Incidental Bequests: Bequest Motives and the Choice to Self-Insure Late-Life Risks[*]

Lee M. Lockwood

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Abstract

Retirees face significant uncertainty about how long they will live and, in many countries, how much costly health care they will require. Yet few buy life annuities or long-term care insurance to insure these risks. Low rates of long-term care insurance coverage are often interpreted as evidence against the importance of bequest motives since failing to buy insurance exposes bequests to significant risk. In this paper, however, I find that low rates of long-term care insurance coverage, especially in combination with the slow rate at which many retirees draw down their wealth, constitute evidence in favor of bequest motives. I use the Method of Simulated Moments to estimate a life cycle model of retirement based on the saving and long-term care insurance decisions of single retirees in the U.S. Retirees' choices are highly inconsistent with standard life cycle models in which people care only about their own consumption but match well models in which bequests are luxury goods. Such bequest motives reduce the value of insurance by reducing the opportunity cost of precautionary saving. Buying insurance reduces one's need to engage in precautionary saving, which is most valuable to individuals without bequest motives who wish to consume all of their wealth. The results suggest that bequest motives significantly increase saving and significantly decrease purchases of long-term care insurance and annuities, especially by retirees in the top half of the wealth distribution.

1 Introduction

Retirees face significant uncertainty, especially about how long they will live and, in many countries, how much money they will spend coping with bad health. Among 65-year-olds in the U.S., for example, about one in five will die before age 75 while another one in five will live to at least age 90 (Bell and Miller, 2005). About one in three 65-year-olds will eventually enter a nursing home (Brown and Finkelstein, 2008), and nursing home stays, which in countries such as the U.S. and U.K. are not covered by universal social insurance programs, cost an average of about $75,000 per year (MetLife Mature Market Institute, 2010). Although these risks could quickly exhaust the wealth of even relatively wealthy retirees, few retirees choose to insure them. In the U.S., only about 5 percent of retirees buy life annuities to convert their wealth into a lifelong income stream and only about 10 percent buy long-term care insurance to cover the costs of nursing homes and other long-term care.

In this paper, I propose and test a new explanation for why many retirees self-insure: bequest motives. Bequest motives are often thought to increase the demand for insurance products, such as long-term care insurance, that insure bequests. But the type of bequest motive that appears to be widespread among U.S. retirees—in which bequests are luxury goods—tends to decrease the demand for insurance against late-life risks, including long-term care insurance. One way to understand why bequest motives can reduce the demand for insurance is to consider the benefits of long-term care insurance for someone without bequest motives. A major benefit of long-term care insurance for someone without bequest motives is that it reduces the need for the individual to engage in precautionary saving, which allows the individual to enjoy a higher rate of consumption. Failing to buy insurance limits how much one can consume by obliging one to set aside wealth for contingencies such as a costly nursing home stay. This limitation on consumption is extremely costly to people without bequest motives, who would like to consume all of their wealth, but is much less costly for people with bequest motives, who value the prospect of

leaving wealth to their heirs. For people with bequest motives, self-insurance has a major advantage that is absent for people without bequest motives: Only people with bequest motives value the large bequests that arise incidentally from self-insuring late-life risks.

I estimate several versions of a life cycle model of retirement to answer two main questions. First, can a standard life cycle model match retirees' saving and long-term care insurance choices? (Yes) Second, can the model match the data without a bequest motive? (No) I use the Method of Simulated Moments to estimate bequest and precautionary motives in a model that nests as special cases models with a wide range of bequest motives, including no bequest motive. This enables me to perform statistical tests of the model's fit and of the restrictions implicit in nested versions of the model. At the core of the model are rich approximations of U.S. social insurance programs and of the medical spending and lifespan risks facing single retirees in the U.S. The estimation is based on the saving and long-term care insurance choices of single retirees in the Health and Retirement Study, a panel study of people over the age of 50 in the U.S.

Without bequest motives, the model is highly inconsistent with some of the major patterns in the data and is strongly rejected by over-identification tests of the model's fit. One pattern that the model without bequest motives cannot match is the pattern of saving across the wealth distribution. In the model without bequest motives, middle-class retirees save too much relative to both richer and poorer retirees. Middle-class retirees tend to be the ones most affected by the precautionary motive since they are neither so rich as to be well-protected from costly medical needs nor so poor as to be well-insured by means-tested social insurance programs. A second pattern that the model cannot match is the low rate of long-term care insurance coverage among the top third of the wealth distribution. In the model without bequest motives, over two-thirds of single retirees in the top third of the wealth distribution buy long-term care insurance, whereas less than 15 percent do empirically.

A third pattern that the model without bequest motives cannot match is the combination,

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among middle-class retirees, of low long-term care insurance coverage and slow drawdown of wealth. Previous research has established that standard life cycle models without bequest motives can match the low rates of long-term care insurance coverage among middle-class retirees (Brown and Finkelstein, 2008) and, separately, the slow drawdown of wealth among middle-class retirees (e.g., Palumbo, 1999; De Nardi et al., 2010; Ameriks et al., 2011). I find, however, that these models cannot match both decisions simultaneously. To match the long-term care insurance decisions of middle-class retirees, the model without bequest motives requires people to view publicly-financed nursing care (e.g., nursing home stays that are paid for by the Medicaid program in the U.S.) as a good substitute for privately-financed care. But to match the saving of middle-class retirees, the model without bequest motives requires people to be extremely averse to receiving publicly-financed nursing care. As a result, models without bequest motives that match the long-term care insurance coverage of middle class retirees predict far too little saving and models that match the saving of middle-class retirees predict far too much long-term care insurance coverage.

With bequest motives, by contrast, the model matches retirees' saving choices over the life cycle and throughout the wealth distribution, and it matches the limited demand for long-term care insurance, including by the rich. The estimated bequest motive, in which bequests are luxury goods, increases the saving of richer retirees relative to poorer ones and encourages people to self-insure their late-life risks. Although buying long-term care insurance would allow people to consume more of their wealth by reducing their need to engage in precautionary saving, my estimates indicate that many retirees do not wish to significantly increase their consumption at the expense of leaving smaller bequests. Buying long-term care insurance would also protect bequests from the risk of being depleted by costly care episodes, but my estimates—as well as other evidence such as the high wealth elasticity of bequests (Auten and Joulfaian, 1996; Hurd and Smith, 2002)—indicate that most retirees are not sufficiently risk-averse over bequests to justify buying available long-term care insurance contracts. For most people, the benefits of buying long-term care

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insurance are outweighed by the costs, which are comprised of the loads on these contracts (which in the U.S. average 18 percent of premiums [Brown and Finkelstein (2007)]) and the reduced eligibility for means-tested social insurance (Pauly, 1990; Brown and Finkelstein, 2008).[1]

Bequest motives are usually thought to play only a minor role in the saving and insurance decisions of most retirees. This view is based to a large extent on the findings that standard life cycle models without bequest motives can (separately) match the saving and long-term care insurance decisions of non-rich retirees. It is also based on the low rates of long-term care insurance coverage observed empirically, since (non-strategic) bequest motives are generally thought to increase the demand for long-term care insurance.[2] My results suggest instead that low rates of long-term care insurance coverage, especially among retirees in the top half of the wealth distribution and especially in combination with the slow drawdown of wealth, are more likely to be evidence in favor of bequest motives. In addition to reducing long-term care insurance coverage, bequest motives also appear to significantly increase saving, even by people in the bottom half of the wealth distribution, and to reduce purchases of life annuities.

Understanding retirees' saving and insurance decisions may be more important now than ever before. Individuals have become increasingly responsible for providing for their own retirement—especially with the decline of employer-directed retirement plans—even as medical spending growth and lifespan improvements have made retirement planning more difficult. Retirees' choices about how much to save and whether to buy insurance already have significant effects on government budgets and the broader economy, and these effects will grow in importance as the population ages. People aged 55 and older hold roughly 70 percent of the world's wealth (The Economist, 2007). In 2009, Medicaid, the safety-net

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[1]An insurance policy with an 18 percent load pays 82 cents of benefits per dollar of premiums on average.

[2]The view that (non-strategic) bequest motives should increase the demand for long-term care insurance is based on two observations made by Pauly (1990): Bequest motives make spending down wealth to qualify for means-tested programs such as Medicaid less attractive, and long-term care insurance insures bequests. Strategic bequest motives, on the other hand, which refer to situations in which people exchange bequests for services from their heirs, have been proposed as an explanation for why some people do not buy long-term care insurance (Bernheim et al., 1985; Pauly, 1990; Zweifel and Struwe, 1996).

health insurance program in the U.S., spent more than \$100 billion on long-term care—43 percent of all spending on long-term care (Kaiser Commission on Medicaid and the Uninsured, 2011). A better understanding of the determinants of retirees' saving and insurance decisions can improve the design and evaluation of several important policies, including policies to encourage private insurance coverage; policies to provide social insurance; and policies regarding the tax treatment of savings, insurance, and inter-household transfers.

2 Model

The model follows closely that in Brown and Finkelstein's (2008) analysis of the demand for long-term care insurance. A single retiree decides how much to consume each period and whether to buy long-term care insurance at the beginning of retirement. Each period is one year.

Preferences.— The individual maximizes expected utility from consumption and bequests,

$$EU_t = u(c_t) + E_t \left\{ \sum_{a=t+1}^{T+1} \beta^{a-t} \left(\prod_{s=t}^{a-1}(1 - \delta_s) \right) [(1 - \delta_a)u(c_a) + \delta_a v(b_a)] \right\}.$$

t is the individual's current age. T is the maximum possible age. β discounts future utility from consumption and bequests. δ_s is the (stochastic) probability that an $(s - 1)$-year-old will die before age s. Utility from consumption is constant relative risk aversion,

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}.$$

Utility from bequests is

$$v(b) = \left(\frac{\phi}{1 - \phi} \right)^\sigma \frac{\left(\frac{\phi}{1-\phi}c_b + b \right)^{1-\sigma}}{1 - \sigma} \text{ if } \phi \in (0, 1),$$

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$v(b) = c_b^{-\sigma} b$ if $\phi = 1$, and $v(b) = 0$ if $\phi = 0$. This is a re-parameterized version of a commonly-used functional form (e.g., De Nardi, 2004; De Nardi et al., 2010; Ameriks et al., 2011), which nests as special cases nearly all of the functional forms used in the literature, including linear (e.g., Hurd, 1989; Kopczuk and Lupton, 2007) and constant relative risk aversion (e.g., Friedman and Warshawsky, 1990). This parameterization has good numerical properties and easy-to-interpret parameters. $c_b \geq 0$ is the threshold consumption level below which, under conditions of perfect certainty or with full, fair insurance, people do not leave bequests: $v'(0) = c_b^{-\sigma} = u'(c_b)$. Smaller values of c_b mean the bequest motive "kicks in" at a lower rate of consumption. If $c_b = 0$, preferences over consumption and bequests are homothetic and people are equally risk-averse over consumption and bequests. If $c_b > 0$, bequests are luxury goods and people are less risk-averse over bequests than over consumption. $\phi \in [0, 1)$ is the marginal propensity to bequeath in a one-period problem of allocating wealth between consumption and an immediate bequest for people rich enough to consume at least c_b.[3] Larger values of ϕ mean that people leave a larger fraction of the wealth left over after buying c_b worth of consumption as bequests. As ϕ approaches one, the bequest motive approaches a linear bequest motive with a constant marginal utility of bequests equal to $c_b^{-\sigma}$. Together with a parameter governing the strength of the precautionary motive to be introduced shortly, the bequest motive parameters, ϕ and c_b, are the main objects of interest in the estimation.

