The Effects of Health, Wealth, and Wages on Labor Supply and Retirement Behavior

Eric French, Review of Economic Studies, 2005

By Mariacristina De Nardi
Saving and labor: This paper

• Estimate a life-cycle model of:
  • Labor supply and retirement
Saving and labor: This paper

• Estimate a life-cycle model of:
  • Labor supply and retirement
  • Saving at the household level
Saving and labor: This paper

- Estimate a life-cycle model of:
  - Labor supply and retirement
  - Saving at the household level
  - For male heads of households (spouse’s earnings are exogenous)
Saving and labor: This paper

- Estimate a life-cycle model of:
  - Labor supply and retirement
  - Saving at the household level
  - For male heads of households (spouse’s earnings are exogenous)

With
  - Uncertain health and wages
Saving and labor: This paper

- Estimate a life-cycle model of:
  - Labor supply and retirement
  - Saving at the household level
  - For male heads of households (spouse’s earnings are exogenous)

With
- Uncertain health and wages
- Fixed cost of working
Saving and labor: This paper

- Estimate a life-cycle model of:
  - Labor supply and retirement
  - Saving at the household level
  - For male heads of households (spouse’s earnings are exogenous)

With
- Uncertain health and wages
- Fixed cost of working
- Borrowing constraints
Saving and labor: This paper

- Estimate a life-cycle model of:
  - Labor supply and retirement
  - Saving at the household level
  - For male heads of households (spouse’s earnings are exogenous)

With

- Uncertain health and wages
- Fixed cost of working
- Borrowing constraints
- Social Security benefits and private pensions
Contributions

Novelty of this framework, treat systematically

• Whole life cycle
Contributions

Novelty of this framework, treat systematically

- Whole life cycle
- Assets
Contributions

Novelty of this framework, treat systematically

- Whole life cycle
- Assets
- Labor force participation decision
Contributions

Novelty of this framework, treat systematically

- Whole life cycle
- Assets
- Labor force participation decision
- Liquidity constraints
Contributions

Novelty of this framework, treat systematically

- Whole life cycle
- Assets
- Labor force participation decision
- Liquidity constraints
- Wage and health uncertainty
Contributions

Novelty of this framework, treat systematically

- Whole life cycle
- Assets
- Labor force participation decision
- Liquidity constraints
- Wage and health uncertainty
- Decisions of men ages 30-90
Contributions

- Can consider whether individuals will work more and save more when young or retire later in response to changes in Social Security benefits
Important background: SS rules

- Social Security rules are matched to 1997, the middle year of the sample. In that year, it provided three major labor supply incentives/disincentives
Important background: SS rules

- Social Security rules are matched to 1997, the middle year of the sample. In that year, it provided three major labor supply incentives/disincentives
  - Labor supply: Increased labor income leads to increased earnings during the highest 35 earnings year.
    Social security depends on $AIME_t$: average indexed monthly earnings over the highest 35 years
Important background: SS rules

- Social Security rules are matched to 1997, the middle year of the sample. In that year, it provided three major labor supply incentives/disincentives
  - Labor supply: Increased labor income leads to increased earnings during the highest 35 earnings year. Social security depends on $AIME_t$: average indexed monthly earnings over the highest 35 years
  - Timing incentives for retirement
    - Individuals cannot apply before age 62
Important background: SS rules

• Social Security rules are matched to 1997, the middle year of the sample. In that year, it provided three major labor supply incentives/disincentives
  • Labor supply: Increased labor income leads to increased earnings during the highest 35 earnings year. Social security depends on $AIME_t$: average indexed monthly earnings over the highest 35 years
  • Timing incentives for retirement
    • Individuals cannot apply before age 62
    • Between ages 62 and 65, early application reduces benefits by about 6.7% every year, which is roughly fair
Important background: SS rules

- Social Security rules are matched to 1997, the middle year of the sample. In that year, it provided three major labor supply incentives/disincentives
  - Labor supply: Increased labor income leads to increased earnings during the highest 35 earnings year. Social security depends on $AIME_t$: average indexed monthly earnings over the highest 35 years
  - Timing incentives for retirement
    - Individuals cannot apply before age 62
    - Between ages 62 and 65, early application reduces benefits by about 6.7% every year, which is roughly fair
    - Between ages 65 and 70, every additional year of work increases benefits by 3%, which is roughly unfair
Important background: SS rules

- More timing incentives for retirement: SS taxes labor earnings for SS beneficiaries at a high rate
Important background: SS rules

- More timing incentives for retirement: SS taxes labor earnings for SS beneficiaries at a high rate
  - Every dollar above $6,000 is taxed at 50% until all benefits are taxed away
Important background: SS rules

- More timing incentives for retirement: SS taxes labor earnings for SS beneficiaries at a high rate
  - Every dollar above $6,000 is taxed at 50% until all benefits are taxed away
  - Thus, the marginal tax rate is 50% plus Federal, state, and payroll marginal taxes
Important background: SS rules

- More timing incentives for retirement: SS taxes labor earnings for SS beneficiaries at a high rate
  - Every dollar above $6,000 is taxed at 50% until all benefits are taxed away
  - Thus, the marginal tax rate is 50% plus Federal, state, and payroll marginal taxes
  - Between ages 62 and 65, this is partly compensated by an increased AIME, but not after age 65
Important background: SS rules

