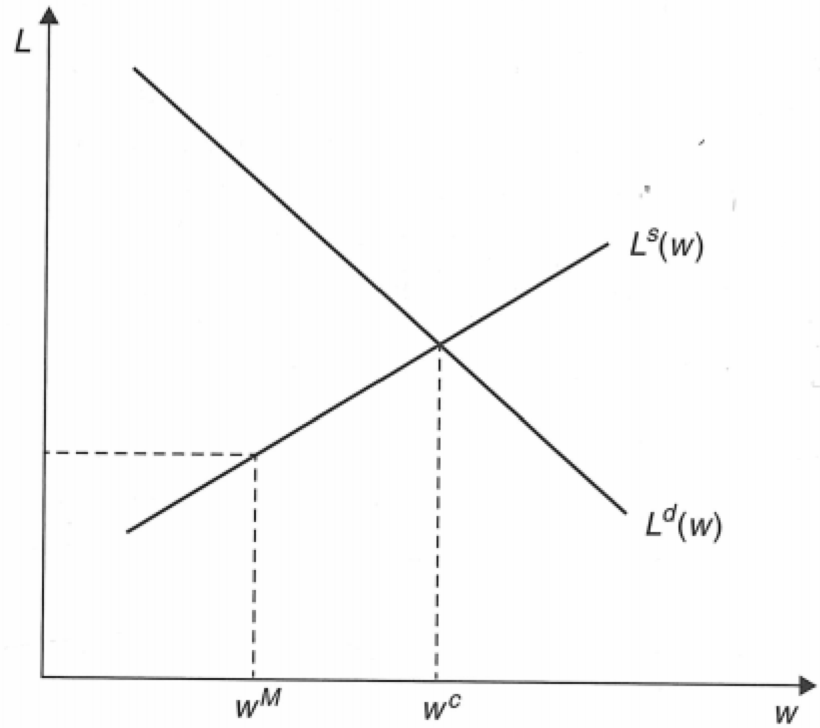


FIGURE 12.21
Employment and wage in the monopsony model.

Sources of monopsony power

- **Workers must have limited mobility**
    - **transportation cost**
    - **qualifications that cannot be used elsewhere**

- **Entry costs must prevent entry of competitors**

Simple game-theoretic model for why the existence of entry costs can uphold a monopsony

N **firms can enter**
c **is the entry cost**
Each worker produces ***y***

Stage 1: entry decision
Stage 2: wage decision

- **Solve the model backwards**

- **If only one firm it sets the monopsony wage**

If there are $n > 1$ competitors, firm i sets its wage w_i so as to maximise its profit
$\pi_i = L_i (y-w_i)$ taking the wages of other firms as given

Employment L_i in firm i depends on all wages ($w_i, \ldots \ldots w_n$) in the following way:

$$L_i = L^s(w_i) \text{ if } w_i > w_j, \quad \forall j \neq i$$

$$L_i = (1/J)L^s(w_i) \text{ if } i \text{ sets the highest wage together with } J\text{-1 other firms, } 1 < J < n$$

$$L_i = 0 \text{ if there exists one firm } j \neq i \text{ which sets } w_i < w_j$$

- **All wages equal to y is a Nash equilibrium**
- **Then each firm has zero profits and cannot improve its profits**
  - **with a lower wage all labour disappears**
  - **with a higher wage it makes a loss**
- **No single firm can set $w_i < y$.**
  - **it would then make a profit**
  - **hence it would pay for a competitor to raise the wage above w_i and capture the whole labour supply**
  - **This is so-called <u>Bertrand competition</u>, which forces the wage up to the competitive level**

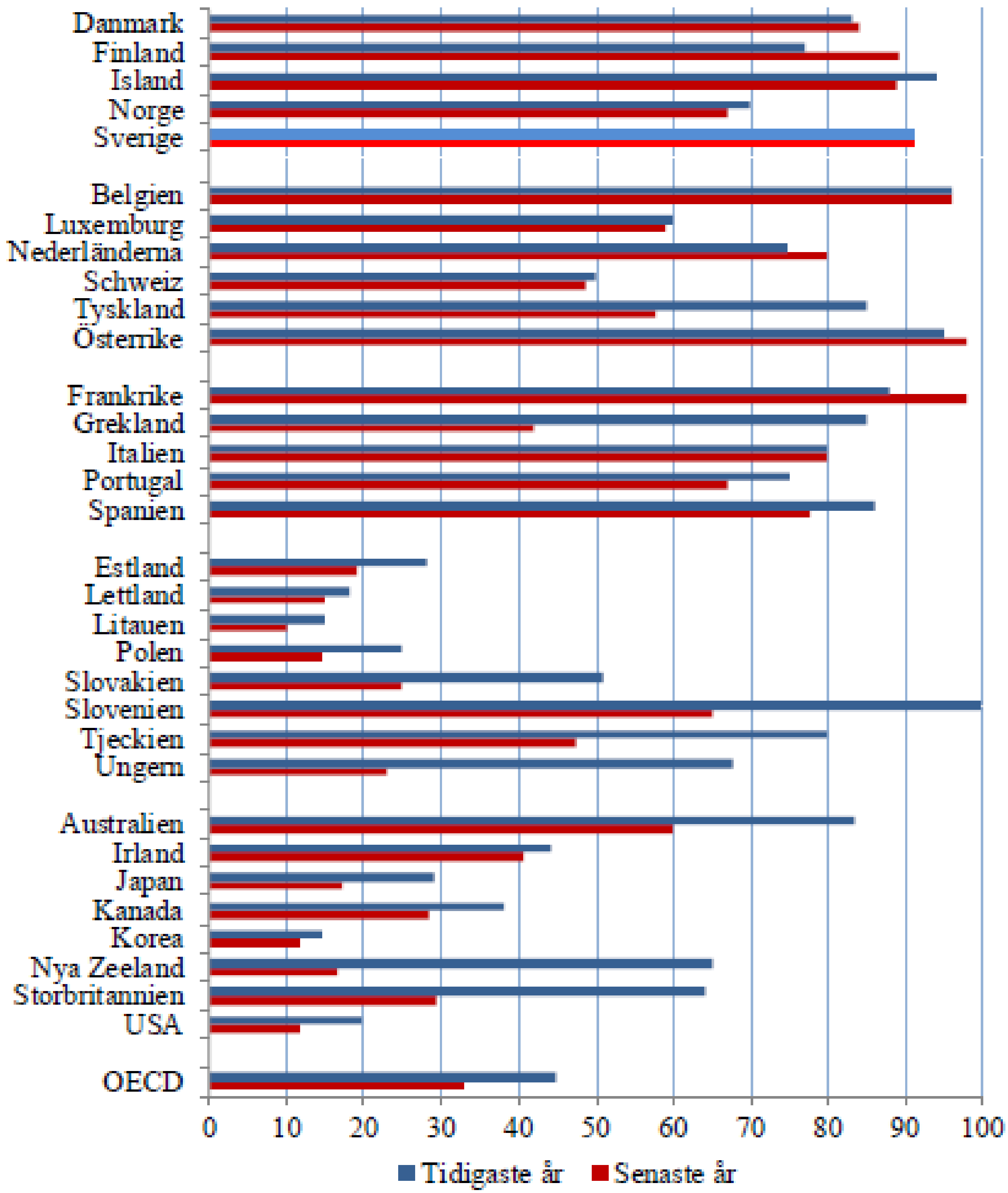
Stage 1 decision

- **Each firm knows that**
  (i) it will make zero profits with competitors present in the market
  (ii) it will make monopsony profits if it alone enters

