Online Appendix

Old, Sick, Alone and Poor: A Welfare Analysis of Old-Age Social Insurance Programs

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1 Our HRS Sample and Wealth Transitions

The principal data set used in this paper is the 1995–2010 waves of HRS and AHEAD and includes retired individuals aged 65 and above who are single or married to retired spouses. Our sample is essentially the same as that of Kopecky and Koreshkova (2014) and we refer the interested reader to that paper for more specifics on the construction of the sample. We define healthy individuals to be those who self-report their health status to be excellent, very good or good.

1.1 Wealth Transition Computations

We use the wealth variable ATOTN which is reported at the household level in the HRS. This wealth measure is the sum of the value of owned real estate (excluding primary residence), vehicles, businesses, IRA/Keogh accounts, stocks, bonds, checking/savings accounts, CDs, treasury bills and "other savings and assets," less any debt reported. To carry out an analysis of individuals, wealth is divided by two for married couples (and is left as is for single people). Additionally, irregular patterns in the dataset are fixed to eliminate spurious wealth transitions. For example, if a person has wealth > 0 in period 1, wealth $= 0$ in period 2, and wealth > 0 in period 3, the wealth in period 2 is replaced by the average of the wealth in period 1 and period 3. These patterns are present in less than 1 percent of the total number of observations. Finally, wealth is censored at -\$500 (if -\$500 $<$ wealth < 0) and at \$500 (if $0 \leq$ wealth $<$ \$500) to avoid problems of dividing by 0 or very small numbers when calculating percent changes in wealth from period to period. Wealth is reported in real terms. This is accomplished by deflating reported nominal wealth using the CPI.

For the unconditional wealth transitions, we omit most imputations of wealth performed by RAND. In particular, we only include observations where there is no imputation or wealth lies in a reported range. For the conditional wealth transitions, the resulting samples are too small if we omit the wealth imputations performed by RAND so we include all of their imputed wealth data. Their imputations of wealth only use a households current characteristics. As a result, we are concerned that some of these imputations create spurious wealth transitions. These effects are partially controlled for by the interpolation scheme we described above. To further control for these effects, we trim the top and bottom 1% of wealth transitions in each two year interval. The omitted observations do not appear to be clustered in any systematic way.

Table 1: Percentage of retired women moving from each quintile of the wealth distribution to quintile 1 two years later by marital status

	65–74 Year-olds		75–84 Year-olds		85+ Year-olds	
Quintile	**Married**	**Widowed**	**Married**	**Widowed**	**Married**	**Widowed**
1	72.5	80.0	69.6	75.9	80.2	76.1
2	17.3	22.9	17.2	20.6	28.1	28.0
3	3.4	6.5	4.4	6.9	8.1	11.5
4	1.0	1.6	1.1	2.4	3.7	6.2
5	0.4	1.1	0.3	0.5	2.6	2.8

The percentage of women moving down to quintile 1 from quintiles 2–5 in a 2-year period by marital status in the initial period. The first row is the percentage of women who stay in quintile 1. Source: Authors' computations using our HRS sample.

1.2 Additional Wealth Transitions

Table 1 has three noteworthy properties. Observe first that impoverishment increases with age among both married and widowed women. This point is clearest if one compares women aged 65-74 with those aged 85+. The probability of a transition into wealth quintile 1 is higher for those starting in each of quintiles 2-5 for women who are 85 or older. This regularity is equally apparent among married and widowed women and can also be seen if one compares women aged 75-84 with those aged 85+ instead. A second interesting property of Table 1 is that a higher percentage of widows transit to quintile 1 from each other wealth quintile as compared to married women. This pattern is robust across wealth quintiles and also across age with one exception. For 85+ year old women in the second wealth quintile, the percentage experiencing transitions to quintile 1 is about the same for married women and widows. The third property is that low wealth is more persistent for widows than married women aged 65–74 and 75–84. The percentage of quintile 1 to quintile 1 transitions for married women and widows is respectively 73% and 80% for women aged 65–74 and 70% for married versus 76% for widows in the 75–84 age group.

Table 2 reports wealth mobility transitions to the first wealth quintile for married men and widowers. Observe that the results for older men are similar to those for older women. Men aged 85+ also exhibit higher transitions into quintile 1 than men aged 65-74. However, this only occurs for those starting in wealth quintiles 3-5. Widowers have higher probabilities of impoverishment as compared to married men and the lowest wealth state is more persistent for widowers.

Poor health is also associated with higher flows into the lowest wealth quintile as Table 3 shows. Some of the differences are small, but we find it remarkable that the pattern is

Table 2: Percentage of retired men moving from each quintile of the wealth distribution to quintile 1 two years later by marital status

	65–74 Year-olds		75–84 Year-olds		85+ Year-olds	
Quintile	**Married**	**Widowed**	**Married**	**Widowed**	**Married**	**Widowed**
1	74.5	75.7	73.9	79.0	70.7	73.9
2	18.3	24.1	17.4	18.8	15.0	19.2
3	3.9	12.2	3.5	9.6	4.6	8.1
4	1.3	3.5	2.0	2.0	4.1	4.3
5	0.7	1.7	0.9	1.8	0.0	4.0

The percentage of men moving down to quintile 1 from quintiles 2–5 in a 2-year period by marital status in the initial period. The first row is the percentage of men who stay in quintile 1. Source: Authors' computations using our HRS sample.

Table 3: Percentage of retired individuals moving from each quintile of the wealth distribution to quintile 1 two years later by health status

	65–74 Year-olds		75–84 Year-olds		85+ Year-olds	
Quintile	**Healthy**	**Unhealthy**	**Healthy**	**Unhealthy**	**Healthy**	**Unhealthy**
1	69.7	80.9	70.8	79.3	67.8	73.1
2	15.6	22.6	15.1	22.1	17.7	27.5
3	3.4	5.5	3.8	7.2	7.8	8.2
4	0.9	2.2	1.3	4.1	4.1	4.7
5	0.4	1.5	0.5	1.3	1.4	2.8

The percentage of individuals moving down to quintile 1 from quintiles 2–5 in a 2-year period by health status in the initial period. The first row is the percentage of individuals who stay in quintile 1. Source: Authors' computations using our HRS sample.

consistent across quintiles and all three age groups. A report of poor health is also associated with higher persistence of low wealth. The difference is largest for the 65–74 age group and narrows a bit as individuals age.

Table 4 reports wealth mobility transitions to the first wealth quintile conditional on whether or not individuals experience a nursing home stay and Table 5 reports the transitions conditional on whether or not they experience a hospital stay. Both nursing home and hospital stays are associated with an increased frequency of transitions to quintile 1. Hospital stays have a smaller impact compared to nursing home stays but the impoverishing effect of a hospital stay is clearly discernible in Table 5. Given that acute medical expenses are transient in nature, it is not surprising at all to see a weaker pattern of impoverishment for hospital stays than nursing home stays.

