

# 31E00700 Labor Economics:

## **Lecture 3**

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# First Part of the Course: Outline

- ① Supply of labor
  - ① static labor supply: basics
  - ② static labor supply: benefits and taxes
  - ③ **intertemporal labor supply (today)**
- ② Demand for labor
- ③ Labor market equilibrium

# Intertemporal Models

- What parameters of interest do reduced-form regressions on labor supply on wages identify (like the ones covered in lect 1&2)?
  - MaCurdy (1981): None. These estimates are a mix of income effects, intertemporal substitution effects, and (compensated) wage elasticities. "An Empirical Model of Labor Supply in a Life-Cycle Setting." *Journal of Political Economy*, 89(6), 1059-1085.

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- Life cycle models differentiate between wage changes that are
  - Evolutionary (movements along profile)
  - "Parametric" (e.g. temporary tax cut)
  - Profile shifts (changing wage rate for every period)
- Basic idea: workers shift hours between low-wage and high-wage periods

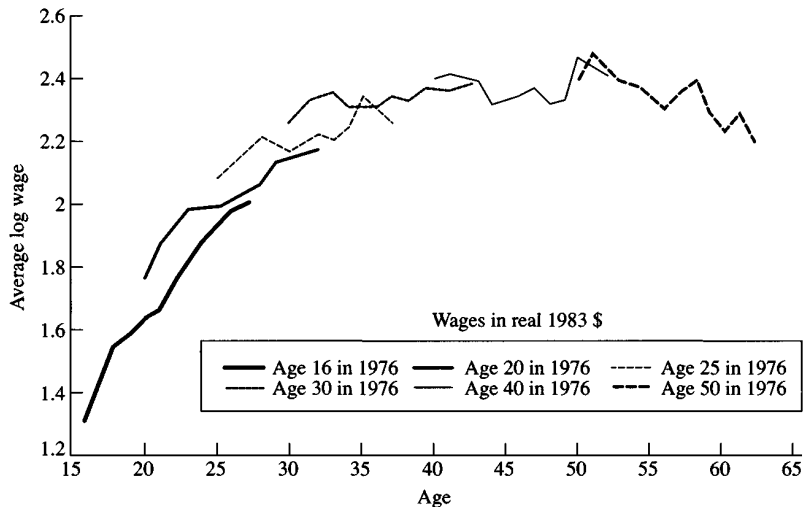
# Why Does Intertemporal Labor Supply Matter?

- Business cycles
  - an extreme view: recessions reflect fluctuations in the rate of technological progress → sometimes wages low due to exogenous reasons → people choose to consume more leisure [so, the Great Depression was really the Great Vacation...]
- Retirement decisions
  - Lifetime income affected by the timing of retirement
  - Wage changes have a substitution and income effect (if pension benefits constant)
  - An increase in pension benefits reduces the price of retirement

# Today

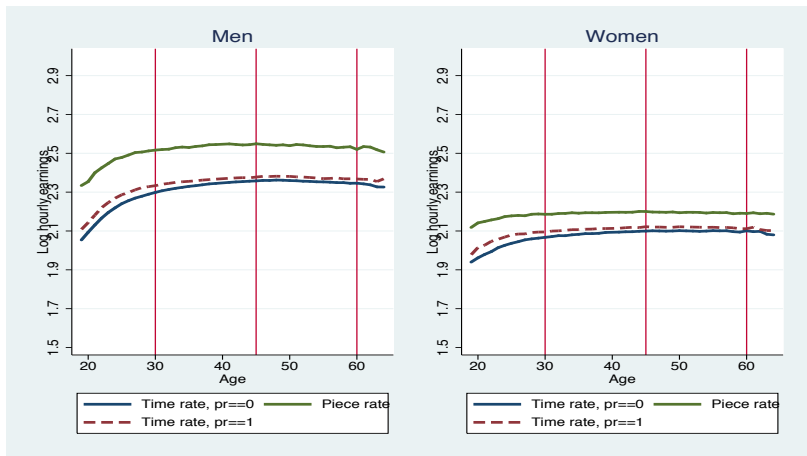
- Stylized Facts
- Brief overview of alternative approaches
- Three models and a field experiment

