Lecture 8: Labour economics

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Technological progress

- **Labour productivity growth**
- **Capitalisation effect increases the profit due to job creation.**
- **The individual's productivity *y* grows at the rate *g*.**
- **Assume a balanced growth path where productivity, the real wage and profits all increase at the rate of *g*.**

$\pi_e =$ **profit from a filled vacancy (discounted value)**

$\pi_V =$ **profit from an unfilled vacancy (discounted value)**

$$\pi_e = \frac{1}{1 + rdt}\left[(y - w)dt + qdt(1 + gdt)\pi_V + (1 - qdt)\right]$$

$$(1 + gdt)\pi_e \tag{3}$$

***q* = rate of job destruction**

Equation (3) can be rewritten:

$$(r - g)\pi_e = (y - w) + q(1 + gdt)(\pi_V - \pi_e)$$

$$dt \to 0 \Rightarrow$$

$$(r - g)\pi_e = (y - w) + q(\pi_V - \pi_e) \tag{4}$$

- **If π_e is "invested" in the labour market it earns a return made up of the instantaneous profit $(y - w)$ and an expected "capital gain" $q(\pi_V - \pi_e)$.**

- **In addition the value of the asset has risen by $q\pi_e$.**

- **A financial investment yields $r\pi_e$.**

- **$(r - g)\pi_e$ is the return from a financial investment less the "opportunity cost" $g\pi_e$ in an environment characterized by growth g.**

- **$(r - g)\pi_e$ is the <u>effective</u> rate of return on an investment.**

- **Growth is accompanied by a capitalisation effect equivalent to a reduction in the interest rate.**

- **The cost of a vacancy is assumed to be indexed to productivity, i.e. it is *hy*.**

<u>The return from an unfilled vacancy</u>

$$(r - g)\pi_V = -hy + m(\theta)(\pi_e - \pi_V) \qquad (4a)$$

The free-entry condition $\pi_V = 0$ together with (4) and (4a) give:

$$\frac{y - w}{r - g + q} = \frac{hy}{m(\theta)} \qquad (5)$$

The expected profit from a filled job, π_e, is equal to the average cost of a vacancy, $hy / m(\theta)$.

- **(5) represents labour demand.**
- $g \uparrow \ \Rightarrow \ LHS \uparrow \ \Rightarrow \ \pi_e \uparrow$
- **Hence, the *RHS*, the cost of an unfilled vacancy, must also go up. This occurs if the average duration of a vacancy $1/m(\theta)$ increases, which happens when labour market tightness increases.**
- **Hence, $g \uparrow \ \Rightarrow \ \theta \uparrow$, i.e. an upward shift of the labour demand schedule.**

