



Life-cycle Decisions

Female vs. Male

Econ 350

The University of Chicago, Economics

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- 1 Two Models of Life-cycle Choices
- 2 Motivation of the Papers
- 3 Research Question and Approach
- 4 Models
- 5 Data
- 6 Estimation
- 7 Results
- 8 Counter-factual Exercises

- ❶ Objective: compare two models of life-cycle decisions
 - ▶ One model for females, one for males
 - ▶ “Females Model”: Keane and Wolpin (2010)
 - ▶ “Males Model”: Keane and Wolpin (1997)
- ❷ Learn about modeling decisions
- ❸ Understand the main features of female and male “life-cycle” or career decisions

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- ❶ Large differences in economic and demographic characteristics of majority (white) versus minority (black and Hispanic) women
- ❷ NLSY79 in 1990 (Ages 25 to 33):
 - ▶ Mean schooling years: white 13.4; black 12.8; Hispanic 12.1
 - ▶ Percent Married: white 65%; black 32%; Hispanic 55%.
 - ▶ Children: white 1.2; black and Hispanic 1.7
 - ▶ Employment: white 74%, black 66%, Hispanic 67%
 - ▶ AFDC previous year: white 4%, black 20%, Hispanic, 11%

- ➊ Analyze the “life-cycle” or career decisions of a core sample of white men

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Research Question and Approach: Females



- ▶ Model labor supply, marriage markets, preference heterogeneity, and the welfare system to answer:
 - ① How much of observed minority-majority differences in behavior can be attributed to differences in labor market, marriage opportunities, and preferences?
 - ② How do welfare system effects augment the differences minority-majority differences?
 - ③ How will the new cohorts that grow up under the new welfare system (TANF) behave compared to older cohorts?

- ▶ Combine extensions to the basic Roy (1951) model in Heckman and Sedlaeck (1985) and Willis (1986) to assess self-selection in three dimensions - schooling, work, and occupational choice, as well as understand
 - ① Human capital investment
 - ② School attendance
 - ③ Work
 - ④ Occupational choices
 - ⑤ Future work decisions
 - ⑥ Wage patterns

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- ▶ $j = 1, \dots, J$ defines the types of women
- ▶ At each time a each women j decides to:
 - ① work (if she gets an offer), h_a^p, h_a^f
 - ② attend school, s_a
 - ③ marry (remain married) (if someones proposes), m_a
 - ④ become pregnant (if fecund), p_a
 - ⑤ government help (if eligible)
- ▶ Life span: 14 to 62 (fecund stage: 14 to 45)
- ▶ Utility depends on:
 - ① Past and current choices
 - ② Number of children, N_a
 - ③ Consumption, C_a
 - ④ Completed level of Schooling, S_a

$$\begin{aligned}U_a^j &= U_a \left(C_a, S_a, m_a, p_a, g_a, h_a^p, h_a^f; \varepsilon_a, \mathbf{1}(\text{type} = j), \Omega_a^a \right) \\c_a &= y_a^o(1 - m_a)(1 - z_a) + [y_a^o + y_a^m] m_a \tau_a^m \\&+ [y_a^o + y_a^z \tau_a^z] z_a + \beta_1 g_a - [\beta_3 (\mathbf{1}(S_a \geq 12))] \\&+ \beta_4 (\mathbf{1}(S_a \geq 16))\end{aligned}$$

Job Offers and Wages: Females

- ▶ Probabilities of receiving full and part-time job offers:
 π^{wp}, π^{wf}
- ▶ Earnings: $y_a^o = 500w_a^p h_a^p + 1000w_a^f h_a^f$
- ▶ Hourly wage: $\ln w_a^k = r^k + \Psi_a(\cdot) + \varepsilon_a^w$, for $k = p, f$ and where r^k is the rental rate and $\Psi_a(\cdot)$ is human capital stock
- ▶ Marriage:
 - ① offers of marriage depend on age and welfare status, π_a^m
 - ② offers to continue marriage depend on age and marriage current duration
- ▶ Husband's human capital (conditional on marriage offer): drawn from a distribution that depends on woman's race/ethnicity, schooling, age, state of residence, type, Psi_a^m
- ▶ After marriage, husband's earnings are
 $\ln y_a^m = \mu^m + \Psi_{0a}^m + \varepsilon_a^m$

- ▶ The welfare system is time and state particular

$$b_t^s (N_{at}^{18}, y_{at}^o, y_{at}^z) = \begin{cases} b_{0t}^s + b_{1t}^s N_{at}^{18} - b_{3t}^s \beta_2 y_{at}^z z_{at}, & y_{at}^o < y_{at}^{s1}(\cdot) \\ b_{2t}^s + b_{4t}^s N_{at}^{18} - b_{3t}^s \\ \quad \times [y_{at}^o - y_{at}^{s1} + \beta_2 y_{at}^z z_{at}], & y_{at}^{s1}(\cdot) < y_{at}^o < y_{at}^{s2}(\cdot) \\ 0, & \text{otherwise} \end{cases}$$