- More timing incentives for retirement: SS taxes labor earnings for SS beneficiaries at a high rate
  - Every dollar above $6,000 is taxed at 50% until all benefits are taxed away
  - Thus, the marginal tax rate is 50% plus Federal, state, and payroll marginal taxes
  - Between ages 62 and 65, this is partly compensated by an increased AIME, but not after age 65
  - Major disincentive to work after age 65
Important background: Pensions

- Pensions are typically employer-provided, but like SS in two important respects
  - Pension wealth is illiquid until either 55, 60, or 62, depending on plan. Assumed illiquid until 62 in model
Important background: Pensions

- Pensions are typically employer-provided, but like SS in two important respects
  - Pension wealth is illiquid until either 55, 60, or 62, depending on plan. Assumed illiquid until 62 in model
  - Pension benefits depend on one’s individual’s work history. Assumed to be a function of AIME in the model
Important background: Pensions

- Pensions are typically employer-provided, but like SS in two important respects
  - Pension wealth is illiquid until either 55, 60, or 62, depending on plan. Assumed illiquid until 62 in model
  - Pension benefits depend on one’s individual’s work history. Assumed to be a function of AIME in the model
Important background: Pensions

• Pensions are typically employer-provided, but like SS in two important respects
  • Pension wealth is illiquid until either 55, 60, or 62, depending on plan. Assumed illiquid until 62 in model
  • Pension benefits depend on one’s individual’s work history. Assumed to be a function of AIME in the model
• In practice, there is some heterogeneity in pension plans depending on the employer
Important background: Pensions

- Pensions are typically employer-provided, but like SS in two important respects
  - Pension wealth is illiquid until either 55, 60, or 62, depending on plan. Assumed illiquid until 62 in model
  - Pension benefits depend on one’s individual’s work history. Assumed to be a function of AIME in the model
- In practice, there is some heterogeneity in pension plans depending on the employer
- A common incentive is to stay with the firm until age 62 and leave by 62 or 65. Little incentive to stay after 65
Important background: Pensions

- Pensions are typically employer-provided, but like SS in two important respects
  - Pension wealth is illiquid until either 55, 60, or 62, depending on plan. Assumed illiquid until 62 in model
  - Pension benefits depend on one’s individual’s work history. Assumed to be a function of AIME in the model
- In practice, there is some heterogeneity in pension plans depending on the employer
- A common incentive is to stay with the firm until age 62 and leave by 62 or 65. Little incentive to stay after 65
- Accrual rates tend to be higher for those with higher wages
Important background: Pensions

- Pension accrual, because typically linked to the five highest earnings years, is highest around age 50, when earnings peak
- They also depend on years at the firm and age
Important background: Pensions

- Pension accrual, because typically linked to the five highest earnings years, is highest around age 50, when earnings peak
- They also depend on years at the firm and age
- Model
Important background: Pensions

- Pension accrual, because typically linked to the five highest earnings years, is highest around age 50, when earnings peak
- They also depend on years at the firm and age
- Model
  - Illiquid until 62
Important background: Pensions

- Pension accrual, because typically linked to the five highest earnings years, is highest around age 50, when earnings peak.
- They also depend on years at the firm and age.
- Model
  - Illiquid until 62
Important background: Pensions

- Pension accrual, because typically linked to the five highest earnings years, is highest around age 50, when earnings peak.
- They also depend on years at the firm and age.
- Model
  - Illiquid until 62.
  - Base it on AIME plus an age-dependent residual to account for different accrual rate by age.
  - Thus, the residual is negative at younger ages and positive at older ages.
Important background: Pensions

- Pension accrual, because typically linked to the five highest earnings years, is highest around age 50, when earnings peak.
- They also depend on years at the firm and age.
- Model
  - Illiquid until 62.
  - Base it on AIME plus a age-dependent residual to account for different accrual rate by age.
  - Thus, the residual is negative at younger ages and positive at older ages.
  - Model regressivity of pensions as a function of AIME due to higher accrual rates for highest earners.
Key findings

- Fixed costs make labor supply a discontinuous decision
Key findings

- Fixed costs make labor supply a discontinuous decision
- Labor supply more elastic at older ages
Key findings

- Fixed costs make labor supply a discontinuous decision
- Labor supply more elastic at older ages
- Job exit (retirement) rates spike at ages 62 and 65
Key findings

- Fixed costs make labor supply a discontinuous decision
- Labor supply more elastic at older ages
- Job exit (retirement) rates spike at ages 62 and 65
- Key determinants of retirement: Tax incentives generated by Social Security and pensions
  - Example: Removing the Social Security earnings test (tax) for individuals aged 65 and older ⇒ workers delay job exit by one year
Key findings

• Less important:
  • Social Security benefit levels
  • Health
  • Borrowing constraints
  • Example: Reducing Social Security benefits by 20% delays exit from the labor force by only three months.
Flow Utility

- Flow utility at age $t$

$$U(C_t; H_t; M_t) = \frac{1}{1 - \nu} \left[ C_t^\gamma L_t^{1-\gamma} \right]^{1-\nu}, \quad \gamma \in (0, 1), \quad \nu > 0$$

$$L_t = L - H_t - \phi_P \cdot 1\{H_t > 0\} - \phi_M \cdot 1\{M_t = \text{bad}\}$$

where:

- $C_t$ consumption
- $H_t$ hours of work
- $M_t \in \{\text{bad, good}\}$ health
- $L_t = \text{leisure}$
- $\phi_P = \text{fixed cost of working}$
- $1\{A\} = \text{indicator function returning 1 when event } A \text{ occurs, 0 otherwise}$
- $\phi_M = \text{time cost/disutility of bad health}$
Flow Utility

• \( \nu \) controls:
  • Intertemporal substitution of consumption-leisure composite
  • Intratemporal substitutability of consumption and leisure:
    \( \nu > 1 \Rightarrow \) leisure and consumption are substitutes.
Fixed Costs of Working

- Hours of work are clustered around 0 and 2,000 hours.
- This reflects fixed costs of work
Fixed Costs of Working

- Hours of work are clustered around 0 and 2,000 hours.
- This reflects fixed costs of work
  - Employee side: commuting, work-related goods and services
  - Employer side: training, office space and equipment, administrative overhead
Fixed Costs of Working

• Hours of work are clustered around 0 and 2,000 hours.
• This reflects fixed costs of work
  • Employee side: commuting, work-related goods and services
  • Employer side: training, office space and equipment, administrative overhead
• Fixed costs of work cause elasticity of labor supply to vary
  • Elasticity is high when zero hours is an attractive option: older workers, spouses with small children.
  • Elasticity is low when zero hours is not attractive: “prime-age” workers
Intertemporal elasticity of labor supply

- PSID data: low level of labor supply substitutability for young men, high degree of substitutability for older men
Intertemporal elasticity of labor supply

- PSID data: low level of labor supply substitutability for young men, high degree of substitutability for older men
- Little life-cycle variation in hours worked for men between ages 30 and 55
Intertemporal elasticity of labor supply

- PSID data: low level of labor supply substitutability for young men, high degree of substitutability for older men
- Little life-cycle variation in hours worked for men between ages 30 and 55
- Labor force participation declining sharply after age 55, especially at 62 and 65
Intertemporal elasticity of labor supply

- PSID data: low level of labor supply substitutability for young men, high degree of substitutability for older man
- Little life-cycle variation in hours worked for men between ages 30 and 55
- Labor force participation declining sharply after age 55, especially at 62 and 65
- Ages at which Soc. Sec., pensions and declining wages provide incentives to leave labor force
## Distribution of Hours Worked (percentage shares) in the U.S. by Age and Gender (HRS data)

<table>
<thead>
<tr>
<th></th>
<th>Men</th>
<th></th>
<th>Women</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50-54</td>
<td>60-64</td>
<td>50-54</td>
<td>60-64</td>
</tr>
<tr>
<td>0 hours</td>
<td>16.8%</td>
<td>44.7%</td>
<td>30.8%</td>
<td>59.0%</td>
</tr>
<tr>
<td>1-500 hours</td>
<td>0.4%</td>
<td>0.9%</td>
<td>0.9%</td>
<td>1.1%</td>
</tr>
<tr>
<td>501-1000 hours</td>
<td>0.9%</td>
<td>2.2%</td>
<td>2.3%</td>
<td>2.4%</td>
</tr>
<tr>
<td>1001-1500 hours</td>
<td>1.7%</td>
<td>2.4%</td>
<td>4.2%</td>
<td>3.7%</td>
</tr>
<tr>
<td>1501-2000 hours</td>
<td>43.1%</td>
<td>30.0%</td>
<td>40.0%</td>
<td>24.0%</td>
</tr>
<tr>
<td>2001-2500 hours</td>
<td>21.1%</td>
<td>12.4%</td>
<td>16.2%</td>
<td>7.8%</td>
</tr>
<tr>
<td>2501-5000 hours</td>
<td>15.9%</td>
<td>7.8%</td>
<td>5.5%</td>
<td>2.0%</td>
</tr>
</tbody>
</table>

Source: French and Jones (Econometrica, 2011).
Sources of Uncertainty

- Health: $\pi_{ij,t+1} = \Pr( M_{t+1} = j | M_t = i ) = \text{age-dependent transition probabilities}$
Sources of Uncertainty

- Health: \[ \pi_{ij,t+1} = \Pr(M_{t+1} = j \mid M_t = i) = \text{age-dependent transition probabilities} \]
- Mortality: \[ s_{M,t+1} = \text{age- and health-dependent survival probability} \]
  - \[ s_{M,T+1} = 0 \]
Sources of Uncertainty

- Health: \( \pi_{ij,t+1} = \Pr( M_{t+1} = j \mid M_t = i ) = \text{age-dependent transition probabilities} \)
- Mortality: \( s_{M,t+1} = \text{age- and health-dependent survival probability} \)
  - \( s_{M,T+1} \equiv 0 \)
- Wages:
  \[
  \ln W_t = \alpha \ln H_t + W(M_t, t) + AR_t,
  \]
  \( W(M_t, t) = \text{age- and health-dependent component}, \)
  \( \alpha \ln H_t = \text{effect of employer-side fixed costs}, \)
  \( AR_t = \rho AR_{t-1} + \eta_t, \quad \eta_t \sim N(0, \sigma_{\eta}^2), \)
  \( = \text{idiosyncratic shock}. \)
Budget Constraints