Table 4: Percentage of retired individuals moving from each quintile of the wealth distribution to quintile 1 two years later conditional on having a nursing home (NH) stay

	65–74 Year-olds		75–84 Year-olds		85+ Year-olds	
Quintile	**None**	**NH Stay**	**None**	**NH Stay**	**None**	**NH Stay**
1	75.8	90.7	74.4	85.2	67.5	80.2
2	17.9	41.7	16.5	37.2	18.5	37.3
3	3.1	30.8	4.1	19.6	6.2	17.6
4	1.0	15.8	1.6	15.8	3.0	11.7
5	0.5	0.5	0.6	2.0	0.9	7.3

The percentage of individuals moving down to quintile 1 from quintiles 2–5 in a 2-year period conditional on spending at least 90 days in a nursing home during that period. The first row is the percentage of individuals who stay in quintile 1. Source: Authors' computations using our HRS sample.

Table 5: Percentage of retired individuals moving from each quintile of the wealth distribution to quintile 1 two years later conditional on whether or not they stayed overnight in a hospital

	65–74 Year-olds		75–84 Year-olds		85+ Year-olds	
Quintile	**None**	**Hospital Stay**	**None**	**Hospital Stay**	**None**	**Hospital Stay**
1	75.1	78.3	73.8	77.3	70.7	71.8
2	17.9	18.8	16.4	18.8	19.7	24.3
3	3.4	5.1	4.3	5.5	6.6	9.6
4	1.0	1.3	1.4	3.0	3.1	5.4
5	0.5	0.7	0.5	0.9	2.0	1.7

The percentage of individuals moving down to quintile 1 from quintiles 2–5 in a 2-year period conditional on an overnight hospital stay during the 2-year period. The first row is the percentage of individuals who stay in quintile 1. Source: Authors' computations using our HRS sample.

2 Additional Details on the Two-Period Model

The government budget constraint is

$$(1+r)\left[\theta y_h + (1-\theta)y_l\right]\tau = \gamma\Big\{\phi\big[\theta TR_h^b + (1-\theta)TR_l^b\big] + (1-\phi)\left[\theta TR_h^g + (1-\theta)TR_l^g\right]\Big\},$$

where TR_i^j are transfers to individuals of type $i \in \{h, l\}$ who are in state $j \in \{b, g\}$. We assume that accidental bequests are taxed and consumed by the government. This assumption is made because we want to omit the potentially large redistributional consequences of giving the bequests to survivors. Thus government consumption g is given by

$$g = (1-\gamma)(1+r)(\theta a_h + (1-\theta)a_l),$$

where a_i is the savings of agents of type i where $i \in \{h, l\}$. The aggregate resource constraint is

$$\theta c_h^y + (1-\theta)c_l^y + \gamma\left[\phi(\theta c_h^b + (1-\theta)c_l^b) + (1-\phi)\left(\theta c_h^g + (1-\theta)c_l^g\right) + \phi m\right] + g =$$
$$(1+r\tau)(\theta y_h + (1-\theta)y_l) + r(\theta a_h + (1-\theta)a_l),$$

where c_i^y is the consumption of individuals of type $i \in \{h, l\}$ when young, and c_i^j, $j \in \{b, g\}$, is their consumption when old in each medical expense state.

3 Additional Features of the Model

3.1 Evolution of the population

Let the fraction of households with health and marital status (h^m, h^f, d) at age j be denoted by $\lambda_j(h^m, h^f, d)$ and be determined as follows. First, for $j = 1, 2, 3, \ldots, R$, let $\lambda_j(g, g, 0) = 1$, and set it to 0 for all other combinations of h^m, h^f and d. Then set

$$\lambda_{R+1}(h^m, h^f, d) = \sum_{\mathbf{s}} \int_{\bar{e}^m} \Lambda_d(\bar{e}^m)\Lambda_h^m(s^m)\Lambda_h^f(s^f)\iota_R(\bar{e}^m, \mathbf{s})d\bar{e}^m,$$

where $\Lambda_d(\bar{e}^m)$ is the age-65 marital status distribution,$\Lambda_h^i(s^i)$, $i \in \{m, f\}$ are the initial distributions of health status conditional on education for males and females, and $\iota_R(\bar{e}^m, \mathbf{s})$

is the distribution of households across $(\bar{e}^m, \mathbf{s})$ at age R. Finally, set

$$\lambda_j(g,g,0) =$$
$$\lambda_{j-1}(g,g,0)\pi_j(0|g,g,0)\nu_j^m(g,0)\nu_j^f(g,0) + \lambda_{j-1}(b,g,0)\pi_j(0|b,g,0)\nu_j^m(b,0)\nu_j^f(g,0)$$
$$+\lambda_{j-1}(g,b,0)\pi_j(0|g,b,0)\nu_j^m(g,0)\nu_j^f(b,0) + \lambda_{j-1}(b,b,0)\pi_j(0|b,b,0)\nu_j^m(b,0)\nu_j^f(b,0),$$

$$\lambda_j(b,g,0) =$$
$$\lambda_{j-1}(g,g,0)\pi_j(0|g,g,0)\left(1-\nu_j^m(g,0)\right)\nu_j^f(g,0) + \lambda_{j-1}(b,g,0)\pi_j(0|b,g,0)\left(1-\nu_j^m(b,0)\right)\nu_j^f(g,0)$$
$$+\lambda_{j-1}(g,b,0)\pi_j(0|g,b,0)\left(1-\nu_j^m(g,0)\right)\nu_j^f(b,0) + \lambda_{j-1}(b,b,0)\pi_j(0|b,b,0)\left(1-\nu_j^m(b,0)\right)\nu_j^f(b,0),$$

$$\lambda_j(g,b,0) =$$
$$\lambda_{j-1}(g,g,0)\pi_j(0|g,g,0)\nu_j^m(g,0)\left(1-\nu_j^f(g,0)\right) + \lambda_{j-1}(b,g,0)\pi_j(0|b,g,0)\nu_j^m(b,0)\left(1-\nu_j^f(g,0)\right)$$
$$+\lambda_{j-1}(g,b,0)\pi_j(0|g,b,0)\nu_j^m(g,0)\left(1-\nu_j^f(b,0)\right) + \lambda_{j-1}(b,b,0)\pi_j(0|b,b,0)\nu_j^m(b,0)\left(1-\nu_j^f(b,0)\right),$$

$$\lambda_j(b,b,0) =$$
$$\lambda_{j-1}(g,g,0)\pi_j(0|g,g,0)\left(1-\nu_j^m(g,0)\right)\left(1-\nu_j^f(g,0)\right)$$
$$+\lambda_{j-1}(b,g,0)\pi_j(0|b,g,0)\left(1-\nu_j^m(b,0)\right)\left(1-\nu_j^f(g,0)\right)$$
$$+\lambda_{j-1}(g,b,0)\pi_j(0|g,b,0)\left(1-\nu_j^m(g,0)\right)\left(1-\nu_j^f(b,0)\right)$$
$$+\lambda_{j-1}(b,b,0)\pi_j(0|b,b,0)\left(1-\nu_j^m(b,0)\right)\left(1-\nu_j^f(b,0)\right),$$

