Labor Supply Responses to Social Security

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Economists' workhorse dynamic framework for studying social security policy issues, national debt, and tax policy in general is the life–cycle saving model (e.g., Modigliani [1986], Diamond [1965], Tobin [1967], Auerbach and Kotlikoff [1987], and many others). Even analyses which incorporate bequests – in order to study the role of exceptionally wealthy families, for example — often rely on life–cycle saving as a model of the behavior of most households (e.g., Altig et al. [2001], Gookhale et al. [2001], Laitner [2001b, 2002]). The simplest life–cycle model merely describes household saving in youth and middle age, in preparation for retirement, and dissaving in old age. Although one can easily extend the basic framework to household choices over labor/leisure hours as well (e.g., Auerbach and Kotlikoff [1987], Gustman and Steinmeier [1986], etc.), basic utility–function coefficients are not easily calibrated for the simplest model (utility is not, after all, directly observable), and, since extensions introduce still more parameters, one might worry about the possibility of calibrating them accurately. This paper, however, proposes that we can employ evidence on behavior immediately after retirement to attempt to estimate key features of life–cycle preference orderings. The analysis suggests that as we augment the model to include labor and leisure decisions, the set of implications about household behavior expands in such a way that opportunities to calibrate parameters may grow faster than the number of parameters. Based on our calibrations, this paper's last section provides illustrative simulations of the effect of social security taxes and benefits on retirement ages.

Financial advisors have long said that retirees have less "need" for consumption than working people. For example, Laitner [2001a] quotes a TIAA–CREF brochure suggesting "you'll need 60 to 90 percent of current income in retirement, adjusted for inflation, to maintain the lifestyle you now lead" and a *Reader's Digest* article stating that "many financial planners say it will take 70 to 80 percent of your current income to maintain your standard of living when you retire." Several recent papers document the drop in household consumption at retirement, and some suggest the decline may be inconsistent with the life–cycle theory's assumptions of rational behavior and careful planning.[1, 2] The

[1] Bernheim et al. [2001] examine consumption declines using the Panel Study of Income Dynamics 1978–90. Data limitations force them to proxy consumption with food at home, food away from home, and rental value of home. Their Table 1 shows a consumption drop averaging 14% in the first two years after retirement – though the decline seems to build during retirement, perhaps averaging 9% in the first year and 18%, cumulatively, in the second. Table 3 implies the magnitude of the decline is negatively related to asset and pension resources. Bernheim et al. seem to favor explanations based on poor planning. Use British data, Banks et al. [1998] measure consumption declines at retirement of 22 to 35% (Table 1). The authors suggest that individuals may tend to overestimate their pension entitlements (e.g., p.784).

[2] Hurd and Rohwedder [2003], using cross–sectional data from the Consumption Ac-

first part of the present paper examines evidence from the *Consumer Expenditure Survey* 1983–2001 and finds that household consumption does indeed seem to fall 20–25 percent on average at retirement. This paper proceeds to argue, however, that not only is the evidence consistent with variants of many widely used life–cycle models but also that measurements of the size of the drop can reveal valuable information about the magnitude of the models' parameters.

The organization of this paper is as follows. Section 1 considers the possible structure of simple life–cycle saving models which incorporate labor/leisure choices. Section 2 examines U.S. data from the *Consumer Expenditure Survey*, using it to assess the possible life–cycle shape of household consumption profiles. Section 3 sets up a life–cycle model of family behavior with nonseparable consumption and leisure, and Section 4 calibrates the parameters of the latter model. Section 5 uses the new parameter estimates to attempt to assess the impact of social security on household decisions of when to retire.

1. Household Preferences

Three of the elements of many life–cycle models of saving and labor supply are household utility maximization, subject to lifetime budget constraints; indivisibilities in options for market work, with even small reductions from full-time hours leading to large reductions in wage rates (e.g., Hurd [1996]); and, sensitivity of utility and earning power to health status. This paper incorporates the first two — leaving the role of health status as a topic for the future. Although some analyses stress the importance of features of workers' private pension plans in determining retirement behavior, this paper takes the opposite point of view: this paper assumes that a worker picks an employer whose pension plan matches his requirements and/or that employers design their pension–plan options in accordance with worker preferences in the first place; thus, private pensions form a part of private wealth accumulation and do not require separate attention. In the interests of analytic tractability, economists adopt various simplifications about preference orderings for their models of household behavior. Since the implications of some of these assumptions are very significant for the type of data on which this paper focuses, we begin with a comparison of specifications.

Many economic models specify utility functions which are time separable, and many find an additional assumption that concurrent leisure and consumption are separable natural as well (e.g., Gustman and Steinmeier [1986], Anderson et al. [1999]). Concurrent separability, however, certainly restricts a model's range of outcomes. Consider a specific example. A household lives from $t = 0$ to $t = 2$, retiring at $t = 1$. Its time endowment at each t is 1; when it works, its leisure falls to $\bar{\ell} \in (0, 1)$. This paper assumes that indivisibilities force $\bar{\ell}$ to be a fixed parameter. The wage is W; the interest rate is r. The

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tivities Mail Survey of a subsample of HRS participants, have a different interpretation. Novel questions on anticipations show that households expect their consuption to fall about 20% at retirement. (Among those already retired, realized declines are actually somewhat smaller.) This seems to imply that expenditure reductions at retirement are intentional and planned.

household's consumption c_t yields utility flow $u(c_t)$; its leisure ℓ_t yields utility flow $v(\ell_t)$; and, its assets (net worth) are a_t. Think of the household's behavior as following from

$$\max_{c_t, \ell_t} \int_0^2 [u(c_t) + v(\ell_t)]\, dt \tag{1}$$

$$\text{subject to:} \quad \ell_t = \begin{cases} \bar{\ell}, & \text{for } t \leq 1 \\ 1, & \text{for } t > 1 \end{cases} ,$$

$$\dot{a}_t = r \cdot a_t + (1 - \ell_t) \cdot W - c_t \,,$$

$$a_0 = 0 = a_2 \,.$$

Provided $u(.)$ is concave, specification (1) predicts that consumption changes continuously with age. To see this, note along an optimal consumption path, the change in utility at date s from one extra dollar's consumption, $u'(c_s)$, must equal the change in utility if the dollar is saved until later date t, by which time the dollar has grown to an amount $e^{r \cdot (t-s)}$, and then spent:

$$u'(c_s) = e^{r \cdot (t-s)} \cdot u'(c_t) \,. \tag{2}$$

Letting c_{t-} be consumption the instant before t, and c_{t+} the instant after, condition (2) yields

$$u'(c_{t-}) = u'(c_{t+}) \,. \tag{3}$$

The latter is inconsistent with a jump in consumption at any t.

