RELATIVE-WAGE MODELS: GENERAL OBSERVATIONS

w_i Wage paid by firm i

w Wage paid by all others

u Unemployment rate

$(1-bu)w$ *Ex ante* value to a worker of entering a search for a job.

b A parameter > 0. Effect of Δu on value of job search. (If $u\uparrow$, less likely to find a job.)

w_i^* Wage that maximizes wagesetter's objective function

Equilibrium Unemployment:

Assume $w_i^* = \mu(1-bu)w \qquad \mu > 1$

"Optimal wage is a markup over a worker's opportunity cost"

Equilibrium: $w_i^* = w \qquad u = \hat{u}$

$$\Rightarrow w = \mu(1-b\hat{u})w$$

$$\hat{u} = \frac{1-\frac{1}{\mu}}{b}$$

Equilibrium unemployment rate depends on
- wage markup
- effect of Δu on value of job search

How you get to equilibrium:

Holding w fixed, $m\downarrow \rightarrow Z\downarrow \rightarrow u\uparrow \rightarrow w_i^*\downarrow \rightarrow w\downarrow$

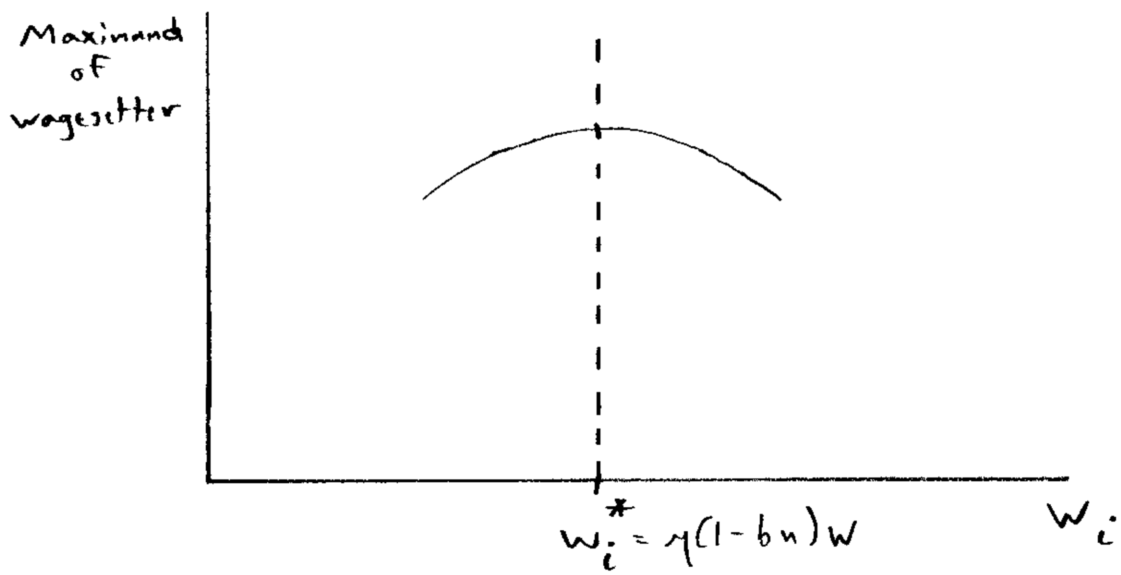
aggregate demand shock

b enters here

RELATIVE-WAGE MODELS: GENERAL OBSERVATIONS

How to get nominal wage rigidity from a "small" adjustment cost:

1) Holding u fixed, deviation from w_i^* has small effect on wagesetter's objective function



2) Holding w fixed, Δu has small effect on w_i^*, which means

b is small

(Δu has small enough effect on ex ante value of job search)

"Real rigidity."

EFFICIENCY WAGES

General assumption

e Efficiency of labor force at firm i

L_i Number of workers employed at firm i

eL_i Effective labor input at firm i

$e(\overset{+}{w_i}, X)$ $\partial e / \partial w_i$ or $e'(w_i) > 0$

real wage   other stuff

Implication of general assumption

real profit $\rightarrow$ $\pi_i = Y_i - w_i L_i = F(eL_i) - w_i L_i$

$$\underset{w_i, L_i}{\text{Max}} \; \pi_i = F(e(w_i), L_i) - w_i L_i \qquad (9.4)$$