• Asset accumulation equation:

\[ A_{t+1} = A_t + Y(rA_t + W_tH_t + y_s + p_b + \varepsilon_t, \tau) + B_tss_t - C_t, \]

where:

- \( Y(I, \tau) = \) net income as a function of total income \( I \) and the tax parameter vector \( \tau \)
- \( y_s = y_s(W_t) = \) spousal (non-family head) income
- \( p_b = \) pension benefits, calculated as a function of Social Security benefits
- \( \varepsilon_t = \) pension accrual residual
- \( ss_t = \) Social Security benefits
- \( B_t = 1 \) if agent is receiving Social Security, \( = 0 \) otherwise
Budget Constraints

- Asset accumulation equation:

\[ A_{t+1} = A_t + Y(rA_t + W_t H_t + y_s t + pb_t + \varepsilon_t, \tau) + B_t ss_t - C_t, \] (AA)

where:

- \( Y(I, \tau) \) = net income as a function of total income \( I \) and the tax parameter vector \( \tau \)
- \( y_s t = y_s t(W_t) \) = spousal (non-family head) income
- \( pb_t \) = pension benefits, calculated as a function of Social Security benefits
- \( \varepsilon_t \) = pension accrual residual
- \( ss_t \) = Social Security benefits
- \( B_t = 1 \) if agent is receiving Social Security, = 0 otherwise

- Borrowing constraint

\[ A_{t+1} \geq 0. \] (BC)
Social Security

- Benefits based on $AIME = \text{average earnings in 35 best years}$:
  - Calculations adjust for wage inflation (inflation and economic growth).
  - Formula converting AIME to benefits is increasing and concave.
Social Security

• Benefits based on $AIME = \text{average earnings in 35 best years}$:
  • Calculations adjust for wage inflation (inflation and economic growth).
  • Formula converting AIME to benefits is increasing and concave.
• First eligible for benefits at age 62: delaying benefit receipt increases benefit size.
  • Delaying benefits actuarially fair (for average person) prior to age 65.
  • Receive “full” benefit at normal retirement age = 65.
  • Delaying benefits actuarially unfair after age 65.
Social Security

- Social Security provides 3 retirement incentives
  - Borrowing against Social Security is illegal ⇒ some workers can retire only upon receiving benefits.
  - After 35 years of work, earnings increase benefits only if they raise worker’s average earnings.
  - Social Security beneficiaries have labor income taxed through the earnings test.
Pension Wealth

- Illiquid until age 62.
- Pension wealth/benefits are modelled as a function of AIME.
  - Reduces dimension of state space when finding decision rules.
- Pension accrual (accumulation) explicitly modelled as a function of age and earnings.
  - When pension accrual deviates from AIME accrual, use the residual $\varepsilon_t$ to compensate.
Recursive Formulation

- State vector: $X_t = (A_t, AR_t, B_t, M_t, AIME_t)$.
- Social Security receipt is permanent: $B_{t-1} = 1 \Rightarrow B_t = 1$.
- Bellman equation:

$$V_t(X_t) = \max_{\{C_t, H_t, B_t\}} \frac{1}{1 - \nu} \left[ C_t^\gamma L_t^{1-\gamma} \right]^{1-\nu}$$

$$+ \beta s_{M,t+1} \int V_{t+1}(X_{t+1}) dF(X_{t+1}|X_t, C_t, H_t, B_t)$$

$$+ \beta (1 - s_{M,t+1}) \theta_B \frac{1}{1 - \nu} (A_{t+1} + \kappa)^{1-\nu}$$

subject to (AA), (BC), and laws of motion for Social Security, pensions and net income.
Recursive Formulation

- $\theta_B \frac{1}{1-\nu} (A_{t+1} + \kappa)^{1-\nu}$ represents utility from bequests.
- $\theta_B > 0$ controls intensity, $\kappa \geq 0$ controls curvature.
Estimation and calibration

- Split parameter vector into

\[ \chi = \left( r, \{ \pi_{ij,t+1} \}_t, \{ s_{M,t+1} \}_t, \rho, \sigma^2_\eta, \alpha, \{ W(M_t, t) \}_t, \{ y_{st}(W_t) \}_t, \right. \]

\[ \left. Y(I, \tau), \text{Social Security rules, pension rules} \right) \]

= first-stage parameters,

\[ \theta = (\gamma, \nu, \phi_P, \phi_M, \theta_B, \kappa, L, \beta) = \text{preference parameters} \]

= second-stage parameters.
Data

- Labor supply data: male heads of households
- Asset data: household-level
Calibration and estimation of first-step parameters

- The part-time wage penalty coefficient is chosen so that part-time workers earn 25% less than full time workers.
Calibration and estimation of first-step parameters

- The part-time wage penalty coefficient is chosen so that part-time workers earn 25% less than full time workers.
- The other parameters of the wage evolution are estimated using their implied moments and minimum distance techniques.
Calibration and estimation of first-step parameters

- The part-time wage penalty coefficient is chosen so that part-time workers earn 25% less than full time workers.
- The other parameters of the wage evolution are estimated using their implied moments and minimum distance techniques.
- Interest rate set to 4%.
Calibration and estimation of first-step parameters

