

Appendix for “The Impact of Medical and Nursing Home Expenses on Savings and Welfare”

A.1 Probability Transition Matrix

Formally, the probability of an age- j agent going from current state x to future state x' and is given by

$$\begin{aligned}
 Q_j(x, x') &\equiv \mathbf{I}[j = 1, a' = a'(1, a, 0, d, z), \bar{e}' = w\Omega(1, d, z)] \Gamma_z \\
 &+ \mathbf{I}[1 \leq j < R, a' = a'(j, a, \bar{e}, d, z), \bar{e}' = (w\Omega(j, d, z) + j\bar{e})/(j + 1)] \Lambda_{z, z'} \\
 &+ \mathbf{I}[j = R, a' = a'(R, a, \bar{e}, d, z), \bar{e}' = \bar{e}] \\
 &\times \{ \Gamma_{h'} \mathbf{I}[l' = 0] (1 - \bar{\theta}_{R+1}) + \mathbf{I}[h' = h^n, l' > 0] \bar{\theta}_{R+1} \} \\
 &+ \mathbf{I}[R < j \leq J, a' = a'(j, a, \bar{e}, h, 0), \bar{e}' = \bar{e}] \\
 &\times \{ \Lambda_{h, h'} \mathbf{I}[l' = 0] (1 - \theta(j + 1, \bar{e})) + \mathbf{I}[h' = h^n, l' = 1] \theta(j + 1, \bar{e}) \} \frac{s_{j+1}^n}{\bar{s}_{j+1}} \\
 &+ \mathbf{I}[R < j \leq J, a' = a'(j, a, \bar{e}, h^n, 1), \bar{e}' = \bar{e}, l' = 1] \frac{s_{j+1}^n}{\bar{s}_{j+1}} \\
 &+ \mathbf{I}[R < j \leq J, a' = 0, \bar{e}' = \bar{e}, l' = 2] \frac{s_{j+1}^n}{\bar{s}_{j+1}}.
 \end{aligned}$$

A.2 Data

As noted in Section 4, we use 1995–2008 HRS and AHEAD data to estimate the coefficients in the medical expense process and calculate many of the targeted empirical moments. Our measure of OOP medical expenditures include expenditures on hospital, physician and clinical services, prescription drugs, dental care, other professional and personal health care, home health care, nondurables and durables. We also include insurance premia but not expenses covered by insurance. OOP nursing home expenditures include expenditures on skilled nursing facilities (facilities for individuals who require daily nursing care and living assistance) but not the costs of services provided by retirement homes or assisted-living facilities.¹ Expenses are reported as total expenses over a 2 year period. We use average annual expenses over the 2 year period as our measure of annual expenses. Expenditures during the last year of life taken from the HRS and AHEAD exit files are also included.

¹Retirement home expenses are not included as they are not eligible for Medicaid coverage. The cost of assisted-living services within an assisted-living facility is counted as a medical expense however room and board in such facilities is not. Medicaid does not cover room and board expenses in assisted-living facilities and the criteria for eligibility of assisted-living services differs from that for nursing home care. See Mollica (2009) for details.

We consider retired individuals, ages 65 and above, single or married but with retired spouses. Our sample consists of 13,287 individuals, of whom 5,455 are men, 7,832 are women, 6,231 are single, and 7,056 are married. Singles include individuals who are widowed, never married, divorced, and partnered. All our empirical results are robust to dropping divorced and partnered individuals from the sample. In order to compute the lifetime earnings distribution, we define household heads as individuals who are either single, or married and male.

To obtain the medical expense profiles in Figure 1 we regress log medical expenses on a quartic in age, lifetime earnings quintile dummies, and lifetime earnings quintile dummies interacted with age using a fixed-effects regressor. Observations from periods where an individual spent any time in a nursing home are not included. We also run this regression for total (medical and nursing home) expenses. We then estimate cohort effects by regressing the estimated fixed-effects on cohort dummies. All the OOP expense moments targeted our calculated net of the estimated cohort effects.