# Wage Profiles (1977-1989, U.S.)



Annual averages of log wages for six cohorts using the 1977-1989 March CPS data. Each line tracks the wage profile of a single cohort over the 13 year sample period. Source: Card (1994): "Intertemporal Labor Supply: An Assessment"

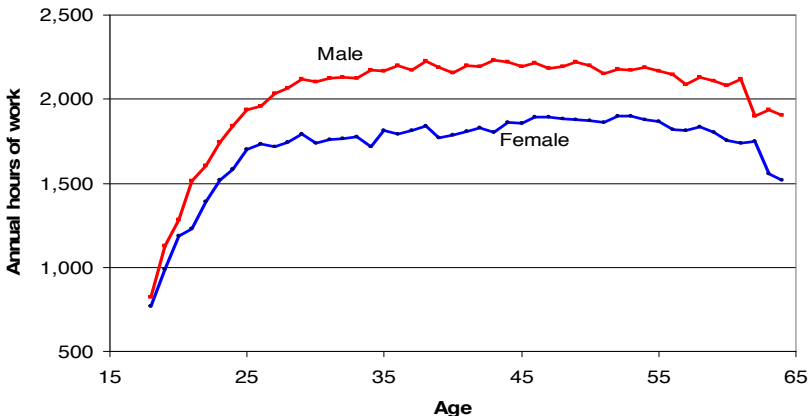
# Wage Profiles: Finnish manufacturing workers (1990-2002)



Age profiles of hourly piece-rate and time-rate earnings for men and women in the Finnish manufacturing worker population during 1990-2002. Source: Pekkarinen, Uusitalo (2012): Aging and Productivity: Evidence from Piece Rates. IZA DP 6909



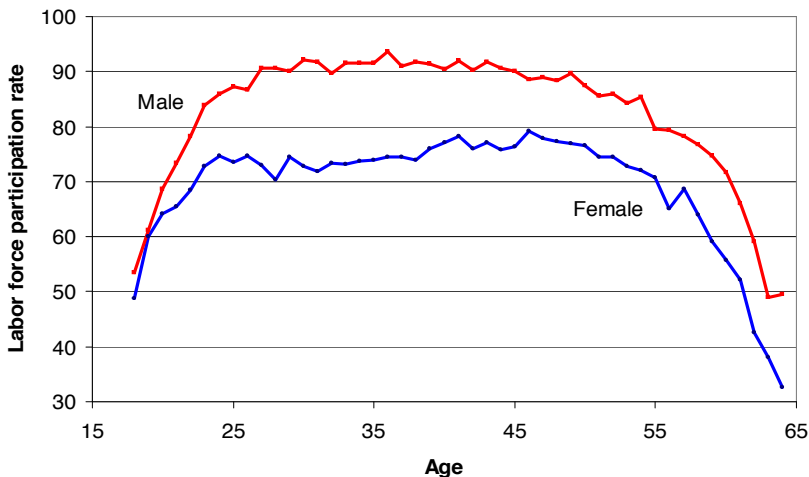
# Hours of Work over Life Cycle (2005, U.S.)



Annual hours of work *among those who are working*.