$$\lambda_j(h^m,b,1) =$$
$$\lambda_{j-1}(g,g,0)\pi_j(1|g,g,0)\left(1-\nu_j^f(g,0)\right) + \lambda_{j-1}(b,g,0)\pi_j(1|b,g,0)\left(1-\nu_j^f(g,0)\right)$$
$$+\lambda_{j-1}(g,b,0)\pi_j(1|g,b,0)\left(1-\nu_j^f(b,0)\right) + \lambda_{j-1}(b,b,0)\pi_j(1|b,b,0)\left(1-\nu_j^f(b,0)\right)$$
$$+\lambda_{j-1}(h^m,b,1)\pi_j^f(b,0)\left(1-\nu_j^f(b,0)\right) + \lambda_{j-1}(h^m,g,1)\pi_j^f(g,0)\left(1-\nu_j^f(g,0)\right),$$

$$\begin{gathered}\lambda_j(h^m,g,1)= \\ \lambda_{j-1}(g,g,0)\pi_j(1|g,g,0)\nu_j^f(g,0)+\lambda_{j-1}(b,g,0)\pi_j(1|b,g,0)\nu_j^f(g,0) \\ +\lambda_{j-1}(g,b,0)\pi_j(1|g,b,0)\nu_j^f(b,0)+\lambda_{j-1}(b,b,0)\pi_j(1|b,b,0)\nu_j^f(b,0) \\ +\lambda_{j-1}(h^m,b,1)\pi_j^f(b,0)\nu_j^f(b,0)+\lambda_{j-1}(h^m,g,1)\pi_j^f(g,0)\nu_j^f(g,0),\end{gathered}$$

$$\begin{gathered}\lambda_j(b,h^f,2)= \\ \lambda_{j-1}(g,g,0)\pi_j(2|g,g,0)\left(1-\nu_j^m(g,0)\right)+\lambda_{j-1}(b,g,0)\pi_j(2|b,g,0)\left(1-\nu_j^m(b,0)\right) \\ +\lambda_{j-1}(g,b,0)\pi_j(2|g,b,0)\left(1-\nu_j^m(g,0)\right)+\lambda_{j-1}(b,b,0)\pi_j(2|b,b,0)\left(1-\nu_j^m(b,0)\right) \\ +\lambda_{j-1}(b,h^f,2)\pi_j^m(b,0)\left(1-\nu_j^m(b,0)\right)+\lambda_{j-1}(g,h^f,2)\pi_j^m(g,0)\left(1-\nu_j^m(g,0)\right),\end{gathered}$$

and

$$\begin{gathered}\lambda_j(g,h^f,2)= \\ \lambda_{j-1}(g,g,0)\pi_j(2|g,g,0)\nu_j^m(g,0)+\lambda_{j-1}(b,g,0)\pi_j(2|b,g,0)\nu_j^m(b,0) \\ +\lambda_{j-1}(g,b,0)\pi_j(2|g,b,0)\nu_j^m(g,0)+\lambda_{j-1}(b,b,0)\pi_j(2|b,b,0)\nu_j^m(b,0) \\ +\lambda_{j-1}(b,h^f,2)\pi_j^m(b,0)\nu_j^m(b,0)+\lambda_{j-1}(g,h^f,2)\pi_j^m(g,0)\nu_j^m(g,0).\end{gathered}$$

It follows that the fraction of households that are age j is given by

$$\eta_j=\frac{\eta_{j-1}}{1+n}\sum_{h^m}\sum_{h^f}\sum_{d}\lambda_j(h^m,h^f,d),\ \text{for } j=2,3,...,J,$$

where η_1 is set such that

$$\sum_{j=1}^{J}\eta_j=1.$$

3.2 Distribution of Education

We use x_s^i to denote the fraction of individuals of gender $i\in\{m,f\}$ with either high school or college educational attainment $s\in\{hs,col\}$. The distribution of households across education types $\mathbf{s}\equiv(s^m,s^f)$ is $\Gamma_{\mathbf{s}}$.

3.3 Marital Status Transition Probabilities

During retirement, households face uncertainty about their members' health and survival, and household medical expenses. An individual's health status, h^i, takes on one of two values:

good ($h^i = g$) and bad ($h^i = b$). The probability of having good health next period, $\nu_j^i(h, d)$, depends on age, gender, current health status and marital status. The initial distribution of health status, $\Gamma_h^i(s^i)$, depends on education. We denote a household's health status by $\mathbf{h} \equiv (h^m, h^f)$. The probability of an individual surviving to age $j+1$ conditional on surviving to age j is given by $\pi_j^i(h, d)$ and depends on age, gender, health status and marital status. Household marital status changes as individual household members die. Let $\pi_j(d'|\mathbf{h}, d)$ denote the probability of marital status d' at age $j+1$ for an age-j household with health status $\mathbf{h}$ and marital status d. The probabilities are given by

	$d' = 0$	$d' = 1$	$d' = 2$
$d = 0$	$\pi_j^m(h^m, 0)\pi_j^f(h^f, 0)$	$\left[1 - \pi_j^m(h^m, 0)\right] \pi_j^f(h^f, 0)$	$\pi_j^m(h^m, 0)\left[1 - \pi_j^f(h^f, 0)\right]$
$d = 1$	0	$\pi_j^f(h^f, 1)$	0
$d = 2$	0	0	$\pi_j^m(h^m, 2)$

3.4 Medical Expenses Transition Probabilities

Household-level medical and long-term care expenses evolve stochastically according to the function $\Phi(j, \mathbf{h}, \boldsymbol{\varepsilon_M}, d, d')$ that depends on household age j, household health status $\mathbf{h}$, the vector of medical expense shocks $\boldsymbol{\varepsilon_M} \equiv (\varepsilon_m^p, \varepsilon_m^t)$, marital status d, and death year, captured by the change in the marital status ($d \neq d'$).[1] The first medical expense shock follows an age-invariant Markov process with transition probabilities $\Lambda_{MM'}$ and initial distribution Γ_{M_p}. The largest realization of this persistent medical expense shock is a nursing home event and is denoted by $\bar{\varepsilon}_m^p$. The second shock is a transient, *iid* shock with probability distribution Γ_{M_t}.

