

**Behavioral Macroeconomics:  
Part 2 - Labor Market**

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# Efficiency Wages Solow (1979)

- Output with one unit of capital is a function of labor efficiency units

$$q = f(e(w)l) \quad (1)$$

where  $q$  is output,  $e$  is effort,  $w$  is the real wage and  $l$  is man-hours

# Optimum

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$$\pi = f(e(w)l) - wl \quad (2)$$

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$$\pi' \stackrel{!}{=} 0 \quad (3)$$

therefore

$$e(w^*)f'(e(w^*)l^*) = w^* \quad (4)$$

where the asterisk stands for the optimal value

- K units of capital and labor inelastically supplied, unemployment is  $N - Kl^*$

# Fairness and Unemployment

Akerlof and Yellen (1988), AER

- Workers have a conception of a fair wage
- Actual wage less than fair wage - workers supply a corresponding fraction of normal effort:

$$e = \min(w/w^*, 1) \quad (5)$$

where  $e$  is the effort supplied in units such that 1 is normal effort,  $w$  the actual wage paid and  $w^*$  the fair wage.

- Unemployment may exist if the fair wage  $w^*$  exceeds the market-clearing wage.

# Evidence for the Fair Wage-Effort Hypothesis

- Psychology: Adams' (1963) theory of equity
- Blau-Homans (1955, 1961) theory of social exchange: equity prevails in social exchange
- Fair wage-effort hypothesis in line with common sense
- F w-e h explains wage compression among individuals with different skills
- Simple models explain empirically observed unemployment-skill correlations, also explain that unemployment has not fallen with rise in education despite lower unemployment of more educated workers

# Equity Theory by Adams (1963)

- In social exchange perceived value of input = perceived value of outcome

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$$e = w/w^* \quad (6)$$

The perceived value of the labor input will equal the perceived value of the remuneration

# More Points to Consider I

- Agents who feel underrewarded will supply fewer inputs
- Experimental results show that overpayment does not increase input,  $e = 1$  for  $w > w^*$
- Underpaid workers reduce self-esteem
- Pay equal - workers work in pairs
- Pay unequal - workers even willing to sacrifice earnings to work alone (Schmitt and Marwell (1972))

# More Points to Consider II

- Often secrecy with regard to wages - secrecy of organisations evidence that other's pay does matter
- If firms pay high wage to some groups of workers general wage scale for other labor rises, otherwise wage perceived as unfair
- As a general rule: unemployment lower for workers with greater education and skill

# The Model - Effort

- Exogenously given fair wage  $w^*$

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$$e = \min(w/w^*, 1) \quad (7)$$

- If  $w \geq w^*$  effort  $e = 1$
- If  $w < w^*$  effort is reduced proportionately

# The Model - Production

- Large number of identical firms
- Product market perfectly competitive
- Production function is

$$Q = \alpha eL \quad (8)$$

where  $Q$  is output,  $e$  is average effort of labor hired,  $L$  is the labor hired

- Fixed supply of labor  $\bar{L}$ , independent of the wage rate
- Marginal product of a unit of effective labor is  $\alpha$

# Equilibrium

- Marginal cost of the firm is  $w^*$  for  $w \leq w^*$
- Marginal cost of the firm is  $w$  for  $w > w^*$
- Marginal cost of a unit of effective labor to the firm is  $w/e$  - the wage per unit of effort

## Case $\alpha < w^*$

- Marginal cost of labor at least  $w^*$
- Thus, marginal cost of effective labor  $>$  marginal product, the firm cannot produce productively
- Demand for labor is zero and unemployment rate is unity

## Case $\alpha > w^*$

- Demand for labor infinite up to  $w = \alpha$  since marginal product  $>$  costs  $\rightarrow$  wages will be driven up
- Labor demand is zero if  $w > \alpha$
- Demand for labor infinitely elastic at the wage  $w = \alpha$  - this is the equilibrium, characterized by full employment with all firms paying the market-clearing wage  $w = \alpha$

# Summary Rudimentary Model

- Model is completely linear, thus unemployment rate either zero or one
- Remedies: production function with diminishing returns
- Different classes of labor, each with its own value of  $\alpha$  and  $w^*$  - those with  $\alpha > w^*$  employed, those with  $\alpha < w^*$  unemployed
- Make  $w^*$  dependent on unemployment rate.  $w^*(0) = \infty$ ,  $w^*(1) = 0 \rightarrow$  high unemployment rate so people thankful to be employed, perceived fair wage is low and vice versa