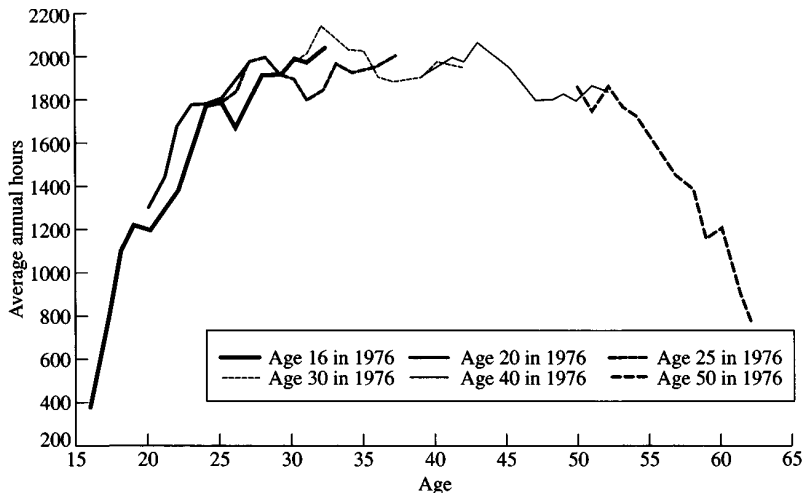
Source: Borjas Figure 2-21

# Labor Force Participation over Life Cycle (2005, U.S.)



Source: Borjas Figure 2-20

# Hours of Work over Life Cycle (1977-1989, U.S.)



Annual averages hours. Source: Card (1994): "Intertemporal Labor Supply: An Assessment"

# Wage and Hours Profiles

- Wages and hours of work (conditional on participation)
  - increase until roughly mid-30s
  - remain quite constant until early-50s
  - decline afterwards
- A simple explanation
  - lifetime income determined by the entire wage profile
  - price of leisure determined by the current wage
    - leisure is cheap when young/old
- Note that the decline of participation rates after mid-50s (and thus average hours including zeros) is much more rapid than the decline of wages.

# Alternative Approaches

- Dominant: dynamic labor supply with perfect capital markets
  - Friedman (1957), Lucas and Rapping (1970), MaCurdy (1981)...
  - Keane, 2011. "Labor Supply and Taxes: A Survey," Journal of Economic Literature 49(4): 961-1075
- Examples of alternative approaches
  - Contracting (e.g. Abowd and Card 1987, 1989)
  - "Behavioral" (e.g. Camerer et al. 1997)

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  - "Behavioral" (e.g. Camerer et al. 1997)
- Challenges for empirical work
  - Theory about *transitory* and *anticipated* changes in wages (but real shocks tend to affect lifetime income and may not be anticipated)
  - Wages determined by supply and demand (endogeneity problems)
  - Institutional constraints (workers not free to adjust working hours)

# Empirical Strategies

- Structural life-cycle models
  - e.g. Eckstein and Wolpin (1989), French (2005)
  - advantages: solves everything
  - criticism: requires a lot of assumptions & simplifications, identification not transparent
- “Reduced form” models testing implications of frictions
  - e.g. Beaudry and Dinardo (1995), Ham and Reilley (2002), Chetty (2010)
- High frequency studies
  - e.g. Camerer et al. (1997), Faber (2005), Fehr and Goette (2007)
  - advantages: transparent identification
  - criticism: external validity

# The Experiment (Fehr and Goette, 2007)

- Fehr and Goette study the intertemporal labor supply among 42 bicycle messengers working in a firm where
  - earnings a fixed percentage of daily revenues (no fixed-wage)
  - 5-hour shifts (and no-one works two shifts per day)
  - workers commit to some shifts, but can flexibly add more
  - within a shift, workers can choose their effort (how fast to ride, whether to accept delivery offers)



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- The experiment
  - Participants randomly allocated to groups A and B
  - Sept '00: A paid 25% more of daily revenues, B paid as usual
  - Nov '00: A paid as usual, B paid 25% more of daily revenues
- Fehr and Goette discuss the results of this experiment in the light of three alternative models

# The Baseline Neoclassical Model

Individuals maximize lifetime utility

$$U_0 = \sum_{t=0}^T \delta^t u(c_t, e_t, x_t)$$

where  $\delta = \frac{1}{1+\rho} < 1$  is the discount factor,  $c_t$  is consumption,  $e_t$  is the amount of work (effort) provided and  $x_t$  a variable affecting preferences at period  $t$ .