F.O.C.'s $\boxed{\text{NOTE: DEVIATION FROM } w_i^* \text{ HAS "SMALL" EFFECT ON } \pi_i}$

$$\frac{\partial \pi_i}{\partial L_i} = 0 = F'(e(w_i^*) L_i^*) e(w_i^*) - w_i^* = 0 \qquad (9.5)$$

$$\frac{\partial \pi_i}{\partial w_i} = 0 = F'(e(w_i^*) L_i^*) L_i^* e'(w_i^*) - L_i^* = 0 \qquad (9.6)$$

(9.5) gives $F'(e(w_i^*) L_i^*) = \dfrac{w_i^*}{e(w_i^*)}$

stick in (9.6) gives $\dfrac{w_i^*}{e(w_i^*)} L_i^* e'(w_i^*) - L_i^* = 0$

implies

$$w_i^* = \frac{e(w_i^*)}{e'(w_i^*)} \quad \text{OR} \quad \underbrace{e'(w_i^*) \cdot \frac{w_i^*}{e(w_i^*)}}_{\text{elasticity of effort with respect to wage}} = 1 \quad (9.8)$$

Same as "Minimize cost of efficiency-unit of labor" $\rightarrow \dfrac{w_i}{e(w_i)}$

EFFICIENCY WAGES

More implications of general assumption

Recall $w_i^* = \dfrac{e(w_i^*)}{e'(w_i^*)}$ ← this determines w_i^*

$0 = F'(e(w_i^*)L_i^*)\, e(w_i^*) - w_i^*$ ← (given w_i^*, this determines L_i^*

Hence real wage & employment entirely determined by
$e(w_i)$ Effect of w on efficiency
$F(eL_i)$ Production function & output demand.

Labor supply doesn't matter!

- If w_i^* is <u>above</u> market-clearing wage, unemployment,
- If w_i^* is <u>below</u> market-clearing wage, wage is bid up to market-clearing; no unemployment.

But what about X?
Think more about e function.

EFFICIENCY WAGES (cont.)

Efficiency depends on W_i relative to X

$$e = \left(\frac{w_i - X}{X}\right)^{\beta} \qquad e'(w) = \frac{\beta}{X}\left(\frac{w_i - X}{X}\right)^{\beta-1} \qquad 0 < \beta < 1 \quad (9.12)$$

$$w_i^* = \frac{e(w_i^*)}{e'(w_i^*)} = \frac{\left(\frac{w_i^* - X}{X}\right)^{\beta}}{\frac{\beta}{X}\left(\frac{w_i^* - X}{X}\right)^{\beta-1}} = \frac{w_i^* - X}{\beta}$$

$$\Rightarrow \frac{w_i^*}{\beta} - w_i^* = \frac{X}{\beta}$$

$$\left(\frac{1}{\beta} - 1\right) w_i^* = \frac{X}{\beta}$$

$$w_i^* = \frac{X}{\beta\left(\frac{1}{\beta} - 1\right)} = \frac{1}{1-\beta} X$$

} w_i^* is markup over X

What is X?

$X = P$ Efficiency is greater if real wage is higher (nutrition)
price of consumption unit

$X = \overline{w}$ "Fair" wage, representing a social norm

$X = (1 - bu)W$ Ex ~~ante~~ value of job search

— e is labor net of turnover cost (finding, training new guys) and turnover depends on w_i vs. $(1-bu)W$

— Unobserved ability

— Screwing off

In any case, $w_i^* = \underbrace{\frac{1}{1-\beta}}_{\mu}(1-bu)W$ (9.15)

But how big is b?

EFFICIENCY WAGES

Assuming $X = (1 - bu)\,w$

Assuming all firms are identical,

$$w_i^* = W = \frac{1}{1-\beta}(1-bu)\,w$$

$$\Rightarrow 1 = \frac{1}{1-\beta}(1-bu)$$

$$\Rightarrow u_{EQ} = \beta/b \qquad (9.17)$$

$$e = \left(\frac{w-(1-bu)\,w}{(1-bu)\,w}\right)^{\beta}$$

$$e_{EQ} = \left(\frac{bu}{1-bu}\right)^{\beta}$$

Equilibrium unemployment rate determined by

- effect of u on ex-ante utility of job-search state
- effect of $\frac{w-x}{x}$ on effort

Meanwhile,

$$e_{eq} = \left(\frac{bu_{EQ}}{1-bu_{EQ}}\right)^{\beta} = \left(\frac{\beta}{1-\beta}\right)^{\beta}$$

Effort level depends only on effect of $\left(\frac{w-x}{x}\right)$ on effort

Total employment is

$$L_{EQ} = (1-u_{EQ})\,\bar{L} = (1-\beta/b)\,\bar{L}$$

labor Force

Labor supply, labor demand factors like marginal disutility of labor, productivity don't affect employment!