Health and medical spending risks.— The individual faces uncertainty about how long he or she will live and how much acute medical care and long-term care he or she will require. At any time, the individual is in one of five health states: healthy (he), requiring home health care (hhc), requiring assisted living facility care (alf), requiring nursing home care (nh), or dead (d). The individual's future health prospects depend probabilistically on the individual's current age and health status as well as on the individual's sex (s) and (permanent) income (y), $Pr(h_{t+1} = h'|h_t, t; s, y)$. The cost of the individual's long-term care requirements is a deterministic function of the individual's current age and health

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[3]With these utility functions, the optimal bequest by someone maximizing $U = \max\{u(c) + v(b)\}$ subject to $c + b = w$ is $b^*(w) = \max\{0, \phi(w - c_b)\}$.

status, $ltc(h_t, t)$. The cost of the individual's acute medical care requirements is log-normally distributed with mean μ_m and variance σ_m^2, $m_t \sim \log N(\mu_m, \sigma_m^2)$.

Long-term care insurance.— Individuals make a once-and-for-all choice about whether to buy long-term care insurance at the beginning of retirement. People who buy long-term care insurance pay premiums when they are healthy ($h_t = he$) in exchange for receiving benefits when they require long-term care ($h_t \in \{hhc, alf, nh\}$). Net long-term care insurance benefits received (net of premiums paid) are $\lambda(h_t, t; ltci)$, where $ltci \in \{0, 1\}$ is an indicator of whether the individual owns long-term care insurance.

Timing, budget sets, and social insurance.— Health status and medical needs are realized at the beginning of each period. The individual enters the period with wealth $w_t \geq 0$. The individual then incurs acute medical care costs of m_t, for which the individual's liability is limited to his or her wealth, w_t. Wealth after acute medical spending is $\hat{w}_t \equiv \max\{w_t - m_t, 0\}$. Mortality and long-term care needs are then realized. Individuals who die ($h_t = d$) transfer their remaining wealth to their heirs as a bequest, $b_t = \hat{w}_t$. People cannot die in debt or, equivalently, leave negative bequests. Together with mortality risk, this amounts to a no-borrowing constraint. Individuals receive a constant (real) stream of non-asset income, y, as long as they live. Individuals that live ($h_t \neq d$) receive their income y, incur long-term care costs $ltc(h_t, t)$, and receive net long-term care insurance benefits $\lambda(h_t, t; ltci)$, before receiving government transfers and deciding how much to consume. Net wealth before government transfers is

$$\hat{x}_t(\hat{w}_t, h_t, t; y, ltci) = \hat{w}_t + y - ltc(h_t, t) + \lambda(h_t, t; ltci).$$

Net wealth before transfers may be negative, as medical needs may exceed the value of assets, income, and net insurance transfers.

Social insurance programs ensure that people receive the medical care they require and enjoy at least a minimum standard of living. The consequences of having too little wealth to achieve a minimum standard of living after paying for medical care depend on whether

the individual requires institutional care. Individuals who do not require institutional care ($h_t \in \{he, hhc\}$) and who have their wealth fall below $\bar{c}$ receive transfers to top up their wealth to $\bar{c}$. Long-term care insurance premiums are paid *after* receiving transfers. Net wealth after transfers is

$$x_t(\hat{w}_t, h_t, t; y, ltci) = \max\left\{\hat{x}_t(\hat{w}_t, h_t, t; y, ltci),\ \bar{c} + \min\{0, \lambda(h_t, t; ltci)\}\right\} \text{ if } h_t \in \{he, hhc\}.$$

Individuals who require institutional care ($h_t \in \{alf, nh\}$) can have part of their care paid for by the government if they satisfy income- and assets-based means tests. To qualify for public coverage of institutional costs, people must exhaust all but $\bar{x}$ of their assets ($\hat{x}_t \leq \bar{x}$) and have no more than $\bar{y}$ of income net of medical spending and insurance transfers ($\hat{y}_t \equiv y - ltc_t + \lambda_t \leq \bar{y}$). Individuals who qualify for public coverage but can afford to pay for their care privately ($\hat{x}_t \in [0, \bar{x}]$ and $\hat{y}_t \leq \bar{y}$) can choose whether to accept public support or, if publicly-financed care is sufficiently less attractive than privately-financed care, to pay for their care themselves. These eligibility rules are modeled on those of the U.S. Medicaid program (Brown and Finkelstein, 2008). Net wealth after transfers is

$$x_t(\hat{w}_t, h_t, t; y, ltci) = \begin{cases} \hat{x}_t(\hat{w}_t, h_t, t; y, ltci) & \text{if } h_t \in \{alf, nh\} \text{ and } Pub_t = 0\,, \\ \min\{\hat{w}_t, \bar{x}\} + \min\{y, \bar{y}\} & \text{if } h_t \in \{alf, nh\} \text{ and } Pub_t = 1\,, \end{cases}$$

where $Pub_t \in \{0, 1\}$ is an indicator of whether the individual receives public support for his or her institutional care.

Consumption and saving.— Utility-producing consumption, c_t, is the sum of consumption spending, $\hat{c}_t$, and the consumption value of long-term care services received, if any, $c_m(h_t, Pub_t)$,

$$c_t = \hat{c}_t + c_m(h_t, Pub_t).$$

Residents of nursing homes and assisted living facilities receive a certain amount of consumption from their long-term care, $c_m(h_t \in \{alf, nh\}, Pub_t) > 0$ and they cannot buy

additional consumption beyond that, $\hat{c}_t = 0$ if $h_t \in \{alf, nh\}$. These assumptions reflect the fact that residents of nursing homes and assisted living facilities receive some non-medical goods and services, such as food and housing, bundled with their long-term care. Many also have limited opportunities to buy additional consumption, both because care-giving facilities provide for many of their needs and because of their (usually severe) chronic illnesses. Individuals who are healthy or who are receiving home health care, on the other hand, neither receive consumption from their care, $c_m(h_t \in \{he, hhc\}, Pub_t) = 0$, nor have their other consumption opportunities limited except by their net wealth after transfers, $\hat{c}_t \in [0, x_t]$ if $h_t \in \{he, hhc\}$. Assets earn a real, after-tax rate of return of r. Next-period wealth is

$$w_{t+1} = (1 + r)(x_t - \hat{c}_t) \geq 0.$$

Public care aversion and the precautionary motive.— The consumption value of long-term care potentially depends on whether the care is paid for at least partially by the government: $c_{pub} \equiv c_m(h_t \in \{alf, nh\}, Pub_t = 1)$ may differ from $c_{priv} \equiv c_m(h_t \in \{alf, nh\}, Pub_t = 0)$. Institutional care that is at least partially financed by the government (which I follow Ameriks et al. (2011) in calling "public care") may be less desirable than privately-financed care for several reasons. For example, it may be costly to apply for government support, there may be a stigma attached to receiving government support, or recipients of government support may stay in lower-quality nursing homes. These or other factors would give people an additional reason to save or buy insurance beyond a desire to smooth their marginal utility over time and across states. Public care aversion, i.e., the extent to which people prefer privately-financed care to publicly-financed care, $PCA \equiv [u(c_{priv}) - u(c_{pub})]$, is the other object of interest in the estimation in addition to bequest motives.

Solution method and value functions.— Given a set of parameter values, I solve the model numerically by backward induction from the maximum age T. As long-term care insurance is purchased once-and-for-all, long-term care insurance ownership, $ltci \in \{0, 1\}$, is a fixed

characteristic in every period other than the purchasing period, in which it is a control variable. The other fixed individual characteristics are sex (s) and retirement income (y). The state variables are age (t), health (h_t), and wealth after acute medical spending ($\hat{w}_t$). The individual dies by age $T+1$ with probability one, and leaves any remaining wealth as a bequest, $V_{T+1}(\hat{w}_{T+1}) = v(\hat{w}_{T+1})$. For younger ages, I discretize wealth into a fine grid and use piecewise cubic hermite interpolation to evaluate the value function between grid points. At each age-health-wealth node, I solve for optimal consumption and optimal claiming of public support for institutional care. The problem can be written recursively in terms of the value function as

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V(\hat{w}_t, h_t, t; s, y, ltci) = \begin{cases} \max_{\hat{c}_t \in \Gamma(x_t, h_t)} \left\{ u\big[\hat{c}_t + c_m(h_t, Pub_t(\hat{w}_t, h_t, t; s, y, ltci))\big] \right. \\ \left. \qquad\qquad + \beta E_t V(\hat{w}_{t+1}, h_{t+1}, t+1; s, y, ltci) \right\} & \text{if alive}, \\ \\ v(\hat{w}_t) & \text{if dead}, \end{cases}
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where consumption spending is zero for individuals living in assisted living facilities or nursing homes, $\Gamma(x_t, h_t \in \{alf, nh\}) = \{0\}$, and is otherwise limited to net wealth after transfers, $\Gamma(x_t, h_t \in \{he, hhc\}) = [0, x_t]$. The individual makes a once-and-for-all choice about whether to buy long-term care insurance at age l. The individual buys insurance if and only if $V(\hat{w}_l, h_l, t = l; s, y, ltci = 1) > V(\hat{w}_l, h_l, t = l; s, y, ltci = 0)$.

3 Method of Simulated Moments

The Method of Simulated Moments (MSM) extends Minimum Distance Estimation to situations in which the model is too complex to admit closed-form analytical solutions.[4] MSM estimations typically proceed in two stages. In the first stage, all of the parameters that can be identified without using the model are estimated or calibrated. In the second stage, the remaining parameters are estimated using the MSM, taking as given the

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[4]See Pakes and Pollard (1989), McFadden (1989), and Duffie and Singleton (1993) for the development of the MSM and Gourinchas and Parker (2002) for its application to the life cycle model.

first-stage parameter estimates.

