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

Eric French, Review of Economic Studies, 2005

By Mariacristina De Nardi

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  - Social Security benefits and private pensions

# Methodological contributions

Novelty of this framework, treat systematically

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- Decisions of men ages 30-90
- Structural estimation using Method of Simulated Moments

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- Is it most effective to change retirement age or benefits taxation? What about cutting benefits?
- When will people change their behavior in response to policy? Will they work more and save more when young or retire later in response to changes in Social Security benefits?

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    - Between ages 65 and 70, every additional year of work increases benefits by 3%, which is roughly unfair

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  - Major disincentive to work after age 65

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- Accrual rates tend to be higher for those with higher wages

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  - Base it on AIME plus a age-dependent residual to account for different accrual rate by age
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  - Model regressivity of pensions as a function of *AIME* due to higher accrual rates for highest earners

# Key findings

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- 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 $\Rightarrow$ 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 $t$

$$\begin{aligned} U(C_t; H_t; M_t) &= \frac{1}{1-\nu}\left[C_t^{\gamma} L_t^{1-\gamma}\right]^{1-\nu}, \ \gamma \in (0,1), \nu > 0 \\ L_t &= L - H_t - \phi_P \cdot 1\{H_t > 0\} - \phi_M \cdot 1\{M_t = \text{bad}\} \end{aligned}$$

where:

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

# Flow Utility

- The parameter $\nu$ controls:
  - Intertemporal substitution of consumption-leisure composite
  - Intratemporal substitutability of consumption and leisure: $\nu > 1 \Rightarrow$ leisure and consumption are substitutes

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  - Elasticity is low when zero hours is not attractive: "prime-age" workers

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- 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) | | | | |
|---|---|---|---|---|
| | Men | | Women | |
| | 50-54 | 60-64 | 50-54 | 60-64 |
| 0 hours | 16.8 | 44.7 | 30.8 | 59.0 |
| 1-500 hours | 0.4 | 0.9 | 0.9 | 1.1 |
| 501-1000 hours | 0.9 | 2.2 | 2.3 | 2.4 |
| 1001-1500 hours | 1.7 | 2.4 | 4.2 | 3.7 |
| 1501-2000 hours | 43.1 | 30.0 | 40.0 | 24.0 |
| 2001-2500 hours | 21.1 | 12.4 | 16.2 | 7.8 |
| 2501-5000 hours | 15.9 | 7.8 | 5.5 | 2.0 |

Source: French and Jones (Econometrica, 2011).

# Sources of Uncertainty

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- Wages:

$$\begin{aligned}
\ln W_t &= \alpha \ln H_t + W(M_t, t) + AR_t, \\
W(M_t, t) &= \text{age- and health-dependent component}, \\
\alpha \ln H_t &= \text{effect of employer-side fixed costs}, \\
AR_t &= \rho AR_{t-1} + \eta_t, \quad \eta_t \sim N(0, \sigma_\eta^2), \\
&= \text{idiosyncratic shock}.
\end{aligned}$$

# Budget Constraints

- Asset accumulation equation:

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

where:

- $Y(I, \tau)$ = net income, function of total income $I$ and tax parameter vector $\tau$
- $ys_t = ys_t(W_t)$ = spousal (non-family head) income
- $pb_t$ = pension benefits, calculated as function of Social Security benefits
- $\varepsilon_t$ = pension accrual residual
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- Borrowing constraint

$$A_{t+1} \geq 0. \tag{BC}$$

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- Benefits based on $AIME$ = average earnings in 35 best years
  - Formula converting AIME to benefits increasing and concave
- First eligible for benefits at age 62
  - 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 $\Rightarrow$ Some workers wait to retire to receive 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:

$$V_t(X_t) = \max_{\{C_t, H_t, B_t\}} \frac{1}{1-\nu}\left[C_t^{\gamma} L_t^{1-\gamma}\right]^{1-\nu} + \beta s_{M,t+1} \int V_{t+1}(X_{t+1}) dF(X_{t+1}|X_t, C_t, H_t, B_t) + \beta\left(1 - s_{M,t+1}\right)\theta_B \frac{1}{1-\nu}(A_{t+1} + \kappa)^{1-\nu}$$

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

# Recursive Formulation

- $\theta_B \frac{1}{1-\nu}(A_{t+1} + \kappa)^{1-\nu}$: utility from bequests
- $\theta_B > 0$ controls intensity
- $\kappa \geq 0$ controls curvature