A.3 Computation

To compute the benchmark equilibrium, first guesses on aggregate capital and accidental bequests are made. Second, individual maximization problems are solved starting at age T and working back to age 1. Decision rules are computed using piecewise linear interpolation. The grids for assets and average lifetime earnings consist of 200 and 100 nonlinearly-spaced points, respectively. Third, the distribution of the population over the discrete state is computed using forward iteration. Finally, updated aggregates are computed. This procedure is iterated on until the capital stock converges and the bequest constraints hold.

A.4 Probability Transition Matrices

As a result of the calibration, the probability transition matrix for productivity is

$$\Lambda_{zz'} = \begin{bmatrix} 0.5326 & 0.1468 & 0.2722 & 0.0651 & 0.0033 \\ 0.0075 & 0.8641 & 0.1241 & 0.0039 & 0.0005 \\ 0.0083 & 0.1443 & 0.7984 & 0.0482 & 0.0008 \\ 0.0190 & 0.0345 & 0.0045 & 0.8909 & 0.0511 \\ 0.0034 & 0.0047 & 0.0312 & 0.3142 & 0.6465 \end{bmatrix},$$

and the probability transition matrix for medical expenses is

$$\Lambda_{hh'} = \begin{bmatrix} 0.7165 & 0.1894 & 0.0783 & 0.0158 \\ 0.1746 & 0.5130 & 0.2901 & 0.0224 \\ 0.0772 & 0.2784 & 0.7809 & 0.3851 \\ 0.0633 & 0.3851 & 0.4576 & 0.0940 \end{bmatrix}.$$

A.5 Model Version With Long-term Care Insurance

In this version of the model agents can purchase a long-term care insurance (LTCI) policy. Under the policy an agent pays a fixed premium each period he is not in a nursing home and receives a fixed benefit each period he is in one.² Let b denote the benefit amount received each period and $p(b)$ the insurance premium. We assume that $b \in \{0, \hat{b}\}$, where $b = 0$ means an individual is not a policy-holder ($p(0) = 0$) and \hat{b} is fixed exogenously. For simplicity, we assume that individuals make LTCI decisions at age 65 before retiring and observing their initial health shock and that they cannot modify their insurance coverage later in life.

The problem of an age $j < R$ year-old worker is the same as in the baseline model. The problem of an age R individual is

$$V(R, a, \bar{e}, d, z) = \max_{c, a' \geq 0, b \in \{0, \hat{b}\}} \left\{ U(c) + \beta s_{R+1} (1 - \bar{\theta}_{R+1}) E[V(R+1, a', \bar{e}, h', 0, b)] + \beta s_{R+1} \bar{\theta}_{R+1} \max[V(R+1, a', \bar{e}, 1, b), V(R+1, a', \bar{e}, 2, b)] \right\}$$

subject to

$$\begin{aligned} c + a' + p(b) &= a + y - \tau_y(\tilde{y}) + T(y, a), \\ y &= e - \tau_e(e) + ra, \\ \tilde{y} &= \max\{0, y - \max[0, p(b) - \kappa y]\}, \\ e &= w\Omega(j, d, z), \\ \bar{e}' &= (e + j\bar{e})/(j+1), \\ T(y, a) &= \max\{0, \underline{c}^w - [a + y - \tau_y(\tilde{y})]\}. \end{aligned}$$

Retired individuals solve similar problems to those in the baseline model. Those not in a nursing home solve (8) with the extra state variable b and subject to

²This is the same LTCI contract used by Brown and Finkelstein (2008).

$$\begin{aligned}
c + M(j, h) + a' + p(b) &= a + y - \tau_y(\tilde{y}) + T(j, a, h), \\
\tilde{y} &= \max\{0, ra - \max[0, M(j, h) + p(b) - \kappa ra]\}, \\
T(j, a, h) &= \max\{0, \underline{c}^m + M(j, h) - [a + y - \tau_y(\tilde{y})]\}.
\end{aligned}$$

Note that while LTCI premiums are tax-deductible expenses, they are not covered by the means-tested insurance program. Private nursing home residents solve (13) with the extra state variable b and budget constraint

$$c + M^n + f + a' = b + a + y - \tau_y\left(\max\{0, ra - \max[0, M^n + d + \underline{c}^n - b - \kappa ra]\}\right).$$