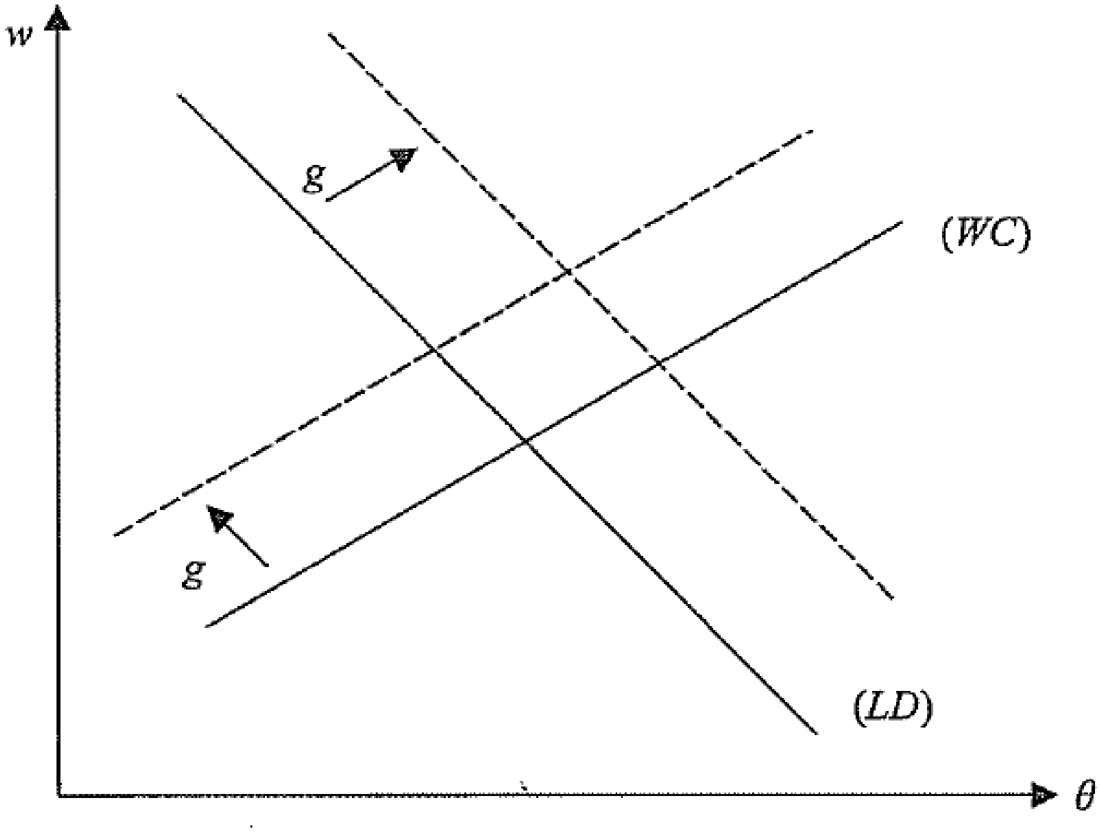


FIGURE 10.1
The effect of an increase in productivity.

<u>Wage setting</u>

V_e **= the discounted expected utility of an employed worker**

V_u **= the discounted expected utility of an unemployed worker**

$$(r-g)V_e \;=\; w \;+\; q(V_u - V_e) \qquad (6)$$

We assume that the income of an unemployed worker is indexed to productivity, such that it is *zy*.

Then:

$$(r-g)V_u \;=\; zy \;+\; \theta m(\theta)(V_e - V_u) \qquad (7)$$

Apply the same wage bargaining model as in chapter 9, but change *z* to *zy* and *r* to (*r*-*g*).

Equation (20) in chapter 9 can then be rewritten:

$$w \;=\; y\left[z \;+\; (1-z)\Gamma(\theta)\right]$$

$$\Gamma(\theta) \;=\; \frac{\gamma\left[r-g \;+\; q \;+\; \theta m(\theta)\right]}{r-g \;+\; q \;+\; \gamma\theta m(\theta)} \qquad (8)$$

- **The "strength of the employee in bargaining",** $\Gamma(\theta)$**, increases with** g**.**
- $g \uparrow$ **reduces the effective interest rate.**
- **The "capital loss" from job destruction is reduced.**
- **Hence, less fear of unemployment.**
- **WC curve is shifted upwards.**

<u>From Figure 10.1</u>

A rise in productivity growth:

(i) raises the wage

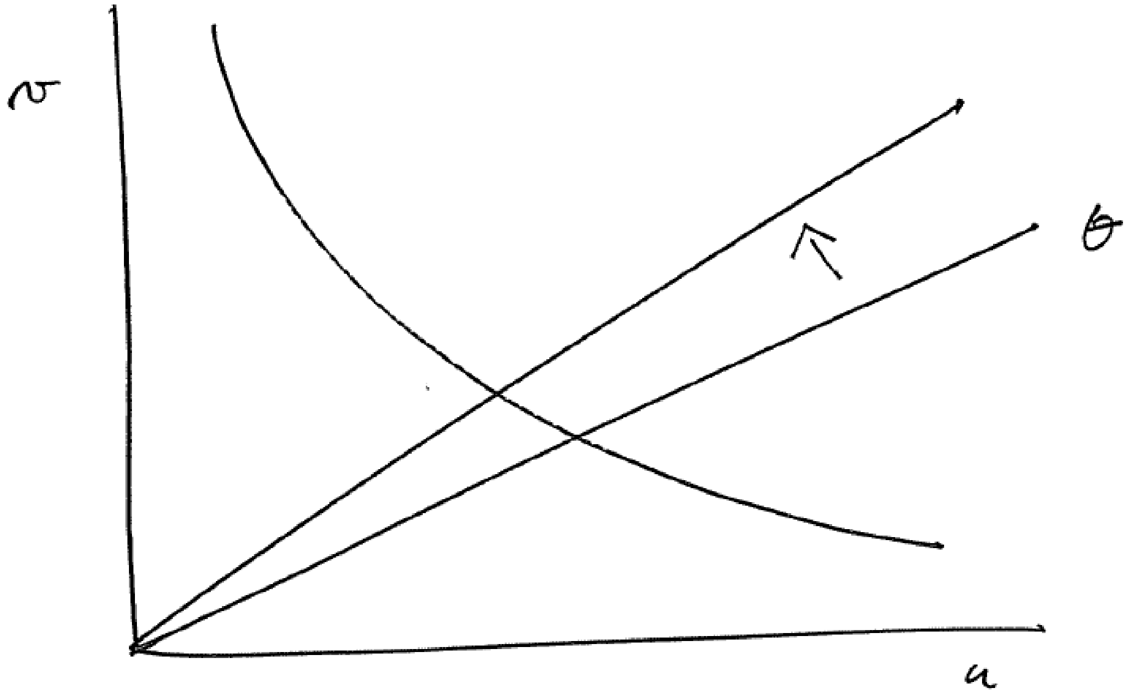
(ii) has an ambiguous effect on θ**.**

But (5) and (8) together give:

$$\frac{(1-\gamma)(1-z)}{r-g \; + \; q \; + \; \gamma\theta m(\theta)} = \frac{h}{m(\theta)} \tag{9}$$

Differentiation of (9) shows that rise in *g* raises *θ*.

$$\frac{d\theta}{dg} = \frac{h}{h\gamma\underbrace{\left[m(\theta) \; + \; \theta m'(\theta)\right]}_{(+)} \underbrace{-(1-\gamma)(1-z)m'(\theta)}_{(+)}} > 0$$



$\theta \uparrow \;\; \Rightarrow \; u \downarrow$

<u>Intuition</u>: The profit from a filled job increases also after the effect on wage bargaining has been taken account of.

- **Productivity growth makes job creation more profitable.**
- **Note that the effect is associated with higher <u>productivity growth</u>, not with a one-shot increase in the productivity level.**
- **Limitation: Exogenous rate of job destruction q.**
- **But if $q = q(g)^{(+)}$, then the effect on unemployment is not à priori clear!**

Table 10.2

Evolution of the D5/D1 ratio among men in the 1980s and 1990s.

Country	1975–79	1995–96	1975–79 to 1995–96
Australia	1.57	1.68	0.11
Canada*	2.07	2.22	0.15
France	1.68	1.60	−0.08
Germany†	1.52	1.46	−0.06
Japan	1.58	1.60	0.02
Sweden	1.32	1.40	0.08
United Kingdom	1.58	1.80	0.22
United States	1.93	2.20	0.27

Source: Bertola et al. (2001, table 3).

*Periods 1980–1984 and 1990–1994.

†The first period is 1980–1984.

Table 10.3

Evolution of unemployment rates per skill level between 1981 and 1996.

	u_ℓ			u_h			
Country	1981	1996	Δu_ℓ	1981	1996	Δu_h	$\Delta u_\ell - \Delta u_h$
Canada	7.3	13.4	6.1	2.0	6.6	4.6	1.5
France	5.4	13.0	7.6	3.0	5.9	2.9	4.7
Sweden	3.0	10.5	7.5	0.6	5.4	4.8	2.7
United Kingdom	13.7	15.1	1.4	2.7	4.1	1.4	0
United States	10.3	11.0	0.7	2.2	2.6	0.4	0.3

Source: OECD data and personal calculations.

Note: u_ℓ designates the unemployment rate of individuals with low educational levels (secondary school education not completed). u_h designates the unemployment rate of individuals with high educational levels (college or university training). Δ designates the difference between 1996 and 1981.

Table 10.4

The evolution of employment rates per skill level between 1981 and 1996.

	e_ℓ			e_h			
Country	1981	1996	Δe_ℓ	1981	1996	Δe_h	$\Delta e_\ell - \Delta e_h$
Canada	79.6	64.3	−15.3	74.6	84.7	−9.9	−5.4
France	80.3	67.2	−12.8	92.5	87.4	−5.1	−7.7
Sweden	85.3	73.5	−12.2	95.2	93.1	−2.1	−10.1
United Kingdom	71.7	61.7	−10	91.3	88.8	−2.5	−7.5
United States	69.8	66.1	−3.7	91.8	90.5	−1.3	−2.4

Source: OECD data and personal calculations.

Note: e_ℓ designates the employment rate of individuals with low educational levels (secondary school education not completed). e_h designates the employment rate of individuals with high educational levels (college or university training). Δ designates the difference between 1996 and 1981.

