Tax Reform Encouraging Longer Careers: An Analysis Using Microeconomic Data*

John Laitner† & Dan Silverman‡

January 24, 2015

* This work was supported by NIH/NIA grant R01-AG030841-01. The opinions and conclusions are solely those of the authors and should not be considered as representing the opinions or policy of any agency of the Federal Government.

† University of Michigan, Dept. of Economics
‡ Arizona State University, Dept. of Economics
Reference:

Idea

• In an environment with declining mortality & fertility rates, encouraging longer careers may be an attractive policy goal

• We want to examine the possibility of removing some tax & other distortions that discourage later retirement
Proposal

- We consider the possibility of age-specific payroll tax rate adjustments that could counterbalance biases toward early retirement

- We seek efficiency gains

- Our proposal would utilize a reformed version of US Social Security System. However, it would be revenue neutral for that System

- The benefits of the proposed reform would accrue to individual households and to society as a whole (through enhanced income-tax collections)
Outline

• Present a model of life-cycle saving and labor supply for individual households

• Estimate the parameters of the model with two large data sets, the Consumer Expenditure Survey (CEX) and the Health and Retirement Study (HRS)

• Outline a hypothetical change in the Social Security System that might encourage later retirement

• Simulate outcomes from the change, using the model and our estimated parameters
Background References

• Modigliani [1986], Feldstein [1974], Auerbach & Kotlikoff [1987]


• Goda et al [2009], Burtless & Quinn [2002]


• Gustman & Steinmeier [1986], Rust & Phelan [1997], French [2005], van der Klaauw & Wolpin [2005]
Model

\[
\max_{c_s \geq 0} \int_{0}^{S} e^{-\rho \cdot s} \cdot u(c_s, s) \, ds \tag{1}
\]

subject to: \( \frac{da_s}{ds} = \)

\[
\begin{cases} 
    r \cdot a_s + w \cdot E \cdot e_s \cdot (1 - \tau) + b_s - c_s, & \text{if } s < R, \\
    r \cdot a_s + b_s - c_s, & \text{if } s \geq R,
\end{cases}
\]

\( a_0 = 0, \quad a_S \geq 0, \)

where \( S \) is age of death and \( R \) is age of retirement
Utility Function

- \( u_s = u(c_s, s) \equiv \begin{cases} 
  v(c_s), & \text{if } s < R, \\
  v(\lambda \cdot c_s), & \text{if } s \geq R 
\end{cases} \)

- \( \lambda > 1 : \)
  
  with \( \lambda \) registering the complementarity of the extra leisure after retirement and consumption expenditure

- \( v(f) = \begin{cases} 
  [f]^{\gamma / \gamma}, & \gamma < 1, \gamma \neq 0, \\
  \ln(f), & \text{the } "\gamma = 0" \text{ case}
\end{cases} \)
Household Budget

- \( \frac{da_s}{ds} = r \cdot a_s + w \cdot E \cdot e_s \cdot (1 - \tau) + b_s - c_s \) if \( s < R \),

- \( \frac{da_s}{ds} = r \cdot a_s + b_s - c_s \) if \( s \geq R \),

- \( a_0 = 0, \quad a_S \geq 0 \)

with \( a_s = \) household assets

\( E = \) earning ability

\( e_s = \) age-dependent earning ability

\( r = \) aftertax real interest rate

\( \tau = \) Social Security payroll tax

\( w = \) wage (net of all other taxes)

\( b_s = \) Social Security benefit flow

\( c_s = \) consumption expenditure on goods
Treatment of Labor/Leisure Choice

Work is full-time or not at all

- Justification: Costs of going back & forth to work, needs to coordinate schedule with colleagues & customers, needs to arrange schedule at home, etc.
- E.g., Rust & Phelan [1997], Hurd [1996]

Alternative: time endowment=1, leisure=$\ell_s$

- Make $\ell_s \in [0, 1]$ a control variable
- E.g., Auerbach-Kotlikoff [1987]
Social Security Benefits

- Social Security benefit flow is

\[ b_s = b(R, E, s) \]

with \( \partial b / \partial R \geq 0 \), \( \partial b / \partial E \geq 0 \),

and \( b_s = 0 \) until \( s \geq \max \{62, R\} \)

- \( B(R, E) = \int_R^S e^{-r(s-R)} \cdot b(R, E, s) \, ds = \) present value Social Security benefits

- Idea: in practice, line between Social Security benefits & a later retirement age is often weak — i.e., \( \partial b / \partial R \) may be modest
Solution Procedure