Other papers assume intertemporal separability but not atemporal separability.[3] A well–known example is Auerbach and Kotlikoff [1987]. We can easily modify example (1) to illustrate such nonseparability. Let a household have a constant returns to scale neoclassical production function $f : R^2 \mapsto R^1$ which maps current consumption and leisure to a flow of services; let the latter flow yield a flow of utility, say, $u(f)$. The household solves

$$\max_{c_t, \ell_t} \int_0^2 u(f(c_t, \ell_t))\, dt \tag{4}$$

$$\text{subject to:} \quad \ell_t = \begin{cases} \bar{\ell}, & \text{for } t \leq 1 \\ 1, & \text{for } t > 1 \end{cases} ,$$

$$\dot{a}_t = r \cdot a_t + (1 - \ell_t) \cdot W - c_t \,,$$

$$a_0 = 0 = a_2 \,.$$

[3] E.g., King et al. [1988], Hurd and Rohwedder [2003].

As before, post–retirement leisure is 1, pre-retirement leisure is $\bar{\ell} < 1$, and we fix the retirement age to be $t = 1$. Since a bivariate neoclassical production function has $f_{12}(.) > 0$, inputs are complementary in the sense that more leisure (consumption) raises the marginal product of consumption (leisure). If $u(.)$ is linear, this will make the household want to step up its consumption at retirement: consumption should discontinuously increase after the discrete rise in leisure at retirement because the marginal value of consumption rises. If, on the other hand, $u(.)$ is very concave, a household will strongly desire a very even flow of consumption services at different ages. Since the household produces such services more easily during retirement, it may then choose more consumption prior to $t = 1$. In other words, rational behavior may lead to an age profile of consumption which discontinuously changes (in either direction) at retirement.

To make the nonseparable model more specific, let $f(.)$ have the familiar Cobb–Douglas form

$$f(c, \ell) = [c]^{\alpha} \cdot [\ell]^{1-\alpha}, \quad \alpha \in (0, 1)\,,$$

and let $u(.)$ have the familiar isoelastic form

$$u(f) = \frac{[f]^{\gamma}}{\gamma}, \quad \gamma < 1\,.$$

Condition (3) at retirement date $t = 1$ is

$$\begin{aligned} ([c_{t-}]^{\alpha} \cdot [\bar{\ell}]^{1-\alpha})^{\gamma-1} \cdot \alpha \cdot [c_{t-}]^{\alpha-1} \cdot [\bar{\ell}]^{1-\alpha} &= ([c_{t+}]^{\alpha})^{\gamma-1} \cdot \alpha \cdot [c_{t+}]^{\alpha-1} \iff \\ [c_{t-}]^{\alpha\cdot\gamma-1} \cdot [\bar{\ell}]^{(1-\alpha)\cdot\gamma} &= [c_{t+}]^{\alpha\cdot\gamma-1} \iff \\ [c_{t-}] \cdot [\bar{\ell}]^{-\frac{\gamma\cdot(1-\alpha)}{1-\alpha\cdot\gamma}} &= [c_{t+}]\,. \end{aligned} \tag{5}$$

If γ is nearly 1, $u(.)$ is nearly linear. Then we expect an upward jump in consumption at retirement. In fact,

$$\begin{aligned} c_{t-} < c_{t+} \quad \text{if} \quad & [\bar{\ell}]^{-\frac{\gamma\cdot(1-\alpha)}{1-\alpha\cdot\gamma}} > 1 \iff \\ & -\frac{\gamma \cdot (1-\alpha)}{1-\alpha\cdot\gamma} < 0 \iff \\ & \gamma > 0\,. \end{aligned}$$

So, indeed, whenever $\gamma > 0$, under rational planning, consumption discontinuously rises at retirement . On the other hand, we have

$$\begin{aligned} c_{t-} > c_{t+} \quad \text{if} \quad & [\bar{\ell}]^{-\frac{\gamma\cdot(1-\alpha)}{1-\alpha\cdot\gamma}} < 1 \iff \\ & -\frac{\gamma \cdot (1-\alpha)}{1-\alpha\cdot\gamma} > 0 \iff \\ & \gamma < 0\,. \end{aligned}$$

Thus, whenever $\gamma < 0$, the model predicts a discontinuous drop in consumption at retirement. Not only is an abrupt adjustment in consumption at retirement fully consistent with rational behavior, but also we can see that data on the size of change can potentially help us to calibrate the sign and magnitude of γ — an otherwise rather subtle parameter.

2. Consumer Expenditure Survey

The most complete source of disaggregate consumption data for the U.S. is the *Consumer Expenditure Survey* (CXS). The CXS has respondent households collect extensive diary information on small purchases over a multi–week time period. It conducts interviews at longer intervals asking about major purchases. The interviews also collect demographic data, data on current income, on value of house, etc. The sample is large (the BLS uses the survey in setting the CPI). The survey was conducted at multi–year intervals prior to 1984, and annually thereafter. The web site is

http://stats.bls.gov.gov/csxhome.htm .

The following discussion uses, at this point, data from the site's "standard tables" for 1984–2001.

Table 1. National Income and Product Accounts Personal Consumption for 1985, 1990, 1995, and 2000 (billions of current dollars)[a]

Category	1985	1990	1995	2000
food[b]	498.5	677.9	802.5	1027.2
apparel	188.3	261.7	317.3	409.8
personal care	37.6	53.7	67.4	87.8
shelter	406.8	585.6	740.8	960.0
household operation	344.0	433.6	555.0	723.9
transportation	372.8	455.4	560.3	768.9
medical care	367.4	619.7	888.6	1171.1
recreation	187.6	284.9	401.6	564.7
education	53.8	83.7	114.5	164.0
personal business	188.1	284.7	406.8	632.5
miscellaneous[c]	67.9	90.8	114.2	174.0
total	2712.6	3831.5	4969.0	6683.7

a. Source: http://www.bea.doc.gov/bea/dn/nipaweb/AllTables.asp, Section 2, Table 2.4.

b. Includes tobacco and alcohol.

c. Includes religious activities and foreign travel.

Table 2. Consumer Expenditure Survey Consumption (billions of current dollars)[a]				
Category	1985	1990	1995	2000
food[b]	366.4	471.6	520.9	639.7
apparel	130.0	156.9	175.7	203.0
personal care	27.7	35.3	41.6	61.7
shelter	351.0	468.9	611.3	778.0
household operation	297.9	375.0	467.1	569.3
transportation	420.0	496.5	620.2	811.2
medical care	101.5	143.5	178.6	226.0
recreation[c]	120.0	152.7	182.9	219.7
education	29.4	39.4	48.6	69.1
personal business[d]	184.6	251.3	305.7	368.0
miscellaneous[e]	122.1	160.8	174.4	215.2
total	2150.8	2752.0	3327.2	4160.9

a. Source: http://stats.bls.gov/csxhome.htm, "one year standard tables."
b. Includes tobacco and alcohol.
c. Includes entertainment and reading.
d. Includes personal insurance and pensions.
e. Includes cash contributions.