The second stage of the estimation attempts to recover the strength and curvature of bequest motives and the consumption value of publicly-financed nursing care, $\theta \equiv (\phi, c_b, c_{pub})$, by minimizing the distance between simulated and empirical wealth and long-term care insurance moments. The parameter estimates, $\hat{\theta}$, are those that minimize the following scalar-valued objective function

$$(\hat{\pi} - g_s(\theta, \hat{\chi}))'W(\hat{\pi} - g_s(\theta, \hat{\chi})).$$

The objective is a quadratic form in the deviations of the simulated moments, $g_s(\theta, \hat{\chi})$, evaluated at the first-stage parameter values, $\hat{\chi}$, from their empirical counterparts, $\hat{\pi}$. W is a positive definite weighting matrix. Appendix A contains details about the asymptotic distribution of the parameter estimates and over-identification tests of the model's fit.

4 Data and Parameterization

4.1 Data and Sample Selection Procedure

I use the Health and Retirement Study (HRS), a longitudinal survey of a representative sample of the U.S. population over 50 years old.[5] The HRS surveys more than 22,000 Americans every two years. It is a rich dataset with especially detailed information about health and wealth. Households are initially drawn from the non-institutionalized population, which excludes people living in nursing homes, but members of sampled households who later move into nursing homes remain in the sample. I use data from the six most recent waves in which the final versions of the RAND release are available, which occur in even-numbered years from 1998–2008. Individuals in my sample are therefore covered for up to ten years. I restrict the analysis to single retirees who are at least 65

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[5]The HRS is sponsored by the National Institute of Aging (grant number NIA U01AG009740) and conducted by the University of Michigan.

years old in 1998 and who do not miss any of the 1998–2008 interviews while they are alive. The resulting sample contains 3,386 individuals. Where possible, I use the RAND version of the variables.[6]

Table 1 presents summary statistics from the HRS. The first column corresponds to the population of people aged 65 and over in the U.S., and the second column corresponds to the population of single retirees aged 65 and over, who are the focus of the analysis. The population of single retirees is older, more female, and poorer than the overall elderly population. Only about ten percent of each group owns long-term care insurance and only about six percent owns life annuities. The vast majority of both samples have children; even among the sample of single retirees, 85 percent have children. Slightly more than two-thirds of the people in each group (and more than half of people without children) report that it is somewhat or very important to leave an inheritance to their heirs.[7]

4.2   First-Stage Parameter Values

Table 2 presents the baseline values of the first-stage parameters and the sources from which these values are adopted or estimated. These values are chosen to approximate the situation facing single retirees in the U.S. I adopt most of the values for the first-stage parameters from other sources, following Brown and Finkelstein (2008) wherever possible, and estimate the others. Later, I test the robustness of the results to many changes in the values of the parameters. All dollar values are inflated to 2010 dollars.

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[6]I restrict to retirees by dropping individuals who earn more than $3,000 dollars in any wave 1998–2008. I exclude waves that occur before 1998 due to sample size issues and problems with certain key variables. The first two waves of the HRS cohort (1992 and 1994) contain individuals who are too young. The first wave of the AHEAD cohort (1993) has inaccurate data on wealth (Rohwedder et al., 2006) and long-term care insurance (Brown and Finkelstein, 2007). The second wave of the AHEAD cohort (1995) and the third wave of the HRS cohort (1996) have inaccurate wealth data due to problems with information about secondary residences (RAND Codebook). I convert all dollar variables to constant 2010 dollars using the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W), the price index that the Social Security Administration uses to adjust Social Security benefits.

[7]This question was asked only in the first wave of the HRS (in 1992), at which time most of the members of my sample were not yet part of the HRS. As a result, less than nine percent of the members of my sample answered this question.

Health and lifespan risk.— The (Markov) transition probabilities across health states are based on a widely-used actuarial model developed by James Robinson (see Robinson, 2002; Brown and Finkelstein, 2004). I use Robinson's model for women for both men and women because it better approximates the long-term care risk facing single individuals, who receive much less informal care than the typical (married) man. I adjust the model to match De Nardi et al.'s (2010) estimates of life expectancy conditional on reaching age 70 for different sex and income groups. Women live longer than men, and richer retirees live longer than poorer ones. Details are available in Appendix B.[8]

Long-term care costs.— Long-term care costs, $ltc(h_t, t)$, equal the average costs that are forecasted to be faced by members of the sample. Historically, the relative price of long-term care services has grown roughly in line with wages, or about 1.5 percent per year in real terms (see Brown and Finkelstein, 2008, and the cites therein). I use these growth rates and the model of health transitions to inflate the average prices of each service in the U.S. in 2002 (MetLife Mature Market Institute, 2002a,b) to match the average prices that members of the sample are likely to pay. Based on the forecasted timing of nursing home usage by members of the sample, for example, the average price that members of the sample will pay for each year of nursing home care is $69,500, roughly the average price of a year in a semi-private room in a nursing home in 2008 (MetLife Mature Market Institute, 2009).

Long-term care insurance.— The long-term care insurance contract, $\lambda(h_t, t; ltci)$, is a simplified version of a typical contract. In exchange for paying annual premiums when healthy ($h = he$), people with insurance have their long-term care costs covered up to a maximum of $44,350 in years in which they are sick ($h \in \{hhc, alf, nh\}$) (which corresponds to a maximum daily benefit of $100 in 2002 inflated to 2010 dollars). Premiums exceed expected discounted benefits by 18 percent, the average load on

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[8]The major advantage of basing the model of long-term care risk on observed patterns of utilization as opposed to spending is that it captures the care paid for by all sources, not just the care paid for out-of-pocket by households. This is important because Medicaid pays for about 45 percent of the nursing home costs of people aged 65 and over in the U.S. (Kopecky and Koreshkova, 2009) and even higher shares for poorer retirees.

long-term care insurance policies held for life in the U.S. (Brown and Finkelstein, 2007).[9]

Acute medical care costs.— Acute medical care costs are log-normally distributed with a mean of \$2,825 and a standard deviation of \$11,003, $m_t \sim \log N(\$2,825, (\$11,003)^2)$. This distribution is a scaled up version of the distribution that matches the mean, variance, and overall shape of the empirical distribution of out-of-pocket medical spending among the members of my sample who are not currently receiving long-term care and who have at least \$100,000 in non-housing wealth. I scale up the mean and standard deviation to match the average medical spending risk faced by members of the sample over their lifetimes, which, because spending on acute medical care is growing in real terms (it grew by about 4.2 percent per year in real terms between 1975 and 2005 (Orszag, 2007)), exceeds the risk they faced during the sample period. I use the distribution of spending by retirees with significant holdings of liquid wealth to minimize the bias introduced by the fact that Medicaid pays for much of the care received by people with little wealth. I approximate the distribution of acute medical care costs using Gaussian quadrature to solve the model.

Social insurance and public care aversion.— Social insurance programs ensure that people who are not living in care-giving facilities have at least $\bar{c} = \$7,800$ of purchasing power each year. This is roughly the consumption level that the Supplemental Security Income (SSI) program (which is meant to provide a subsistence level of food and housing) provided to single elderly individuals in 2000, inflated to 2010 dollars. To qualify for public coverage of nursing care, people must exhaust all but $\bar{x} = \$2,650$ of their assets and $\hat{y}_t \equiv y - m_t \leq \$450$ of their income. These figures are the modal income and asset eligibility requirements employed by U.S. states in 1999 (Brown and Finkelstein, 2008) inflated to 2010 dollars. The estimation recovers the utility penalty of staying in a publicly-financed care-giving facility as opposed to a privately-financed facility, $PCA \equiv [u(c_{priv}) - u(c_{pub})]$. To facilitate interpretation of the results and comparison with

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[9]Brown and Finkelstein (2007) find that men face significantly higher loads on long-term care insurance than women, mainly because married men receive much more care from their spouses—and thus less formal, benefit-eligible care—than married women do. Among single retirees, however, spousal care is not an issue and men and women likely face more similar loads.

other studies, I follow Brown and Finkelstein (2008) by setting the benchmark value of privately-financed care to $c_{priv} = \$7,800$, the same food and housing value that people who are not living in care-giving facilities receive from social insurance. Estimating public care aversion is then equivalent to estimating the consumption-value of publicly-financed care, c_{pub}. Different c_{priv} benchmarks simply shift the implied c_{pub} to maintain the same utility advantage of privately-financed care.

Rate of return.— The real, after-tax rate of return that retirees expect to earn on their wealth is four percent per year, $r = 0.04$. (As discussed below, the return that a particular retiree actually earns each year in the simulations is based on his or her portfolio allocation and the realized returns on different assets in that year.) Four percent is roughly the average real, after-tax return on a "typical" retiree's portfolio during the 38 years immediately preceding the sample period (3.9 percent from 1960–1997) or during the 51-year period including the sample period (4.0 percent from 1960–2010).[10]

Preferences: discount factor and risk aversion.— I again follow Brown and Finkelstein (2008) in adopting standard, widely-used values for the discount factor and the coefficient of relative risk aversion and later test the sensitivity of the results to these choices. The discount factor β, is $\frac{1}{1.03} \approx 0.97$, corresponding to a rate of time preference of three percent per year. The coefficient of relative risk aversion, σ, is three.

4.3   Second-Stage Moments: Wealth and Insurance

Empirical wealth moments.— The wealth moments track the evolution of wealth over time as members of the sample age. I split the sample into six 5-year birth cohorts based on the individual's age in the 1998 wave: 65–69, 70–74, 75–79, 80–84, 85–89, and 90–94. For each cohort, I calculate three percentiles of the wealth distribution—the 25th, 50th (median),

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[10]Retirees' portfolios, though not without risk, are roughly an order of magnitude less volatile than the stock market. Over the past 51 years (1960–2010), the standard deviation of the rate of return based on the average portfolio shares of my sample of single retirees was about 3.3 percent. In the Robustness section I show that adding rate-of-return risk has almost no effect on the results. Additional details of the rate-of-return calculations are available in Appendix C.

and 75th percentiles—in each wave *after* 1998: 2000, 2002, 2004, 2006, and 2008. Thus there are 90 wealth moments: three percentiles in five waves for six cohorts. Each cohort's wealth moments trace the evolution over time of the distribution of wealth among its surviving members. Later waves contain fewer people due to deaths. Of the 3,386 individuals in the sample in 1998, 1,183 (34.9 percent) were still alive in the last wave in 2008. The measure of wealth is the total value of non-annuity wealth including housing.