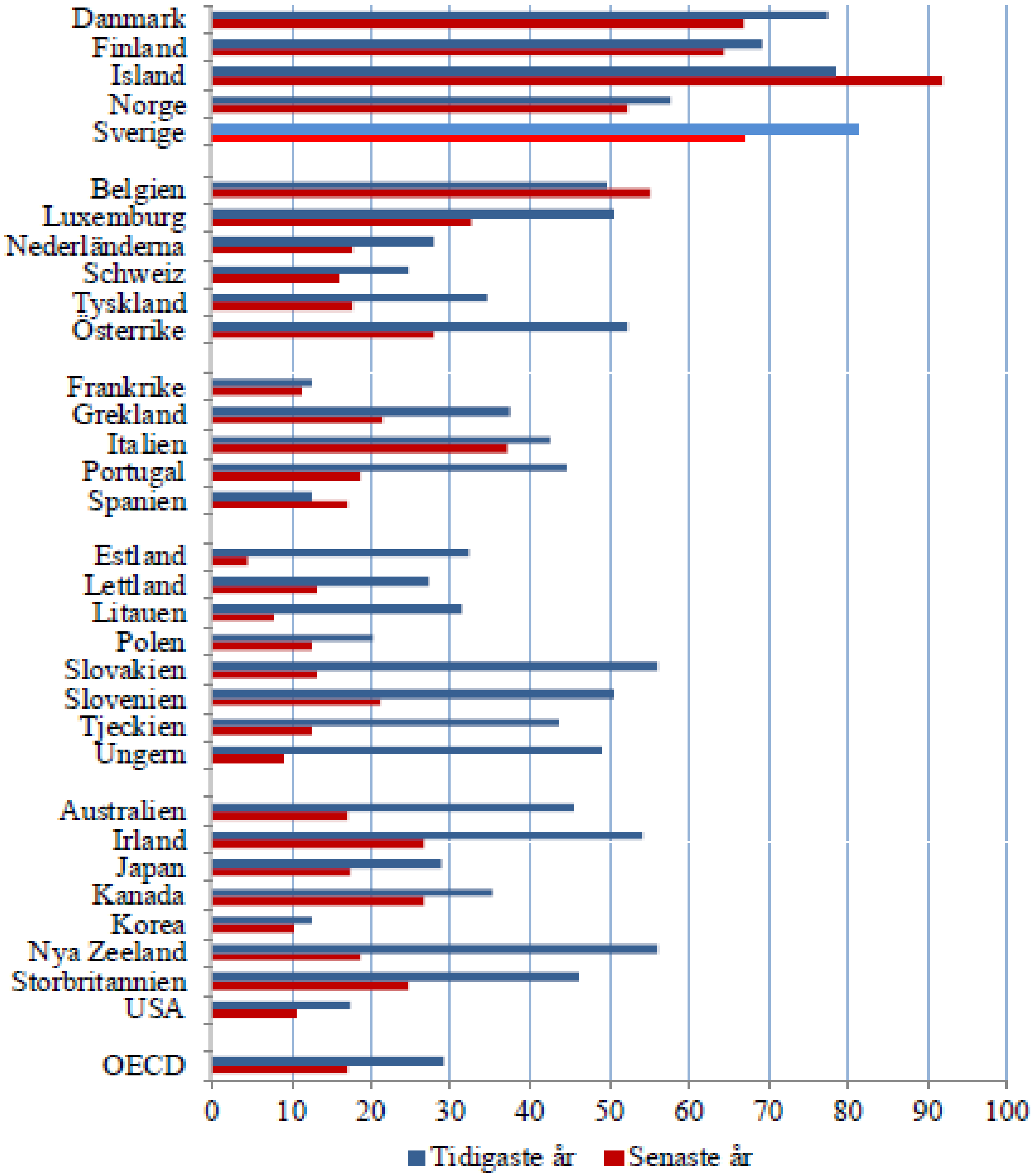
- **Once a firm has entered it does not pay for any other firm to enter**
  - **profits will be zero**
  - **but an entry cost *c* has to be paid**
  - **the first firm (if possibilities to enter come sequentially) chooses to enter if $\pi(w_M) > c$.**

- **Extreme assumptions here regarding Bertrand competition but good illustration of how entry costs may give rise to monopsony and wage differences to other sectors unrelated to productivity.**

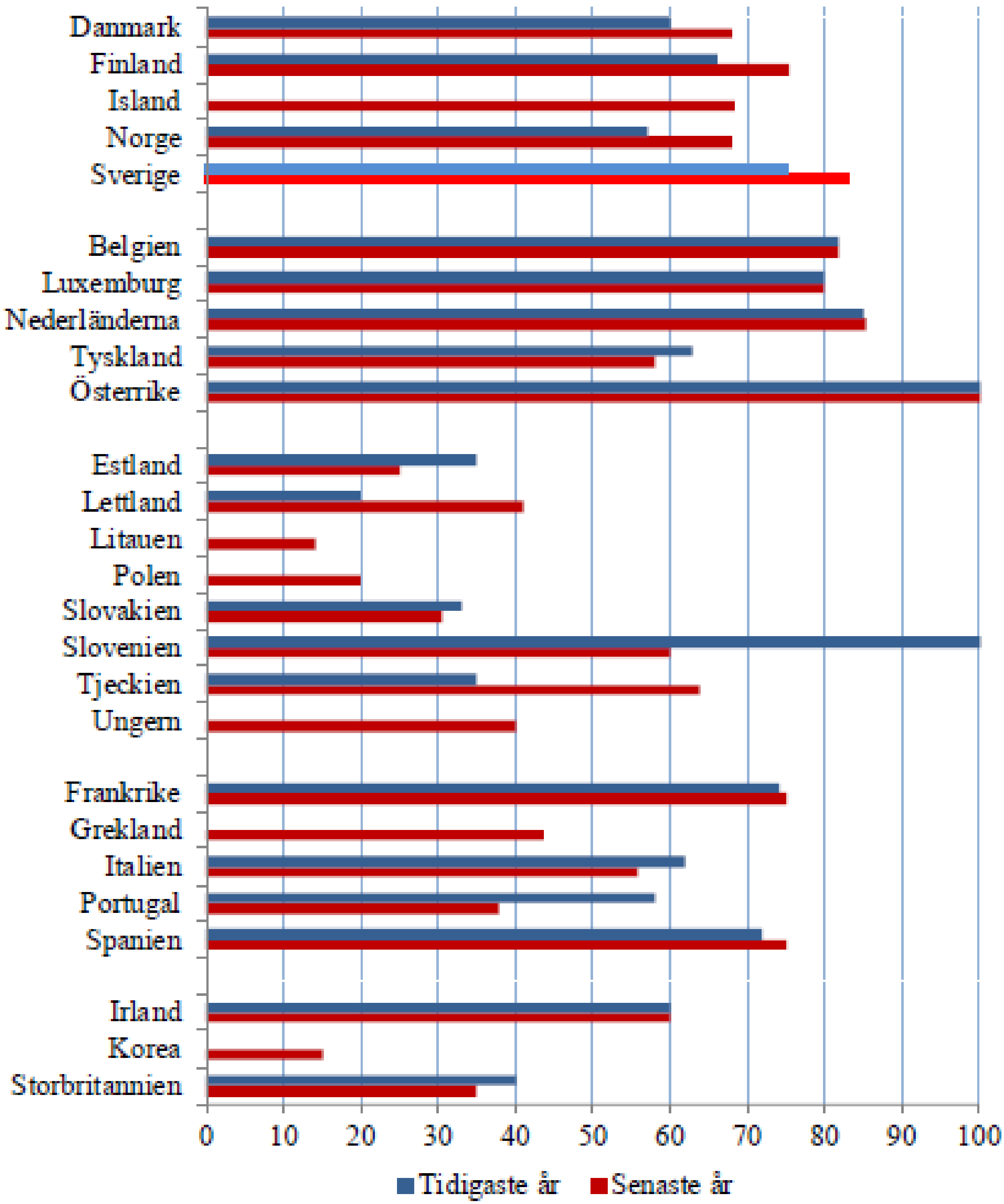
Figur 4.1 Täckningsgrad för kollektivavtal, procent av alla anställda