• Assume unique $R \in (0, S)$

• Conditional on any $R$, solve for $c_s = c_s^*$ all adult ages $s \in [0, S]$

• Call maximized lifetime utility $U = U(R)$

• Set $R^* = \arg \max_{R_0} \{U(R_0)\}$
Optimal Age-Path of Consumption, given R

- \( c_s^* = c_0^* \cdot e^{\frac{r - \rho}{1 - \gamma} \cdot s}, \quad s \in [0, R) \)

- \( c_s^* = c_R^* \cdot e^{\frac{r - \rho}{1 - \gamma} \cdot (s - R)}, \quad s \in [R, S] \)

- \( c_R^* = [\lambda]^\frac{\gamma}{1 - \gamma} \cdot c_{R-}^* \),

where \( c_{R-}^* \equiv \lim_{s \uparrow R} c_s^* \),

- \( c_0^* \) from lifetime budget
Intuitions

- Role of $\rho : (r - \rho)/(1 - \gamma)$ sets slope of lifetime consumption-expenditure profile

- Role of $\lambda > 1$ : determines attractiveness of retirement; sets $R$

- Role of $\gamma : [\lambda^{\frac{\gamma}{1 - \gamma}}$ sets magnitude of upward or downward “jump” in consumption expenditure at retirement
  - Recall “retirement consumption puzzle” of Bernheim et al [2001], and others
  - Reflects the complementarity of consumption expenditure and leisure
Optimal Age of Retirement

\[ \partial u(c_{R-}, R-) \cdot \left[ y_{R-} + \frac{\partial B(R-, E)}{\partial R} - c_{R-} + c_R \right] \]

\[ = u(c_R, R) - u(c_{R-}, R-) \]

where \( y_s \equiv w \cdot E \cdot e_s \cdot (1 - \tau) \)

- Can be rewritten here as

\[ \frac{y_{R-} + \frac{\partial B(R-, E)}{\partial R}}{c_{R-}} = \text{a constant} \]
Reasons for Retirement in the Model

• “Positive” reasons:
  • If \( r - \rho > 0 \), optimal consumption expenditure rises with age, and consumption and leisure may be complementary
  • Even if \( r - \rho = 0 \), raising \( R \) raises a household’s lifetime consumption profile, making the greater leisure that emerges during retirement more attractive

• “Negative” reasons:
  • \( e_s \) may decline at advanced ages due to failing health & stamina
  • Disabilities may arise that end the feasibility of work
Estimation — Data

• CEX (Consumer Expenditure Survey) 1984-2002
  • Annual cross section; large sample
  • $\bar{c}_{st}$ cell-by-cell; “pseudo panel”: $\bar{c}_{s+1,t+1} - \bar{c}_{st}$

• HRS (Health and Retirement Study) 1992-2002
  • Complete panel data on households, including retirement age and earnings all ages
  • Also includes household wealth, which was not used here
Estimation Procedure

- Estimate $\rho$, $\lambda$, $\gamma$ (as well as child & spousal consumption weights)

- Method of moments

- Utilize:
  - CEX: Age-shape for $c_s^*$
  - CEX: Magnitude of “jump” in $c_s^*$ at $R$
  - HRS: Household choice of $R$
Estimation Results: see Table 4

• Representative estimates:

\[ \rho = 0.0144, \ \lambda = 3.0847, \ \gamma = -0.0797 \]

• Implications:

○ Mild “consumption puzzle” behavior at retirement; consumption expenditure should drop 8-9%  

○ Leisure quite important to households

○ \( r = 0.0425 \) implies \( r - \rho > 0 \)
Table 4. Estimated Coefficients Equations (19)-(20): Estimated Parameter (Std. Error/T Stat.)

<table>
<thead>
<tr>
<th>Parameter or Observation Count</th>
<th>Specification of (19):(^a, b)</th>
<th>Time Dummies in Eq. (19)(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Time Dummies</td>
<td>Time Dummies in Eq. (19)</td>
</tr>
<tr>
<td></td>
<td>Stringent Def. Male Disability</td>
<td>Stringent Def. Male Disability</td>
</tr>
<tr>
<td></td>
<td>Broad Def. Male Disability</td>
<td>Broad Def. Male Disability</td>
</tr>
<tr>
<td>Male Disability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equation (19): Estimates of (\beta^{CEX}) from CEX Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\beta_1^{CEX} = \frac{r-\rho}{1-\gamma})</td>
<td>0.0264*** (0.0008/34.5720)</td>
<td>0.0279*** (0.0010/29.2975)</td>
</tr>
<tr>
<td>(\beta_2^{CEX} = \beta_3 = \xi^S)</td>
<td>0.3351*** (0.0523/6.4107)</td>
<td>0.3066*** (0.0505/6.0678)</td>
</tr>
<tr>
<td>(\beta_3^{CEX} = \beta_4 = \xi^K)</td>
<td>0.3372*** (0.0181/18.6686)</td>
<td>0.3363*** (0.0172/19.5193)</td>
</tr>
<tr>
<td>(\beta_4^{CEX} = \frac{\gamma}{1-\gamma} \ln(\lambda))</td>
<td>-0.0831** (0.0370/-2.2482)</td>
<td>-0.0750** (0.0352/-2.1299)</td>
</tr>
<tr>
<td>Observations</td>
<td>765</td>
<td>765</td>
</tr>
</tbody>
</table>