The Anglo-Saxon vs the European model

- **Biased technological progress**
- **Two labour markets: skilled and unskilled labour**
- **Three goods**
  - final good
  - two intermediate goods (one produced with skilled labour; one produced with unskilled labour)
- **Each employee produces one intermediate good per unit of time.**

Production of the final good

$F(A_h L_h,\ A_l L_l)$ A_h **and** L_h **measure the levels of technical progress**

- **The market for the final good is perfectly competitive.**

$$\max_{L_h, L_l} \quad F(A_h L_h,\ A_l L_l) - p_h L_h - p_L L_L$$

$$p_i = A_i F_i (A_h L_h,\ A_l L_l) \qquad i = h,\ l$$

$$\frac{p_h}{p_l} = \frac{A_h F_h (A_h L_h, A_l L_l)}{A_l F_l (A_h L_h, A_l L_l)}$$

Stationary state

$$r\pi_i \;=\; p_i - w_i \;+\; q_i(\pi_{Vi} - \pi_i) \qquad (39)$$

h_i **= cost of a vacancy**

$\theta_i = V_i / U_i =$ **labour market tightness**

$m(\theta_i) \;=\; M_i\left(V_i / U_i\right)/V_i \;=$ **the rate at which vacant jobs of type *i* are filled**

$$r\pi_{Vi} \;= -h_i + m_i(\theta_i)(\pi_i - \pi_{Vi}) \qquad (40)$$

From free-entry condition π_{Vi} = 0, (39) and (40) we have:

$$\frac{h_i}{m(\theta_i)} \;=\; \frac{p_i - w_i}{r \;+\; q_i}$$

Wage negotiations

z_i **= income of an unemployed person**

V_{ei} **= discounted utility of an employed *i* worker**

V_{ui} **= discounted utility of an unemployed *i* worker**

$$rV_{ei} \;=\; w_i \;+\; q_i(V_{ui} - V_{ei})$$

$$rV_{ui} \;=\; z_i \;+\; \theta_i m(\theta_i)(V_{ei} - V_{ui})$$

From eq. (20) in chapter 9

$$w_i = z_i + (p_i - z_i)\Gamma_i(\theta_i) \tag{42}$$

$$\Gamma_i(\theta_i) = \frac{\gamma_i\left[r + q_i + \theta_i m(\theta_i)\right]}{r + q_i + \gamma_i\theta_i m(\theta_i)} \qquad i = h,\ l$$

$$z_i = b_i w_i$$

$$h_i = hp_i$$

$$w_i = b_i w_i + (p_i - b_i w_i)\Gamma_i(\theta_i)$$

$$w_i = p_i\Phi(\theta_i) \qquad \Phi(\theta_i) = \frac{\Gamma_i(\theta_i)}{1 - b_i + b_i\Gamma_i(\theta_i)} \quad i = 1,\ 2 \tag{42a}$$

(41) and (42a) give:

$$\frac{h}{m_i(\theta_i)} = \frac{1 - \Phi_i(\theta_i)}{r + q_i}$$

- **Labour market tightness is independent of the prices of the intermediate goods and thus of technological progress.**
- **Hence, unemployment from the Beveridge curve does not depend on technological progress (bias).**
- **But the relative wage w_l / w_h does depend on technological bias (prices).**
- **This is an Anglo-Saxon labour market.**

<u>A European labour market</u>

- **Unskilled workers are paid a <u>minimum wage</u>.**
- **<u>Assumption</u>: The minimum wage is indexed to the wage of skilled workers.**

$$w_l = \mu w_h = \mu p_h \Phi_h(\theta_h) \qquad 0 \leq \mu \leq 1$$

$$\frac{h_l}{m(\theta_l)} = \frac{p_l - w_l}{r + q_l} = \frac{p_l - \mu p_h \Phi_h(\theta_h)}{r + q_l}$$

$$\frac{hP_l}{m(\theta_l)} = \frac{p_l - \mu p_h \Phi_h(\theta_h)}{r + q_l}$$

$$\frac{h}{m(\theta_l)} = \frac{1 - \mu \dfrac{p_h}{p_l} \Phi_h(\theta_h)}{r + q_l}$$

- **Obviously θ_l is affected by a change in p_h / p_l due to technological bias.**
- **θ_h is determined as in the Anglo-Saxon model and is not affected by technological bias.**
- **It follows that relative unemployment is affected by technological bias.**