# Estimation and calibration

- Split parameter vector into

$$
\begin{aligned}
\chi &= \Big( r, \{\pi_{ij,t+1}\}_t, \{s_{M,t+1}\}_t, \rho, \sigma_\eta^2, \alpha, \{W(M_t, t)\}_t, \{ys_t(W_t)\}_t, \\
&\qquad Y(I, \tau), \text{Social Security rules, pension rules} \Big) \\
&= \text{first-stage parameters,} \\
\theta &= (\gamma, \nu, \phi_P, \phi_M, \theta_B, \kappa, L, \beta) = \\
&= \text{second-stage parameters (preference parameters)}
\end{aligned}
$$

# Data

- Panel Survey of Income Dynamics, 1968-1997
- Labor supply data: Male heads of households
- Asset data: Household-level

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- Spousal earnings: polynomial in age and log wage

# Estimation of profiles

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Take $Z_{it}$ to be one of our profiles

$$\begin{aligned} Z_{it} &= f_{it} + \sum_{k=1}^{T} \Pi_{gk} I\{age_{it} = k\} prob(M_{it} = good | M_{it}) \\ &+ \sum_{k=1}^{T} \Pi_{bk} I\{age_{it} = k\} prob(M_{it} = bad | M_{it}) \\ &+ \sum_{j=1}^{F} \Pi_{f} famsize_{it} + \Pi_{U} U_{t} + u_{it} \end{aligned}$$

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\end{aligned}
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- Assets are assumed not to depend on health
- Keep age and health effect profiles for model
- Family size = 3
- Unemployment =6.5%

# Moment Conditions

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

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- Mean labor force participation, conditional on health
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- Assume that individuals do not work after age 70 and do not match any moments after that

# Moment Conditions

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

$$
\begin{aligned}
E\left(1\left\{A_{it} \leq A_t^{\text{median}}(X;\theta,\chi)\right\} - 1/2\right) &= 0, \\
E\left(A_{it} - \overline{A}_t(X;\theta,\chi)\right) &= 0, \\
E\left(\left[\ln H_{it} - \overline{\ln H}_t(X,M;\theta,\chi)\right] \cdot 1\{H_{it} > 0\} \cdot 1\{M_{it} = M\}\right) &= 0, \\
E\left(\left[1\{H_{it} > 0\} - \overline{P}_t(X,M;\theta,\chi)\right] \cdot 1\{M_{it} = M\}\right) &= 0
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- Composition bias: low wage growth people drop out of labor market
- Not accounting for selection biases estimated wage growth upward

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- NOTE: The wage profile from the model is also biased as in the data, because people decide to participate!

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- Fixed-effects wage profiles
- Fixed-effect profiles using simulated workers from model
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- Assume that the data wage profile and the model wage profile are biased in the same way

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- 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 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

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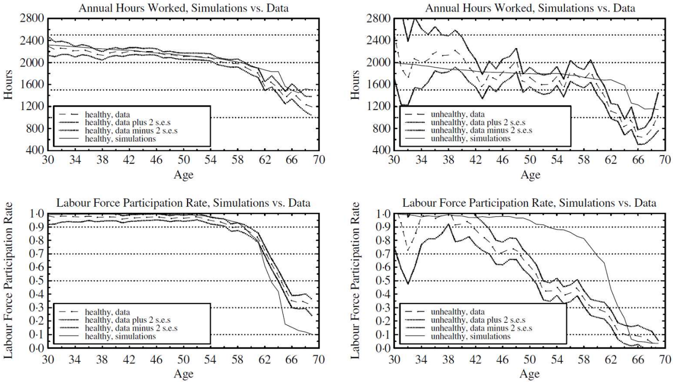
- Health has a large effect on hours. Hours are lower and decline earlier
- Health has a large effect on participation after age 40. Participation of unhealthy declines much earlier and fast
- Participation of the healthy is very high until past age 50