- The part-time wage penalty coefficient is chosen so that part-time workers earn 25% less than full time workers.
- The other parameters of the wage evolution are estimated using their implied moments and minimum distance techniques.
- Interest rate set to 4%.
- The “bliss point” in the bequest function is set to $500,000 as in De Nardi, Restud, 2004.
Calibration and estimation of first-step parameters

- The part-time wage penalty coefficient is chosen so that part-time workers earn 25% less than full-time workers.
- The other parameters of the wage evolution are estimated using their implied moments and minimum distance techniques.
- Interest rate set to 4%.
- The “bliss point” in the bequest function is set to $500,000 as in De Nardi, Restud, 2004.
- Spousal earnings follow a polynomial in age and log wage.
Estimation of profiles

The life cycle profiles of assets, hours, participation and wages are estimated from the PSID. Take $Z_{it}$ to be one of our profiles.
Estimation of profiles

The life cycle profiles of assets, hours, participation and wages are estimated from the PSID. Take $Z_{it}$ to be one of our profiles

$$Z_{it} = f_{it} + \sum_{k=1}^{T} \Pi_{gk} I\{age_{it} = k\} \text{prob}(M_{it} = \text{good}|M_{it})$$

$$+ \sum_{k=1}^{T} \Pi_{bk} I\{age_{it} = k\} \text{prob}(M_{it} = \text{bad}|M_{it})$$

$$+ \sum_{j=1}^{F} \Pi_{f} famsize_{it} + \Pi_{\text{Unemployment}} U_t + u_{it}$$
Estimation of profiles

The life cycle profiles of assets, hours, participation and wages are estimated from the PSID. Take $Z_{it}$ to be one of our profiles

$$Z_{it} = f_{it} + \sum_{k=1}^{T} \Pi_{gk} I\{age_{it} = k\} \text{prob}(M_{it} = \text{good}|M_{it})$$

$$+ \sum_{k=1}^{T} \Pi_{bk} I\{age_{it} = k\} \text{prob}(M_{it} = \text{bad}|M_{it})$$

$$+\sum_{j=1}^{F} \Pi_f famsize_{it} + \Pi_U U_{it} + u_{it}$$

- Assets are assumed not to depend on health
- Keep age and health effect profiles for model
- Family size = 3
- Unemployment = 6.5%
- Mean individual fixed effect of 1940 cohort
Moment Conditions

Method of Simulated Moments, match data and model generated data for life cycle profile of:

- Mean labor force participation, conditional on health
Moment Conditions

Method of Simulated Moments, match data and model generated data for life cycle profile of:

- Mean labor force participation, conditional on health
- Mean hours worked, conditional on health
Moment Conditions

Method of Simulated Moments, match data and model generated data for life cycle profile of:

- Mean labor force participation, conditional on health
- Mean hours worked, conditional on health
- Median and mean assets, unconditional of health
Moment Conditions

Method of Simulated Moments, match data and model generated data for life cycle profile of:

- Mean labor force participation, conditional on health
- Mean hours worked, conditional on health
- Median and mean assets, unconditional of health
- Assume that individuals do not work after age 70 and do not match any moments after that
Moment Conditions

- Let $\bar{Z}_t = E(Z_t)$.
- For $t = 31, 32, \ldots, 70, \ M \in \{\text{good, bad}\}$:

  $$E \left( 1 \left\{ A_{it} \leq A_t^{\text{median}}(X; \theta, \chi) \right\} - 1/2 \right) = 0,$$
  $$E \left( A_{it} - A_t(X; \theta, \chi) \right) = 0,$$
  $$E \left( [\ln H_{it} - \ln H_t(X, M; \theta, \chi)] \cdot 1\{H_{it} > 0\} \cdot 1\{M_{it} = M\} \right) = 0,$$
  $$E \left( [1\{H_{it} > 0\} - P_t(X, M; \theta, \chi)] \cdot 1\{M_{it} = M\} \right) = 0.$$
Wage selection: The problem

The fixed-effect estimator does not account for selection: not everyone works

- Fixed effect-estimators use wages for workers but do not use the potential wages of non-workers
**Wage selection: The problem**

The fixed-effect estimator does not account for selection: not everyone works

- Fixed effect-estimators use wages for workers but do not use the potential wages of non-workers
- Fixed effect estimator demeans average level of wages for people in the sample ⇒ identifies growth rate of wages while working

<table>
<thead>
<tr>
<th>Question</th>
<th>Background</th>
<th>Key findings</th>
<th>Model</th>
<th>Estimation</th>
<th>Estimates and results</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Wage selection: The problem

The fixed-effect estimator does not account for selection: not everyone works

- Fixed effect-estimators use wages for workers but do not use the potential wages of non-workers
- Fixed effect estimator demeans average level of wages for people in the sample \( \Rightarrow \) identifies growth rate of wages while working
- Composition bias: is it high wage or low wage people dropping out of labor market?
### Wage selection: The problem

The fixed-effect estimator does not account for selection: not everyone works

- Fixed effect-estimators use wages for workers but do not use the potential wages of non-workers
- Fixed effect estimator demeans average level of wages for people in the sample ⇒ identifies growth rate of wages while working
- Composition bias: is it high wage or low wage people dropping out of labor market?
- Not a problem if they have the same wage growth rate
Wage selection: The problem