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## ... subject to a lifetime budget constraint

$$\sum_{t=0}^T \frac{\hat{p}_t c_t}{(1+r)^t} = \sum_{t=0}^T \frac{\hat{w}_t e_t + y_t}{(1+r)^t}$$

where  $\hat{p}_t$  is price of the consumption good at period  $t$ ,  $r$  is the interest rate (assumed constant),  $\hat{w}_t$  is the wage rate at time  $t$  and  $y_t$  is non-labor income.

# The Baseline Neoclassical Model

## First-Order-Conditions

$$\begin{aligned}u_{c_t}(c_t, e_t, x_t) &= \lambda \left( \frac{1 + \rho}{1 + r} \right)^t \hat{p}_t \\ -u_{e_t}(c_t, e_t, x_t) &= \lambda \left( \frac{1 + \rho}{1 + r} \right)^t \hat{w}_t\end{aligned}$$

where  $u_z$  is the derivative of  $u(\cdot)$  with respect to  $z$ . To derive these FOCs, note that the Lagrangian is  $\mathcal{L} = \sum_{t=0}^T \delta^t u(c_t, e_t, x_t) - \lambda \sum_{t=0}^T (\hat{w}_t e_t + y_t - \hat{p}_t c_t)(1 + r)^{-t}$  and  $\delta = \frac{1}{1 + \rho}$ .

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In words, consumption and effort at period  $t$  are determined by

- the marginal utility of lifetime wealth ( $\lambda$ ),
- discount ( $\rho$ ) and interest ( $r$ ) rates
- and the current price of consumption ( $\hat{p}_t$ ) and effort ( $\hat{w}_t$ )

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Useful thing to note: The intertemporal maximization problem corresponds to the static problem of maximizing

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- Rational workers take this into account when deciding today's effort  $\rightarrow$  **higher wages may decrease effort within a shift**
- Nevertheless, overall labor supply,  $\sum e_t$ , within the high wage period will increase
- **Predictions:** Increase in  $\hat{w}_t$ 
  - increases shifts
  - may increase or decrease effort within shifts

# A Model with Reference Dependent Utility

Suppose that one-period utility is

$$v(e_t) = \begin{cases} \lambda(w_t e_t - \tilde{y}) - g(e_t, x_t) & \text{if } w_t e_t \geq \tilde{y} \\ \gamma \lambda(w_t e_t - \tilde{y}) - g(e_t, x_t) & \text{if } w_t e_t < \tilde{y} \end{cases}$$

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- **Predictions:** Increase in  $\hat{w}_t$ 
  - increases shifts (utility of working in a given day increases)
  - reduces effort within shifts (easier to cross the reference point)
  - the magnitude of effort reduction depends on  $\gamma$

# Results

- Effect on total revenue (Tables 1–3)
  - Increase of CHF1,000 (from the baseline level of roughly CHF3,500) → intertemporal elasticity of substitution roughly  $\frac{1000/3500}{0.25} = 1.14$
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- Effect on effort (Figure 1, Table 5)
  - Reduction of revenue per shift of roughly 6 percent  $\rightarrow$  wage elasticity of revenue per shift roughly  $\frac{-0.06}{0.25} = -0.24$
  - inconsistent with the baseline model; consistent with nonseparable utility and reference dependent utility models

# Distinguishing between the Neoclassical and Reference Dependent Utility Models

- Fehr and Goette suggest a test based on a measurement of  $\gamma_i$  (individual-level loss aversion parameter)
  - Neoclassical model: this does not matter
  - RDU model: results driven by workers with high  $\gamma_i$
- Measure of  $\gamma_i$  obtained by revealed preferences to participate in two lotteries (Appendix A and B)
  - according to this measure 2/3 of the messengers are loss averse
- Only loss averse messengers reduce their effort (Figure 2, Table 6)

## Summary (of Fehr and Goette, 2007)

- Intertemporal substitution large
- Results most consistent with the reference dependent utility model (but: 1/3 of the messengers do not exhibit loss aversion)
- External validity: how representative are bicycle messengers?