Tables 1–3 compare National Income and Product Account (NIPA) personal consumption for 1985, 1990, 1995, and 2000 with population–weighted totals from the *CXS* for similar categories. The following observations seem justified. (A) For categories such as food, apparel, personal care, and recreation, the *CXS* captures 65–75% of the NIPA figures in 1985; the *CXS* captures about 110% of 1985 NIPA transportation (primarily private automobiles). (B) Other categories differ significantly between the two sources in terms of definition. NIPA "shelter" imputes service flows to owner occupied houses, whereas *CXS* housing does not. NIPA "medical care" is the output of the private medical sector, but *CXS* medical care is private household spending on the same — excluding employer contributions to private medical insurance. The *CXS* measures household outlays on education such as tuition; the NIPA category includes the entire output (i.e., the entire cost of operation) of the education and private foundation sectors (less government grants). NIPA "personal business" includes the output of the financial services sector, much of which households implicitly support through low interest on bank accounts, etc.; *CXS* "personal business" is completely different — it includes household payments for life insurance and pensions. *CXS* "miscellaneous" consumption incorporates household cash

Table 3. Consumer Expenditure Amount ÷ NIPA Amount (percent)[a]				
Category	1985	1990	1995	2000
food	73.5	69.6	64.9	62.3
apparel	69.0	60.0	55.4	49.5
personal care	73.8	65.7	61.7	70.3
shelter	86.3	80.1	82.5	81.0
household operation	86.6	86.5	84.2	78.6
transportation	112.7	109.0	110.7	105.5
medical care	27.6	23.2	20.1	19.3
recreation	64.0	53.6	45.6	38.9
education	54.6	47.0	42.4	42.1
personal business	98.1	88.3	75.1	58.2
miscellaneous	179.9	177.1	152.7	123.7
total	79.3	71.8	67.0	62.3

a. Source: see Tables 1–2.

contributions to charity and alimony payments, whereas the same NIPA category does not. (C) *CXS* totals slip at an annual rate of 1.7% relative to NIPA personal consumption — perhaps the BLS is having more and more difficulty obtaining accurate responses.

Although the *CXS* data seems to have its share of problems, it has the great advantages of comprehensiveness and of providing information on expenditures at different ages; hence, this paper uses it — after adjusting it in several ways. The "adjustments" are as follows. (1) We drop mortgage payments from "shelter" but substitute NIPA housing service flows assigned to ages in proportion to relative *CXS*–reported housing values. (2) We drop "personal business" — for which the BLS definition differs greatly from the NIPA, and for which the BLS data includes pension contributions (which correspond to saving rather than consumption in our framework of analysis). (3) For rows in which Tables 1–2 are very similar — food, apparel, personal care, household operation, transportation, and recreation — we proportionately adjust *CXS* values so that category (weighted) totals coincide with NIPA figures. (4) We proportionately scale the remaining *CXS* categories — medical care, education, and miscellaneous — with an arithmetic average of the scaling factors from adjustment 3.

Table 4 presents *CXS* data on consumption and income by age and this paper's adjusted consumption. Website tables present average data for (10–year wide) age groups. Table 4 interpolates consumption and after–tax income figures for each age in each year; then it computes rates of change of consumption for each year t and age s, taking, for example the age–25 consumption in 1984 away from the age–26 consumption in 1985 to

Table 4. Consumer Expenditure Survey Data: Growth Rates for Real Consumption and Real Income[a]

Age	Consumption[b]	Adjusted Consumption[c]	Income[d]
25	0.0690	0.0729	0.1025
26	0.0652	0.0696	0.0962
27	0.0619	0.0666	0.0909
28	0.0589	0.0639	0.0863
29	0.0503	0.0573	0.0733
30	0.0306	0.0425	0.0449
31	0.0295	0.0411	0.0436
32	0.0284	0.0397	0.0424
33	0.0274	0.0384	0.0413
34	0.0265	0.0372	0.0402
35	0.0255	0.0360	0.0391
36	0.0246	0.0349	0.0381
37	0.0238	0.0339	0.0372
38	0.0230	0.0329	0.0363
39	0.0126	0.0226	0.0254
40	0.0077	0.0179	0.0206
41	0.0077	0.0180	0.0206
42	0.0077	0.0180	0.0207
43	0.0077	0.0181	0.0207
44	0.0076	0.0182	0.0207
45	0.0076	0.0182	0.0208
46	0.0076	0.0183	0.0208
47	0.0076	0.0183	0.0208
48	0.0076	0.0184	0.0209
49	-0.0110	0.0015	0.0003
50	-0.0159	-0.0028	-0.0049
51	-0.0160	-0.0027	-0.0054
52	-0.0161	-0.0027	-0.0058
53	-0.0162	-0.0026	-0.0063
54	-0.0163	-0.0025	-0.0068
55	-0.0164	-0.0024	-0.0073
56	-0.0165	-0.0023	-0.0078
57	-0.0167	-0.0023	-0.0084
58	-0.0168	-0.0022	-0.0089
59	-0.0190	-0.0031	-0.0165

Table 4. Consumer Expenditure Survey Data: Growth Rates for Real Consumption and Real Income[a]

Age	Consumption[b]	Adjusted Consumption[c]	Income[d]
60	-0.0207	-0.0035	-0.0230
61	-0.0208	-0.0029	-0.0243
62	-0.0209	-0.0023	-0.0257
63	-0.0210	-0.0016	-0.0272
64	-0.0211	-0.0009	-0.0288
65	-0.0212	-0.0002	-0.0306
66	-0.0213	0.0005	-0.0325
67	-0.0214	0.0013	-0.0347
68	-0.0215	0.0021	-0.0371
69	-0.0137	0.0042	-0.0176
70	-0.0105	0.0047	-0.0088
71	-0.0109	0.0043	-0.0096
72	-0.0113	0.0038	-0.0104
73	-0.0118	0.0034	-0.0112
74	-0.0123	0.0029	-0.0121
75	-0.0128	0.0024	-0.0130

a. Source: see Table 2. All nominal amounts deflated with NIPA personal consumption chain index.
b. Log real consumption age $i+1$ at $t+1$ less same age i at t for $t = 1984, ..., 1996$.
c. Drops pension and social security contributions, drops mortgage payments, adds service flow from owner occupied dwellings. See text.
d. Same formula (and deflator) as consumption.

derive $\Delta \ln(c_{25,1985})$; finally, for each age $s = 25, ..., 75$, it reports the mean of the 13 available $\Delta \ln(c_{st})$ annual figures, $t = 1984, ..., 2000$, as $\Delta \ln(c_s)$. It does the same for *CXS*–reported household income and for this paper's adjusted household consumption.

Figure 1 plots the consumption and income changes.[4] Carroll and Summers [1991] note that consumption and income grow at the same high rate for early ages in the *CXS*, and they suggest liquidity constraints bind until age 40 or so. Browning and others, in contrast, argue that children's births, and children's departures to form new households, lead to high, then low, consumption growth rates as parent households age. When Mariger [1986] considers these hypotheses together, he concludes that demographics are the more important factor.

In fact, for ages less than 30, the following scenario presumably dominates the data:

[4] This is the only place in which we use the BLS measure of income.