Equation (20): Estimates of \(\beta\) given \(\beta^{CEX}\); HRS Data; \(\xi^S (= \beta_3)\) and \(\xi^K (= \beta_4)\) as above

<table>
<thead>
<tr>
<th></th>
<th>No Time Dummies</th>
<th>Time Dummies in Eq. (19)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stringent Def.</td>
<td>Stringent Def.</td>
</tr>
<tr>
<td></td>
<td>Male Disability</td>
<td>Male Disability</td>
</tr>
<tr>
<td></td>
<td>Broad Def. Male</td>
<td>Broad Def. Male</td>
</tr>
<tr>
<td>(\beta_1 = \rho)</td>
<td>0.0143***</td>
<td>0.0141***</td>
</tr>
<tr>
<td></td>
<td>(0.0016/8.9820)</td>
<td>(0.0017/8.1098)</td>
</tr>
<tr>
<td>(\beta_2 = \gamma)</td>
<td>-0.0797**</td>
<td>-0.0888**</td>
</tr>
<tr>
<td></td>
<td>(0.0370/-2.1537)</td>
<td>(0.0432/-2.0532)</td>
</tr>
<tr>
<td>(\beta_5 = \lambda)</td>
<td>3.0847***</td>
<td>2.7716***</td>
</tr>
<tr>
<td></td>
<td>(0.5328/5.7893)</td>
<td>(0.5751/4.8193)</td>
</tr>
<tr>
<td>(\sigma_\eta^2)</td>
<td>0.1783</td>
<td>0.1587</td>
</tr>
<tr>
<td></td>
<td>(0.1912/0.9325)</td>
<td>(0.1828/0.8681)</td>
</tr>
<tr>
<td>Observations</td>
<td>924</td>
<td>924</td>
</tr>
</tbody>
</table>

Source: see text. Significant at * 10%, ** 5%, and *** 1% level.

a. Unless otherwise noted, CEX adult (female) ages 25-69 and no time dummies.
b. Regressor 3, top panel: per household number kids ages 0-17, with weight 0.7, and 18-25 if in school or living with parents, with weight 1.0; up to maximum of 2 — see text.
c. Time-dummy coefficients omitted.
A Hypothetical Reform

- Set vesting age for Social Security, say, 54

- After vesting age, your benefits already established & your payroll tax ends

- Payroll tax higher before vesting (about 1 percent higher); budgetary neutrality for Social Security System; benefit formula unchanged

- Reform seems feasible — no legacy-cost issues provided we initiate the reform only for new laborforce entrants

- Goal: end payroll tax before most households come to margin for stopping work
Intuitions

At retirement age, we want you to face giving up

\[ y_R = w \cdot E \cdot e_R \]

rather than

\[ y_R = w \cdot E \cdot e_R \cdot (1 - \tau) \]
Intuitions (cont.)

- Income & substitution effects of payroll tax exactly offset in our model

- Social Security benefits tend to have strong income effect but weak substitution effect

- On balance, Social Security System encourages early retirement — which our hypothetical reform would seek to reverse
Simulation Outcomes: see Table 5

- Vesting age 54 implies 1.7 extra years work on average

- Equivalent variation per household: average = $4100\textsuperscript{1}

- Average extra income-tax revenues per household = $15,700

- Vesting after career span of 34 years yields about the same outcomes

\textsuperscript{1} All figures, 2005 dollars & present value age 50
Table 5. Policy Simulations using Estimated Parameters of Table 4, LHS: Mean/Median Value and [95% Confidence Interval]^a