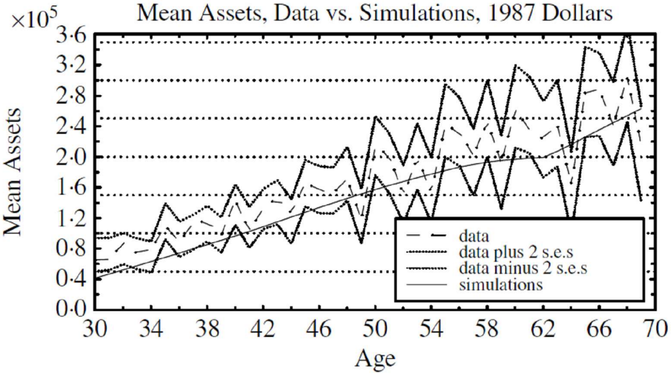
# Results


Annual Hours Worked, Simulations vs. Data
Hours
Age
healthy, data
healthy, data plus 2 s.e.s
healthy, data minus 2 s.e.s
healthy, simulations
Annual Hours Worked, Simulations vs. Data
unhealthy, data
unhealthy, data plus 2 s.e.s
unhealthy, data minus 2 s.e.s
unhealthy, simulations
Labour Force Participation Rate, Simulations vs. Data
Labour Force Participation Rate
healthy, data
healthy, data plus 2 s.e.s
healthy, data minus 2 s.e.s
healthy, simulations
Labour Force Participation Rate, Simulations vs. Data
unhealthy, data
unhealthy, data plus 2 s.e.s
unhealthy, data minus 2 s.e.s
unhealthy, simulations

# 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


Mean Assets, Data vs. Simulations, 1987 Dollars
×10^5
Mean Assets
3·6
3·2
2·8
2·4
2·0
1·6
1·2
0·8
0·4
0·0
30
34
38
42
46
50
54
58
62
66
70
Age
data
data plus 2 s.e.s
data minus 2 s.e.s
simulations

# Estimates

TABLE 2

*Preference parameter estimates*

| Parameter and definition | Specification (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $\gamma$ Consumption weight | 0·578 (0·003) | 0·602 (0·003) | 0·533 (0·003) | 0· 615 (0·004) |
| $\nu$ Coefficient of relative risk aversion, utility | 3·34 (0·07) | 3·78 (0·07) | 3·19 (0·05) | 7·69 (0·15) |
| $\beta$ Time discount factor | 0·992 (0·002) | 0·985 (0·002) | 0·981 (0·001) | 1·04 (0·004) |
| $L$ Leisure endowment | 4466 (30) | 4889 (32) | 3900 (24) | 3399 (28) |
| $\phi$ Hours of leisure lost, bad health | 318 (9) | 191 (7) | 196 (8) | 202 (6) |
| $\theta_P$ Fixed cost of work, in hours | 1313 (14) | 1292 (15) | 335 (7) | 240 (6) |
| $\theta_B$ Bequest weight | 1·69 (0·05) | 2·58 (0·07) | 1·70 (0·04) | 0·037 (0·001) |
| $\chi^2$ Statistic: (233 degrees of freedom) | 856 | 880 | 830 | 1036 |
| $\epsilon_{h,W}(40)$ Labour supply elasticity, age 40 | 0·37 | 0·37 | 0·35 | 0·19 |
| $\epsilon_{h,W}(60)$ Labour supply elasticity, age 60 | 1·24 | 1·33 | 1·10 | 1·04 |
| Reservation hours level, age 62 | 885 | 916 | 1072 | 1051 |
| Coefficient of relative risk aversion | 2·35 | 2·68 | 2·17 | 5·11 |

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

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- 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
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- 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?

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- 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 | | | | | |
|---|---|---|---|---|---|
| | Years Worked | Hours per Year | PDV of Labor Income | PDV of Cons. | Assets at Age 62 |
| | (1) | (2) | (3) | (4) | (5) |
| 1987 Results | 32.60 | 2,097 | 1,781 | 1,583 | 190 |
| $\Downarrow$ 20% | 32.83 | 2,099 | 1,789 | 1,569 | 200 |
| $\Downarrow$ benefits & taxes | 33.00 | 2,115 | 1,803 | 1,586 | 203 |
| Early retirement at 63 | 32.62 | 2,096 | 1,781 | 1,584 | 190 |
| No earnings test, age 65+ | 33.62 | 2,085 | 1,799 | 1,594 | 188 |
| 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 $\Rightarrow$ 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
- $\Rightarrow$ labor supply elasticities rise from .3 at age 40 to 1.1 at age 60

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- No pension choice. No role for pension defaults and "nudges"