Empirical long-term care insurance moment.— The empirical long-term care insurance moment is the ownership rate among the subset of the sample who were 70–79 years old in 1998, weighted by the 1998 HRS individual sample weights. This ownership rate is 5.6 percent. This calculation counts an individual as owning long-term care insurance if he or she owns a long-term care insurance policy that covers both nursing home care and home care in at least half of the waves in which information on his or her long-term care insurance is available.[11]

Policies that cover both nursing homes and home health care are the most popular type empirically (Brown and Finkelstein, 2007) and are the type I use in the model. Averaging an individual's reported ownership over time likely provides a better measure of his or her "lifetime" ownership than point-in-time estimates because of measurement error and policy lapsation.[12] The subset of the sample who were 70–79 years old in 1998 completed their prime buying years, age 65–69 (Brown and Finkelstein, 2007), immediately before the sample period, 1998–2008.

4.4   Simulation Procedure and Estimation

For each candidate parameter vector θ, I solve the model separately for men and women, different income groups, and people with and without long-term care insurance. I use the

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[11]Missing data prevent me from determining the ownership status of 11 individuals. I exclude these individuals from the calculation of the empirical long-term care insurance moment. When simulating their wealth paths, I assume that they do not own long-term care insurance.

[12]For this group, the point-in-time ownership rate (5.7 percent) is only slightly higher than the "lifetime" ownership rate (5.6 percent).

resulting value functions and optimal choice rules to simulate the wealth path and long-term care insurance ownership status of each individual in the simulation sample, which is described below. I use the resulting simulated data to calculate the simulated moments, using the same procedure as that used to calculate the empirical moments from the actual data. Finally, I evaluate the goodness of fit of the simulated moments at this particular set of parameter values θ to the empirical moments using the Method of Simulated Moments objective function. Details of the simulation procedure are available in Appendix D.

To create the simulation sample, I draw with replacement 10,000 individuals from the sample of single retirees in the HRS. To ensure that the resulting population is representative of the population of single retirees in the U.S., the probability that individual i in the sample of single retirees is chosen on any draw is proportional to i's 1998 person-level weight, $\frac{weight_i}{\sum_{j=1}^{3,386} weight_j}$. For each individual in the simulation sample, the simulation uses: three fixed individual characteristics (sex, average retirement income, and long-term care insurance ownership status), three initial state variables (age, health, and wealth in 1998), health status in 1999–2008, and portfolio shares in 1998–2006.[13] The simulation uses each individual's health status in 1999–2008 to ensure that individuals contribute to the same wealth moments in the simulation as in the data—individuals who die in 2001 in the data also die in 2001 in the simulation. This protects against bias from the model of health transitions not matching perfectly the true risk facing retirees.

The simulation uses individuals' portfolio shares in 1998–2008 together with Baker et al.'s (2007) estimates of the annual returns on various assets to construct person-year-specific realized rates of return on wealth, $r_{i,t}$. Details are available in Appendix C. Estimating

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[13]Each individual's average (real) retirement income equals the simple average between 1998 and 2008 of his or her non-asset income less the cash value of means-tested government transfers received, such as Supplemental Security Income and food stamps. Means-tested transfers are excluded from income because these transfers arise endogenously in the model. Health status in the year of interview j is nursing home if the individual is living in a nursing home when interview j occurs, home health care if the individual is not living in a nursing home when interview j occurs and reports using home care anytime in the two years preceding interview j, dead if the individual is dead when interview j would otherwise occur, and healthy otherwise. I simulate health status between interview years using the model health transition probabilities and Bayes' rule.

person-wave-specific rates of return protects against two potential sources of bias. One potential source of bias is that the sample period, 1998–2008, was characterized by unusually high rates of return on many assets. The average real return earned by retirees around the middle of the wealth distribution was about 6 percent per year over the period, compared to about 4 percent in the three-and-a-half decades leading up to the sample period. Failing to account for the unusually—and probably unexpectedly—high rates of return could bias the results; the naive estimation would attribute wealth outcomes as arising solely from purposeful saving behavior whereas unusual capital gains or losses may have been important as well (Baker et al., 2007). The other source of bias that this procedure protects against is that retirees' portfolios vary systematically across the wealth distribution. Retirees in the middle of the wealth distribution, for example, hold more of their wealth in housing than richer and poorer retirees, and the average return on housing wealth was especially high (7.9 percent per year) over the sample period. Ignoring the differences in retirees' portfolios could bias the results by leading the estimation to wrongly attribute differences in wealth as arising solely from differences in saving behavior whereas differences in realized returns may have been important as well.

Estimation.— The baseline estimation of $\theta = (\phi, c_b, c_{pub})$ is based on 91 moment conditions: one long-term care insurance moment and 90 wealth moments. The baseline weighting matrix is the inverse of the estimated variance-covariance matrix of the second-stage (empirical) moments, $W = \hat{V}(\hat{\pi})^{-1}$. More-precisely estimated moments receive greater weight in the estimation. I estimate the variance-covariance matrix of the second-stage moments by bootstrap. Following Pischke (1995), I check the robustness of the results to using the inverse of the diagonal of the estimated variance-covariance matrix of the second-stage moments as the weighting matrix, $W_{robust} = diag(\hat{V}(\hat{\pi}))^{-1}$.

5 Results

5.1 The Baseline Model Matches Retirees' Choices

The first column of Table 3 contains the results of the baseline estimation. The parameters are fairly precisely estimated and the overall fit of the model is good. The p-value of the chi-squared test of over-identifying restrictions is 0.85, which indicates a very good fit for a model of this kind. The estimates suggest that public care aversion is modest: The estimated consumption value of publicly-financed facility care, $\hat{c}_{pub} = \$7,375$, is similar to the baseline consumption value of privately-financed care, $c_{priv} = \$7,800$, and the hypothesis that people are not averse to public care ($c_{pub} = c_{priv}$) cannot be rejected.

The estimates of the bequest motive parameters indicate important bequest motives in which bequests are luxury goods. The estimates imply that with actuarially fair insurance, only people who could afford to consume more than $\hat{c}_b = \$20,416$ per year would leave bequests. Were the costs of long-term care and acute medical care fully insured at actuarially fair rates and were actuarially fair annuities available, 46 percent of the sample would leave bequests; the rest would annuitize all of their wealth and leave no bequests. The estimates imply that people are only moderately risk-averse over bequests and, equivalently, that among people rich enough to leave bequests, the marginal propensity to bequeath out of wealth is fairly high. Among healthy 70-year-olds in the middle of the income distribution, the marginal propensity to bequeath with full insurance is 0.47. The estimated bequest motive resembles that of an altruist who places equal weight on his own and his heir's utility and whose heir's permanent income is $\$20,416$ per year.[14]

The good fit of the model revealed by the over-identification test is also apparent in the long-term care insurance ownership rate and the wealth moments. Simulated long-term care insurance ownership is 5.9 percent, compared to 5.6 percent in the data. Figure 1

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[14]Such an altruist would have the same $c_b = \hat{c}_b = \$20,416$ and would have $\phi = 0.972$ compared to the estimate of $\hat{\phi} = 0.919$. Details of the relationship between the bequest motive in the text and altruistic bequest motives are available in Appendix E.

plots the empirical and simulated wealth moments of four of the six cohorts, split into two
figures for clarity. The model reproduces the main patterns in the wealth data and
therefore in consumption and saving decisions. Moreover, as the second column of Table 3
shows, the estimation based on the robust weighting matrix produces similar results.

5.2   Identification

The Model Without Bequest Motives Is Strongly Rejected.—The third column of Table 3
shows results from estimating the model without bequest motives, i.e., under the
restriction that $\phi = 0$. The model without bequest motives fits the data very poorly, and
the restriction of no bequest motive is rejected at the one percent confidence level. Figure 2
shows why. The left panel shows simulated long-term care insurance ownership rates in the
model without bequest motives as a function of the consumption value of publicly-financed
long-term care. The right panel shows for cohorts one and four the empirical wealth
moments (solid lines), the simulated wealth moments at the baseline estimates (dashed
lines), and the simulated wealth moments from estimating the model without bequest
motives on the basis of the 25th and 75th wealth percentiles, excluding long-term care
insurance and the median wealth percentiles (dotted lines with triangles). Together, these
figures show that the model without bequest motives cannot match:

- The low rates of long-term care insurance coverage: Even without public care
  aversion ($c_{pub} = c_{priv} = \$7,800$), the model without bequest motives predicts that
  15.7 percent of the sample should buy long-term care insurance, almost three times
  the observed rate of 5.6 percent.[15] With stronger public care aversion, predicted
  insurance coverage can be many times greater.

- The pattern of saving across the wealth distribution: With extremely strong public

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[15]This is consistent with Brown and Finkelstein's (2008) finding that Medicaid alone is not sufficient to
eliminate long-term care insurance coverage by people in the upper third or so of the wealth distribution.
I find a lower ownership rate without bequest motives or public care aversion than Brown and Finkelstein
(2008) do because single retirees (my sample population) are poorer than the general elderly population
(Brown and Finkelstein's (2008) sample population).

care aversion ($\hat{c}_{pub} = \$2,500$), the model without bequest motives matches well the 25th and 75th wealth moments (dotted lines with triangles). But such strong public care aversion leads retirees in the middle of the wealth distribution to save far too much. Weaker levels of public care aversion ($\hat{c}_{pub} = \$4,300$) help the model match the saving of retirees in the middle of the wealth distribution but cause it to under-predict the saving of both poorer and, especially, richer retirees. Middle-class retirees are particularly sensitive to precautionary concerns because they have enough wealth to be poorly-insured by means-tested programs but not enough wealth to pay for especially costly health problems.

- The combination of the saving and long-term care insurance decisions of non-poor retirees: The public care aversion required to match the median wealth moments without bequest motives ($\hat{c}_{pub} = \$4,300$), leads to a predicted rate of insurance coverage of 44.5 percent, almost eight times the observed level. The public care aversion required to approach the long-term care insurance decisions of middle-class retirees without bequest motives leads to far too little saving by all retirees, especially rich ones. Long-term care insurance ownership is too low—both absolutely and, especially, relative to saving—to be consistent with the model without bequest motives.

Strong Public Care Aversion and Near-Homothetic Bequest Motives are Strongly Rejected.— The fourth column of Table 3 shows estimation results when public care aversion is constrained to be moderate ($c_{pub} = \$5,000$ relative to $c_{priv} = \$7,800$), and the fifth column shows results when preferences are constrained to be nearly homothetic over consumption and bequests ($c_b = \$5,000$).[16] Both restrictions are strongly rejected by over-identification tests of the model's fit. The same features of the data are responsible for both rejections. With either strong public care aversion or strong homothetic bequest motives, the model predicts high rates of long-term care insurance ownership and too much

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[16] With homothetic preferences ($c_b = 0$), an individual with twice as much wealth consumes twice as much and leaves twice the bequest as someone with half as much wealth. With preferences in which bequests are luxury goods, an individual with twice as much wealth consumes less than twice as much and leaves more than twice the bequest as someone with half as much wealth.

saving by poorer retirees relative to richer ones.