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  FIG 1. CXS LOG DIFFERENCES ADJUSTED CONSUMPTION AND INCOME, 1984--2001
                       (+ INCOME, * CONSUMPTION, M OVERLAP)
       0.125 ::::::+::::::::::::::::+::::::::::::::::+::::::::::::::::+
             .                                                        .
             .                                                        .
             .                                                        .
       0.100 +                                                        +
             .+ +                                                     .
             .   +                                                    .
             .                                                        .
       0.075 *    +                                                   +
             .* *                                                     .
P            .   *                                                    .
E            .    *                                                   .
R      0.050 +                                                        +
C            .     MM++                                               .
E            .       ** MMM++                                         .
N            .             **                                         .
T      0.025 +              M                                         +
             .               MM MMMMMMM                               .
             .                                                        .
             .                                    *** **              .
       0.000 +---------------------------M*******-***-***-*****------**
             .                            +++++++ ++ *          +     .
             .                                                   + ++++
             .                                      +          +      .
      -0.025 +                                       ++++             +
             .                                            +++         .
             ::::::+::::::::::::::::+::::::::::::::::+:::::::++:::::::+
                  30               45               60               75
                                           AGE
```

Mr. M, with annual income of \$10,000 and consumption of \$8,000, marries Miss F, who has annual income of \$10,000 and consumption of \$8,000, and the next year they constitute a married household MF with income \$20,000 and consumption \$16,000. Marriages cause average consumption and income per household to skyrocket. As this phenomenon is widespread, average "household" consumption and income will both tend to increase rapidly at youthful ages.

To bypass changes due strictly to marriage, this paper concentrates on households of ages 30–75 or 35–75. At older ages, the issues of children and liquidity constraints are potentially important. The remainder of this section seeks to measure the role of children but ignores possible liquidity constraints; the next section returns to the latter.

To incorporate children into our analysis, let the number of "equivalent adults" per household be n_t. For example, if a household has two parents, let parent each constitute 1 "equivalent adult." Suppose children consume 50% as much as adults. Then a two–child family with two parents might have $n_t = 3$ for parent ages t at which the children remain at home. Following Tobin [1967] and others, let household's utility flow at age t be

$$n_t \cdot u(\frac{f_t}{n_t}) .$$

The new version of our life–cycle maximization model allows $n_t \neq 1$ and allows a household to choose its retirement age R. If the age of death is T, and if households discount the future at subjective discount rate ρ, we replace (4) with

$$\max_{c_t, R} \int_0^T e^{-\rho \cdot t} \cdot n_t \cdot u(\frac{f(c_t, \ell_t)}{n_t})\, dt \tag{6}$$

$$\text{subject to:} \quad \ell_t = \begin{cases} \bar{\ell}, & \text{for } t < R \\ 1, & \text{for } t \geq R \end{cases} ,$$

$$\dot{a}_t = r \cdot a_t + (1 - \ell_t) \cdot W_t - c_t ,$$

$$a_0 = 0 = a_T .$$

As before, let $f(.)$ be Cobb–Douglas, and let $u(.)$ be isoelastic. The Euler equation (e.g., (2)) implies

$$[c_t]^{\alpha \cdot \gamma - 1} \cdot [n_t]^{1-\gamma} = e^{r-\rho} \cdot [c_{t+1}]^{\alpha \cdot \gamma - 1} \cdot [m_{t+1}]^{1-\gamma} \quad \text{for} \quad t \neq R - 1 ,$$

$$[c_t]^{\alpha \cdot \gamma - 1} \cdot [n_t]^{1-\gamma} \cdot [\bar{\ell}]^{\gamma \cdot (1-\alpha)} = e^{r-\rho} \cdot [c_{t+1}]^{\alpha \cdot \gamma - 1} \cdot [m_{t+1}]^{1-\gamma} \quad \text{for} \quad t = R - 1 .$$

If

$$\chi_t(R) = \begin{cases} 1, & \text{if } t = R \\ 0, & \text{if } t \neq R \end{cases} ,$$

and if

$$\Delta x_t \equiv x_{t+1} - x_t \quad \text{and} \quad \Delta \ln(x_t) \equiv \ln(x_{t+1}) - \ln(x_t)$$

for any variable x, one can rewrite the Euler equation as

$$\Delta \ln(c_t) = \frac{1}{1 - \alpha \cdot \gamma} \cdot (r - \rho) + \frac{1 - \gamma}{1 - \alpha \cdot \gamma} \cdot \Delta \ln(n_t) - \chi_t(R) \cdot \frac{\gamma \cdot (1 - \alpha)}{1 - \alpha \cdot \gamma} \cdot \ln(\bar{\ell}) .$$

In practice, each household in our data has at least one adult, and it may have two (or, with grandparents, for instance, even more). Normalize the first adult's equivalency weight to one. Let n_t^A and n_t^C be the number of additional adults and the number of children, respectively, in a household when the first adult's age is t. Let ξ^A and ξ^C, respectively, be the adult equivalency of adults beyond the first and of each child. Although ξ^A may be 1, it could also be substantially less than this if there are scale economies for consolidating single–adult households. We have

$$n_t = 1 + \xi^A \cdot n_t^A + \xi^C \cdot n_t^C \, .$$

Then the following approximates our Euler equation:

$$\Delta \ln(c_t) \approx \frac{1}{1-\alpha\cdot\gamma} \cdot (r-\rho) + \frac{1-\gamma}{1-\alpha\cdot\gamma} \cdot \xi^C \cdot \Delta n_t^C + \frac{1-\gamma}{1-\alpha\cdot\gamma} \cdot \xi^A \cdot \Delta n_t^A - \chi_t(R) \cdot \frac{\gamma\cdot(1-\alpha)}{1-\alpha\cdot\gamma} \cdot \ln(\bar{\ell}) \, . \tag{7}$$

We use a regression equation based on (7) to summarize our adjusted *CXS* data. Equation (7) applies to an individual household. Since the *CXS* lacks a panel structure, we estimate population averages for each time and age group. Our dependent variable is the difference of the logs of the averages. For example, we compute average "adjusted" consumption for age s at time t, say, $\bar{c}_{st}$. Then we find average adjusted consumption for age $s+1$ at $t+1$ and set

$$\Delta \ln(\bar{c}_{st}) = \ln(\bar{c}_{s+1,t+1}) - \ln(\bar{c}_{st}) \, .$$

This is our regression's dependent variable.

Our first independent variable is a constant. Turning to demographic information, the *CXS* measures average numbers of people per household and numbers of children under 18. Our "adults" per household equal "people" minus children under 18. Our second independent variable is $\Delta\bar{n}_{st}^C$, the average number of children (under 18) in age $s+1$ households at time $t+1$ less the average for age s households at t, etc. Our third independent variable, $\Delta\bar{n}_{st}^A$, measures changes in adults per household. Our fourth variable, $\Delta\bar{R}_{st}$, is the average proportion of retired males of age $s+1$ at $t+1$ minus the average for age s at time t.[5] We also add a time dummy, say, D_t, for each year 1984–2000, constraining the sum of the coefficients on the dummies to equal 0. Appending an error to the right–hand side of (7) — capturing measurement error in consumption — our regression equation is