- ▶ The parameters that define the welfare system evolve according to a VAR

$$\mathbf{b}_t^s = \lambda^s + \Lambda^s \mathbf{b}_{t-1}^s + \mathbf{u}_t^s \quad (1)$$

- ▶ (1) is estimated outside the model with simulated data

$$V_a(\Omega_a) = \begin{cases} \max_{l \in \mathcal{L}} U_a^j + \delta \mathbb{E}(V_{a+1}(\Omega_{a+1}) | l \in \mathcal{L}, \Omega_a), & a < A \\ U_A^j, & a = A \end{cases}$$

- ▶ The value of option $l \in \mathcal{L}$ depends on the current state space: Ω_A , which includes residence, the WS rule parameters, preference shocks, husband's earnings shocks, parental income shocks, labor market, marriage, and parental co-residence opportunities
- ▶ Solution: set of “Emax's” for all $l \in \mathcal{L}$ and all elements in Ω_a

Model Basics: Males

- ▶ $k = 1, \dots, J$ defines the types of men (by human capital at age 16)
- ▶ At each age a individuals choose among five mutually exclusive, exhaustive alternatives ($m = 1, \dots, 5$):
 - ① Blue collar job
 - ② White collar job
 - ③ Military job
 - ④ Go to school
 - ⑤ Engage in household production
- ▶ Per period reward:

$$R(a) = \sum_{m=1}^5 R_m(a) d_m(a)$$

where $R_m(a)$ is the per period reward in the m_{th} alternative and $d_m(a)$ indicates the choice of the m_{th} alternative

- For $m = 1, 2, 3$:

$$\begin{aligned} R_m(a) &= w_m(a) \\ &= r_m \exp[e_m(16) + e_{m1}g(a) + e_{m2}x_m(a) \\ &\quad - e_{m3}x_m^2 + \epsilon_m(a)] \end{aligned}$$

- For $m = 4, 5$:

$$\begin{aligned} R_4(a) &= e_4(16) - tc_1 \mathbf{1}[g(a) \geq 12] - tc_2 \mathbf{1}[g(a) \geq 16] + \epsilon_4(a) \\ R_5(a) &= e_5(16) + \epsilon_5(a) \end{aligned}$$

- Rental rate of human capital, r_m ; completed schooling years, $g(a)$; work experience, $x_m(a)$; skill endowment, $e_m(16)$; college/grad school costs, tc_1, tc_2 ; skill technology shock, $\epsilon_m(a)$

$$V(\mathbf{S}_a) = \begin{cases} R_m(\mathbf{S}_a) + \delta \mathbb{E} [V((S(a+1))|d_m(a), \mathbf{S}(a))], & a < A \\ R_m(\mathbf{S}_a), & a = A \end{cases}$$

- ▶ The value of option m depends on the current state space, \mathbf{S}_a ; endowment at age 16 (occupation and type particular), $\mathbf{e}(16)$; completed schooling years, g_a ; experience in each (labor) occupation, $\mathbf{x}(a)$; skill technology shocks (occupation particular), $\epsilon(a)$
- ▶ Solution: set of “Emax’s” for $m = 1, \dots, 5$ and all elements in \mathbf{S}_a

- ▶ Extensions to fit the data adequately:
 - ① Skill technology functions:
 - ▶ Occupation particular skill depreciation
 - ▶ First year experience effect
 - ▶ Age effects
 - ▶ High School and College graduation effects
 - ② Mobility and search costs:
 - ▶ Direct monetary job-finding cost (when unemployed in previous period)
 - ▶ Additional monetary job-finding costs (no occupational specific experience)
 - ③ Non-pecuniary rewards for civilian workers (additive parameter)
 - ④ Consumption value of school attendance (function of age)
 - ⑤ Reentry costs to high school and post-secondary school
 - ⑥ Remaining-at-home payoff as a function of age
 - ⑦ Psychic reward of earning high school/college diploma; psychic cost of leaving the military early

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- ▶ NLSY79: represents the cohort of young individuals (ages 14 to 21) in 1979: 12,686 total observations
- ▶ 6,000 women (nationally representative sample plus over-sample of poor white, blacks, and Hispanics)
- ▶ Data on all decisions available in very high frequency
- ▶ Period decision: trade-off between information precision and computational burden
 - ▶ 6 months from 14 to 45
 - ▶ 1 year from 45 to 62
- ▶ Restrict sample to U.S. states with largest sample representations: CA, MI, NY, NC, OH

Choice Distribution by Age: Females



Table 1 KW(2010) goes here.