3.5 Definition of Equilibrium

For the purposes of defining an equilibrium in a compact way, we suppress the household state into a vector (j, x), where

$$x = \begin{cases} x_W \equiv (a, \bar{\mathbf{e}}, \boldsymbol{\varepsilon_e}, \mathbf{s}), & \text{if } 1 \leq j \leq R, \\ x_R \equiv (a, \bar{\mathbf{e}}, \mathbf{h}, \boldsymbol{\varepsilon_M}, d, d'), & \text{if } R < j \leq J. \end{cases}$$

Accordingly, we redefine value functions, decision rules, income taxes, means-tested transfers and SS benefits to be functions of the household state (j, x): $V^W(j, x)$, $V^R(j, x)$, $c(j, x)$,

[1]The assumption that medical expense shocks are household level is made for reasons of tractability.

$a'(j,x)$, $l_f(j,x_W)$, $l_m(j,x_W)$, $T_y(x)$, $Tr(j,x)$ and $S(x_R)$. Define the household state spaces:

$$X_W \subset [0,\infty) \times [0,\infty) \times [0,\infty) \times \{(hs,hs),(hs,col),(col,hs),(col,col)\},$$
$$X_R \subset [0,\infty) \times [0,\infty) \times \{(g,g),(b,g),(g,b),(b,b)\} \times [0,\infty) \times \{0,1,2\} \times \{0,1,2\}.$$

and denote by $\Xi(X)$ the Borel σ-algebra on $X \in \{X_W, X_R\}$. Let $\Psi_j(X)$ be a probability measure of age-j households with state $x \in X$. Note that these households constitute a fraction $\eta_j \Psi_j(X)$ of the total number of households.

DEFINITION. Given a fiscal policy $\{S(\bar{\mathbf{e}},d), \tau_c, \tau_{mc}(e), \tau_{ss}(e), T_y(x), \underline{a}^d, \underline{c}^d, \underline{y}^d, \kappa\}$ and a real interest rate r, a steady-state competitive equilibrium consists of household policies $\{c(j,x), a'(j,x), l_f(j,x), l_m(j,x)\}_{j=1}^J$ and associated value functions $\{V^W(j,x)\}_{j=1}^R$, $\{V^R(j,x)\}_{j=R+1}^J$, government purchases and prices $\{G,w\}$, per capita capital stocks $\{\bar{K}, K\}$ and an invariant distribution $\{\Psi_j\}_{j=1}^J$ such that

1. At the given prices and taxes, the household policy functions $c(j,x)$, $a'(j,x)$, $l_f(j,x)$ and $l_m(j,x)$ achieve the value functions.

2. At the given prices, firms are on their input demand schedules: $w = F_L(K,L)$ and $r = F_K(K,L) - \delta$.

3. Aggregate domestic savings are given by $\sum_j \eta_j \int_X a'(j,x) d\Psi_j = (1+n)\bar{K}$.

4. Markets clear:

   (a) Goods $\sum_j \eta_j \int_X c(j,x) d\Psi_j + (1+n)\bar{K} + \tilde{M} + G = F(K,L) + (1-\delta)\bar{K} + (r+\delta)(\bar{K} - K)$, where $\tilde{M} = \sum_{j=R}^J \eta_j \int_{X_R} \Phi(j, \mathbf{h}, \boldsymbol{\varepsilon_M}, d, d') d\Psi_j$.

   (b) Labor: $\sum_j \eta_j \int_X \{(1 - l_f(j,x))\Omega^f(j, \boldsymbol{\varepsilon_e}, s^f) +$
   $(1 - l_m(j,x)\mathbf{I}_{j \geq \bar{j}} - \bar{l}\mathbf{I}_{j<\bar{j}})\Omega^m(j, \boldsymbol{\varepsilon_e}, s^m)\} \, d\Psi_j = L.$

5. Distributions of households are consistent with household behavior:

$$\Psi_{j+1}(X_0) = \int_{X_0} \left\{ \int_X Q_j(x,x') \mathbf{I}_{j'=j+1} d\Psi_j \right\} dx',$$

   for all $X_0 \in \Xi$, where $\mathbf{I}$ is an indicator function and $Q_j(x,x')$ is the probability that a household of age j and current state x transits to state x' in the following period.

6. The government's budget is balanced:

$$IncomeTaxes + CorporateTaxes + MedicareTaxes + PayrollTaxes =$$
$$SSbenefits + Transfers + G$$

where income tax revenue is given by

$$IncomeTaxes = \sum_{j=1}^{J} \eta_j \int_X T_y(x) d\Psi_j,$$

corporate profits tax revenue is

$$CorporateTaxes = \sum_{j=1}^{R} \eta_j \int_{X_W} \tau_c r a(j,x) d\Psi_j,$$

Medicare tax revenue is

$$MedicareTaxes = \sum_{j=1}^{R} \eta_j \int_{X_W} \left\{ \tau_{mc}\left(e^m(j,x)\right) e^m(j,x) + \tau_{mc}\left(e^f(j,x)\right) e^f(j,x) \right\} d\Psi_j,$$

payroll tax revenue is

$$PayrollTaxes = \sum_{j=1}^{R} \eta_j \int_{X_W} \left\{ \tau_{ss}\left(e^m(j,x)\right) e^m(j,x) + \tau_{ss}\left(e^f(j,x)\right) e^f(j,x) \right\} d\Psi_j$$

SS benefits are

$$SSbenefits = \sum_{j=R+1}^{J} \eta_j \int_{X_R} S(x) d\Psi_j$$

and means-tested transfer payments are

$$Transfers = \sum_{j=1}^{J} \eta_j \int_X Tr(j,x) d\Psi_j.$$

3.6 Computational Algorithm

The steps in computing the equilibrium of the baseline economy are as follows. First, a guess of average earnings is made. From this guess, a guess on average household income is derived. Second, individual maximization problems are solved. Agents' problems in the last period of their lives are solved first, followed by the previous period, up to the first period. To this end, the state space is discretized and optimal assets and labor supply are found via grid search. Value functions are constructed using piecewise linear interpolation. The grids for assets and average lifetime earnings consist of 100 and 10 nonlinearly-spaced points, respectively. Increases in these grid sizes does not significantly change the solution. Female labor supply is chosen from an evenly-spaced grid of 10 points. Third, the distribution of the population over the discrete state is computed using forward iteration. Finally, average earnings and average household income are updated. This procedure is iterated on until both average earnings and average household income converge. The government budget constraint is cleared by setting government spending to the residual.

The algorithm to compute counterfactual economies is similar. The main difference is that, in addition to average earnings and average household income, the tax rate used to clear the government budget constraint is also iterated on while government spending as a fraction of output is held fixed at the baseline economy level.

4 Calibration Details

4.1 Stochastic Structure of Medical expenses

When calibrating the five state Markov process of medical expense shocks, we allow one of the states to be associated with nursing home stays. We set the fifth state to reproduce the average annual cost of a nursing home stay for a Medicaid recipient. This cost is $33,500 in year 2000 dollars and includes both the cost of care and the cost of room and board.[2] We focus on Medicaid recipients because it allows us to decompose this expense into a consumption and medical expense component. In particular, for these individuals, the consumption component is given by $\underline{c}$. One way to assess this calibration is to consider the situation of a private payer. Under the assumption that 1/2 of total consumption is room and board for nursing home care, total average nursing home expenses for a private payer in the model are about $70,000 per year in year 2000 dollars. For purposes of comparison the average annual cost of a semi-private room was $60,000 in 2005 and the cost of a private room was $75,000 in 2005 according to the Metlife Market Survery of Nursing Home and Assisted Living Costs.