CES production function

$$F(A_h L_h,\ A_l F_l) \ = \ \left[(A_h L_h)^{(\sigma-1)/\sigma} \ + \ (A_l L_l)^{(\sigma-1)/\sigma}\right]^{\sigma/(\sigma-1)}$$

$$\frac{p_h}{p_l} \ = \ \left(\frac{A_h}{A_l}\right)^{(\sigma-1)/\sigma} \left(\frac{L_h}{L}\right)^{-1/\sigma} \qquad (46)$$

Anglo-Saxon model

$$\frac{w_h}{w_l} \ = \ \left(\frac{A_h}{A_l}\right)^{(\sigma-1)/\sigma} \left[\frac{N_h(1-u_h)}{N_l(1-u_l)}\right]^{-1/\sigma} \qquad \frac{\Phi_h(\theta_h)}{\Phi_l(\theta_l)}$$

European labour market

(46) together with $L_i \ = \ N_i(1-u_i)$ **and**

$$\frac{h_l}{m_l(\theta_l)} \ = \ \frac{p_l - w_l}{r \ + \ q_l}$$

gives:

$$\frac{h(r \ + \ q_l)}{m_l(\theta_l)} \ = \ 1-\mu\left(\frac{A_h}{A_l}\right)^{(\sigma-1)/\sigma} \left[\frac{N_h(1-u_h)}{N_l(1-u_l)}\right]^{-1/\sigma} \Phi_h(\theta_h)$$

- **θ_h and u_h are independent of technological bias.**
- **It can be derived that $\nu_l = \overset{(+)}{\nu_l(\mu_l)}$.**
- **Rise of $x = A_h / A_l$ with $\sigma > 1$ shifts *LD* curve downwards in Figure 10.11.**
- **$u_l \uparrow$ and $\frac{u_l}{u_h} \uparrow$.**

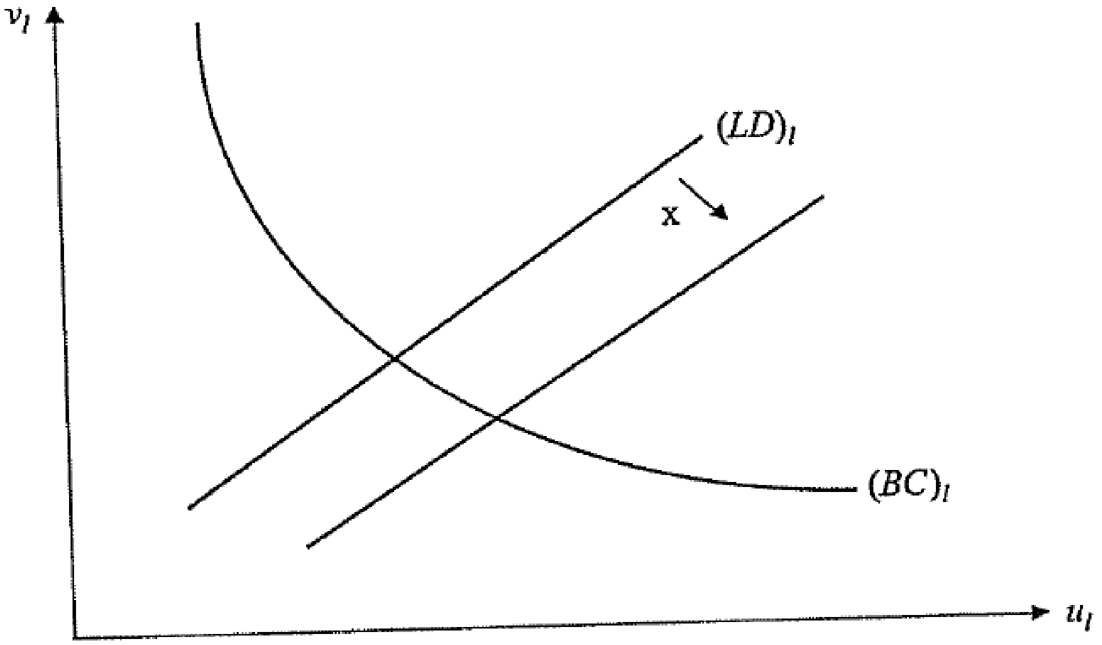


FIGURE 10.11
The unskilled labor market equilibrium.