# Fairness Model 2 with Two Types of Labor

- Two types of labor:  $l_1$  and  $l_2$
- Output with one unit of capital:  $f(l_1, e(\sigma^2(w))l_2)$  so  $e$  depends on the variance of wages paid by the representative firm. Also, only effort of the lower-paid labor depends on the wage gap
- Firms with less variance  $\rightarrow$  more harmonious labor relations  $\rightarrow$  higher output per worker

# The Firm's Profit Function

- The firm's profit function is then

$$\pi = f(l_1, e(\sigma^2(w))l_2) - w_1l_1 - w_2l_2 \quad (9)$$

- Here,  $w_1$  and  $l_1$  are at market-clearing levels and wage for type 2 labor satisfies the familiar Solow condition. Elasticity of effort with respect to type 2 labor will be unity
- Rationale for wage compression, workers with high pay will show lower unemployment, high skill and high pay typically correlated, so higher-skilled groups usually lower unemployment rates, positive correlation of industry wage premia across occupations

# Extensions

- Fairness requires a relation between remuneration and performance
- Workers with low skill do not consider it fair to receive the identical wage as obviously more skilled workers
- But that's just a problem how the fair wage is defined
- Fair wage system: pay differentials which are more compressed than productivity differentials

# Wages, Seniority, and the Demand for Rising Consumption Profiles - Frank and Hutchens (1993)

- Theory of competitive labor markets: worker is paid value of his marginal product at every moment
- Evidence, that wages grow faster than productivity
- People prefer rising consumption profiles - achieved through private savings or use of upward sloping wage profile
- Take as an example pilots' salary
- Even juniors do require experience, some skills may deteriorate with age

# Explanations for Wage Deferrals

- Firm specif. human capital: prospect of earning premium wages encouragement to remain in firm (pilots?, training of highly general nature)
- Bonding contracts (if you cheat you lose subsequent earnings stream (cheating pilots?))
- Risk-aversion: insurance motive, hence agreement on cross-sectional wage equality within each work group - most productive would leave firm - lifetime earnings profile more steeply upward sloping to discourage
- Adverse selection: first in trial period firm pay less than marginal productivity, afterwards low-productivity workers get marginal utility, high-productivity workers receive a wage in excess of marginal product. This compensation scheme discourages applications from low-prod. workers.

# A Simple Model

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$$\max_{C_t} \int_0^T U(C_t) dt \quad \text{subject to} \quad \int_0^T C_t dt = \int_0^T W_t dt = W, \quad (10)$$

where  $U =$  utility index with  $U' > 0$  and  $U'' < 0$ ,  $C_t$  is consumption at time  $t$  and  $W_t =$  wage income at time  $t$ .

- Given concavity of the utility function, the maximization problem yields constant consumption at every moment

$$C_t^* = (1/T) \int_0^T W_t dt. \quad (11)$$

# Representative Consumer with Consumption Growth in the Utility Function

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$$V_t = V[U(C_t), g_t] \quad (12)$$

where  $g_t = (dC_t/dt)/C_t$  and the function  $V$  is increasing in both arguments.

- The maximization problem is given by

$$\max_{C_t} \int_0^T V[U(C_t), g_t] dt \quad \text{subject to} \quad \int_0^T C_t dt = \int_0^T W_t dt \quad (13)$$

- Two opposing effects: concavity of  $U \rightarrow$  pressure to hold consumption constant,  $V_2 > 0$  pressure for consumption to rise.

# An Example

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$$V[U(C_t), g_t] = C_t^{\alpha_1} g_t^{\alpha_2} \quad (14)$$

Consumption paths with constant growth rate  $g$ :

$$C_t = C_0 e^{gt} \quad (15)$$

- Maximization problem given by:

$$\max_g \int_0^T C_t^{\alpha_1} g^{\alpha_2} dt \quad \text{subject to} \quad \int_0^T C_0 e^{gt} dt = W \quad (16)$$

# An Example (continued)

- Solving the budget constraint for  $C_0 = gW/(e^{gT} - 1)$  and substituting into the maximand yields:

$$M = \int_0^T [gW e^{gt} / (e^{gT} - 1)]^{\alpha_1} g^{\alpha_2} dt \quad (17)$$