The probabilities of a nursing home stay are assumed to vary with age. We estimate the transition probabilities in and out of this state using the following targets. The probabilities of entry into the nursing home state are chosen to match the distribution of age of first nursing

[2]This number is based on Medicaid per diem rates in Meyer (2001).

home entry for individuals aged 65 and above. This distribution is taken from Murtaugh, Kemper, Spillman and Carlson (1997). They find that 21% of nursing home stayers have their first entry between ages 65–74, 46% between ages 75–84, and 33% after age 85. The probabilities of exiting the nursing home state are chosen to match the average years of nursing home stay over their lifetime organized by age of first entry. We limit attention to stays of at least 90 days because we want to focus on true long-term care expenses. Murtaugh et al. (1997) do not report the figures we need. However, we are able to impute these durations by combining data they provide with data from Liu, McBride and Coughlin (1994). The specific targets are as follows. For those who had a first entry between 65-74, the average duration of all nursing home stays is 3.9 years. For those whose first entry is between the ages of 75-84 the average duration is 3.2 years and for those with first entry after age 85 the average duration is 2.9 years.

The above targets are all conditional on a nursing home entry. In order to estimate the unconditional probability of a nursing home entry, we target the probability that a 65 year old will enter a nursing home before death for a long term stay. That probability is 0.295 and is imputed using data from the two sources above.

In order to hit these targets, as well as the French and Jones (2004) AR(1) targets, we use a simulated method of moments procedure that does a bias correction for the well known downward bias in estimated AR(1) coefficients.

4.2 Preferences

We set $\beta = 0.944$ to obtain a wealth to earnings ratio in the model of 3.2. This is the wealth to earnings ratio for the bottom 95 percent of the wealth distribution in the US and the same target used by Hong and Ríos-Rull (2007). Following the macro literature, we set σ equal to 2.0.[3] The degree of joint consumption is governed by χ. We set χ to 0.67 following Attanasio, Low and Sanchez-Marcos (2008).

We set γ, the leisure exponent for females to 2. This is the baseline value used by Erosa, Fuster and Kambourov (2014). This choice in conjunction with steady-state hours worked implies a theoretical Frisch-elasticity of 2.43. This choice implies that the correlation between the year-on-year growth rate of the husbands wages and the corresponding growth rate of the wive's hours worked is -0.34 in our model. For purposes of comparison, the model of Heathcote et al. (2010) produces a correlation of -0.11 for the same statistic.

We allow $\psi(\mathbf{s})$ to vary with the education level of each household member. The targets, taken from McGrattan and Rogerson (2007), are average female hours by educational attain-

[3] See for example Castañeda, Díaz-Giménez and Ríos-Rull (2003), Heathcote, Storesletten and Violante (2010) and Storesletten, Telmer and Yaron (2004).

ment of both household members. Expressed as a fraction of a total time endowment of 100 hours per week, they are 0.16 for high-school-educated households, 0.17 for households where the female has a high-school degree and her spouse has a college degree, 0.24 for households where the female has a college degree and her husband has a high-school degree, and 0.21 for college-educated households. The corresponding parameter values are 3.5, 1.7, 2.25, and 1.7.

Our general strategy for calibrating the preferences for leisure is to choose them to reproduce differences in hours and employment for different types of married individuals over the lifecycle. We do not use any business cycle observations as targets because our model period is 2 years and thus too long to analyze business cycle moments. The parameters that govern the extent of disutility the household experiences if the female or older male is participating in the labor market, $\phi_f(\mathbf{s})$ and $\phi_m(\mathbf{s})$, also vary with education. The targets for $\phi_f(\mathbf{s})$, taken from Kaygusuz (2010), are female participation rates by educational attainment of each household member. The participation rates are for married females aged 50 to 59. For high-school-educated households the rate is 0.48. For households with high-school-educated females and college-educated males the rate is 0.45. For households with college-educated females and high-school-educated males the rate is 0.68 and for college-educated households the rate is 0.58. The corresponding parameter values are 0.21, 0.16, 0.11, and 0.11. The targets for $\phi_m(\mathbf{s})$ are the participation rates by educational attainment of each household member for married males aged 55 to 64. For high-school-educated households the rate is 0.68. For households with high-school-educated females and college-educated males the rate is 0.77. For households with college-educated females and high-school-educated males the rate is 0.72 and for college-educated households the rate is 0.82. The corresponding parameter values are 1.33, 0.94, 0.71, and 0.59. The targets for all these parameters are based on IPUMS data from the 1980 and 1990 U.S census.

4.3 Technology

Consumption goods are produced according to a production function,

$$F(K, L) = AK^{\alpha}L^{1-\alpha},$$

where capital depreciates at rate δ. The parameters α and δ are set using their direct counterparts in the U.S data: a capital income share of 0.3 and an annual depreciation rate of 7% (Gomme and Rupert, 2007). The parameter A is set such that the wage per efficiency unit of labor is normalized to one under the baseline calibration.

4.4 Earnings Process

The basic strategy for calibrating the labor productivity process follows Heathcote et al. (2010) who also consider earnings for married households. We assume that college graduates begin their working career four years later than high school graduates. The specific form of the labor productivity process is:

$$\log \Omega^i(j, \epsilon_e, s^i) = \alpha_1 \mathbf{I}(s^i = col) + \alpha_2 \mathbf{I}(i = f) + \beta_1 j + \beta_2 j^2 + \beta_3 j^3 + \epsilon_e^i,$$

where α_1 and α_2 are intercepts that capture the college premium and the gender gap. The β's determine the experience premium. The specific values of these parameters are $\alpha = 4.96 \times 10^{-1}$, $\alpha_2 = -4.78 \times 10^{-1}$, $\beta_1 = 4.80 \times 10^{-2}$, $\beta_2 = -8.06 \times 10^{-4}$ and $\beta_3 = -6.46 \times 10^{-7}$. All these values are taken from Heathcote et al. (2010).

Following Heathcote et al. (2010), we assume that females and males face a persistent productivity shock process. In particular, ϵ_e^i is assumed to follow an AR(1) process with a serial correlation coefficient of $\epsilon_e^i = 0.973$ and a standard deviation of 0.01. We allow the innovation to earning productivity to be correlated with the spouse's innovation. Heathcote et al. (2010) choose this correlation to reproduce a targeted correlation of male wage growth and female wage growth of 0.15. We set the correlation of the earnings innovations to match this same target. The resulting correlation between the two earnings innovations is 0.05.