The fixed-effect estimator does not account for selection: not everyone works

- Fixed effect-estimators use wages for workers but do not use the potential wages of non-workers
- Fixed effect estimator demeanes average level of wages for people in the sample ⇒ identifies growth rate of wages while working
- Composition bias: is it high wage or low wage people dropping out of labor market?
- Not a problem if they have the same wage growth rate
- But: if individuals drop because of a sudden wage drop, such as wage loss, ⇒ growth rate for wage workers is higher than that for non-workers
Wage selection: The problem

The fixed-effect estimator does not account for selection: not everyone works

- Fixed effect-estimators use wages for workers but do not use the potential wages of non-workers
- Fixed effect estimator demeans average level of wages for people in the sample ⇒ identifies growth rate of wages while working
- Composition bias: is it high wage or low wage people dropping out of labor market?
- Not a problem if they have the same wage growth rate
- But: if individuals drop because of a sudden wage drop, such as wage loss, ⇒ growth rate for wage workers is higher than that for non-workers
- Not accounting for selection biases estimated wage growth upward
Wage selection: Toward a solution

Consider three important objects

- Unobserved wage profile for individual. This is what we need.
Wage selection: Toward a solution

Consider three important objects

- Unobserved wage profile for individual. This is what we need.
- Fixed-effects wage profiles
Wage selection: Toward a solution

Consider three important objects

- Unobserved wage profile for individual. This is what we need.
- Fixed-effects wage profiles
- Fixed-effect profiles using simulated workers from model
Wage selection: Toward a solution

Consider three important objects

- Unobserved wage profile for individual. This is what we need.
- Fixed-effects wage profiles
- Fixed-effect profiles using simulated workers from model
- NOTE: The wage profile from the model is also biased as in the data, because people decide to participate!
Wage selection: Toward a solution

Consider three important objects

- Unobserved wage profile for individual. This is what we need.
- Fixed-effects wage profiles
- Fixed-effect profiles using simulated workers from model
- NOTE: The wage profile from the model is also biased as in the data, because people decide to participate!
- Assume that the data wage profile and the model wage profile are biased in the same way.
Wage selection: Toward a solution

Consider three important objects

- Unobserved wage profile for individual. This is what we need.
- Fixed-effects wage profiles
- Fixed-effect profiles using simulated workers from model
- NOTE: The wage profile from the model is also biased as in the data, because people decide to participate!
- Assume that the data wage profile and the model wage profile are biased in the same way.
- True if simulated individuals face same wage generating process, same state variables, and same preferences as people in data
French’s wage selection adjustment

1. Feed estimated (and biased) fixed-effect wage profile in model. Solve and simulate model
2. Estimate fixed-effect wage profiles for both simulated workers and all simulated individuals
3. Compute difference between the two profiles in 2 to evaluate wage growth overestimation by age
4. Use estimated difference to correct wage-profiles that are fed into the model
5. Repeat until convergence
6. Repeat for every set of preference parameters we are estimating until GMM criterion function is satisfied
Results, data

- LHS: healthy, RHS: unhealthy
- Health has a large effect on hours. Hours are lower and decline earlier
Results, data

- LHS: healthy, RHS: unhealthy
- Health has a large effect on hours. Hours are lower and decline earlier
- Health has a large effect on participation after age 40. Participation of unhealthy declines much earlier and fast
Results, data

- LHS: healthy, RHS: unhealthy
- Health has a large effect on hours. Hours are lower and decline earlier
- Health has a large effect on participation after age 40. Participation of unhealthy declines much earlier and fast
- Participation of the healthy is very high until past age 50
Results, data

• LHS: healthy, RHS: unhealthy
• Health has a large effect on hours. Hours are lower and decline earlier
• Health has a large effect on participation after age 40. Participation of unhealthy declines much earlier and fast
• Participation of the healthy is very high until past age 50
• In the aggregate, because the number of unhealthy people is quite small, these effects are not large
Results
Results, model fit

- LHS: healthy, RHS: unhealthy
- Unhealthy: Model misses gradual decline in HOURS until age 58 and fast decline after that
- Unhealthy: Model misses decline in PARTICIPATION during working life
- Some serious issues for modeling the unhealthy. Perhaps health measure is not good enough. Perhaps modeling disability is important
- Healthy: model misses hours and participation after age 62.
Results
### Estimates

#### TABLE 2

*Preference parameter estimates*

<table>
<thead>
<tr>
<th>Parameter and definition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>$\gamma$ Consumption weight</td>
<td>0.578 (0.003)</td>
</tr>
<tr>
<td>$\nu$ Coefficient of relative risk aversion, utility</td>
<td>3.34 (0.07)</td>
</tr>
<tr>
<td>$\beta$ Time discount factor</td>
<td>0.992 (0.002)</td>
</tr>
<tr>
<td>$L$ Leisure endowment</td>
<td>4466 (30)</td>
</tr>
<tr>
<td>$\phi$ Hours of leisure lost, bad health</td>
<td>318 (9)</td>
</tr>
<tr>
<td>$\theta_P$ Fixed cost of work, in hours</td>
<td>1313 (14)</td>
</tr>
<tr>
<td>$\theta_B$ Bequest weight</td>
<td>1.69 (0.05)</td>
</tr>
<tr>
<td>$\chi^2$ Statistic: (233 degrees of freedom)</td>
<td>856</td>
</tr>
<tr>
<td>$\epsilon_{L,40}$ Labour supply elasticity, age 40</td>
<td>0.37</td>
</tr>
<tr>
<td>$\epsilon_{L,60}$ Labour supply elasticity, age 60</td>
<td>1.24</td>
</tr>
<tr>
<td>Reservation hours level, age 62</td>
<td>885</td>
</tr>
<tr>
<td>Coefficient of relative risk aversion</td>
<td>2.35</td>
</tr>
</tbody>
</table>