If there are N firms, each firm employs $\frac{(1-\beta/b)\,\bar{L}}{N}$

Real wage determined by

$$F'(e(w)\,L_i)\,e(w) = w \qquad (9.5)$$

$$\frac{(1-\beta/b)\,\bar{L}}{N} \qquad \left(\frac{\beta}{1-\beta}\right)^{\beta}$$

EFFICIENCY WAGES

Assuming $X = (1 - bu)w$ (cont.)

Hence real wage is determined by

$$F'\left(\left(\frac{\beta}{1-\beta}\right)^{\beta}\frac{(1-\beta/b)\bar{L}}{N}\right)\left(\frac{\beta}{1-\beta}\right)^{\beta} = w$$

note

- an increase in productivity or other labor-demand factors <u>boosts</u> the real wage as it increases

  $F'(\ )$ (real marginal revenue product of labor

- an increase in supply of potential workers per firm

  $\bar{L}/N$ <u>reduces</u> the real wage

  (because $F'(\ )$ is diminishing)

even though these factors <u>don't</u> affect equilibrium unemployment rate or effort.

EFFICIENCY WAGES

"Menu cost" calculation

How strong is incentive for firm to not follow Calvo (or Taylor) pricing, but rather adjust W_i continually? or adjust W_i before next scheduled adjustment-time?

Similar question, asked by Romer: what is incentive to adjust W_i assuming other firms don't adjust W_i? (in Calvo/Taylor, question would be: what is incentive ... assuming $(1-\pi)$ ← proportion of firms don't adjust w_i)

Do you need a "big" menu cost to maintain "fixed-wage equilibrium"? ("are small frictions enough?")

Story: initially, $d = d_a$ (demand variable), $W = W_a$, $u = u_{EQ}$ $\Rightarrow W_a = \frac{1}{1-\beta}(1-b u_{EQ}) W_a$

then d falls to d_b, u rises to $\hat{u}$, if other firms hold $W = W_a$.

$$W_i^* = \frac{1}{1-\beta}(1-b\hat{u})W_a < W_a$$

Taking behavior of other firms as given, we maintain fixed-wage equilibrium if

$$\text{Profit}(W_i^*, d_a) - \text{Profit}(W_a, d_a) < \text{menu cost}.$$

Romer considers a portion of this problem:

$$\overset{C_{ADJ}}{\text{Labor Cost}(W_i^*)} - \overset{C_{FIX}}{\text{Labor Cost}(W_a)} < \text{menu cost}$$

menu cost ← described as a % of Labor Cost

Labor cost: $$\frac{W}{e(W)} = \frac{W_i}{\left(\frac{W_i - (1-b\hat{u})W}{(1-b\hat{u})W}\right)^{\beta}}$$

d doesn't enter here

EFFICIENCY WAGES

"Menu cost" calculation

For small shocks,

$$\text{LaborCost}(w_i^*) - \text{LaborCost}(w_a)$$

$$\approx \left.\frac{\partial LC}{\partial w_i}\right|_{w_i = w_i^*} \cdot (w_i^* - w_a)$$

In competitive labor market, $\left.\frac{\partial LC}{\partial w_i}\right|_{w_i=w_i^*} = 1$ ← labor cost moves one-to-one with w_i

Under e-wage, $\left.\frac{\partial LC}{\partial w_i}\right|_{w_i=w_i^*} = 0$ ← First-order condition: at w_i^* effect of wage cut on \$/worker exactly counterbalanced by effect of wage cut on efficiency

What about bigger shocks?

$C_{ADJ} - C_{FIX}$?

$$C_{FIX} = \frac{w_a}{e(w_a)} = \frac{w_a}{\left(\frac{w_a - (1-b\hat{u})w_a}{(1-b\hat{u})w_a}\right)^{\beta}} = \left(\frac{1-b\hat{u}}{b\hat{u}}\right)^{\beta} w_a \qquad (9.18)$$

$$C_{ADJ} = \frac{w_i^*}{e(w_i^*)} = \frac{\frac{1}{1-\beta}(1-b\hat{u})w_a}{\left(\frac{\frac{1}{1-\beta}(1-b\hat{u})w_a - (1-b\hat{u})w_a}{(1-b\hat{u})w_a}\right)^{\beta}} = \frac{1}{\beta^{\beta}}\frac{1}{(1-\beta)^{1-\beta}}(1-b\hat{u})w_a \qquad (9.19)$$

Romer puts in "reasonable" numbers.