Summary.— Within the context of the standard life cycle model, retirees' saving and long-term care insurance choices indicate that public care aversion is modest and that important bequest motives in which bequests are luxury goods are widespread. As Appendix F shows in detail, the model is well-identified and the identification is not driven by any particular moment or set of moments. Poorer and richer retirees save too much relative to retirees in the middle of the wealth distribution and non-poor retirees buy too little long-term care insurance relative to how much they save to be explained by versions of the model in which public care aversion is strong or bequests are not valuable luxury goods.

5.3   Bequest Motives Encourage Retirees to Self-Insure

Figure 3 shows simulated and empirical long-term care insurance ownership rates. The three simulated ownership rates correspond to three different sets of preferences: the baseline estimates, the baseline public care aversion with no bequest motive, and the estimates from fitting a model without bequest motives to the median wealth moments ($\phi = 0, \hat{c}_{pub} = \$4,300$). One way to judge the importance of the bequest motive in reducing the demand for long-term care insurance is to shut down the bequest motive while holding constant the other preference parameters. This experiment gives the model's forecast of the effect on long-term care insurance coverage of 100 percent estate (and gift) taxes, if such taxes were levied successfully. Such an experiment reveals that the bequest motive reduces long-term care insurance coverage by a factor of four, from 23.4 percent to 5.9 percent, almost entirely by reducing coverage in the top half of the wealth distribution.

One disadvantage of this counterfactual of shutting down the bequest motive is that it conflates the effects of two separate factors that affect the value of long-term care insurance: the value that people place on bequests and the "implicit tax" on private insurance from means-tested programs like Medicaid (Brown and Finkelstein, 2008). The implicit tax from Medicaid is much greater in the model without bequest motives since

individuals spend down their wealth much more rapidly and thus qualify for greater transfers from Medicaid. An alternative counterfactual that controls (albeit imperfectly) for the implicit tax from Medicaid to produce a cleaner measure of the effect of valuing bequests on the value of insurance involves adjusting the other key preference parameter, public care aversion, to maintain similar saving behavior without bequest motives as under the baseline preferences. This comparison suggests a much larger effect of the bequest motive on reducing the demand for insurance: Long-term care insurance coverage is almost eight times greater in a model without bequest motives that matches the saving of median-wealth retirees than in the baseline model (44.5 percent compared to 5.9 percent).

To help understand why the estimated bequest motive reduces the demand for long-term care insurance, Table 4 shows, for a healthy 67-year-old around the 75th percentile of the wealth distribution, expected consumption and bequests with and without long-term care insurance and the willingness to pay for long-term care insurance. These outcomes are simulated using the three sets of preferences just discussed. With the baseline preferences, the individual is better off not buying long-term care insurance: The individual would have to be paid at least $2,513 to be induced to commit to holding the long-term care insurance contract for life. Although the individual values the bequest insurance that long-term care insurance provides and would be willing to pay up to $6,765 for actuarially fair insurance, the individual does not value bequest insurance enough to justify paying the loads on available contracts and losing access to means-tested benefits in some states. Together, the loads on the typical contract and the loss of means-tested benefits from buying insurance mean that by self-insuring the individual can consume almost $11,000 more and leave almost $8,200 more wealth as bequests on average than he or she could by buying insurance.

Without the bequest motive, by contrast, the individual is better off buying available long-term care insurance, and, in the case of the individual without bequest motives whose saving matches that of middle-class retirees, the welfare gain from long-term care insurance is extremely large. Shutting down the bequest motive increases the value of long-term care

insurance by over $7,000, from −$2,513 to $4,618, despite the fact that without bequest motives the individual draws down his or her wealth rapidly and thus faces a large implicit tax from Medicaid on his or her insurance purchase. The effect of valuing bequests on the value of insurance, controlling for differences in the implicit tax from Medicaid, is much greater. Whereas the individual with the baseline preferences is better off not buying long-term care insurance at typical loads, an individual without bequest motives who saves a similar amount is willing to pay $86,098 for access to long-term care insurance—43 percent of his or her initial wealth. Long-term care insurance is so valuable in this case because, by reducing the individual's need to engage in precautionary saving, it allows the individual to enjoy a higher rate of consumption. Without insurance, the individual's strong desire to avoid running out of wealth forces the individual to consume much less—and leave much larger bequests on average—than the individual would otherwise like. The individual leaves bequests worth $105,078 on average without insurance—over half of initial wealth—despite not valuing bequests at all. Buying long-term care insurance allows the individual to convert about half of these bequests into greater consumption, which increases the individual's average lifetime consumption by $36,367.

Among retirees who do not wish to rely on social insurance or their families, a key determinant of how much they will value long-term care insurance is the value they place on the bequests that arise incidentally from self-insuring their long-term care risk. People who value the prospect of leaving wealth to their heirs but are not very risk-averse over how much they leave—a preference that is consistent with altruism and appears to be widespread—are in many cases better off not buying available long-term care insurance. The wealth they hold into old age serves the dual purpose of paying for costly care episodes in some states and of augmenting bequests in others. For them, the benefits of buying long-term care insurance—of being able to choose a more desirable mix of consumption and bequests, of insuring their consumption and bequests, and of avoiding public care—are outweighed by the costs: insurance loads and reduced social insurance transfers.

5.4 The Results are Robust to Many Alternative Assumptions

Table 5 presents results from estimating the model with different estimating moments and "first-stage" parameter values. These include: excluding long-term care insurance from the estimation, thereby estimating the model based on retirees' saving decisions alone; increasing the discount factor β from 0.97 to 1.01 to make retirees more patient; estimating the model based only on the decisions of middle-class retirees, i.e., estimating the model based on the median wealth moments and the long-term care insurance ownership rate among people in the middle wealth quintile; introducing uncertainty into the returns that retirees expect to earn on their wealth; allowing residents of nursing homes and assisted living facilities to buy additional consumption beyond what they receive from their care; increasing long-term care costs by 50 percent; and increasing the coefficient of relative risk aversion, σ, from 3 to 5. Although most of the alternative versions of the model do not fit the data as well as the baseline specification does, the parameter estimates are fairly similar across specifications, and the qualitative conclusions—that retirees' decisions favor models with important bequest motives and modest public care aversion—are extremely robust. In every specification, the model without bequest motives is highly inconsistent with some of the main features of the data and can be rejected at the one percent confidence level.

One reason the results are so robust is that the same conclusions emerge from several different patterns in the data, which makes the conclusions robust to discounting or even excluding certain evidence.[17] Table 5 shows, for example, that excluding long-term care insurance from the estimation produces a bequest motive that is by at least one measure stronger than that in the baseline estimation: were medical spending risks fully insured and actuarially fair annuities available, a larger fraction of the sample would leave bequests (61.9 percent compared to 45.7 percent), though the average share of wealth left as a

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[17]Moreover, many of the factors that would help the model without bequest motives match the slow rates at which retirees draw down their wealth hurt that model's ability to match the low rates of long-term care insurance ownership. For example, if retirees were more patient, more risk-averse, or more averse to public care, the model without bequest motives would be better able to match the slow rates of wealth drawdown. But all of these factors also increase the demand for long-term care insurance, which hurts that model's ability to match the low rates of long-term care insurance ownership.

bequest would be smaller (18.7 percent compared to 23.6 percent). Richer and poorer retirees save too much relative to middle-class retirees for saving to be driven primarily by medical spending and lifespan risk.[18]

Similarly, Table 5 shows that excluding richer and poorer retirees from the estimation also produces results that are similar to the baseline results. Middle-class retirees buy too little long-term care insurance relative to how much they save to be consistent with the model without bequest motives. This raises the question: How strong is the evidence of bequest motives from the saving and insurance decisions of middle-class retirees alone (setting aside the evidence of bequest motives in the pattern of saving and in the long-term care insurance coverage of the rich)? More specifically, how much less attractive would long-term care insurance have to be to allow the model to match the saving and insurance decisions of middle-class retirees without bequest motives?

Figure 4 shows simulated long-term care insurance ownership rates among retirees in the middle quintile of the wealth distribution in a model without bequest motives that is fitted to the median wealth moments. At the average load in the U.S., predicted ownership among the middle quintile is 38.5 percent, an order of magnitude larger than the 3.8 percent empirical ownership rate among this group. To match both the saving and long-term care insurance decisions of middle-class retirees, the model without bequest motives requires extremely high loads on long-term care insurance, far higher than those observed in the U.S. market. Whereas the average load on long-term care insurance contracts in the U.S. requires people to pay about 22 cents of loads per dollar of benefits (corresponding to an 18 percent load as a fraction of premiums, $\frac{\$0.22}{\$1.22} = 0.18$), the model without bequest motives cannot come close to matching the data unless people have to pay over \$1 of loads per dollar of benefits—almost five times the market average. The model

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[18]Although the significant heterogeneity in wealth at retirement or in average medical spending across income groups might appear to reflect significant heterogeneity in preferences, such heterogeneity in outcomes arises naturally in representative-agent life-cycle models. Scholz et al. (2006) find that a representative-agent life cycle model can account for more than 80 percent of the variation in retirement wealth. Similarly, as Appendix ?? shows, my model predicts a strong relationship between income and out-of-pocket medical spending—similar to that found by De Nardi et al. (2010) in the Health and Retirement Study—despite its assumption that, conditional on health, the (exogenous) demand for medical care is independent of income.

without bequest motives has even more trouble matching the saving and insurance decisions of richer retirees, such as those around the 75th percentile. These results suggest that default risk or other un-modeled disadvantages of long-term care insurance are unlikely to overturn the result that the model without bequest motives is inconsistent with the behavior of middle-class retirees. Middle-class (and richer) retirees buy far too little long-term care insurance relative to how much they save to be consistent with the model without bequest motives.