Standard errors in parentheses

Specifications described below:

(1) Does not account for selection or tied wage-hours offers
(2) Accounts for selection but not tied wage-hours offers
(3) Accounts for tied wage-hours offers but not selection
(4) Accounts for selection and tied wage-hours offers
Estimates, discussion

- Labor supply elasticity increases by age. Age 40: 0.2-0.4. Age 60: 1.0-1.3.
Estimates, discussion

• Labor supply elasticity increases by age. Age 40: .2-.4. Age 60: 1.0-1.3.

• Fixed cost of working generates volatility on the participation margin. By age 60, many workers are close to the participation margin and thus react more strongly to wage changes.
Estimates, discussion

- Labor supply elasticity increases by age. Age 40: 0.2-0.4. Age 60: 1.0-1.3.
- Fixed cost of working generates volatility on the participation margin. By age 60, many workers are close to the participation margin and thus react more strongly to wage changes.
- Fixed cost of working: 1313-240 hours, depending on wage equation.
Estimates, discussion

- Labor supply elasticity increases by age.
  Age 40: 0.2-.4. Age 60: 1.0-1.3.

- Fixed cost of working generates volatility on the participation margin.
  By age 60, many workers are close to the participation margin and thus react more strongly to wage changes.

- Fixed cost of working: 1313-240 hours, depending on wage equation

- Fixed cost of working $\Rightarrow$ minimum numbers of hours worked, between 885 to 1072
Estimates, discussion

- Labor supply elasticity increases by age.
  Age 40: 0.2-0.4. Age 60: 1.0-1.3.
- Fixed cost of working generates volatility on the participation margin.
  By age 60, many workers are close to the participation margin and thus react more strongly to wage changes.
- Fixed cost of working: 1313-240 hours, depending on wage equation
- Fixed cost of working $\Rightarrow$ minimum numbers of hours worked, between 885 to 1072
- It is identified by the profile of hours over the life cycle. If there is no fixed cost of working, hours decline smoothly
Estimates, discussion

- Risk aversion identified by
  - Amount of assets held when young to self-insure against wage shocks
  - Labor supply when young, to help earn and save
Estimates, the effects of selection and tied-wage offers

- Correcting for selection due to participation implies that
  - At ages 62 and 65 wages are respectively 7% and 11% lower than implied by the fixed effects wage regression
  - Health reduces wages by an additional 2% than implied by the fixed effects wage regressions
Estimates, the effects of selection and tied-wage offers

- Correcting for selection due to participation implies that
  - At ages 62 and 65 wages are respectively 7% and 11% lower than implied by the fixed effects wage regression
  - Health reduces wages by an additional 2% than implied by the fixed effects wage regressions
- There is evidence that the drop in wages after age 60 is linked to a drop in hours. Failure to account for tied wage-hours offers may lead to a downward bias in productivity growth after age 60
Estimates, the effects of selection and tied-wage offers

- Correcting for selection due to participation implies that
  - At ages 62 and 65 wages are respectively 7% and 11% lower than implied by the fixed effects wage regression
  - Health reduces wages by an additional 2% than implied by the fixed effects wage regressions
- There is evidence that the drop in wages after age 60 is linked to a drop in hours. Failure to account for tied wage-hours offers may lead to a downward bias in productivity growth after age 60
  - The fixed cost of working is very sensitive on whether wages and hours are linked. This is because part-time work pays less and is thus less desirable
  - A large fixed cost of working is needed if wages and hours are not tied.
What causes the high job exit rate at 62?

- People are assumed to start drawing benefits at 62. They are taxed and, due to progressive taxation, the marginal tax rate increases. This causes about half of the decline in labor supply at 62.
What causes the high job exit rate at 62?

- People are assumed to start drawing benefits at 62. They are taxed and, due to progressive taxation, the marginal tax rate increases. This causes about half of the decline in labor supply at 62.

- Pensions are modelled with discontinuous jumps at 61, 62, 63, 64, and 65 to be consistent with many plans. This causes about 25% of the drop.
What causes the high job exit rate at 62?

- People are assumed to start drawing benefits at 62. They are taxed and, due to progressive taxation, the marginal tax rate increases. This causes about half of the decline in labor supply at 62.
- Pensions are modelled with discontinuous jumps at 61, 62, 63, 64, and 65 to be consistent with many plans. This causes about 25% of the drop.
- Borrowing constraints are not important.
What causes the high job exit rate at 62?