A.5.1 LTCI Firms

LTCI companies behave competitively. However, to account for fact that LTCI policy prices are marked up substantially above actuarially fair levels we assume that a portion of LTCI premiums is used to pay administrative costs. Thus both the benefit amount \hat{b} and the premium $p(\hat{b})$ are set exogenously. We set \hat{b} such that the daily benefit amount received is \$102. This is the average daily benefit amount for nursing home care over the period 1990 to 2005 according to a study by Life Plans, Inc.³ The premium is set such that 7.6 percent of agents purchase the contract. This is the percentage of individuals 65 and over in the HRS who own a LTCI policy for at least half of the waves in which they are observed. The resulting value for $p(\hat{b})$ corresponds to an annual premium amount of \$2,158 which is slightly higher than the annual premium Brown and Finkelstein (2008) use of \$1,816 but still consistent with premium estimates in the Life Plans, Inc. study cited above.⁴ The administrative cost ϕ is then set such that the following budget constraint holds:

$$\sum_j \eta_j \int_X \mathbf{I}[b(j, x) = \hat{b}] (\mathbf{I}[l(j, x) = 0] p(b) - \mathbf{I}[l(j, x) > 0] b) d\Psi_j = \phi.$$

A.5.2 Results

We now assess the effects of adding LTCI to the benchmark economy as calibrated in Section 4. LTCI is purchased almost exclusively by the top lifetime earnings quintile, where 36.1

³Source: Life Plans, Inc. (2007). “Who buys long-term care insurance?” Prepared for: America’s Health Insurance Plans.

⁴Aside from our rudimentary modeling of the LTCI market, another reason why the model premium might be higher than premiums observed in the data is that while all agents can purchase LTCI in the model many individuals are excluded from the LTCI market in the US due to pre-existing conditions.

Table A.1: The effects of removing nursing home expense risk and publicly funding all expenses and nursing home expenses in the economy with LTCI.

<i>Medical Expenses</i>	Stochastic	OOP	Publicly funded
<i>Nursing Home Expenses</i>	Deterministic	Publicly funded	Publicly funded
Capital Stock			
Aggregate	-2.2	-4.6	-10.5
Bequests			
Aggregate	-9.0	-15.3	-23.0
Consumption			
Aggregate	-0.2	-0.4	-1.1
Welfare			
Aggregate	-1.0		
Low type	-0.9		
High type	-1.2		

All numbers are percentage change from the LTCI economy level. A proportional earnings tax is imposed to balance the government budget due to changes in tax revenues. Only the non-consumption component of nursing home care is publicly financed. ‘Low (high) type’ refers to agents with the low (high) permanent productivity type. Welfare is measured as an equivalent consumption variation — a constant percentage change in consumption of each agent at each age which makes an agent indifferent between the benchmark economy and an alternative economy. A positive welfare number indicates that the corresponding risk generates a welfare loss. Similarly, negative numbers indicate welfare benefits from the risk.

percent choose to buy it, compared to 0.1 percent of the fourth earnings quintile. The only moment of interest that is substantially affected is the fraction of nursing home expenses paid out-of-pocket: it increases from 51 to 56 percent. Thus, LTCI insurance reduces the need for Medicaid transfers to nursing home residents coming from the top lifetime earnings quintile.

Table A.1 shows the results we get when we repeat the three main experiments in our analysis in the LTCI economy: elimination of nursing home risk, public finance of nursing home expenses only and public finance of all health expenses. Effects of nursing home risk and expenses are slightly lower with LTCI, with aggregate savings and welfare effects reduced by 10 percent or less. For example, the effect of nursing home expense risk on capital is 0.2 percentage points lower (2.0 vs 2.2) while the welfare cost is 0.8 percentage points lower (0.96 vs 1.04) relative to the economy without LTCI (see Table 8). Since the economy with LTCI behaves very similarly to the benchmark economy, all of our conclusions with respect to the relative importance of nursing home risk and expenses hold in the economy with LTCI.