5.5   Implications of the Results

Bequest motives increase saving significantly; medical spending risk has little effect.—
Figure 5 shows, for three different simulations, the simulated evolution of the median and 5th percentile of the distribution of total non-annuity wealth for a balanced panel of retirees in the first cohort (aged 65–69 in 1998, with an average age of 67).[19] Bequest motives significantly slow the speed at which retirees' draw down their wealth: Wealth declines more slowly in the baseline model (solid lines) than in the model without bequest motives (dashed lines). The bequest motive-induced slowing of the draw down of wealth leads to significantly greater wealth holdings among the oldest retirees and significantly larger bequests. Among all retirees in the first cohort (not just the long-lived represented in the figure), the estimated bequest motive increases the share of initial non-annuity wealth bequeathed from 28 percent to 45 percent of initial wealth. This is not driven solely by the rich: The bequest motive nearly doubles the share of wealth bequeathed by people in the third quartile of the wealth distribution (from 19 to 36 percent) and more than triples the share of wealth bequeathed by people in the second quartile of the wealth

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[19]Constructing the figure involves three main steps. First I clone each member of the first cohort ten times to increase the sample size. Then I simulate each clone's subsequent health realizations over the next 23 years (at which time the average age of the cohort is 90), and simulate the wealth paths of only those clones who live at least 23 years. Finally, I calculate the median and 5th percentile of the simulated wealth distribution in each of those years and plot it against the average age of the cohort on the x-axis. (Wealth holdings among this sample of long-lived retirees are quite high due to the strong relationship between income and survival.) The figure therefore shows the evolution of the wealth distribution as the cohort ages of only those cloned members of the first cohort that survive at least 23 years. This balanced panel construction avoids the bias that can result from selective mortality.

distribution (from seven to 26 percent).

Medical care costs (including both long-term care and acute medical care), by contrast, have only a modest effect on saving. Wealth paths in the model without medical spending risk (dotted lines) are very similar to those in the baseline model (solid lines). Among all retirees in the first cohort (not just the long-lived represented in the figure), saving due to medical spending increases expected bequests by just two percent of initial non-annuity wealth, from 43 to 45 percent. Even in the model without bequest motives, medical spending increases expected bequests by less than four percent of initial wealth, from 25 to 28 percent.

Bequest motives significantly reduce purchases of annuities.— Figure 6 shows how the estimated bequest motive affects purchases of an annuity that pays $5,000 of (real) income per year for life and has a ten percent load, which is a typical load in the U.S. private market (Brown, 2007). The estimated bequest motive significantly reduces the demand for annuities. Whereas 42.5 percent of the sample buys the annuity in the model without bequest motives—virtually everyone who can afford the premium,—only 3.9 percent buys the annuity in the baseline model, much closer to the empirical ownership rate of 7.1 percent.

Bequest motives increase the scope for and effectiveness of policies to encourage private long-term care insurance coverage.— Many U.S. states have implemented policies designed to increase private insurance coverage (presumably with the goal of reducing spending by means-tested programs). There are at least two reasons why the role of bequest motives in reducing private long-term care insurance coverage could be of interest to policymakers who wish to increase private insurance coverage. First, as Brown and Finkelstein (2008) document, to the extent that means-tested programs like Medicaid explain the low rates of private insurance coverage, the potential for policies to expand coverage are extremely limited, short of fundamental reforms of these programs. This pessimistic conclusion is based on the finding that programs like Medicaid exert a large implicit tax on private

insurance purchases by people who, in the absence of insurance, would rely heavily on public support to pay for their care. In this case, the "net load" on insurance, inclusive of public benefits foregone, remains large even if policies such as premium subsidies reduce the "gross load" on private contracts (Brown and Finkelstein, 2008). As already discussed, however, people who draw down their wealth slowly, as many retirees do, face lower implicit taxes from means-tested programs on their insurance purchases. As a result, their demand for insurance should be more sensitive to the gross load on private insurance, and policies that reduce the after-tax price of insurance should lead to larger increases in private insurance coverage.

Consistent with this logic, I find that premium subsidies have a larger effect on private insurance coverage with bequest motives than without. The first two bars in Figure 7 show the increase in the simulated long-term care insurance ownership rate, in the baseline model and in the model without bequest motives, from a premium subsidy that reduces the after-tax price of insurance exactly enough to make the policy actuarially fair. This subsidy increases predicted coverage by over twice as much in the model with bequest motives (11.4 percentage points, from 5.9 to 17.3 percent) as in the model without bequest motives (5.3 percentage points, from 23.4 to 28.7 percent). Although the subsidy is more effective in increasing private insurance coverage in the model with bequest motives, Medicaid still severely limits the market for private insurance, as even with actuarially fair insurance fewer than one in every five single retirees is predicted to buy insurance. Moreover, as Goda (2011) finds as well, the subsidies increase coverage primarily among rich retirees. The subsidies are therefore unlikely to pay for themselves by reducing Medicaid expenditures, since the rich seldom rely on Medicaid even without insurance.

The second reason that the role of bequest motives in reducing private long-term care insurance coverage could be of interest to policymakers who wish to increase private insurance coverage is that it admits new possibilities for the types of policies that could encourage private coverage. One such policy is a long-term care insurance-contingent estate and gift tax. Under this policy, only people *without* long-term care insurance must pay

taxes on their gifts and bequests; buying long-term care insurance allows one to escape transfer taxation. As Figure 7 shows, an insurance-contingent transfer tax of 25 percent increases predicted insurance ownership in the baseline model by almost twice as much as the premium subsidy. (Estate and gift taxes have no effect on behavior in the model without bequest motives.) The contingent tax increases predicted coverage by 22 percentage points (from 5.9 to 27.8 percent), compared to the increase in coverage due to the subsidy of 11.4 percentage points. The effect of the long-term care insurance-contingent tax is especially strong among retirees in the top quartile of the wealth distribution, whose predicted rate of long-term care insurance coverage increases almost four-fold, from 23.5 to 88.3 percent. With the estimated bequest motive, many people value bequests enough to find it worthwhile to buy available long-term care insurance contracts to escape transfer taxation. Like the premium subsidy, however, the insurance-contingent transfer taxes increase private insurance coverage primarily among rich retirees who rely relatively little on Medicaid even without insurance. This particular insurance-contingent tax reduces Medicaid spending by about four percent.

5.6   Relationship to the Literature

Long-term care insurance.— In an important recent paper, Brown and Finkelstein (2008) show how the U.S. Medicaid program can crowd out private long-term care insurance coverage among not only poor but also middle-class retirees. They find, in a standard model in which individuals do not have bequest motives and are not averse to receiving publicly-financed nursing care, that the bottom two-thirds of the wealth distribution would not buy long-term care insurance even if it were actuarially fair. One of the reasons that Medicaid has such a powerful effect in this model is that individuals who do not have bequest motives and are not averse to receiving publicly-financed nursing care draw down their wealth rapidly and thus have much of their care paid for by Medicaid if they do not have insurance. For such people, long-term care insurance benefits contribute little to net income; a large fraction of the benefits merely displace the Medicaid benefits they would

have received had they not had insurance.[20]

For people who draw down their wealth more slowly, however, as many middle-class retirees do, long-term care insurance benefits make a larger contribution to net income since Medicaid pays for less of their care. Unlike people who draw down their wealth rapidly, whose consumption would be reduced by buying insurance, people who draw down their wealth slowly could increase their consumption by buying insurance: being freed from the need to engage in precautionary saving would more than compensate them for the loads on insurance and foregone Medicaid benefits. So although Medicaid still likely plays an important role in limiting their demand for insurance—people who view Medicaid-financed care as a poor substitute for privately-financed care, for example, should find long-term care insurance extremely valuable,—bequest motives likely play an important complementary role by reducing people's desire to increase their consumption at the expense of leaving smaller bequests. Bequest motives, which primarily affect relatively wealthy retirees, naturally complement Medicaid and other factors that reduce rates of long-term care insurance coverage primarily among people with little wealth to help explain the low rates of insurance coverage throughout the wealth distribution.[21,22]

Although my results suggest that bequest motives reduce the aggregate demand for long-term care insurance, bequest motives likely increase some people's demand for insurance. In theory, people who are unusually risk-averse over bequests should value

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[20]Hubbard et al. (1995) show that a similar mechanism can help explain why many retirees hold very little wealth. Planning to rely on means-tested transfers in at least some future states frees people from the need to save for those states, which enables people to consume more in the present.

[21]Many of the explanations for why few retirees buy long-term care insurance are, like Medicaid, most applicable to people who save little wealth into old age. These include failing to plan for the future or planning to rely on informal care (Pauly, 1990; Zweifel and Struwe, 1996). (See Brown and Finkelstein (2009) for a review.) People with more wealth are more likely to have planned for their retirement (Lusardi and Mitchell, 2007) and are less likely to use informal care (Kemper, 1992; Ettner, 1994). Yet it is difficult to find any group of retirees, even among the rich, in which the long-term care insurance ownership rate exceeds 30 percent.

[22]The role of bequest motives in reducing the demand for long-term care insurance is related to Davidoff's suggestion that housing wealth can substitute for long-term care insurance (Davidoff, 2009, 2010). He observes that people who consume their housing wealth if and only if they require long-term care—a strategy that appears to be widespread empirically—are partially insured by their housing wealth. Bequest motives can help explain why people might consume their housing wealth only in high-cost states and not in other states as well. As a result, bequest motives can also help explain the limited market for reverse mortgages, which is puzzling in the context of selfish life cycle models.

long-term care insurance more than they would without bequest motives. Empirically, survey evidence suggests that the desire to insure bequests contributes to some people's purchasing decisions (LifePlans, 2004). That different types of bequest motives have opposite effects on the value of long-term care insurance may help explain why Sloan and Norton (1997) find no significant relationship between long-term care insurance ownership and reported preferences for leaving bequests. A more fundamental reason, however, to expect a weak or even positive relationship between proxies for bequest motives and insurance coverage is that both bequests and long-term care insurance are luxury goods. Whereas bequests are luxury goods due to preferences, long-term care insurance is a luxury good due to the means-tested nature of safety-net programs such as Medicaid (Brown and Finkelstein, 2008). Because of Medicaid, my model predicts a *positive* relationship between desired bequests and long-term care insurance coverage, despite predicting that bequest motives reduce long-term care insurance coverage relative to the case without bequest motives. My results are therefore consistent with the positive relationship between long-term care insurance ownership and proxies for bequest motives in the survey conducted by Brown et al. (2011), and this relationship is consistent with bequest motives playing an important role in reducing long-term care insurance coverage.