- People are assumed to start drawing benefits at 62. They are taxed and, due to progressive taxation, the marginal tax rate increases. This causes about half of the decline in labor supply at 62.
- Pensions are modelled with discontinuous jumps at 61, 62, 63, 64, and 65 to be consistent with many plans. This causes about 25% of the drop.
- Borrowing constraints are not important.
- The effect of SS actuarial accrual between 62 and 65 depends a bit on the interest rate assumed, but is overall minor.
Model generates consumption drop at retirement

Because consumption and leisure are substitutes
Policy experiments

• Shift early retirement from age 62 to age 63: Almost no effect on labor supply.
• Reduce Social Security benefits by 20%: delay exit from labor market by 3 months.
• Eliminate Soc. Security earnings test: work one more year.
### Policy Experiments

<table>
<thead>
<tr>
<th>Years Worked</th>
<th>Hours per Year</th>
<th>PDV of Labor Income</th>
<th>PDV of Cons.</th>
<th>Assets at Age 62</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
<tr>
<td>1987 Results</td>
<td>32.60</td>
<td>2,097</td>
<td>1,781</td>
<td>1,583</td>
</tr>
<tr>
<td>↓ 20%</td>
<td>32.83</td>
<td>2,099</td>
<td>1,789</td>
<td>1,569</td>
</tr>
<tr>
<td>↓ benefits &amp; taxes</td>
<td>33.00</td>
<td>2,115</td>
<td>1,803</td>
<td>1,586</td>
</tr>
<tr>
<td>Early retirement at 63</td>
<td>32.62</td>
<td>2,096</td>
<td>1,781</td>
<td>1,584</td>
</tr>
<tr>
<td>No earnings test, age 65+</td>
<td>33.62</td>
<td>2,085</td>
<td>1,799</td>
<td>1,594</td>
</tr>
</tbody>
</table>

Columns (3)-(5) are measured in thousands of 1987 dollars.
Results discussion

• Model: reasonable preference parameters
• Captures drops in labor force participation
• To fit both participation an hours worked, estimate a large fixed cost of work ⇒ high labor supply substitutability at the labor force participation margin
• Because of Soc. Sec. and pension incentives to leave lab. force, those in their 60s are near the lab. force partic. margin
• ⇒ labor supply elasticities rise from .3 at age 40 to 1.1 at age 60.
Paper’s limitations

- No medical expenses (French and Jones, Econometrica 2011)

- Health and its dynamics modeled in a rather primitive way (but limited data in the PSID)

- What about women? We are modeling the workers with more inelastic labor supply

- Couples (see section in syllabus)

- No children

- No home production (Dotsey, Li, Yang 2014)

- No human capital

- No unemployment nor richer earnings dynamics

- No pension choice. No role for pension defaults and “nudges”
Paper’s limitations

- No medical expenses (French and Jones, Econometrica 2011)
- Health and its dynamics modeled in a rather primitive way (but limited data in the PSID)
Paper’s limitations

- No medical expenses (French and Jones, Econometrica 2011)
- Health and its dynamics modeled in a rather primitive way (but limited data in the PSID)
- What about women? We are modeling the workers with more inelastic labor supply
Paper’s limitations

- No medical expenses (French and Jones, Econometrica 2011)
- Health and its dynamics modeled in a rather primitive way (but limited data in the PSID)
- What about women? We are modeling the workers with more inelastic labor supply
- Couples (see section in syllabus)

• No children
• No home production (Dotsey, Li, Yang 2014)
• No human capital
• No unemployment nor richer earnings dynamics
• No pension choice. No role for pension defaults and “nudges”
Paper’s limitations

- No medical expenses (French and Jones, Econometrica 2011)
- Health and its dynamics modeled in a rather primitive way (but limited data in the PSID)
- What about women? We are modeling the workers with more inelastic labor supply
- Couples (see section in syllabus)
- No children

• No home production (Dotsey, Li, Yang 2014)
• No human capital
• No unemployment nor richer earnings dynamics
• No pension choice. No role for pension defaults and "nudges"
Paper’s limitations

- No medical expenses (French and Jones, Econometrica 2011)
- Health and its dynamics modeled in a rather primitive way (but limited data in the PSID)
- What about women? We are modeling the workers with more inelastic labor supply
- Couples (see section in syllabus)
- No children
- No home production (Dotsey, Li, Yang 2014)
Paper’s limitations

- No medical expenses (French and Jones, Econometrica 2011)
- Health and its dynamics modeled in a rather primitive way (but limited data in the PSID)
- What about women? We are modeling the workers with more inelastic labor supply
- Couples (see section in syllabus)
- No children
- No home production (Dotsey, Li, Yang 2014)
- No human capital
Paper’s limitations

- No medical expenses (French and Jones, Econometrica 2011)
- Health and its dynamics modeled in a rather primitive way (but limited data in the PSID)
- What about women? We are modeling the workers with more inelastic labor supply
- Couples (see section in syllabus)
- No children
- No home production (Dotsey, Li, Yang 2014)
- No human capital
- No unemployment nor richer earnings dynamics
Paper’s limitations

- No medical expenses (French and Jones, Econometrica 2011)
- Health and its dynamics modeled in a rather primitive way (but limited data in the PSID)
- What about women? We are modeling the workers with more inelastic labor supply
- Couples (see section in syllabus)
- No children
- No home production (Dotsey, Li, Yang 2014)
- No human capital
- No unemployment nor richer earnings dynamics
- No pension choice. No role for pension defaults and “nudges”