Revisiting the Hump-Shaped Wage Profile: Implications for Structural Labor Supply Estimation

Maria Casanova
UCLA

QSPS 2013 Summer Workshop
Motivation

Structural labor supply models rely on accurate estimates of the age profile of offered wages.
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The *deterministic or predictable* component of wages is a key input for the study of:
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- estimation of labor supply elasticities

What does this profile look like?
## Motivation

**Figure:** From Attanasio and Weber (JPE, 1995)

---

### Table 1

<table>
<thead>
<tr>
<th>Cohort Definition</th>
<th>Average Cell Used in Cohort</th>
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<th>Age in 1980</th>
<th>Size Estimation</th>
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**Fig. 1.** —*a, Log of household nondurable consumption. b, Log of after-tax household income.*
Motivation

**Figure:** From French (REStud, 2005)

Average Hourly Wage by Health Status, 1987 Dollars

Health Dynamics Over the Life Cycle

- Age
- Probability of Being in Bad Health

Income is assumed to follow a polynomial in age and the log of the wage.23 Because the PSID has poor information on pensions and Social Security, I use spousal income when young to predict spousal pension and Social Security benefits when old.

RESULTS

The estimated inputs into the MSM algorithm can be divided into data on the exogenous state variables and data on decision variables. The data generating process for the exogenous state variables, parameterized by the vector $X$, includes growth rates for wages conditional on health status, health transition matrices, and mortality probabilities. The decision variables are the set of cohort dummy variables. When I construct the spousal income profile, I set the cohort effect equal to those born in 1940.
1. Data Analysis

- The real hourly wage of the typical male over age 50 increases slightly with age for as long as he is employed full time.
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- For individuals who partially retire there is a one-off 34% wage drop at the point of transition from full-time into part-time work.
Overview of Results

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- Two thirds of individuals transit from full-time work into retirement.

- For individuals who partially retire there is a one-off 34% wage drop at the point of transition from full-time into part-time work.

- The hump-shaped profile often found in the literature is a result of aggregation over workers who transit into partial retirement at different ages.
2. Interpretation of results

- The *ex-post* wage profile just described is consistent with 3 different models of retirement.
  - Self-selection model
  - Involuntary retirement model
  - Voluntary retirement model
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- The offered wage profile is nondecreasing in age at older ages.
3. Implications for structural estimation and calibration

- Focus on the intertemporal elasticity of substitution of labor supply (i.e.s.).
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- I develop a life cycle model of consumption and labor supply choices to measure the sensitivity of estimates of the i.e.s. to misspecification of the wage profile.
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- Focus on the intertemporal elasticity of substitution of labor supply (i.e.s.).

- I develop a life cycle model of consumption and labor supply choices to measure the sensitivity of estimates of the i.e.s. to misspecification of the wage profile.

- Using a hump-shaped wage profile as a proxy for the flat offered wage path leads to upward bias in estimates of i.e.s. of 30 to 130%
Data

Health and Retirement Study

- Panel dataset of adults over 50 years of age and their spouses.
- Data collected every 2 years.
- Self-reported information on wages and hours.
- Extensive information on demographics, health and pensions.
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Sample:

- Individuals born between 1931 and 1941.
- Males who are working full-time in first sample year.
- Self-employed are dropped.
Definition of Partial Retirement

This transitional period is characterized by part-time work, changes of industry/occupation, low attachment to the labor force. Approximately 30% of workers partially retire before fully withdrawing from the labor force.

In the paper:

Full time work is defined as working more than 35 hours per week. An individual becomes partially retired when he is first observed working part-time. Partial retirement is an absorbing state.
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Observed Wage Profiles

Log wage profile:

\[ w_{it} = W(Age_{it}) + X_{it} \beta_w + u_{it} \]
Log wage profile:

\[ w_{it} = \theta_w I\{PR = 1\} + W(Age_{it}) + X_{it}\beta_w + u_{it} \]
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Log hours profile:

\[ h_{it} = \theta_h I\{PR = 1\} + H(Age_{it}) + X_{it}\beta_h + v_{it} \]
Observed Wage Profiles

Figure: Average Wage Profile, FE

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Observed Wage Profiles

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## Observed Wage Profiles

**Table:** Dependent variable: log real hourly wages

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<tr>
<th></th>
<th>OLS</th>
<th>FE</th>
<th>FE</th>
</tr>
</thead>
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<td>PR=1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>age≥59</td>
<td>-0.019</td>
<td>-0.033**</td>
<td></td>
</tr>
<tr>
<td>(0.024)</td>
<td></td>
<td>(0.016)</td>
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</tr>
<tr>
<td>age≥60</td>
<td>0.002</td>
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<tr>
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<tr>
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<td># of individuals</td>
<td>1,834</td>
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Tests of Joint Significance (p-value):