Saving.— Although the ability of models without bequest motives to match the slow drawdown of wealth by middle-class retirees is sometimes interpreted as evidence against the importance of bequest motives, it actually just reflects the difficulty—due to the uncertainty facing retirees and the nature of non-contingent wealth—of interpreting retirees' saving. As Dynan et al. (2002) note, "[a] dollar saved today simultaneously serves both a precautionary life-cycle function (guarding against future contingencies such as health shocks or other emergencies) and a bequest function because, in the likely event that the dollar is not absorbed by these contingencies, it will be available to bequeath to children or other worthy causes" (p. 274). In this paper, I solve this problem of separately identifying precautionary and bequest motives by analyzing long-term care insurance decisions together with saving and by comparing the saving behavior of retirees with

different levels of wealth. Both of these identification strategies produce the same conclusion: Standard models with bequest motives match retirees behavior well while models without bequest motives miss badly. This suggests that precautionary saving against medical spending and lifespan risks is not the main reason that many retirees hold much of their wealth into old age. Bequest motives and other factors that lead people to value holding wealth in old age—but to be not very risk-averse over their wealth—appear to be more promising explanations of retirees' saving behavior.[23]

The conclusion that bequest motives play an important role in the saving of middle-class retirees differs from the conclusions of at least two important papers in the literature. (Appendix G contains details of how my estimates relate to several others and shows a variety of simulated outcomes under each set of estimates.) Hurd (1989) estimates a very weak bequest motive based on a comparison of the saving decisions of households with and without children and the assumption that households without children lack bequest motives. More recent evidence, however, from saving decisions Kopczuk and Lupton (2007), inter-household transfers (Gale and Scholz, 1994), annuity guarantee choices (Laitner and Juster, 1996), and surveys about the importance of leaving bequests (Laitner and Juster, 1996; Ameriks et al., 2011), for example, appears at odds with the idea that people without children lack bequest motives.[24]

De Nardi et al. (2010) investigate the role of medical spending risk in retirees' saving behavior. Using the Health and Retirement Study, they document that out-of-pocket spending on health care rises rapidly with age and is much greater for high-income retirees. Using an approach similar to mine, they find that retirees' saving behavior is consistent

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[23]One possibility is that wealth provides a flow of utility during life over and above its contribution to future consumption and bequests. As Carroll (2000) and Kaplow (2009) discuss, people might value holding wealth for its own sake or for the security or status that holding wealth can provide. This type of preference is difficult to distinguish from bequest motives on the basis of saving and insurance decisions and is an interesting topic for future research.

[24]This is not to say that there are no differences in the bequest motives of people with and without children, only that many people without children appear to have meaningful bequest motives. When I estimate the model separately for people with and without children, I find stronger bequest motives among people with children (the estimates of ϕ are similar to each other and to the baseline estimate, while $\hat{c}_b^{children} \approx \$26,000 < \hat{c}_b^{no\ children} \approx \$39,000$ indicates a stronger bequest motive among people with children), but the restriction of no bequest motive is strongly rejected even in the (small) sample of people without children.

with a model with weak bequest motives and the equivalent of very strong public care aversion, and they conclude that medical spending significantly increases saving and that bequest motives have little effect. In fact, they find that retirees' saving decisions can be matched about equally well without a bequest motive; they cannot reject the hypothesis that members of their sample—also comprised of single retirees in the U.S.—do not have bequest motives.

The main reason that I reach a different result from De Nardi et al. (2010) is that I require the model to be consistent with the low rate of long-term care insurance coverage. Non-poor retirees who are as averse to receiving publicly-financed care as De Nardi et al.'s (2010) estimates imply are usually much better off buying long-term care insurance than saving to pay for their care, especially if they do not value bequests. As Appendix G shows, simulations of my model based on preferences that are similar to De Nardi et al.'s (2010) produce long-term care insurance ownership rates of around 60 percent, an order of magnitude larger than the empirical ownership rate in this sample.[25]

6 Conclusion

Rather than buy insurance against some of the main risks they face, many retirees self-insure by holding much of their wealth into old age. Although the choice of many retirees to self-insure is often viewed as evidence against the importance of bequest motives since it exposes their bequests to significant risk, I find that the choice to self-insure constitutes evidence in favor of bequest motives. Bequest motives reduce the demand for insurance by reducing the opportunity cost of precautionary saving; setting aside wealth to pay for possible future contingencies is much more costly for people without bequest motives who would otherwise like to consume all of their wealth. The evidence in favor of bequest motives is perhaps surprisingly strong given that models without bequest motives

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[25]De Nardi et al. (2010) and I also reach different results even when I exclude long-term care insurance from the estimation and rely solely on retirees' saving behavior. The reason we reach different conclusions in this case is the subject of ongoing investigation.

can roughly match either the saving or long-term care insurance decisions of most retirees and given the elusive nature of bequest motives in which bequests are luxury goods. By their nature, such bequest motives tend to have a marginal rather than a decisive impact on most decisions: Few choices involve a clear tradeoff between bequests and other goods.[26] Despite this, several patterns in the data are much more consistent with a standard life cycle model with bequest motives than with a model without bequest motives.

Although the elusive nature of bequest motives necessarily makes the conclusion that bequest motives play an important role in retirees' behavior more tentative than the conclusion that standard models without bequest motives cannot match retirees' behavior, a variety of evidence supports the idea that bequest motives—or preferences like altruism that might lead people to value bequests—are widespread. This evidence includes the prevalence and size of inter-household transfers during life (e.g., Gale and Scholz, 1994), survey responses about the importance of leaving bequests (e.g., Ameriks et al., 2011), and annuity guarantee choices (Laitner and Juster, 1996). In light of this evidence and my results, bequest motives are a high priority for future research.

My results suggest that the term *accidental bequests*, which is used to describe bequests that arise as a byproduct of precautionary saving against uninsured risks, may be misleading in its connotation that such bequests are neither intended nor valued. Although self-insurance tends to produce bequests that are both larger on average and more variable than those that would arise under full insurance, my results suggest that the value people place on these *incidental bequests* plays a key role in their decisions of how much risk to bear in the first place. Even individuals who would leave small bequests or even no bequest if perfect insurance were available, may—because of the value they place on

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[26]The elusive nature of bequest motives helps explain why bequest motives have been the subject of a prolonged debate in economics (e.g., Kotlikoff and Summers, 1981; Modigliani, 1988). Even life insurance decisions, perhaps the main decision that involves a clear tradeoff between bequests and other goods, would only register much stronger bequest motives (at least among retirees) than those identified in this paper. Due to the actuarial unfairness in life insurance, only retirees who wish to leave more than their entire non-annuity wealth as a bequest should consider buying life insurance to augment their bequest (Bernheim, 1991). I find, by contrast, that about half of retirees would leave *no* bequest were fair insurance available, which is consistent with Brown's (2001) conclusion that few retirees buy life insurance to increase their bequests.

bequests—choose far less insurance coverage than they would if insurance markets were perfect (Lockwood, forthcoming). If bequests were accidental in the sense that people did not value bequests, realized bequests would likely be much smaller, both because people would save less and, even more important for the non-rich, because people would buy more insurance.

My results highlight the importance of accounting for both bequest motives and the connection between bequest motives and insurance in evaluating policies such as social insurance policies and taxes on saving and inter-household transfers. Policies that affect the behavior of retirees, holders of much of the world's wealth, are likely to have significant effects on the economy, especially through their effects on the budgets of means-tested social insurance programs and on the size, distribution, and risk of bequests received by future generations. My results suggest that taxes on saving and inter-household transfers are likely to affect bequests by affecting retirees' insurance coverage as well as their saving. The induced changes in insurance coverage can change not only the magnitude but even the direction of policies' effects on bequests.

Appendices

A Asymptotic Distribution of the MSM Estimator and Over-identification Tests of the Model's Fit

Pakes and Pollard (1989) show that the MSM estimator, $\hat{\theta}$, is consistent and asymptotically normally distributed under regularity conditions satisfied here. The variance-covariance matrix of $\hat{\theta}$ is

$$\Omega_\theta = (G'_\theta W G_\theta)^{-1} G'_\theta W \left[V(\hat{\pi}) + \frac{N_d}{N_s} V(\hat{\pi}) + G_\chi \Omega_\chi G'_\chi \right] W G_\theta (G'_\theta W G_\theta)^{-1},$$

where G_θ and G_χ are the gradient matrices of the moment conditions with respect to θ and χ, $V(\hat{\pi})$ is the variance-covariance matrix of the second-stage empirical moments, Ω_χ is the variance-covariance matrix of the first-stage estimates, and N_d and N_s are the empirical sample size and the simulation sample size, respectively. I approximate the derivatives in the gradient matrices numerically. The square roots of the diagonal entries of Ω_θ are the standard errors of the second-stage parameter estimates, $\hat{\theta}$.

My calculation of the variance of the second stage estimates, Ω_θ, includes a correction for simulation error, $\frac{N_d}{N_s}V(\hat{\pi})$, but does not correct for the uncertainty in the first-stage parameter estimates, $G_\chi\Omega_\chi G_\chi$, since I adopt many of the first-stage parameter values from other sources rather than estimating them. Excluding the correction for the uncertainty in the first-stage parameters tends to make the parameter estimates appear more precise than they actually are and makes the fit of the model (measured by a chi-squared test) appear worse than it actually is. The first-stage correction would be increasing in the uncertainty of the first-stage parameter estimates and the sensitivity of the second-stage moments to the first-stage parameters. Simulation error (and the correction for it) approaches zero as the size of the simulated population relative to the size of the sample goes to infinity. Without the simulation and first-stage corrections, Ω_θ would be the standard variance of minimum distance estimators, $\Omega_\theta = (G_\theta' V(\hat{\pi})^{-1} G_\theta)^{-1}$, and the baseline weighting matrix would be optimal.

The number of second-stage moment conditions exceeds the number of second-stage parameters, so over-identification tests of the model are possible. If the model is correct, the (scalar) statistic

$$(\hat{\pi} - g_s(\hat{\theta}, \hat{\chi}))' W_{opt}(\hat{\pi} - g_s(\hat{\theta}, \hat{\chi}))$$

is a chi-squared random variable with the number of degrees of freedom equal to the number of second-stage moments less the number of second-stage parameters. The

weighting matrix in this statistic is the optimal weighting matrix,

$$W_{opt} = \left[V(\hat{\pi}) + \frac{N_d}{N_s} V(\hat{\pi}) + G_\chi \Omega_\chi G_\chi' \right]^{-1}.$$

B   Heterogeneity in Life Expectancy

I adjust the Robinson model of (Markov) transition probabilities across health states to match De Nardi et al.'s (2010) estimates of life expectancy conditional on reaching age 70 for different sex and income groups. A t-year-old in sex-income quintile group (s, q) faces the Robinson model health transition probabilities of a $(t + \Delta(s, q))$-year-old female, where $\Delta(s, q)$ is chosen to minimize the difference between predicted life expectancy at age 70 and De Nardi et al.'s (2010) estimates of life expectancy at age 70. Table 6 shows the age adjustments, $\Delta(s, q)$, and the resulting life expectancies of each group. The differences in life expectancies at age 70 across sex and income groups are substantial: Women live more than five years longer than men in the same income quintile, and men and women in the top income quintile live almost four years longer than their counterparts in the bottom quintile. Each group's adjusted life expectancy is within 0.6 years of De Nardi et al.'s (2010) estimate.