$$\Delta \ln(\bar{c}_{it}) = \beta_0 + \beta_1 \cdot \Delta\bar{n}_{it}^C + \beta_2 \cdot \Delta\bar{n}_{it}^A + \beta_3 \cdot \Delta\bar{R}_{it} + \beta_4 \cdot D_{1984} + ... + \beta_{19} \cdot D_{1999} - (\beta_4 + ... + \beta_{19}) \cdot D_{2000} + \epsilon_{it} \, . \tag{8}$$

Table 5 relates the regression coefficients to the parameters of our theoretical model.

[5] See Fullerton [1999] and the data on male retirement ages at ftp://ftp.bls.gov/pub/special.requests/ep/labor.force/clra8000.txt.

Table 5. Regression Coefficients and the Model's Parameters[a]

Regression Coefficient	Theoretical Coefficient
β_0	$(r-\rho)/(1-\alpha\cdot\gamma)$
β_1	$(1-\gamma)/(1-\alpha\cdot\gamma)$
β_2	$(1-\gamma)/(1-\alpha\cdot\gamma)$
β_3	$-[(\gamma\cdot(1-\alpha))/(1-\alpha\cdot\gamma)]\cdot\ln(\bar{\ell})$

a. See equations (7)–(8).

Tables 6a–b present regression results; the next section interprets the estimates in more detail.[6] The signs of the constants imply that a household's consumption per equivalent adult increases with age. The magnitude of the rise for a household's consumption over say 50 years is a factor of 2.92 according to Table 6a, and a factor of 2.41 according to Table 6b. Since earnings (corrected for inflation) roughly double for a typical household as it ages, these factors seem plausible. The positive coefficients on labor force participation rates imply that a household's consumption declines in the year it retires. The estimated magnitude of the drop for the year of retirement is 27% in Table 6a and 24% in Table 6b. The signs and magnitudes are consistent with the casual evidence provided in the introduction and the estimates of Bernheim et al. [2001], Banks et al. [1998], and Hurd and Rohwedder [2003].

The estimated relative equivalency weight of two children relative to two adults in Table 6a is

$$\frac{2\times .1341}{1+.2146} = .2208\,;$$

[6] Since the data at this point has been constructed using interpolation, the standard errors are not trustworthy yet. The next revision will use data on individual ages rather than the "standard tables."

Table 6a. OLS Log Difference Adjusted Real Consumption, Ages 30–75, Times 1984–2000, Regressed on Differenced Number of Children, Adults (beyond the first), and Retirement Rate			
Regressor	Coefficient	Std. Error	T-Stat
CONSTANT	0.0214	0.0011	19.4179
CHANGE CHILDREN	0.1341	0.0166	8.0725
CHANGE ADULTS	0.2146	0.0187	11.4776
CHANGE MALE PARTICIPATION[a]	0.2716	0.0392	6.9326
1984	0.0168	0.0034	4.9533
1985	0.0005	0.0033	0.1573
1986	0.0037	0.0031	1.1710
1987	-0.0073	0.0031	-2.3270
1988	0.0051	0.0031	1.6229
1989	-0.0218	0.0033	-6.7052
1990	-0.0422	0.0031	-13.4402
1991	-0.0136	0.0032	-4.2674
1992	0.0214	0.0031	6.8320
1993	0.0106	0.0033	3.2408
1994	-0.0234	0.0032	-7.2513
1995	0.0069	0.0031	2.2012
1996	0.0009	0.0031	0.2827
1997	0.0218	0.0031	6.9374
1998	0.0202	0.0031	6.4502
1999	-0.0060	0.0031	-1.9348
AOV			
SSQ regression	0.4094	deg. freedom	19
SSQ error	0.3591	deg. freedom	762
SSQ total	0.7684	deg. freedom	781
R squared	53.2739		

a. Decline in male labor force participation post age 49.

Table 6b. OLS Log Difference Adjusted Real Consumption, Ages 35–75, Times 1984–2000, Regressed on Differenced Number of Children, Adults (beyond the first), and Retirement Rate

Regressor	Coefficient	Std. Error	T-Stat
CONSTANT	0.0176	0.0013	13.7319
CHNAGE CHILDREN	0.0864	0.0184	4.6872
CHANGE ADULTS	0.1873	0.0191	9.7947
CHANGE MALE PARTICIPATION	0.2359	0.0389	6.0708
1984	0.0176	0.0034	5.1273
1985	-0.0021	0.0034	-0.6338
1986	0.0038	0.0032	1.1945
1987	-0.0113	0.0032	-3.5640
1988	0.0078	0.0032	2.4081
1989	-0.0233	0.0033	-7.1004
1990	-0.0412	0.0032	-12.8269
1991	-0.0161	0.0033	-4.9556
1992	0.0289	0.0032	9.0201
1993	0.0077	0.0033	2.3103
1994	-0.0279	0.0033	-8.4630
1995	0.0092	0.0032	2.9000
1996	-0.0008	0.0032	-0.2584
1997	0.0253	0.0032	7.8768
1998	0.0217	0.0032	6.8095
1999	-0.0100	0.0032	-3.1633
AOV			
SSQ regression	0.3618	deg. freedom	19
SSQ error	0.2949	deg. freedom	677
SSQ total	0.6567	deg. freedom	696
R squared	55.0909		

a. Decline in male labor force participation post age 49.

for Table 6b it is

$$\frac{2 \times .0864}{1 + .1873} = .1455\,.$$

This compares to Tobin's [1967] assumed adult equivalency of .3 for minor children and .7 for teenagers, and to Mariger's estimated relative weight of .30.[7] (One possible problem is that at this point, the data do not allow one to distinguish between children over 18 who live with their parents and other adults (including spouses).)

The esimated equivalency weight for a second adult, 21% as high as the first adult in Table 6a and 19% in Table 6b, is quite low. Such a weight implies very substantial economies of scale in household operation. There are a number of interesting possible ramifications: as the elderly choose more and more to live separately from their children, and as rising divorce rates and, perhaps, later marriages, leave more young adults living alone, the economy will more and more sacrifice these scale economies; and, the U.S. Social Security System's provision of 50% incremental benefit payments for retired workers with spouses may be more generous than equality of living standards for singles and couples requires.

3. Calibration

This section modifies our life–cycle saving model to include income taxes, social security, and a nonnegativity constraint on net worth at each age. Bankruptcy laws presumably lead to the latter constraint. Existing work has noted the possible effect of binding constraints. For example, if the constraint binds consistently in youth, consumption growth at early ages will mimic income growth — biasing upward Table 6's constant term, and presumably biasing downward our estimate of the adult equivalency of children. After presenting the new model, we use it to extract key economic parameters from Section 2's reduced–form estimates. We can then check whether the parameter values lead to binding liquidity constraints past age 30 (or 35 in the case of Table 6b) — in which case Section 2's estimation procedures need to be revised.

The new model is

$$\max_{c_t, R} \int_0^T e^{-\rho \cdot t} \cdot n_t \cdot u(\frac{f(c_t, \ell_t)}{n_t})\, dt \tag{9}$$

$$\text{subject to:} \quad \ell_t = \begin{cases} \bar{\ell}, & \text{for } t \le R \\ 1, & \text{for } t > R \end{cases},$$

$$\dot{a}_t = r \cdot (1 - \tau) \cdot a_t + (1 - \ell_t) \cdot e_t \cdot e^{g \cdot t} \cdot W_t \cdot (1 - \tau - \tau^{ss}) + \text{SSB}_t \cdot (1 - \frac{\tau}{2}) - c_t\,,$$

$$a_t \ge 0 \quad \text{all} \quad t\,,$$

[7] See also Browning *et al.* [1985].

$$a_0 = 0 = a_T \,.$$

The term e_t registers increases in "effective labor supply" with experience; g is the rate of labor–augmenting technological progress. As before, assume