Heathcote et al. (2010) also allow for a transient shock to labor productivity. We abstract from this second shock. This reduces the size of the state space for working households and allows us to model the problem of retirees in more detail.

The distribution of initial productivity levels Γ_e is assumed to be bivariate normal with a standard deviation of 0.352, a correlation of 0.517 and a gender productivity gap of 0.62 in 1970. All of these targets are taken from Heathcote et al. (2010) and apply to males and females.[4]

One difference between us and Heathcote et al. (2010) is that we allow for an earnings state that has a much lower level of earnings as compared to what Gaussian quadrature methods would imply. See Section 5.2 of the paper for more details.

[4]Specifications similar to this have been used by Attanasio et al. (2008) and Heathcote, Storesletten and Violante (2008) to model the joint earnings of married couples.

4.5 Progressive Income Tax Formula

The effective progressive income tax formula is given by:

$$\tau^y(y^{disp}, d) = \left[\eta_1^d + \eta_2^d \log\left(\frac{y^{disp}}{\bar{y}}\right)\right] y^{disp} \tag{1}$$

where y^{disp} is disposable household income, $\bar{y}$ is mean income in the economy. Guner, Kaygusuz and Ventura (2012) estimate $\eta_1^0 = 0.113$ and $\eta_2^0 = 0.073$ for married households and $\eta_1^{d\in\{1,2\}} = 0.153$ and $\eta_2^{d\in\{1,2\}} = 0.057$ for single households. We shift the income tax formula down by 0.07 to match income tax revenue as a fraction of GDP in the model and the data.

The U.S. Federal tax code allows tax-filers a deduction for medical expenses that exceed 7.5% of income. Our income tax schedules indirectly account for deductions when estimating effective tax functions. However, their effective tax functions are averages across many households and do not capture the full benefit of this deduction to those who experience large medical expense shocks such as long-term care. We allow for a deduction for medical expenses that exceed 7.5% of income.

U.S. Federal tax code provides for an exemption of SS benefits. This exemption is phased out in two stages as income rises. Table 6 reports exemption thresholds and minimum income levels by marital status. The left column of Table 6 reports the actual dollar amounts in the year 2000. The right column expresses these figures as a fraction of average earnings of full-time, prime-age male workers. According to our source, the thresholds and minimum income are not indexed to inflation or wage growth.

We use these thresholds to compute the exemptions formulas in the following way. We start by calculating provisional income, Y, which is defined as asset income,Y^a, plus half of the household's SS income, Y^{ss}. If $Y < T_i^1, i \in \{s, m\}$, there is a full exemption for SS benefits and taxable income for that household is equal to Y^a net of the medical expense tax deduction. If $T_i^1 < Y < T_i^2, i \in \{s, m\}$, taxable income is given by

$$Y^a + 0.5\min(Y^{ss}, Y - T_i^1),$$

net of the medical expense tax deduction if eligible. If $Y > T_i^2, i \in \{s, m\}$, then taxable income is given by

$$Y^a + \min\left\{0.85Y^{ss}, 0.85\left[Y - T_i^2 + \min(\underline{Y}_i, 0.5Y_i^{ss})\right]\right\},$$

net of medical expense tax deduction if eligible.

Table 6: Exemption thresholds and minimum income levels for taxation of social security benefit income

Description	Levels ($)	% of ave. earnings
Threshold 1		
Single (T_s^1)	25,000	53
Married (T_m^1)	32,000	67
Threshold 2		
Single (T_s^2)	34,000	72
Married (T_m^2)	44,000	93
Minimum income		
single ($\underline{Y}_s$)	4,500	9
married ($\underline{Y}_m$)	6,000	13

Source: Scott, C. and J. Mulvey (2010). "Social Security: Calculation and History of Taxing Benefits", *Congressional Research Service.*

Table 7: Average Tax Rates in the Baseline Economy

Overall	0.108		
By male permanent earnings quintile:		*By household education type (female, male):*	
1	0.032	high school, high school	0.087
2	0.053	high school, college	0.140
3	0.075	college, high school	0.109
4	0.111	college, college	0.150
5	0.166		

The average income tax rate and average tax rates by household education type and male permanent earnings quintile in the model under the baseline calibration.

The average income tax rate under our baseline calibration is shown in Table 7. The table also shows how the average income tax rate varies by male permanent earnings quintile and household education type. Average tax rates are higher for higher income households.

4.6 Social Security Benefits

The U.S. Social Security system links a worker's benefits to an index of the worker's average earnings, $\underline{e}$. Benefits are adjusted to reflect the annual cap on contributions and there is also some progressivity built into the U.S. Social Security system. We use the following formula to link contributions to benefits for an individual

$$\hat{S}(\bar{e}) = \begin{cases} s_1\bar{e}, & \text{for } \bar{e} \le \tau_1, \\ s_1\tau_1 + s_2(\bar{e} - \tau_1), & \text{for } \tau_1 \le \bar{e} \le \tau_2, \\ s_1\tau_1 + s_2(\tau_2 - \tau_1) + s_3(\bar{e} - \tau_2), & \text{for } \tau_2 \le \bar{e} \le \tau_3, \\ s_1\tau_1 + s_2(\tau_2 - \tau_1) + s_3(\tau_3 - \tau_2), & \text{for } \bar{e} \ge \tau_3. \end{cases}$$

Following the Social Security administration, we set the marginal replacement rates, s_1, s_2, and s_3 to 0.90, 0.33, and 0.15, respectively. The threshold levels, τ_1, τ_2, and τ_3, are set to 20%, 125% and 246% of average earnings for all workers. The U.S. Social Security system also provides spousal and survivor benefits. We model these benefits. Household benefits are determined using the following formula

$$S(\bar{\mathbf{e}}, d) = \begin{cases} \hat{S}\left(\max\limits_{i\in\{m,f\}}\{\bar{e}^i\}\right) + \max\left\{0.5\hat{S}\left(\max\limits_{i\in\{m,f\}}\{\bar{e}^i\}\right), \hat{S}\left(\min\limits_{i\in\{m,f\}}\{\bar{e}^i\}\right)\right\}, & \text{if } d = 0, \\ \max\left\{\hat{S}\left(\bar{e}^m\right), \hat{S}\left(\bar{e}^f\right)\right\}. & \text{if } d \in \{1,2\}. \end{cases}$$

4.7 MTSI Income and Asset Thresholds

The MTSI income and asset thresholds for married and single households are based on the average income and asset thresholds of Qualified Income Medicaid beneficiaries in the U.S. We use the Qualified Income Medicaid thresholds because they are the least stringent and we want to include all types of Medicaid beneficiaries in our MTSI program. The average income and asset thresholds are constructed by taking a weighted average of the state-specific thresholds where the weights are the population size of the state. The state-specific Qualified Income thresholds are taken from the Kaiser Commission on Medicaid and the Uninsured, "Medicaid Financial Eligibility: Primary Pathways for the Elderly and People with Disabilities," (February, 2010).