<table>
<thead>
<tr>
<th>Vesting Age or Span of Years</th>
<th>Average Change in Career Years</th>
<th>Average Equivalent Variation (PV Age 50; 2005 NIPA PCE Dollars)</th>
<th>Average Additional Income Tax Revenue Per Household (PV Age 50; 2005 NIPA PCE Dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Stringent Definition Disability (see Table 2); Vesting by Age</td>
<td>Age Stringent Definition Disability (see Table 2); Vesting by Career Span</td>
<td>span Stringent Definition Disability (see Table 2); Vesting by Career Span</td>
</tr>
<tr>
<td>54</td>
<td>1.69/1.71</td>
<td>4292.82/4197.75</td>
<td>15684.74/15652.77</td>
</tr>
<tr>
<td></td>
<td>[1.61, 1.82]</td>
<td>[3886.82, 4566.05]</td>
<td>[14447.37, 16979.26]</td>
</tr>
<tr>
<td>59</td>
<td>1.08/1.08</td>
<td>2677.61/2503.94</td>
<td>9197.92/9012.78</td>
</tr>
<tr>
<td></td>
<td>[0.99, 1.15]</td>
<td>[1947.75, 3078.05]</td>
<td>[8388.53, 9503.62]</td>
</tr>
<tr>
<td>64</td>
<td>-0.02/-0.03</td>
<td>233.70/89.89</td>
<td>1385.58/1317.73</td>
</tr>
<tr>
<td></td>
<td>[-0.09, 0.06]</td>
<td>[-513.59, 701.00]</td>
<td>[759.79, 2090.91]</td>
</tr>
<tr>
<td>Age</td>
<td>Broad Definition Disability (see Table 2); Vesting by Age</td>
<td>Age Broad Definition Disability (see Table 2); Vesting by Career Span</td>
<td>span Broad Definition Disability (see Table 2); Vesting by Career Span</td>
</tr>
<tr>
<td>54</td>
<td>0.94/0.91</td>
<td>2269.83/2159.03</td>
<td>8188.89/7972.27</td>
</tr>
<tr>
<td></td>
<td>[0.75, 0.99]</td>
<td>[1715.45, 2495.10]</td>
<td>[6340.89, 8675.11]</td>
</tr>
<tr>
<td>59</td>
<td>0.61/0.58</td>
<td>1476.43/1416.73</td>
<td>4623.10/4443.38</td>
</tr>
<tr>
<td></td>
<td>[0.45, 0.67]</td>
<td>[1029.65, 2033.86]</td>
<td>[3428.68, 5301.52]</td>
</tr>
<tr>
<td>64</td>
<td>-0.11/-0.10</td>
<td>-873.87/-765.09</td>
<td>-117.33/-69.85</td>
</tr>
<tr>
<td></td>
<td>[-0.24, -0.03]</td>
<td>[-1402.58, -138.91]</td>
<td>[-883.42, 553.96]</td>
</tr>
<tr>
<td>Age</td>
<td>Broad Definition Disability (see Table 2); Vesting by Age</td>
<td>Age Broad Definition Disability (see Table 2); Vesting by Career Span</td>
<td>span Broad Definition Disability (see Table 2); Vesting by Career Span</td>
</tr>
<tr>
<td>34</td>
<td>0.93/0.89</td>
<td>2192.09/2117.91</td>
<td>7786.25/7626.82</td>
</tr>
<tr>
<td></td>
<td>[0.74, 0.97]</td>
<td>[1683.04, 2379.93]</td>
<td>[6095.13, 8161.78]</td>
</tr>
<tr>
<td>39</td>
<td>0.62/0.62</td>
<td>1586.06/1620.96</td>
<td>4682.04/4718.48</td>
</tr>
<tr>
<td></td>
<td>[0.49, 0.74]</td>
<td>[1209.47, 2531.16]</td>
<td>[3655.60, 5816.34]</td>
</tr>
<tr>
<td>44</td>
<td>-0.05/-0.05</td>
<td>-532.30/-549.03</td>
<td>-3.90/-7.98</td>
</tr>
<tr>
<td></td>
<td>[-0.08, -0.04]</td>
<td>[-703.61, -301.08]</td>
<td>[-234.01, 146.66]</td>
</tr>
</tbody>
</table>

Source: see text.

a. “Mean” based upon point estimates; median and confidence intervals based on 1000 random parameter vector draws — see text.
Intuition

• The reform that we propose gives households a new option: they can work longer than before, not paying payroll tax on their new earnings; we show the reform generates a positive average equivalent variation

• Longer careers imply more federal income-tax revenues; households would consume the services that the revenues support whether they pay the new income taxes or not
Conclusion

• This paper derives & analyzes a dynamic model of household behavior

• The model’s setup allows estimation; the number of parameters is small; our estimation uses several large data sets

• We simulate the consequences of a possible policy change
  • The policy reform that we study is not designed to improve the solvency of the Social Security System
  • The largest gains accrue from increases in government income-tax revenues