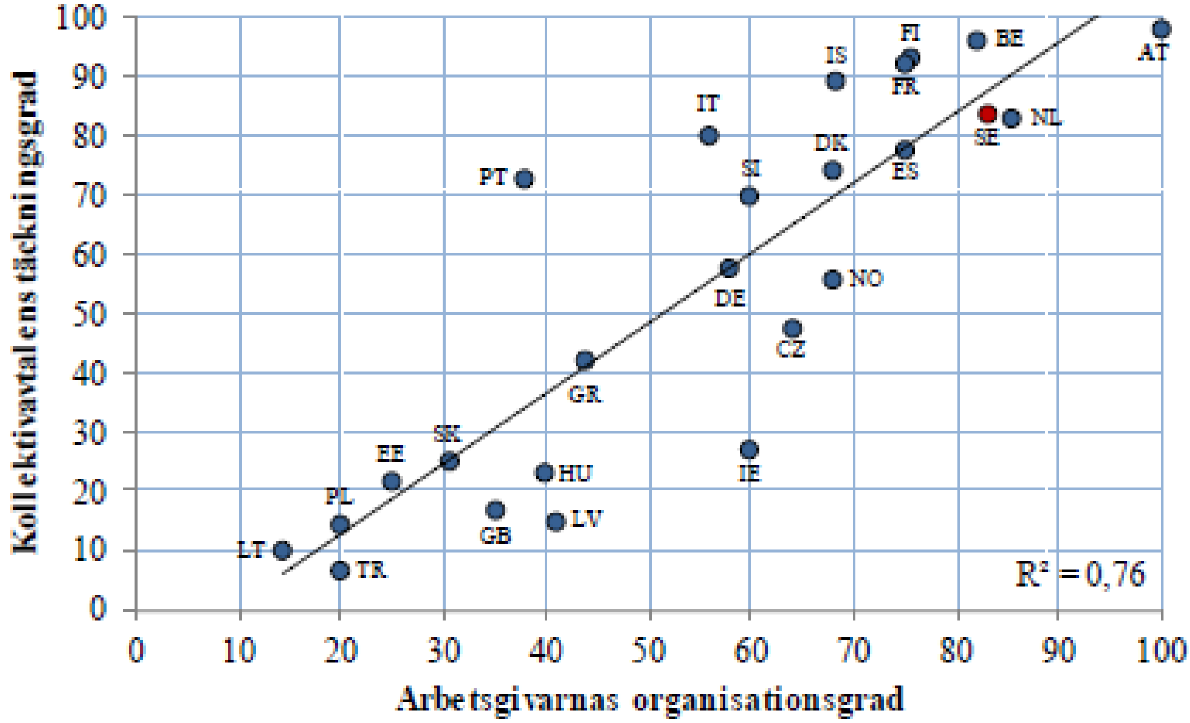
Figur 4.2 Facklig organisationsgrad, procent av alla anställda



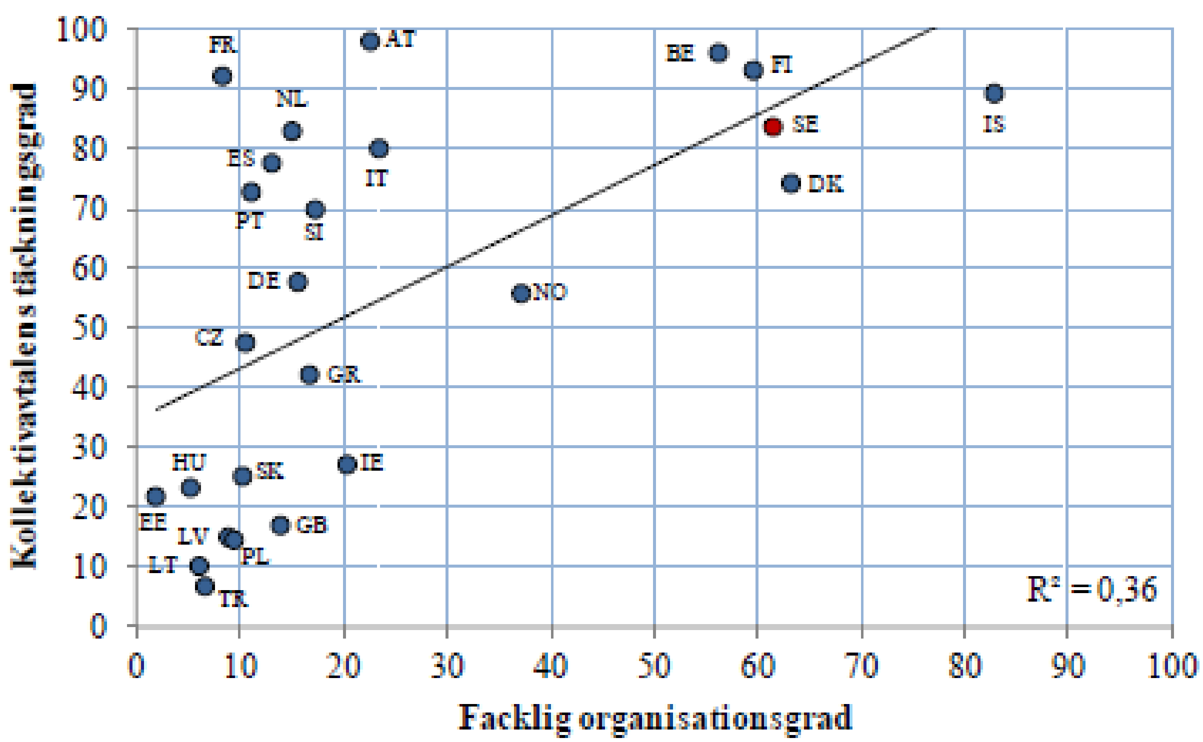
Figur 4.3 Arbetsgivarnas organisationsgrad, procent av anställda i privat sektor