$$f(c, \ell) = [c]^\alpha \cdot [\ell]^{1-\alpha} \,, \quad \alpha \in (0,1) \,, \quad \text{and} \quad u(f) = \frac{[f]^\gamma}{\gamma} \,, \quad \gamma < 1 \,. \tag{10}$$

We solve (9) using Mariger's [1986] algorithm — essentially determining (numerically) one by one the age–intervals on which the liquidity constraint $a_t \geq 0$ does, and does not, bind.

We fix a number of features of our model as follows. We assume each household has two adults. Time 0 corresponds to the adults each being age 22; time T corresponds to their being 76 (e.g., $T = 76 - 22 = 54$). We set $\tau = .25$ and $\tau^{ss} = .13$. We assume a social security replacement rate of .44 if a household retires at 62 and the Social Security "normal retirement age" is 65; if the normal retirement age is 67, our replacement rate for early retirement at 62 is .39.[8] We compute average lifetime wages up to age 62, multiplied by this replacement rate. This is adjusted if benefits begin after age 62 in such a way that the present value of lifetime benefits remains the same (see the discussion in the next section). Half of social security benefits are subject to income tax. The aftertax (real) interest rate is .05.

The age profile of household earnings, the shape of which e_t determines, follows Auerbach–Kotlikoff [1987]. We, however, assume that technological progress raises wages 1% per year every year. Note that because preferences are homothetic, the scaling of the earnings profile — and the scaling of the lifetime profile of equivalent adults — does not affect retirement age R or $\Delta \ln(c_t)$ or the magnitude of the discontinuous change in consumption at retirement. (Nor does the scaling of equivalent adults or earnings affect the ratio of assets to earnings generated by the model.)

A household's two adults both work the same hours: 40 hours per week until retirement; 0 hours per week after retirement. With 16×7 waking hours per week, we set[9]

$$\bar{\ell} = \frac{16 \times 7 - 40}{16 \times 7} = .6429 \,.$$

In some examples below we omit children and normalize $n_t = 1$ all t. (This corresponds to most of the analysis, for instance, in Auerbach and Kotlikoff [1987].) In other cases, we assume that two children are born when a household's adults are 24 and that the children leave home to form their own families when their parents are 46. As stated above, the normalization of our equivalent adults profile is unimportant; nevertheless, the relative size of n_t at different ages is significant. With children, the estimates of Table 6a lead us to use

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[8] See Gruber and Wise [2001, Tab.5.1, p.181]. For a normal retirement age of 67, this paper multiplies .44 by Gruber and Wise's replacement rate for 65 divided by the rate for 67.

[9] Cf. Cooley and Prescott [1995]: on the basis of time–use studies, they determine that households devote 1/3 of waking hours to work.

$$n_t = \begin{cases} 1, & \text{for } 22 \leq t < 24 \text{ and } 46 < t \leq T \\ 1.2208, & \text{for } 24 \leq t \leq 46 \end{cases} .$$

For the coefficient estimates of Table 6b, replace 1.2208 with 1.1455.

Three key parameters remain: ρ, α, and γ. We set them from the regression results of Tables 6a–b and the empirical retirement age. Roughly speaking, we can think of the parameter estimate $\widehat{\beta_3}$, measuring the discontinuous drop in consumption upon retirement, as determining γ: as noted above, a positive *gamma* leads to a rise in consumption at retirement, and a negative gamma to a fall; thus, in terms of magnitudes, a *gamma* near 0 will tend to lead to a small discontinuity, and a gamma far from zero to a large one. *Alpha* determines the role of consumption relative to leisure in producing utility. If *alpha* is one, only consumption matters, so a household should never retire. If *alpha* is zero, only leisure matters, so a household should retire at age 22. Hence, we can expect information on the empirical retirement age to help us set α. Finally, a higher *rho* implies greater impatience, hence, less of a rise in consumption with age. We can then think of $\widehat{\beta_0}$, which measures the growth rate of adult consumption with age, as determining *rho*.

Table 7 presents our calibrations. In the actual computations, we choose a prospective value of γ, determine a corresponding α from $\widehat{\beta_3}$ (c.f., (7) and (8)), determine a corresponding ρ from $\widehat{\beta_0}$ (again compare (7)–(8)), and then solve solve maximization problem (9) for the desired retirement age. The sign of $\widehat{\beta_3}$ implies $\gamma < 0$. A grid search reveals the model's desired retirement age R rises monotically as γ falls. The median retirement age in our data (for each year 1984–2000) is between 63 and 64; so, Table 7 presents the range of choices for γ which imply a retirement age between 63 and 64.[10] The table also presents ranges for the corresponding α and ρ.

For none of the rows of Table 7 do household liquidity constraints bind at any age. This is broadly consistent with Mariger's [1986] findings. It seems to free us from having to reconsider the specification of Section 2's reduced–form regression equation.

Our calibrated values of γ fall within the range of the existing literature. For example, Auerbach and Kotlikoff [1987, p.50–51] suggest $\gamma = -3$; Zeldes [1989] suggests $\gamma = -1$; Laitner [2002] suggests $\gamma = .6 - .7$; and, Cooley and Prescott [1995] assume $\gamma = 0$. The values of ρ are also standard. Auerbach and Kotlikoff [1987,p.51] write, "There is scant evidence of the appropriate value of [this parameter]," and they choose .015. Cooley and Prescott [1995,p.22] choose .053.[11]

Economists have noted that the work week of adult males in the U.S. has been roughly constant for 70 years or more, and retirement ages have changed only slowly. This is true despite substantial technological progress, which has raised the wage rate, and despite substantial changes in tax rates. A Cobb Douglas production function $f(.)$ is consistent with this empirical evidence (see the next section below): proportionate increases in the wage rate W_t all t, or the tax on earnings, change consumption and asset accumulation in the same proportion in utility maximization problem (9) but leave the desired retirement

[10] Footnote 5 details the source of the retirement data.

[11] See also Barsky et al. [1997].

age unchanged. Indeed, if we allowed variable work hours at every age, desired hours would remain unchanged.

Auerbach and Kotlikoff use a CES functional form for $f(.)$ and their ("base case") choice for the elasticity of substitution between capital and labor is .8. They warn [p.51], "There is far less direct empirical evidence concerning the value of [the elasticity of substitution]." A Cobb–Douglas function is a special case of a CES function with elasticity 1; no other CES function is consistent with constant labor supply in the face of secular technological change, tax rate changes, etc.[12] Cooley and Prescott use the Cobb Douglas form, and their calibrated value for *alpha* is .36.