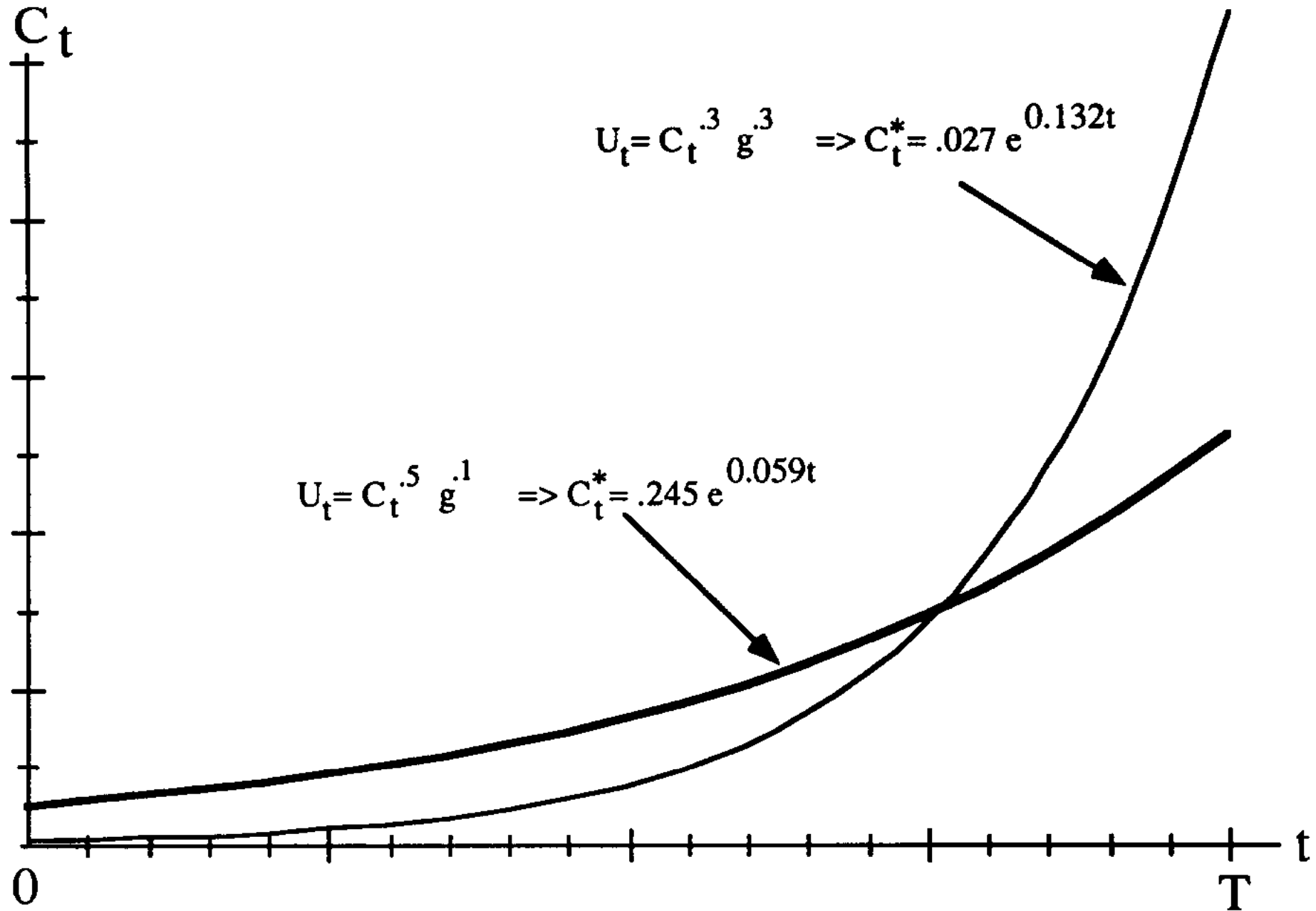
- Thus,

$$M = (W^{\alpha_1} / \alpha_1) [g^{(\alpha_1 + \alpha_2 - 1)} (e^{\alpha_1 g T} - 1) / (e^{gT} - 1)^{\alpha_1}]. \quad (18)$$

- Taking logs and differentiating w.r.t.  $g$  yields

$$\frac{d \ln M}{dg} = (\alpha_1 + \alpha_2 - 1)/g + \alpha_1 T e^{\alpha_1 g T} / (e^{\alpha_1 g T} - 1) - \alpha_1 T e^{gT} / (e^{gT} - 1) = 0 \quad (19)$$

# Optimal Consumption Paths



# References

- [1] **Akerlof, George A. and Yellen, Janet L. (1988):** “Fairness and Unemployment,” *American Economic Review* , 78, 44 - 49.
- [2] **Frank, Robert H. and Hutchens, Robert M. (1993):** “Wages, Seniority, and the Demand for Rising Consumption Profiles,” *Journal of Economic Behavior and Organization*, 21, 251 - 276.
- [3] **Solow, Robert M. (1979):** “Another Possible Source of Wage Stickiness,” *Journal of Macroeconomics*, 1, 79 - 82.