Figur 4.5 Kollektivavtalens täckningsgrad och arbetsgivarnas organisationsgrad i privat sektor i olika länder, senaste tillgängliga år, procent



Figur 4.6 Kollektivavtalens täckningsgrad och facklig organisationsgrad i privat sektor i olika länder, senaste tillgängliga år, procent



Collective bargaining

- **Common assumption for unions: identical members**
- ***N* identical members in the union's "labour pool"**
- **Indirect utility function for the individual, increasing in income**
- **Every member supplies one unit of labour if the real wage *w* exceeds the reservation wage $\overline{w}$ (= income of an unemployed person)**
- ***L* = Labour demand**
- **Same probability of getting a job for every union member = *L*/*N* if *L* < *N* and unity if *L* ≥ *N***
- **Probability of unemployment $(1-\dfrac{L}{N})$ if *L* < *N* and zero if *L* ≥ *N*.**

Union objective

Maximise the expected utility of members

$$\nu_s = l\nu(w) + (1-l)\nu(\overline{w}) \qquad l = \mathrm{Min}\,(1, L/N)$$

If *N* is exogenous, this is equivalent to maximising the unweighted sum of members' utilities:

$$L\nu(w) + (N-L)\nu(\overline{w})$$

If workers are risk-neutral so that $\nu(w) = w$ and $\nu(\overline{w}) = \overline{w}$, unions maximise the rent from unionisation:

$$lw + (1-l)(\overline{w}) = l(w-\overline{w}) + \overline{w}$$

If $\overline{w} = 0$, this is equivalent to maximising the wage bill: *lw*

- **Assumption of identical union members is convenient and facilitates use of microeconomic underpinnings**

- **But in reality members are heterogeneous**

- **Restrictive assumptions necessary for collective decision-making**
  - majority decisions
  - sincere voting: no attempts to influence voting by announcing intentions beforehand
  - voting on a single question
  - single-peaked preferences
  - then the <u>median-voter</u> theorem can be applied

- **Restrictive assumption for union decision-making**
  - voting only about the wage

- **Conflicts between union leadership and membership**
  - leadership may want to maximise union size
  - union size may increase with employment
  - boss-dominated unions show more wage restraint

Empirical studies of union goals

Stone-Geary utility function

$$\nu_s = (w - w_0)^{\theta}(L - L_0)^{1-\theta} \qquad \theta \in [0,1]$$

Special cases

$\theta = ½$, $w_0 = 0$, $L_0 = 0 \Rightarrow$ $\nu_s = w^{½} L^{½} = \sqrt{wL},$

i.e. wage bill maximisation

$$\theta = 1/2, w_0 = \overline{w}, L_0 = 0 \implies v_s = (w - \overline{w})^{1/2} L^{1/2} = \sqrt{(w - \overline{w})L}$$

i.e. rent maximisation

Pencavel (1984) used Stone-Geary utility function

Decision problem

$$\underset{w}{\text{Max}} \quad \nu_s = (w - w_0)^{\theta}(L - L_0)^{1-\theta}$$

$$\text{s.t.} \qquad L = \alpha_0 + \alpha_1(w/r_1) + \alpha_2(r_2/r_1) + \alpha_3 x + \alpha_4 D$$

r_1 = output price
r_2 = production cost
x = output
D = Dummy variable

FOC:

$$\frac{\theta}{\theta - 1} = \frac{\alpha_1(w - w_0)}{r_1(L - L_0)}$$

Estimation of labour demand function and FOC gives estimates of θ, w_0, L_0, α_0, α_1, α_2, α_3 and α_4.

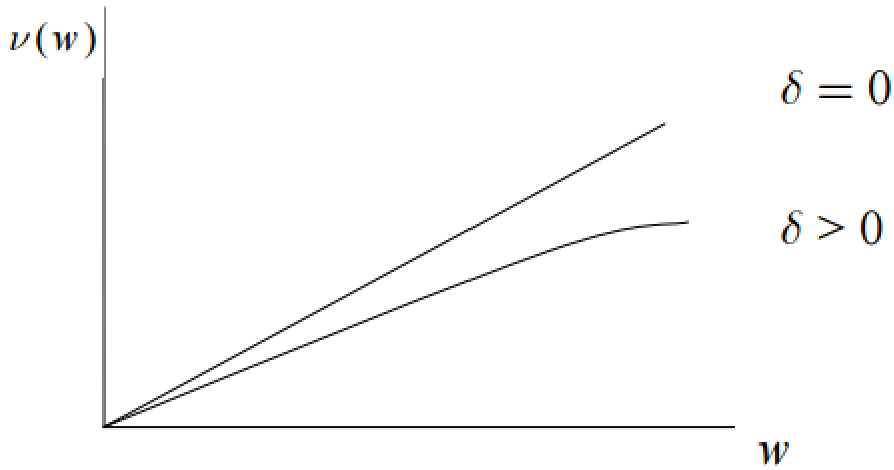
- **Not rent or wage bill maximisation**
- **Different θ, but tendency for θ to be low**
- **w_0 and L_0 increase with the size of the union**

<u>Carruth and Oswald (1985)</u>

- **Rejection of risk neutrality (and wage bill and rent maximisation)**
- **CRRA =** $-w\nu''(w)/\nu'(w) \;\approx\; 0.8$
- **Risk neutrality implies** $-w\nu''(w)/\nu'(w) = -\mathrm{w}\cdot 0/1 = 0$
- $\dfrac{w^{1-\delta}}{1-\delta}$; δ is CRRA

$$\delta = 0 \Rightarrow \frac{w^{1-\delta}}{1-\delta} = w$$

$$\delta = 1 \Leftrightarrow \nu(w) = lnw$$



$\nu(w)$
$\delta = 0$
$\delta > 0$
w

Standard right-to-manage model

- **Bargaining about wages**
- **Employer determines employment unilaterally**

Union objective

$$\nu_s = l\nu(w) + (1-l)\nu(\overline{w}) \qquad l = \mathrm{Min}\,(1, L/N)$$

Firm profit

$$\pi = R(L) - wL \qquad R' > 0, R'' < 0$$

Labour demand from profit maximisation

$$\frac{\partial \pi}{\partial L} = R'(L) - w = 0$$

$$w = R'(L)$$

$$L^d(w) = R'^{(-1)}(w)$$

In case of disagreement

- **Workers get the utility of unemployed persons**
- **Firms get zero profit**

γ denotes relative bargaining strength of the union: $0 < \gamma < 1$

Apply Nash bargaining solution

$$\underset{w}{\text{Max}} \quad (\nu_s - \nu_0)^{\gamma} (\pi - \pi_0)^{1-\gamma}$$