5 Other Model Assessment Results

5.1 Medicaid Flows

Another implication of the model that was not targeted is flows into Medicaid. Table 8 reports flows into Medicaid by age and marital status. Observe that in the data, the flows into Medicaid are much lower for married than singles. Moreover, the flows increase monotonically with age for married but follow a U-shaped pattern for singles. Model flows into Medicaid reproduce almost all of these features of the data.

Table 8: Bi-annual Flows into Medicaid by Age and Marital Status

Age	65–74	75–84	85+
Married			
data	0.028	0.029	0.043
model	0.017	0.031	0.037
Widows			
data	0.065	0.055	0.088
model	0.079	0.061	0.058
Widowers			
data	0.077	0.066	0.090
model	0.057	0.049	0.056

The flows are the fraction of retirees with given initial marital status not receiving Medicaid but who become recipients over the next two years. Data source: Authors' computations using our HRS sample.

5.2 Other Wealth Transitions

Table 9 indicates that the model is in reasonably good accord with the data with respect to both wealth transitions conditional on widowhood for men and medical expenses. First, observe that widowers of all ages face a higher probability and a higher persistence of low wealth compared to married men. One way to compare the effects of medical expenses is to interpret the second highest draw of the medical expense shock in the model as a hospital stay. Notice that, with this interpretation, hospital stays increase the likelihood and persistence of low wealth in the model as in the data. We do not read much into these statistics from the model for the 85+ widowers because the sample size for this group in our model simulated data is extremely small.

Table 9: Additional conditional transitions into and persistence of low wealth statistics

	Model			Data		
Cohort	65–74	75–84	85+	65–74	75–84	85+
Marital Status (Men)						
married	1.10	3.24	5.83	6.08	5.93	5.90
widower	4.05	5.14	32.96	10.36	8.05	8.89
Hospital						
no hospital stay	3.71	5.60	6.28	5.71	5.67	7.87
hospital stay	7.86	14.21	18.69	6.47	7.04	10.25
Marital Status (Men)						
married	87.2	74.6	26.4	74.5	73.9	70.7
widower	97.5	89.9	100	75.7	79.0	73.9
Hospital						
no hospital stay	78.1	66.5	67.7	75.1	73.1	70.7
hospital stay	96.3	90.6	67.1	78.3	77.3	71.8

The upper-panel numbers are the percentage of individuals in wealth quintiles 2–5 who move to quintile 1 two years later conditional on their initial status. The lower-panel numbers are the percentage of individuals in wealth quintile 1 who are still in quintile 1 two years later conditional on their initial status. Wealth quintiles are determined from an individual wealth distribution specific to each age group. Married individuals are assigned half of the household wealth.

6 Additional Tables

Table 10 shows how aggregate variables change when MTSI is removed from the 'No Medical Expenses' baseline and the 'No Earnings Risk' baseline.

Table 10: Aggregate variables in 'No Medical Expenses' economies and 'No Earnings Risk' economies with and without MTSI

	No Medical Expenses		No Earnings Risk	
	Baseline	No MTSI	Baseline	No MTSI
Output	1.00	1.01	1.00	1.05
Consumption	0.68	0.69	0.71	0.75
Wealth	2.55	2.69	1.97	2.73
Tax Revenue Relative to Output	0.20	0.14	0.17	0.13
Aggregate Labor input	1.00	1.00	1.00	1.01
Older Male Labor-Force Part.	0.70	0.69	1.00	1.00
Female Labor-Force Part.	0.50	0.50	0.47	0.54
Working Females' Hours	0.33	0.33	0.20	0.19

Results are reported for the baseline economy with no medical expenses, the baseline economy with no medical expenses when MTSI is at the 'no MTSI' level, the baseline economy with no earnings risk, and the baseline economy with no earnings risk when MTSI is at the 'no MTSI' level. The numbers in the first four rows for each pair of economies are normalized by output in the respective baseline. The numbers in the fifth row are normalized by aggregate labor input in each respective baseline. All flows are annualized. The measure of output is GNP.

7 Additional Figures

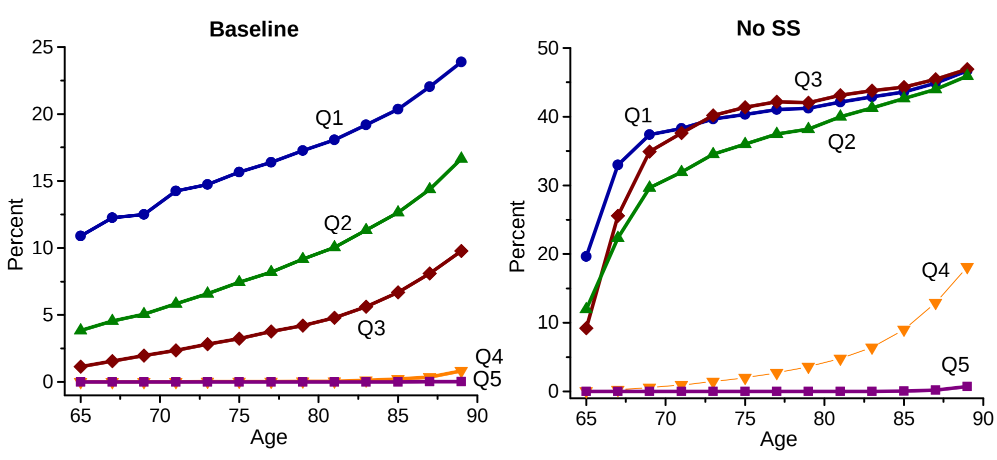

Figure 1: MTSI recipiency rates of retirees in the baseline economy and the baseline economy without SS.

Table 11: Welfare effects of removing MTSI under different assumptions about the alternative consumption floor

Economy	Baseline $\underline{c} = 1.1\text{e-}5$	$\underline{c} = 1.1\text{e-}4$	$\underline{c} = 0.0011$	$\underline{c} = 0.011$
Welfare				
Ex-ante	-4.3	-2.8	-1.7	-0.67
By male permanent earnings:				
quintile 1	-7.0	-4.9	-3.2	-1.8
quintile 2	-4.9	-3.3	-2.1	-0.99
quintile 3	-3.9	-2.5	-1.5	-0.54
quintile 4	-3.0	-1.8	-0.9	-0.12
quintile 5	-1.2	-0.41	0.20	0.70
By household education type (female, male):				
high school, high school	-5.4	-3.7	-2.3	-1.2
high school, college	-2.3	-1.1	-0.21	0.49
college, high school	-1.7	-0.96	-0.34	0.17
college, college	0.0	0.52	0.90	1.2
No MTSI				
percent of retirees at floor	0.07	0.34	2.5	2.6

The welfare effects of replacing MTSI in the baseline economy with the 'no MTSI' consumption floor (first column) and consumption floors that are 10 (second column), 100 (third column) and 1000 (fourth column) times larger than the 'no MTSI' floor. The last row of the table shows the percent of retirees at the floors when MTSI is not available. The consumption floor values are expressed here as a fraction of average male earnings.