A great advantage of our approach is that we can jointly employ data on retirement ages and recent evidence on the drop in consumption after retirement to pin down *alpha* and *gamma* in a seemingly more direct way than previous studies have be able to do. So far, consensus estimates of the parameters from the existing literature are surprisingly well borne out.

Table 7. Calibrations for Parameters *Gamma*, *Alpha*, and *Rho* (see text)

Formulation	*Gamma*	*Alpha*	*Rho*
Tab. 6a coefs; no children	-1.31 to -1.32	.3287 to .3309	.0187 to .0185
Tab. 6a coefs; two children	-1.31 to -1.32 -1.32	.3287 to .3309	.0187 to .0185
Tab. 6b coefs; no children	-1.03 to -1.04	.3140 to .3173	.0260 to .0259
Tab. 6b coefs; two children	-1.03 to -1.04	.3140 to .3173	.0260 to .0259

4. Social Security Policy Implications

This section uses our calibrated parameters to ask how much of a reduction in labor supply the present U.S. Social Security System causes. In our context, the reduction takes place entirely through retirement decisions. The calibrations could, of course, yield predictions of labor–supply responses to potential future changes in the Social Security System (see, for example, President's Commission [2001]).

There are several ways to think about social security's influence on household labor supply. One which is convenient here conceptually separates the impact of social security taxes and benefits, first comparing an economy with no social security to one with taxes but

[12] Note that Auerbach and Kotlikoff's model does not have technological progress.

no benefits, and second comparing an economy with social security taxes but no benefits to one with both taxes and benefits.

For the first step, suppose society imposes a new proportional tax on earnings — but there are no corresponding transfer payments (i.e., benefits). Let the tax rate be τ^{ss}. Consider a household. With the new tax, the household's time endowment is worth only $1 - \tau^{ss}$ times as much as before. That should induce the household to consume less leisure and less goods — hence to supply more labor. Microeconomists refer to this as the "income effect" of the tax. On the other hand, since a tax falls upon work hours but not leisure, it should induce the household to supply less labor relative to leisure. This is the "substitution effect." A special consequence of a Cobb–Douglas home production function $f(.)$ is that a proportional tax's income and substitution effect on labor supply exactly counterbalance one another, leaving desired labor supply unchanged.

Second, add social security benefits. As society institutes benefits, our household is made better off, leading to an "income–effect" increase in household demand for leisure and goods, hence to a reduction in market labor supply. The "substitution effect" from benefits is more complicated. To the extent that benefits rise with retirement age, they implicitly act as a subsidy to wage earnings, inducing households to substitute work for leisure. The question is how large this inducement is. Consider an extra year of work under the present U.S. system — i.e., consider retirement at, say, age $R + 1$ instead of R. The U.S. Social Security System's "normal retirement age" is 65 and 8 months. Early retirement, for age 62 or later, leads to a benefit reduction for any given AIME (see below). Since this particular reduction is roughly neutral in terms of the expected present value of a household's lifetime benefits, it has no substitution–effect implications (e.g., Hurd and Smith [2002]). At least two factors remain. (i) Upon retirement, a worker computes his AIME ("average indexed monthly earnings") from the average of his 35 highest earning years. For future reference, note that the calculation procedure removes the effects of inflation and secular earnings growth due to technological progress. (ii) The worker then computes his PIA ("primary insurance amount") from a formula which provides more generous benefits at lower income: in the calculations below, which are based on 1995 data, a worker's PIA equals 90% of his first $426 of AIME, 32% of his next $2141, and 15% of higher amounts. Steps (i)–(ii) both attenuate the "substitution effect" of social security benefits: in step (i), postponing retirement may provide a higher earning year for one's 35–year average, but only the increment of the new year's earnings over the earnings it replaces counts; step (ii) reduces the marginal impact of an extra dollar of earnings by 10, 68, or 85%. In our numerical examples, a worker's effective labor supply, cleansed of the effect of technological progress, rises with age into his 40s but then falls. Because of the latter fall, the step (i) correction is very severe. For our representative worker, step (ii) provides a marginal benefit rate of 32%. In the end, an extra year of work at age 62 increases social security benefits only .04%.

For comparison, consider a private–sector defined benefit pension with proportionate contributions in each working year. A worker of age 62 contemplating postponing retirement for 1 more year can add a full year's contribution to his pension account. The percentage increase in the account in this case depends on all previous contributions and their appreciation, and our computations assume a 5% annual interest rate. There is no private–sector analogue to the step (ii) adjustment. In our sample computation, an extra year of work at age 62 raises the defined benefit account 3.01% — almost two orders of magnitude more than the social security case.[13]

In view of the tenuous linkage of social security benefits and retirement age, the remainder of our analysis simply ignores the substitution effect of social security benefits; hence, social security reduces desired labor supply because of the "income effect" of social security benefits.

Table 8a computes, for each of Table 7's parameter combinations, the increase in the desired retirement age for an economy without a social security system versus one with a normal retirement age of 65; Table 8b performs the same calculations if the system's normal retirement age is 67. Note that the U.S. Social Security System's normal retirement age was 65 in 1995; it will be 67 in 2022. Social Security seems to shift the desired age of retirement 3–4 years earlier when the normal retirement age is 65, and 2–3 years when it is 67.

Table 8a. Desired Retirement Age without Social Security: "Normal Retirement Age" 65[a]

Formulation	Desired Age with Social Security		Change Desired Age
	Present	Absent	
Tab. 5a coefs; no children; $\gamma = -1.31$ to -1.32	63	66	3
Tab. 5a coefs; two children; $\gamma = -.131$ to -1.32	63	66	3
Tab. 5b coefs; no children; $\gamma = -1.03$ to -1.04	63	66 to 67	3 to 4
Tab. 5b coefs; two children; $\gamma = -1.03$ to -1.04	63	66 to 67	3 to 4

a. Social security replacement rate .44 for early retirement age 62. See text.

There are several reasons why the simulation results should be viewed as upper limits for the effect of social security on retirement. First, as stated, the analysis omits the

[13] This analysis overlooks the facts (a) that social security benefits are not fully taxed under the U.S. income tax and (b) that balances in a defined–benefit–pension account will accrue interest during retirement at the market rate, whereas social security tends to pay its participants a lower rate of return (equal to the rate of population growth plus the rate of technological progress).