π_0 **= Profit in case of disagreement**

ν_0 **= union utility in case of disagreement**

$$\pi_0 = 0$$

$$\nu_0 = \ell \nu(\overline{w}) + (1-\ell)\nu(\overline{w}) = \nu(\overline{w})$$

$$\nu_s - \nu_0 = \ell \nu(w) + (1-\ell)\nu(\overline{w}) - \nu(\overline{w}) = \ell(\nu(w) - \nu(\overline{w})) =$$

$$= \frac{L^d}{N}\left[\nu(w) - \nu(\overline{w})\right]$$

$$\underset{w}{\text{Max}} \quad \left[L^D(w)\right]^{\gamma} \left[\nu(w) - \nu(\overline{w})\right]^{\gamma} \left[\pi(w)\right]^{1-\gamma}$$

$$\text{with} \quad \pi(w) = R\left[L^D(w)\right] - wL^d(w)$$

$$\text{s.t.} \quad L^d(w) \leq N \ \text{ and } \ w \geq \overline{w}$$

Solve by taking logs and then differentiate w.r.t. ***w***

<u>FOC</u>:

$$\frac{\gamma}{L^d(w)}\frac{dL^d(w)}{dw} + \frac{\gamma\nu'(w)}{\nu(w)-\nu(\overline{w})} + \frac{(1-\gamma)}{\pi(w)}\frac{d\pi(w)}{dw} = 0$$

Let $\eta_w^L = -(w/L)(dL/dw)$

$$\eta_w^\pi = -(w/\pi)(d\pi/dw)$$

$$\phi(w,\bar{w},\eta_w^L,\eta_w^\pi,\gamma) = -\gamma\eta_w^L - (1-\gamma)\eta_w^\pi + \frac{\gamma w \nu'(w)}{\nu(w)-\nu(\overline{w})} = 0$$

(1) (2) (3)

(1) Employment loss from wage increase
(2) Profit loss from wage increase
(3) Income gain for employed workers from wage increase

Monopoly union assumption

$$\gamma = 1 \Rightarrow \eta_w^L + \frac{w\nu'(w)}{\nu(w)-\nu(\overline{w})} = 0$$

- **Still interior solution**
- **Trade union balances income gain for employed workers against employment loss from wage increase**

SOC for a maximum is $\phi_w < 0$

$$x = (\overline{w}, z_L, z_\pi, \gamma)$$

$$\phi_w dw + \phi_x dx = 0$$

$$\frac{dw}{dx} = -\frac{\phi_x}{\phi_w}$$

$$\phi_w < 0 \Rightarrow \operatorname{sgn}\frac{dw}{dx} = \operatorname{sgn}\phi_x$$

$$\phi_\gamma = -\eta_w^L + \eta_w^\pi + \frac{w\nu'(w)}{\nu(w) - \nu(\overline{w})}$$

From FOC we can derive:

$$-\eta_w^L + \frac{w\nu'(w)}{\nu(w) - \nu(\overline{w})} = \frac{1-\gamma}{\gamma}\eta_w^\pi$$

Substitution into expression for ϕ_γ **gives**

$$\phi_\gamma = \eta_w^\pi + \frac{1-\gamma}{\gamma}\eta_w^\pi = \frac{\eta_w^\pi}{\gamma} > 0$$

$$\because \frac{dw}{d\gamma} > 0$$

- **Larger union bargaining power raises the wage**

$$\phi_{\overline{w}} = \frac{\gamma w \nu'(w)}{\left[\nu(w) - \nu(\overline{w})\right]^2} \cdot \frac{\partial \nu}{\partial \overline{w}} > 0$$

- **An income increase for a jobless person raises the wage**

$$\phi_{\eta_w^L} = -\gamma < 0$$

- **An increase in the labour demand elasticity lowers the wage**

$$\phi_{\eta_w^\pi} = -(1-\gamma) < 0$$

- **An increase in the profit elasticity lowers the wage**

Rewrite FOC:

$$\frac{\nu(w) - \nu(\overline{w})}{w\nu'(w)} = \frac{\gamma}{\gamma\eta_w^L + (1-\gamma)\eta_w^\pi} \equiv \mu_s$$

No bargaining power for union: $\gamma = 0$

Hence: $\nu(w) = \nu(\overline{w})$

$$w = \overline{w}$$

- **Employed workers only get a wage equal to the income of the unemployed**

No bargaining power for the employer: $\gamma = 1$

$$\frac{\nu(w) - \nu(\overline{w})}{w\nu'(w)} = \frac{1}{\eta_w^L}$$

- **The mark-up factor only depends on the elasticity of labour demand.**

Union indifference curves in *w*, *L*-space

$$\overline{U} = L\left[\nu(w) - \nu(\overline{w})\right]$$

$$0 = L\nu'(w)dw + dL\left[\nu(w) - \nu(\overline{w})\right]$$

$$\frac{dw}{dL} = \Big|_{\overline{U}=const} = -\frac{\left[\nu(w) - \nu(\overline{w})\right]}{L\nu'(w)} \leq 0$$

$$\frac{d^2w}{dL^2} = \Big|_{\overline{U}=const} = \frac{\left[\nu(w)-\nu(\overline{w})\right]}{L^2\left[\nu'(w)\right]^2}\left\{2\nu'(w) - \nu''(w)\frac{\left[\nu(w)-\nu(\overline{w})\right]}{\nu'(w)}\right\} \geq 0$$

Union indifference curves are negatively sloped and convex.

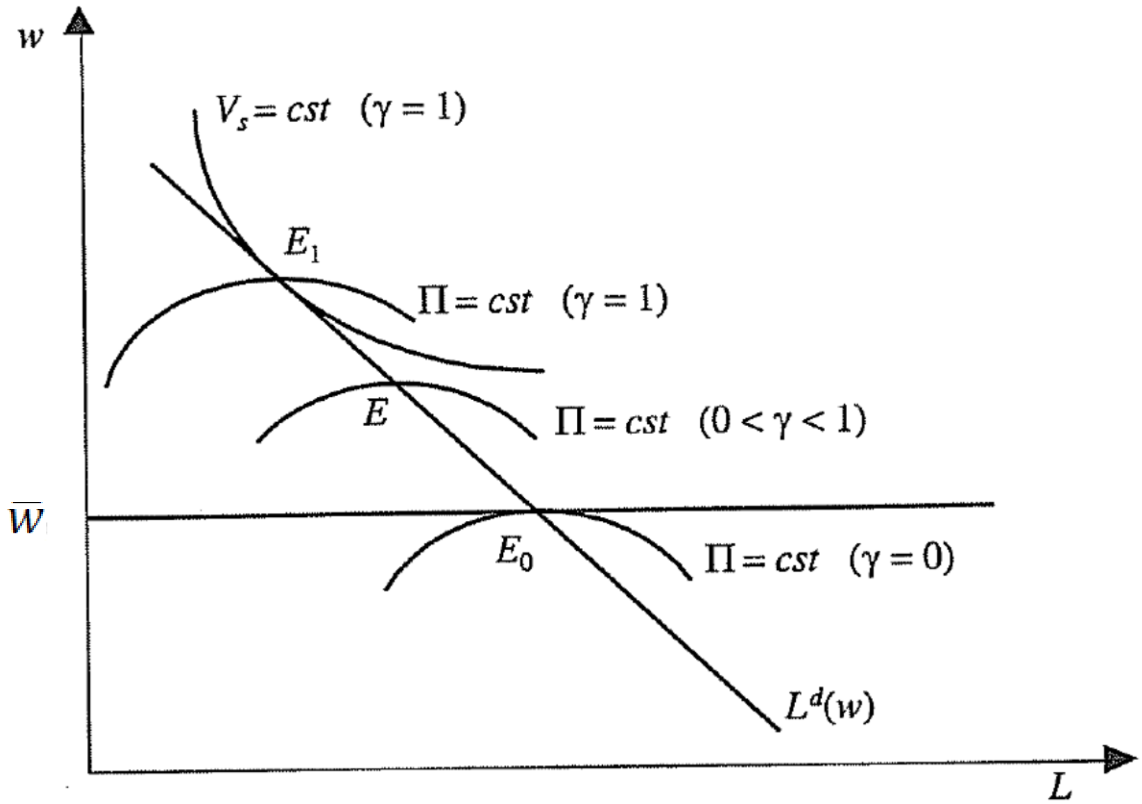


FIGURE 7.5
The right-to-manage model.