- Age≥52-Age≥60
- Age≥61-Age≥67
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**individual-year obs.:** 7,915 7,500

**# of individuals:** 1,834

**Tests of Joint Significance (p-value):**

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Tests of Joint Significance (p-value):

| Age≥52-Age≥60     | 0.659       | 0.059      |
| Age≥61-Age≥67     | 0.000       | 0.000      |

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<td>Age≥61-Age≥67</td>
<td>0.000</td>
<td>0.000</td>
<td>0.618</td>
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Maria Casanova  UCLA  Revisiting the Hump-Shaped Wage Profile
Figure: Predicted wage profile for an individual who enters PR at age 62.
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Figure: Average Hours Profile, FE, with and without controls for PR status
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  - Testable implication: positive self-selection bias
Involuntary retirement model:

- Offered and observed wage profiles are the same.
- The expected wage profile declines smoothly with age.

Voluntary retirement model:

- In every period, worker chooses among bundles of wages and hours.
- Offered wages profile is non-declining in age.
- Retirement transitions do not occur in response to declining wages.
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- Involuntary retirement model:
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- For most workers, hours and wages are determined simultaneously.
- The age profile of offered wages is non-decreasing in age.
Implications for Estimates of the i.e.s. 

i.e.s. measures willingness to intertemporally substitute labor supply in response to their lifecycle wage profile.
I.e.s. measures willingness to intertemporally substitute labor supply in response to their lifecycle wage profile.

Early estimates from micro data found values very close to zero (MaCurdy (1981), Browning et al. (1989), Altonji (1986)).

Recently several papers have argued that these estimates are likely biased downwards due to:
- liquidity constraints (Domeij and Floden, 2006)
- human capital accumulation (Imai and Keane, 2004)
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Model

Follows Chang, Kim, Kwon and Rogerson (AER, 2010) and Rogerson and Wallenius (JET, 2009 and AER, forthcoming)

\[
\text{Agents maximize expected discounted utility:} \quad \max_{\{c_t\}} \sum_{t=t_0}^{T} \beta(t-t_0) \left\{ c_t (1 - \rho) + B_t l (1 - 1/\gamma) \right\},
\]

where:

- leisure is a linear function of hours worked ($h_t$)
- $h$ is discrete and equal to $h_{FT}$, $h_{PT}$ or 0.
- $\gamma$ is intertemporal elasticity of substitution of leisure.

(1) is maximized subject to:

\[
A_{t+1} + c_t = \exp(w_t) h_t + SS_t + (1 + r) A_t,
\]

(2)
Follows Chang, Kim, Kwon and Rogerson (AER, 2010) and Rogerson and Wallenius (JET, 2009 and AER, forthcoming)

Agents maximize expected discounted utility:

\[
\max_{\{c_t\}_{t=t_0}^T, \{h_t\}_{t=t_0}^{R<T}} E_{t_0} \sum_{t=t_0}^T \beta^{(t-t_0)} \left\{ \frac{c_t^{(1-\rho)}}{1-\rho} + B_t l_t^{(1-\frac{1}{\gamma})} \right\},
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The wage process is given by:

\[ w_{it} = f_i + W(t) + u_{it}, \]
\[ u_{it} \sim \text{Normal}(0, \sigma_u), \]
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Part time workers' hourly wage is $(1 - \alpha)w_{it}$
Model

Objective is to fit evolution of PT/FT participation probabilities with age.
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In total, 6 parameters are calibrated.
Calibrated Parameters: Taste for Leisure

**Figure:** Calibrated $B(t)$ for different values of $\gamma$
Figure: Calibrated \( \phi(FT) - \phi(PT) \) for different values of \( \gamma \)
Figure: Baseline model fit for $\gamma = 0.25$
Baseline fit

**Figure**: Baseline model fit for $\gamma = 0.50$
Baseline fit

**Figure:** Baseline model fit for $\gamma = 0.75$
Figure: Baseline model fit for $\gamma = 0.95$
### Results II

**Table**: Simulation results

<table>
<thead>
<tr>
<th></th>
<th>$\gamma = 0.25$</th>
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Conclusions

- The offered wage profile is not hump-shaped, but flat, at older ages.

- Wage and hours declines upon partial retirement are *endogenously* determined for most individuals.

- Assuming that hours choices are a response to an exogenously and smoothly declining wage profile leads to severely biased estimates of preference parameters.
Partial Retirement

**Figure:** Total/FT/PT participation rates by age. HRS.

Maria Casanova UCLA
Revisiting the Hump-Shaped Wage Profile
Figure: Log Wage Profiles for Different Specifications Using Simulated Data.\[\gamma = 0.5\]