Table 8b. Desired Retirement Age: "Normal Retirement Age" 67[a]			
Formulation	Desired Age with Social Security		Change Desired Age
	Present	Absent	
Tab. 5a coefs; no children; $\gamma = -1.31$ to -1.32	63 to 64	66	3 to 2
Tab. 5a coefs; two children; $\gamma = -.131$ to -1.32	63	66	3
Tab. 5b coefs; no children; $\gamma = -1.03$ to -1.04	63 to 64	66 to 67	3
Tab. 5b coefs; two children; $\gamma = -1.03$ to -1.04	63 to 64	66 to 67	3

a. Social security replacement rate .39 for early retirement age 62. See text.

impact of possible changes in health status. Declining health status clearly can affect retirement plans and overwhelm the influence of economic incentives (e.g., Anderson et al. [1999]). Second, business downturns may lead companies to offer buyouts for early retirement (e.g., Brown [2002]). Because our model omits buyouts, it again tends to overstate the significance of social security. It is also the case that income heterogeneity complicates interpretation of our results: social security benefits tend to be a lower share of lifetime resources for workers with higher earnings; thus, the impact of social security on the retirement age of such workers will tend to be less.

We should note that the results in Tables 8a–b are positive rather than normative. While a complete analysis of possible social security reforms would require a general equilibrium framework, for instance, this paper only investigates a way of calibrating one (key) component of such a framework.

5. Conclusion

A number of recent papers measure a decline in average household consumption following retirement. One possible explanation is that people often plan poorly and that they must subsequently retrench. Another is that households compensate themselves for working hard before they retire with relatively high consumption, but they cease this extra spending after they retire.

Under the second story, one can use the sign and magnitude of the change in consumption at retirement to calibrate parameters of the life–cycle saving model. Using data from the *Consumer Expenditure Survey*, this paper illustrates how this can be done. Although the empirical steps are in many ways unusually straightforward, parameter estimates resemble those from other studies.

When Section 4 employs the calibrated parameters to study the effect of the existing U.S. social security system on retirement behavior, the simulations point to a reduction in the average retirement age of about three years. Overlooking health status presumably leads to overstatements. Nevertheless, results point to substantial consequences for labor supply from potential future changes in social security.

Bibliography

[1] Altig, David; Auerbach, Alan J.; Kotlikoff, Laurence J.; Smetters, Kent A.; and Walliser, Jan, "Simulating Fundamental Tax Reform in the United States," *American Economic Review* vol. 91, no. 3 (June 2001): 574–595.

[2] Anderson, Patricia M.; Gustman, Alan L.; and Steinmeier, Thomas L., "Trends in Male Labor Force Participation and Retirement: Some Evidence on the Role of Pensions and Social Security in the 1970s and 1980s," *Journal of Labor Economics* vol. 17, no. 4, part 1 (October 1999): 757–783.

[3] Auerbach, Alan J.; and Kotlikoff, Laurence J. *Dynamic Fiscal Policy*. Cambridge: Cambridge University Press, 1987.

[4] Banks, James; Blundell, Richard; and Tanner, Sarah, "Is There a Retirement–Savings Puzzle?" *American Economic Review* 88, no. 4 (September 1998): 769–788.

[5] Barsky, Robert; Kimball, Miles; Juster, F. Thomas; and Shapiro, Matthew, "Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the Health and Retirement Study," *Quarterly Journal of Economics* vol. 112, no. 2 (May 1997): 537–579.

[6] Blundell, Richard; and MaCurdy, Thomas, "Labor Supply: A Review of Alternative Approaches," in Orley Ashenfelter and David Card (eds.), *Handbook of Labor Economics: vol.3A*. Amsterdam: Elsevier, 1999.

[7] Brown, Charles, "Early Retirement Windows," Michigan Retirement Research Center working paper 2002–028, www.mrrc.isr.umich.edu, 2002.

[8] Browning, Martin; Deaton, Angus; and Irish, Margaret, "A Profitable Approach to Labor Supply and Commodity Demands Over the Life Cycle," *Econometrica* 53, no. 3 (May 1985): 503–543.

[9] Carroll, Chris; and Summers, Lawrence, "Consumption Growth Parallels Income Growth: Some New Evidence," in Bernheim and Shoven (eds.), *National Saving and Economic Performance*. Chicago: The University of Chicago Press, 1991.

[10] Diamond, P.A., "National Debt in a Neoclassical Growth Model," *American Economic Review*, vol. 55, no. 5 (December 1965): 1126–1150.

[11] Gokhale, Jagadeesh; Kotlikoff, Laurence J.; Sefton, James; and Weale, Martin, "Simulating the Transmission of Wealth Inequality via Bequests," *Journal of Public Economics* vol. 79, no. ' (January 2001): 93–128.

[12] Gruber, Jonathan; and Wise, David, "Social Security, Retirement Incentives, and Retirement Behavior: An International Perspective," in Alan J. Auerbach and Ronald D. Lee (eds.), *Demographic Change and Fiscal Policy*. Cambridge: Cambridge University Press, 2001.

[13] Gustman, Alan L., and Steinmeier, Thomas, L., "A Structural Retirement Model," *Econometrica* vol. 54, no. 3 (May 1986): 555-584.

[14] Hurd, Michael, "The Effect of Labor Market Rigidities on the Labor Force Behavior of Older Workers," in (David Wise ed.), *Advances in the Economics of Aging*. Chicago: The University of Chicago Press, 1996.

[15] Hurd, Michael; and Smith, James, "The Effects of Subjective Survival on Retirement and Social Security Claiming," Michigan Retirement Research Center working paper 2002–021, www.mrrc.isr.umich.edu, 2002.

[16] Hurd, Michael; and Rohwedder, Susann, "The Retirement–Consumption Puzzle: Anticipated and Actual Declines in Spending at Retirement," NBER working paper 9586, http://www.nber.org/papers/w9586.

[17] King, Robert; Plosser, Charles; and Rebelo, Sergio, "Production, Growth and Business Cycles: I. The Basic Neoclassical Model," *Journal of Monetary Economics* vol. 21, no. 2 (1988): 195–232.

[18] Laitner, John, "Secular Changes in Wealth Inequality and Inheritance," *The Economic Journal*, vol. 111, no. 474 (October 2001a): 691–721.

[19] Laitner, John, "Wealth Accumulation in the U.S.: Do Inheritances and Bequests Play a Significant Role?" Michigan Retirement Research Center working paper 2001–019, www.mrrc.isr.umich.edu, 2001b.

[20] Laitner, John, "Wealth Inequality and Altruistic Bequests," *American Economic Review* vol. 92, no. 2 (May 2002): 270–273.

[21] Mariger, Randall P., *Consumption Behavior and the Effects of Government Fiscal Policy*. Cambridge: Harvard University Press, 1986.

[22] President's Commission, "Strengthening Social Security and Creating Personal Wealth for All Americans," 2001.

[23] Tobin, J., "Life Cycle Saving and Balanced Growth," in W. Fellner (ed.), *Ten Economic Studies in the Tradition of Irving Fisher*. New York: Wiley, 1967.

[24] Zeldes, S., "Consumption and Liquidity Constraints: An Empirical Investigation," *Journal of Political Economy* 97, no. 4 (April 1989): 305–346.