Isoprofit curves

$$\overline{\pi} \ = \ R(L) \ - \ wL$$

$$R'(L)dL \ - \ wdL \ - \ Ldw \ = \ 0$$

$$\frac{dw}{dL}\bigg|_{\pi=\overline{\pi}} \ = \frac{R'(L)-w}{L}$$

$$d\left[\frac{dw}{dL}\bigg|_{\pi=\overline{\pi}}\right] \ = \ \frac{L\left[R''(L)dL-dw\right] \ - \ dL\left[R'(L)-w\right]}{L^2} \ =$$

$$\frac{d^2w}{dL^2}\bigg|_{\pi=\overline{\pi}} = \frac{LR''(L)}{L^2} - \frac{\frac{dw}{dL}}{L^2} - \frac{\left[R'(L)-w\right]}{L^2}$$

Substitute $\dfrac{R'(L) - w}{L}$ for $\dfrac{dw}{dL}$:

$$\frac{d^2 w}{dL^2}\bigg|_{\pi=\overline{\pi}} = \frac{LR''(L)}{L^2} - \frac{R'(L) - w}{L^2} - \frac{R'(L) - w}{L_2}$$

$$= \frac{LR''(L) - 2\left[R'(L) - w\right]}{L^2}$$

- **Choosing *L* to maximise profit implies R′(*L*) = *w*. Hence isoprofit curve is horizontal where it intersects the labour demand schedule.**
- **At intersection with labour demand schedule, *R′*(*L*) =*w*.**

Hence

$$\frac{d^2 w}{dL^2}\bigg|_{\pi=\overline{\pi}} = \frac{R''(L)}{L} < 0.$$

Isoprofit curves are concave there, which imply maxima.

Simplified model

$$\pi \;=\; R(L) \;-\; wL \;=\; \frac{AL^{\alpha}}{\alpha} \;-\; wL \qquad\qquad \alpha \in \;(0,\,1)$$

Profit maximisation gives:

$$\frac{\partial\pi}{\partial L} \;=\; AL^{\alpha-1} \;-\; w = 0$$

$$L \;=\; \left(\frac{w}{A}\right)^{\frac{1}{\alpha-1}}$$

Then:

$$\pi \;=\; \frac{A}{\alpha} \;\cdot\; \left(\frac{w}{A}\right)^{\frac{\alpha}{\alpha-1}} - \;w\;\cdot\;\left(\frac{w}{A}\right)^{\frac{1}{\alpha-1}}$$

$$\pi \;=\; w^{\frac{\alpha}{\alpha-1}} \;\cdot\; \frac{1\text{-}\alpha}{\alpha} A^{\frac{1}{\alpha-1}}$$

Hence:

$$\eta_w^L \;=\; -\frac{\partial L}{\partial w} \cdot \frac{L}{w} \;=\; \frac{1}{1-\alpha}$$

$$\eta_w^\pi \;=\; -\frac{\partial L}{\partial w} \cdot \frac{w}{\pi} \;=\; \frac{\alpha}{1-\alpha}$$

Also assume that $\nu(w) \;=\; w$ and $\nu(\overline{w}) \;= \overline{w}$

Then $\nu'(w) \;=\; 1$

FOC (A) then becomes:

$$-\gamma \cdot \frac{1}{1-\alpha} \;-\; (1-\gamma)\frac{\alpha}{1-\alpha} \;+\; \frac{\gamma w}{w-\overline{w}} \;=\; 0$$

Solving for w gives:

$$w = \frac{\gamma + \alpha(1-\gamma)}{\alpha}\overline{w}$$

The wage is set as a mark-up on the income of an unemployed, since $\gamma + \alpha(1\text{-}\gamma) > \alpha \Leftrightarrow \gamma(1\text{-}\ \alpha) > 0$, which must hold.

Especially simple form in monopoly-union case, i.e. if $\gamma = 1$

Then $w = \dfrac{\overline{w}}{\alpha}$

We have:

$$\eta_{\mathrm{w}}^{\mathrm{L}} = \frac{1}{1-\alpha}$$

Hence:

$$1 - \alpha = \frac{1}{\eta_{\mathrm{w}}^{\mathrm{L}}}$$

$$\alpha = 1 - \frac{1}{\eta_{\mathrm{w}}^{\mathrm{L}}} = \frac{\eta_w^L - 1}{\eta_w^L}$$

Thus:

$$w = \left[1 - \frac{1}{\eta_{\mathrm{w}}^{\mathrm{L}}}\right]^{-1} \overline{w}$$

$$w = \frac{\eta_w^L}{\eta_w^L - 1} \overline{w}$$

Analogy to monopoly price setting with price as a mark-up over marginal cost

$\eta_w^L > 1$ **is always the case with Cobb-Douglas production function,**

as $\eta_w^L = \dfrac{1}{1-\alpha}$ **and 0 < α < 1.**

General equilibrium model

$$w_i = \frac{\gamma + \alpha(1-\gamma)}{\alpha}\overline{w}$$

- **Assume mobility in the labour market. An unemployed in a given firm (labour pool) can either find a job in another firm (labour pool) or become unemployed.**
- **Symmetric economy with a large number of firms.**
- **Look at wage-setting in firm *i*.**
- **Probability of getting a job in another firm = *l* = the economy-wide employment rate = employment/labour force.**
- **Probability of not finding a job elsewhere = 1-*l*.**
- **A worker who finds a job elsewhere receives the wage *w*.**
- **If unemployed, the worker receives the unemployment benefit *b*.**

$\overline{w}$ **= the expected income if not employed in firm *i* = alternative income**

$$\overline{w} = \ell w + (1-\ell)b$$

Hence:

$$w_i = \frac{\gamma + \alpha(1-\gamma)}{\alpha}\left[\ell w + (1-\ell)b\right]$$

In a symmetric equlibrium $w_i = w$

Denote the mark-up factor $\dfrac{\gamma + \alpha(1-\gamma)}{\alpha} = m$

Then:

$$w = m\left[\ell w + (1-\ell)\right]b$$

$$w = \frac{m(1-\ell)}{1-m\ell}b \qquad \text{(B)}$$

- **The wage is still a mark-up over the unemployment benefit as**

  $$m(1-\ell) > 1-m\ell \Leftrightarrow m > 1$$

- **The overall wage in the economy, *w*, is positively related to employment as:**