Estimated Monthly Benefits: Females



Table 2 KW(2010) goes here.

- ▶ NLSY79: represents the cohort of young individuals (ages 14 to 21) in 1979: 12,686 total observations
- ▶ Focus on core white males who reach 16 years between 1977-1981
- ▶ Period decision: one schooling year
 - ▶ Age span, 16 to 26 years old (follow up to 1988)

Choice Distribution by Age: Males



Table 1 KW(1997) goes here.

Choice-State Combinations, Males



Table 3 KW(1997) goes here.

Average Real Wages: Males



Table 4 KW(1997) goes here.

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- ▶ Usual estimation approach of DCDP models: simulated conditional likelihood
- ▶ Issues in this context:
 - ▶ Requires conditional probability agent makes observed choice at t given Ω_a at t
 - ▶ Lack of complete histories of employment, schooling, and welfare for most cohorts back to age 14
 - ▶ Unobserved initial conditions and unobserved state variables pose DCCP estimation problems (Heckman, 1981)
 - ▶ Need to integrate over distribution of unobserved elements: intractably complex
 - ▶ Estimate based on unconditional simulation of the likelihood function based on the (realistic) assumption that all outcome variables have measurement error (Keane and Wolpin, 2001)

- ▶ Simulated conditional likelihood
- ▶ “Easy” to write and calculate the likelihood function:

$$\Pr(c(16), \dots, c(\bar{a}) | g_n(16)) = \sum_{k=1}^K \prod_{a=16}^{\bar{a}} \pi_{k|g(16)} L_{nk}$$

with

$$L_{nk} = \Pr(c_n(a) | g_n(16), \text{type}=k)$$

where $k = 1, \dots, K$ and $n = 1, \dots, N$ index types and individuals, respectively. $\pi_{k|g_n(16)}$ are type proportions, and $c_n(a)$ is a choice-reward combination

- ▶ Keane and Wolpin (2007) studies this extensively:
 - ▶ Within sample fit: captures features of the data well (choice frequencies and welfare use for each group in each state over the life cycle)
 - ▶ External Validation: outperforms MNL with less parameters (202 vs 240) in external validation exercises:
 - ▶ Forecast behavior of women in TX
 - ▶ What happens if estimation states adopt TX's welfare system?

Model Fit and External Validation: Males



- ▶ Within-sample: Figures 1-5 evidence satisfactory within-sample fit, which is confirmed through tests (Table 5)
- ▶ External validation: model frequency predictions coincide with CPS choice frequencies (Table 10)

Model Fit and External Validation (contd 1), Males



Figures 1-5 KW(1997) goes here.

Model Fit and External Validation (contd 2): Males



Table 10 KW(1997) goes here.

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Behavior by Type: Females



Table 3 KW(2010) goes here

Variance Explained by Initial Conditions: Females



Table 4 KW(2010) goes here

Behavior by Type: Males



Table 11 KW(1997) goes here

Type Proportions by Initial Conditions: Males



Table 9 KW(1997) goes here

Family Background: Males



Table 13 KW(1997) goes here

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- ❶ Equate wage offers, welfare stigma, and parent schooling of blacks and Hispanics to that of whites
- ❷ Welfare experiments for “type 6” black, Hispanic, and white women
- ❸ Increase the wage rate for “type 6” black, Hispanic, and white women
- ❹ Introduction of EITC:
 - ▶ Unexpected in 2004 for “type 6” women
 - ▶ Fully adjusted (in Ω_{14}) in 2004 for “type 6”

Equating Opportunities for Blacks: Females



Table 5A KW(2010) goes here.

Equating Opportunities for Hispanics: Females



Table 5B KW(2010) goes here.

Welfare Experiments and Wage Increase for Blacks (contd): Females

Table 6A KW(2010) goes here.

Welfare Experiments and Wage Increase for Blacks (contd): Females

Table 6A (contd) KW(2010) goes here.



Table 6B KW(2010) goes here.



Table 6B (contd) KW(2010) goes here.

Welfare Experiments and Wage Increase for Whites (contd): Females

Table 6C KW(2010) goes here.

Welfare Experiments and Wage Increase for Whites (contd): Females

Table 6C (contd) KW(2010) goes here.

Introduction of EITC: Females



Table 7 (contd) KW(2010) goes here.



- ① The impact of college tuition subsidies on school attainment and inequality

Effects of a College Subsidy: Males



Table 14 KW(1997) goes here.

Effects of a College Subsidy (contd): Males



Table 15 KW(1997) goes here.