The left panel of Figure 1 shows the MTSI recipiency rates in the baseline economy. The right panel shows the same rates in the economy without SS. These rates were used to construct the changes in recipiency rates shown in Figure 6 in the paper.

8 Additional Robustness Experiments

Table 11 shows that our result that MTSI is welfare-enhancing is robust to the setting of the 'no MTSI' consumption floor and income thresholds. The table reports the welfare effects of removing MTSI under alternative assumptions about the level of this floor. In each scenario, the income thresholds are adjusted down proportionately. Ex-ante welfare of a newborn household falls even when the floor guaranteed when formal MTSI is absent is increased by a factor of 1000 relative to the baseline value. In addition, most types of households continue to experience a welfare loss.

We have posited a non-Gaussian process for earnings. In particular, we have included a low earnings state that helps us reproduce the left tail of the earnings distribution. In

Table 12: Welfare effects of removing MTSI under different model assumptions

Economy	Baseline	HS only shock	NH not med. needy
Ex-ante	-4.3	-4.2	-4.3
By household education type (female, male):			
high school, high school	-5.4	-5.6	-5.4
high school, college	-2.3	0.69	-2.2
college, high school	-1.7	-1.9	-1.7
college, college	0.0	1.8	0.08

The welfare effects of replacing MTSI with the 'no MTSI' consumption floor in the baseline economy (first column), an economy where only high-school-educated males can get the low-earnings shock (second column) and an economy where households that get the nursing home shock are not only eligible for MTSI through the medically-needy pathway (third column).

the baseline model this shock hits all households with equal probability. For retirees in the HRS this was a reasonable assumption. However, in more recent cohorts the poverty rate of high-school educated individuals relative to college-educated individuals has doubled.[5] The second column of Table 12 illustrates how the welfare effects of removing MTSI change when the low earnings shock is assumed to hit households with high-school-educated males only. The ex-ante welfare benefits of MTSI are smaller and there is now disagreement among households. Households with college-educated males now prefer the economy with the 'no MTSI' consumption floor to the one with MTSI.[6]

In the baseline economy we assume that residents can only qualify for MTSI via the medically needy path. The final column of the same table shows how the welfare results change when we assume that they can qualify for MTSI via either path. Notice that the welfare results are essential identical to those of the baseline. This economy is of interest because nursing home stays are less persistent in this economy as compared to the baseline as Table 13 shows.

[5] Pew Research Center (2014) "The Rising Cost of Not Going to College"

[6] Notice that the welfare rankings also change. In the baseline economy, the households with high-school-educated females value MTSI the most as it is more costly for these households to self-insure by increasing female labor supply when MTSI is removed. However, once college males no longer face the risk of incurring the low-income shock, households with high-school-educated females and college-educated males value MTSI much less.

Table 13: Conditional transitions into and persistence of low wealth

	Baseline			NH not med. needy			Data		
Cohort	65–74	75–84	85+	65–74	75–84	85+	65–74	75–84	85+
Transitions to Quintile 1									
no NH stay	4.35	6.21	6.12	5.23	7.86	9.43	5.79	5.67	7.16
NH stay	7.57	17.22	27.86	7.79	9.92	12.7	23.19	18.64	18.49
Persistence of Quintile 1									
no NH stay	82.2	71.9	58.9	78.9	67.9	59.9	75.8	74.4	67.5
NH stay	97.6	99.9	99.2	80.7	73.9	66.4	90.7	85.2	80.2

The upper (lower) panel numbers are the percentage of individuals in wealth quintiles 2–5 who move to (stay in) quintile 1 two years later conditional on nursing home status. Wealth quintiles are determined from an individual wealth distribution specific to each age group. Married individuals are assigned half of the household wealth.

References

ATTANASIO, A., H. LOW AND V. SANCHEZ-MARCOS, "Explaining Changes in Female Labor Supply in a Life-Cycle Model," *American Economic Review* 98 (2008), 1517–52.

CASTAÑEDA, A., J. DÍAZ-GIMÉNEZ AND J.-V. RÍOS-RULL, "Accounting for the US Earnings and Wealth Inequality," *Journal of Political Economy* 111 (2003), 818–857.

EROSA, A., L. FUSTER AND G. KAMBOUROV, "Towards a Micro Founded Theory of Aggregate Labor Supply," University of Toronto Working Paper 516, 2014.

FRENCH, E. AND J. B. JONES, "On the Distribution and Dynamics of Health Care Costs," *Journal of Applied Econometrics* 19 (2004), 705–721.

GOMME, P. AND P. RUPERT, "Theory, Measurement and Calibration of Macroeconomic Models," *Journal of Monetary Economics* 54 (2007), 460–497.

GUNER, N., R. KAYGUSUZ AND G. VENTURA, "Taxing Women: A Macroeconomic Analysis," *Journal of Monetary Economics* 59 (2012), 111–128.

HEATHCOTE, J., K. STORESLETTEN AND G. VIOLANTE, "Insurance and Opportunities: The Welfare Implications of Rising Wage Dispersion," *Journal of Monetary Economics* 55 (2008), 201–525.

HEATHCOTE, J., K. STORESLETTEN AND G. L. VIOLANTE, "The Macroeconomic Implications of Rising Wage Inequality in the United States," *Journal of Political Economy* 118 (2010), 681–722.

HONG, J. H. AND J. RÍOS-RULL, "Social Security, Life Insurance and Annuities for Families," *Journal of Monetary Economics* 54 (2007), 118–140.

KAYGUSUZ, R., "Taxes and Female Labor Supply," *Review of Economic Dynamics* 13 (2010), 725–741.

KOPECKY, K. AND T. KORESHKOVA, "The Impact of Medical and Nursing Home Expenses on Savings," *American Economic Journal: Macroeconomics* 6 (2014), 29–72.

LIU, K., T. MCBRIDE AND T. COUGHLIN, "Risk of Entering Nursing Homes for Long versus Short Stays," *Medical Care* 32 (1994), 315–327.

McGrattan, E. R. and R. Rogerson, “Changes in the Distribution of Family Hours Worked since 1950,” Technical Report, Staff Report 397, Federal Reserve Bank of Minneapolis, 2007.

Meyer, M. H., “Medicaid Reimbursement Rates and Access to Nursing Homes Implications for Gender, Race, and Marital Status,” *Research on Aging* 23 (2001), 532–551.

Murtaugh, C. M., P. Kemper, B. C. Spillman and B. L. Carlson, “The Amount, Distribution, and Timing of Lifetime Nursing Home Use,” *Medical Care* 35 (1997), 204–218.

Storesletten, K., C. I. Telmer and A. Yaron, “Consumption and Risk Sharing over the Life Cycle,” *Journal of Monetary Economics* 51 (2004), 609–633.