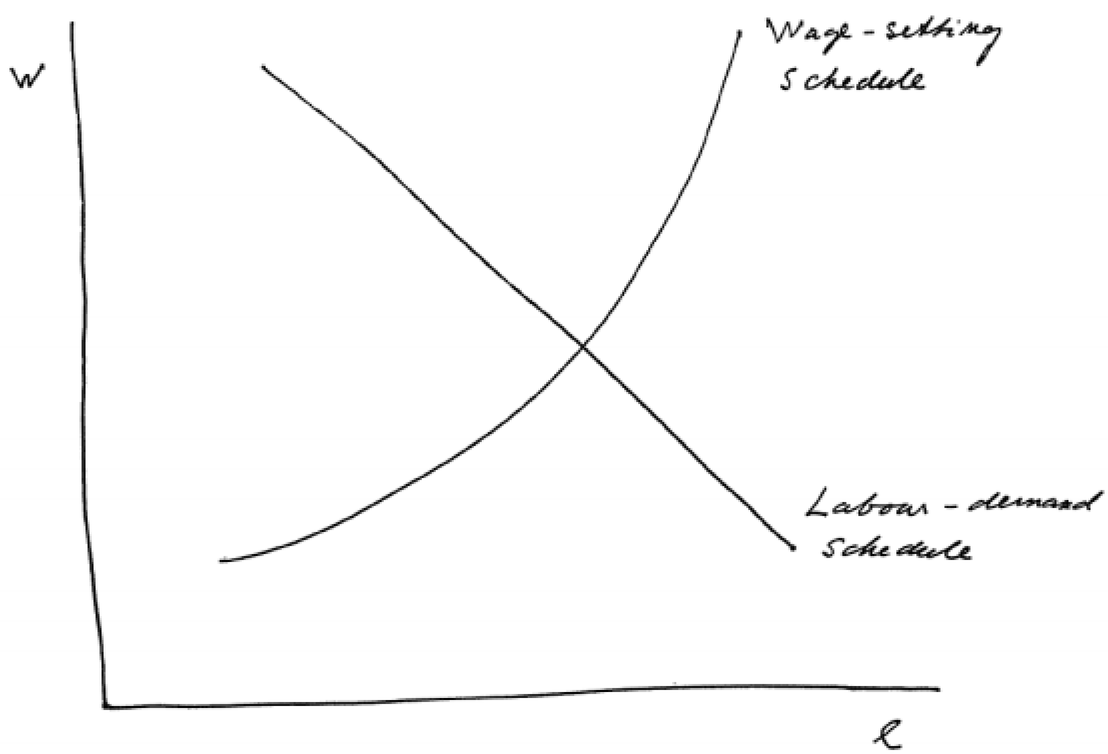
  $$\frac{\partial w}{\partial \ell} = \frac{m(m-1)}{(1-m\ell)^2} > 0$$

$w = f(l)$ is called a <u>wage-setting schedule</u>

It shifts upwards if:

(1) $\gamma\uparrow$
(2) $b\uparrow$

- **Equilibrium employment is given by intersection between the wage-setting schedule and the labour-demand schedule.**
- **Shift of labour-demand schedule affects the equilibrium employment rate.**



Empirical studies

- **Few studies of relation between unemployment benefit and real wage**
- **Theoretical model: elasticity of the real wage w.r.t. unemployment benefit = 1**
    - **Forslund, Gottfries and Westermark (2008): 0.28-0.52**
    - **Bennmarker, Calmfors and Larsson (2013): 0.1-0.2**
- **Elasticity of real wage w.r.t. unemployment according to Blanchflower and Oswald: 0.1**
- **Not so popular to estimate wage setting curves**
    - **reverse causality**
    - **instead reduced-form unemployment equations**

<u>Key question</u>: How is the unemployment benefit determined?

1. **Constant in real terms**
2. **Constant replacement rate *r*, so that *b* = *rw***

<u>Constant replacement rate</u>:

$$w = \frac{m(1-\ell)}{1-m\ell}b$$

$$w = \frac{m(1-\ell)}{1-m\ell}rw$$

$$1 = \frac{m(1-\ell)}{1-m\ell}r$$

$$\ell = \frac{1-rm}{m(1-r)}$$

$$\frac{\partial\ell}{\partial r} = \frac{m(1-m)}{[m(1-r)]^{2}}<0$$

- **Vertical wage-setting schedule determined by labour-market institutions only (here *r* and γ)**
- **An increase in the replacement rate reduces the employment rate**
- **Shifts in labour demand have no effect on the equilibrium employment rate.**

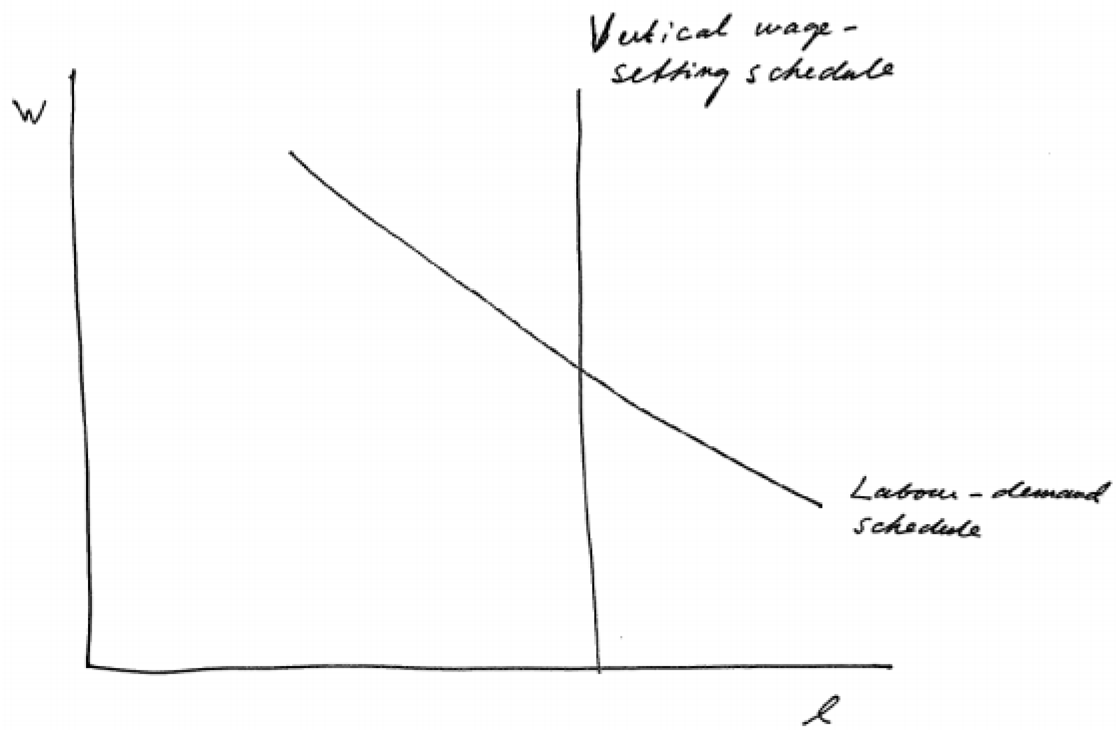


Table 15
Regressions to explain log unemployment rate (%) (20 OECD countries, 1983–1988 and 1989–1994)[a]

	Total unemployment (1)	Longterm unemployment (2)	Shortterm unemployment (3)
Total tax wedge (%)	0.027 (4.0)	0.023 (1.6)	0.028 (3.5)
Employment protection (1–20)		0.052 (1.4)	−0.061 (2.8)
Union density (%)	0.010 (2.3)	0.010 (1.0)	0.0031 (0.5)
Union coverage index (1–3)	0.38 (2.7)	0.83 (2.3)	0.45 (2.1)
Coordination (union + employer) (2–6)	−0.43 (6.1)	−0.54 (3.6)	−0.34 (3.8)
Replacement rate (%)	0.013 (3.4)	0.011 (1.3)	0.013 (2.6)
Benefit duration (years)	0.10 (2.2)	0.25 (2.7)	0.045 (0.8)
Active labor market policies[b]	−0.023 (3.3)	−0.039 (2.8)	−0.097 (1.2)
Owner occupation rate (%)	0.013 (2.6)	−0.0007 (0.1)	0.01 (2.7)
Change in inflation (% pts. p.a.)	−0.21 (2.2)	−0.30 (1.6)	−0.29 (2.7)
Dummy for 1989–1994	0.15 (1.5)	0.30 (1.8)	0.092 (1.0)
R^2	0.82	0.84	0.73
N (countries, time)	40 (20, 2)	38 (19, 2)	38 (19, 2)
Hausman test of the random effects of restriction (χ^2_{10})	6.35	4.52	6.86

[a] Estimation is by GLS random effects (Balestra–Nerlove) using two time periods (1983–1988, 1989–1994). t ratios in parentheses. If we add the following variables, one at a time, to column (1), their coefficients are: payroll tax rate (%), 0.014 (0.5); employment protection, 0.011 (0.6); labor standards, 0.0011 (0.02); real interest rate (%), 0.040 (1.0); centralization, (centralization)^2, 0.048 (0.5), 0.0005(0.1). For the 1989–1994 values of the independent variables, see Tables 5–7, 10 and 14. The 1983–1988 values are available from the author on request. The dependent variables are in Table 1.

[b] The variable is instrumented. Because the active labor market policies variable refers to percent of GDP normalized on *current* unemployment, this variable is highly endogenous. So we renormalized the current percent of GDP spent on active labor market measures on the average unemployment rate in 1977–1979 to create the instrument. Insofar as measurement errors in unemployment are serially uncorrelated, this will help with the endogeneity problem.

Table 16
Regressions to explain labor input measures (Table 2) (20 OECD countries, 1983–1988 and 1989–1994)[a]

	Employment/population ratio (%)		Total hours/ population (index)
	Whole working age population (1)	Males aged 25–54 (2)	(3)
Total tax wedge (%)	−0.24 (2.0)	−0.15 (2.0)	−0.26 (1.6)
Employment protection (1–20)	−0.79 (2.7)	0.037(0.2)	−0.64 (1.6)
Union density (%)	−0.012 (0.1)	−0.058 (1.0)	−0.15 (1.3)
Union coverage index (1–3)	−2.40 (1.0)	−2.00 (1.2)	−2.97 (1.0)
Coordination (union + employer) (2–6)	4.75 (4.0)	2.39 (3.2)	4.08 (2.5)
Replacement rate (%)	−0.067 (1.0)	−0.065 (1.5)	−0.057 (0.6)
Benefit duration (years)	−1.06 (1.8)	−0.57 (1.4)	−0.23 (0.3)
Active labor market policies[b]	0.10 (1.0)	0.036 (0.5)	−0.036 (0.3)
Owner occupation rate (%)	−0.19 (2.7)	−0.11 (2.3)	−0.066 (0.8)
Change in inflation (% pts. p.a.)	−1.21 (1.3)	−0.50 (0.7)	−1.69 (1.6)
Dummy for 1990–1994	3.16 (3.7)	−1.29 (1.9)	0.48 (0.5)
R^2	0.80	0.64	0.51
N (countries, time)	(20, 2)	(20, 2)	(20, 2)

[a] Variables and definitions are in Tables 2 (Cols. 5–7), 5–7 and 10. Estimation is by GLS random effects using two time periods (1983–1988, 1990–1994). *t* ratios in parentheses.

[b] Active labor market policies are instrumented as in Table 15.

Table 7.A1.1. **Baseline unemployment rate equations, 1982-2003**

	1	2	3	4	5	6	7
	Baseline	= 1 with ARR split into two components	= 1 with EPL split into two components	= 1 with tax wedge derived from national accounts	= 4 with separate labour and consumption tax rates	= 1 with standard macroeconomic shocks	= 6 with labour demand shock
Average replacement rate (ARR)	0.12		0.12	0.08	0.09	0.10	0.09
	[6.28]***		[6.79]***	[4.22]***	[4.16]***	[4.14]***	[3.35]***
Tax wedge	0.28	0.27	0.27	0.24		0.24	0.22
	[9.75]***	[10.96]***	[11.14]***	[4.49]***		[7.73]***	[6.40]***
Union density	–0.03	–0.03	–0.03	–0.02	–0.01	0.04	0.06
	[1.57]	[1.89]*	[1.64]	[0.56]	[0.49]	[1.48]	[2.33]**
EPL	–0.31	–0.20		0.03	0.01	–0.61	–0.51
	[0.98]	[0.55]		[0.08]	[0.02]	[–1.52]	[–1.22]
PMR	0.60	0.67	0.73	0.50	0.50	0.54	0.79
	[2.98]***	[3.29]***	[3.52]***	[2.17]**	[2.17]**	[2.25]**	[3.28]***
High corporatism	–1.42	–1.09	–1.39	–2.06	–2.09	–1.42	–1.58
	[3.57]***	[2.88]***	[3.94]***	[4.80]***	[4.89]***	[–2.90]**	[–3.26]***
Output gap	–0.48	–0.48	–0.47	–0.54	–0.54		
	[14.00]***	[14.21]***	[13.99]***	[11.89]***	[11.60]***		
RR 1st year		0.09					
		[7.37]***					
Benefit duration		2.64					
		[2.03]**					
(RR 1st)*(duration)		0.09					
		[2.69]***					
EPL regular			1.28				
			[2.49]**				
EPL temporary			–0.45				
			[2.16]**				
(EPL regular)*(EPL temporary)			–0.28				
			[1.21]				
Labour tax rate					0.25		
					[4.82]***		
Consumption tax rate					0.21		
					[1.92]*		
Macroeconomic shocks							
Productivity shock						–12.81	–8.87
						[–3.34]***	[–2.33]**
Terms of trade shock						19.40	19.09
						[6.45]***	[6.09]***
Interest rate shock						0.22	0.19
						[2.72]***	[2.44]**
Labour demand shock							11.79
							[3.91]***
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	434	434	434	398	398	419	397
R-squared	0.98	0.92	0.92	0.98	0.98	0.98	0.98

***, **, *, statistically significant at 1%, 5% and 10% levels, respectively.
EPL: Employment protection legislation. PMR: Product market regulation. RR: Replacement rate.
OLS estimators. Absolute value of robust t-statistics in brackets.
Source: OECD estimates.