C   Expected and Realized Rates of Return on Wealth

Table 7 lists the historical returns data that I use to estimate the expected and realized rates of returns on retirees' portfolios. I follow Baker et al. (2007) and French and Benson (2011) in terms of data sources and assumptions.[27] Using data from the HRS, I classify retirees' assets into the six categories shown in the table as well as a residual "Other" category (which includes vehicles, for example) that I assume earns 0 percent real,

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[27]The main exception is that I use a different rate-of-return series for bonds because Baker et al.'s (2007) series does not extend to 2008, the end of my sample period. I am very grateful to Eric French for providing me with the historical returns data.

after-tax returns. Following Baker et al. (2007), I assume that Individual Retirement Account (IRA) assets are allocated 60 percent to stocks and 40 percent to bonds and that the rate of return on business assets is a weighted average of the returns on housing and stocks, with an 85 percent weight on housing.

Expected returns, $r = 0.04$.— Four percent is roughly the average real, after-tax return on a "typical" retiree's portfolio during the 38 years immediately preceding the sample period (3.9 percent from 1960–1997) or during the 51-year period including the sample period (4.0 percent from 1960–2010). The portfolio shares in the "typical" portfolio are the average shares in 1998 among the retirees in my sample between the 45th and 55th percentiles of the wealth distribution.[28]

Simulated returns, $r_{i,t} = \sum_j \alpha_{i,j,t} r_{j,t}$.— Retiree i's realized rate of return in year t is the weighted average of the realized rates of returns on different assets j in year t $(r_{j,t})$, weighted by i's portfolio shares in that year $(\alpha_{i,j,t})$. The portfolio shares of retirees with zero or negative net wealth are set equal to the median shares among people with between $5,000 and $15,000 of net worth. I assume that individuals' portfolio shares are the same in years between interviews as they were in the previous year.

Uncertain rates of return.— Section 5.4 tests the robustness of the results to retirees anticipating that they face uncertain rates of return on their wealth. Specifically, this test assumes that retirees view annual rates of return as independent draws from a normal distribution with a mean of four percent and a standard deviation of 3.3 percent, which is the standard deviation of the rate of return based on the average portfolio shares of my sample of single retirees over the past 51 years (1960–2010).

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[28]These shares are: 70.5 percent in occupied housing (on which people earn both a service flow and potentially capital gains), 7.0 percent in stocks (assuming that 60 percent of Individual Retirement Account [IRA] assets were stocks), 2.0 percent in bonds (assuming that 40 percent of IRA assets were bonds), 9.7 percent in liquid assets such as certificates of deposit, 0.1 percent in unoccupied housing (second houses), and (negative) 7.1 percent in debt, nearly all in the form of mortgages. About 17.8 percent of net wealth is in other assets such as vehicles that I assume earn zero real return.

D Simulation Procedure

Simulated wealth moments.— The simulated wealth moments are analogous to their empirical counterparts. Given a vector of parameter values, θ, I solve the model to find optimal consumption spending, $\hat{c}_t(\hat{w}_t, h_t, t; s, y, ltci; \theta)$, and optimal claiming of public support, $Pub_t(\hat{w}_t, h_t, t; s, y, ltci; \theta)$. I use these decision rules together with each individual's fixed characteristics, initial state, subsequent health path, and year-specific rates of return on wealth to simulate each individual's wealth as long as they live between 1999–2008. Specifically, the process of simulating the next-period wealth of a t-year-old with wealth w_t and health $h_t \neq d$ proceeds as follows. The individual: incurs acute medical costs of m_t drawn from distribution of acute medical care costs; incurs long-term care costs of $ltc(h_t, t)$ based on his or her health and age; receives net long-term care insurance benefits of $\lambda(h_t, t; ltci)$ based on his or her health, age, and long-term care insurance ownership status; and receives income equal to his or her average retirement income. Net wealth before government transfers is

$$\hat{x}_t = \max\{w_t - m_t, 0\} + y - ltc(h_t, t) + \lambda(h_t, t; ltci).$$

Net wealth after government transfers, x_t, depends on the individual's health status and the optimal claiming rule. Wealth at age $t + 1$ is

$$w_{i,t+1} = (1 + r_{i,t})(x_{i,t} - \hat{c}_{i,t}(\hat{w}_{i,t}, h_{i,t}, t_{i,t}; s_i, y_i, ltci_i; \theta)),$$

which depends on θ through the optimal consumption rule. I use the same procedure to calculate the simulated wealth moments from the simulated data as I use to calculate the empirical wealth moments from the actual data.

Simulated long-term care insurance moment.— The simulated long-term care insurance moment is the long-term care insurance ownership rate among the subset of the simulation sample who were 65–69 years old in 1998. Given a vector of parameter values, θ, I solve the

model to find the value functions, $V_t(\hat{w}_t, h_t, t; s, y, ltci; \theta)$. Simulated long-term care insurance ownership by individual i is one if i would be better off buying long-term care insurance given his or her state variables and zero otherwise,

$$ltci_i^s = \mathbb{1}\left\{V_{t_i}(\hat{w}_{i,t_i}, h_{i,t_i}, t_{i,t_i}; s, y, ltci = 1; \theta) > V_{t_i}(\hat{w}_{i,t_i}, h_{i,t_i}, t_{i,t_i}; s, y, ltci = 0; \theta)\right\}.$$

The simulated aggregate long-term care insurance ownership rate is the average of the individual ownership indicators. Simulated long-term care insurance ownership depends on θ through the value functions' dependence on θ.

Because the model must be solved separately for each long-term care insurance premium schedule, which is computationally costly, I simulate the demand for long-term care insurance only among 65–69-year-olds, and treat them for this purpose as if they were all healthy 67-year-olds, the average age at which people buy long-term care insurance (Brown and Finkelstein, 2007). Everyone therefore faces the same load on long-term care insurance; there is no adverse selection in the model.[29]

E Relationship of Bequest Motive to Altruistic Case

The bequest motive of an altruist who has a single, selfish heir with a T_h-year planning horizon is

$$v(b) = a \sum_{i=1}^{T_h} \beta^{i-1} u(c_i^h(b)).$$

If the heir has the same constant elasticity preferences for consumption as the altruist, and if her discount rate equals the interest rate, $\beta = \frac{1}{1+r}$, then each period she consumes her (permanent) income, y_h, plus the annuity value of any bequest she receives. In this case,

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[29]In practice, insurance companies limit adverse selection by denying coverage to people with certain health conditions (Murtaugh et al., 1997) and by front-loading premiums to minimize policy lapsation by people who remain healthy (Hendel and Lizzeri, 2003). In long-term care, Finkelstein and McGarry (2006) find that average long-term care usage is roughly equal for the insured and uninsured population, though Finkelstein et al. (2005) find that people who become healthier than average are more likely than others to drop their coverage.

the altruist's bequest motive can be written

$$v(b) = a p_h^\sigma \frac{(p_h y_h + b)^{1-\sigma}}{1-\sigma}, \tag{1}$$

where $p_h \equiv \sum_{i=1}^{T_h}(1+r)^{-(i-1)}$ is the cost of increasing the heir's rate of consumption by one unit. Altruistic bequest motives are defined by three parameters: the strength of altruism, a, the cost of increasing the heir's rate of consumption by one unit, p_h, and the heir's permanent income, y_h.

Using Equation 1, one can express the parameters of the bequest motive in the text in terms of the parameters of the altruistic bequest motive as

$$(c_b,\ \phi) = \left(\frac{y_h}{a^{1/\sigma}},\ \frac{a^{1/\sigma}p_h}{1 + a^{1/\sigma}p_h} \right).$$

c_b is increasing in the heir's permanent income and decreasing in the degree of altruism. ϕ is increasing in both the degree of altruism and the length of the heir's horizon. Because the altruistic bequest motive has three parameters while the parameterization in the paper has two, the estimates in the paper do not imply a unique set of altruistic parameters; one of the altruistic parameters must be set to solve for unique values of the other two. If the altruist places equal weight on his own and his heir's utility ($a = 1$) and the heir has an infinite horizon (because she has heirs of her own, say), then $c_b = y_h$ and $\phi = \frac{1+r}{1+2r}$, which is approximately 0.96 if $r = 0.04$.

F   Identification of the Model

This section shows which features of the data are most informative about the key parameters of the model. Panel (a) of Figure 8 shows a contour plot of the objective function in (c_b, ϕ)-space with c_{pub} fixed at its estimated value, $\hat{c}_{pub} = \$7,375$. The figure reveals that the model is well-identified: The objective function increases steeply as one

moves away from the parameter estimates in any direction. Retirees' saving and long-term care insurance decisions are much more consistent with models that have modest public care aversion and important bequest motives in which bequests are luxury goods than with any other combination of bequest motives and public care aversion. The remaining panels, which show contour plots in (c_{pub}, c_b)-space with ϕ fixed at its estimated value, $\phi = \hat{\phi} = 0.919$, show how the different moments contribute to the identification of the key parameters of the model.

Panel (b) shows the simulated long-term care insurance ownership rate. The 5.6 percent empirical long-term care insurance ownership rate suggests a combination of modest to no public care aversion ($c_{pub} \in [\$7,000, \$7,800]$) and moderate bequest motives ($c_b \in [\$15,000, \$35,000]$).

Panel (c) shows an objective function based on the median wealth moments. Saving by people around the median is inconsistent with very strong bequest motives ($c_b < \$15,000$), very strong public care aversion ($c_{pub} < \$4,000$), and the combination of weak bequest motives and weak public care aversion ($c_b > \$30,000$ and $c_{pub} > \$6,500$). Although the saving behavior of retirees around the median is most consistent with a combination of fairly strong bequest motives and modest public care aversion ($c_b \in [\$15,000, \$20,000]$ and $c_{pub} \in [\$6,000, \$7,800]$), the identification problem is apparent: Models with no bequest motive and moderate public care aversion ($c_b = \$\infty$ and $c_{pub} = \$4,500$) fit the data almost as well as models with moderate bequest motives and no public care aversion ($c_b = \$20,000$ and $c_{pub} > \$7,800$).

Panel (d) shows the objective function based on all of the wealth moments. Collectively, the saving behavior of people at different points in the wealth distribution identify the bequest motive and public care aversion fairly well and suggest that public care aversion is weak ($c_{pub} \geq \$7,000$) and that bequests are valuable luxury goods ($c_b \approx \$20,000$).

G   Other Estimates of Bequest Motives

A variety of approaches to estimating bequest motives have been employed, including comparing the behavior of people with and without children (Hurd, 1989), using survey data (Ameriks et al., 2011), using life cycle models to interpret anticipated and actual bequests (Hurd and Smith, 2002), and using overlapping generations models to interpret the distribution of wealth (De Nardi, 2004). Table 8 shows how my results relate to six of the main estimates in the literature: Hurd and Smith (2002), De Nardi (2004), Kopczuk and Lupton (2007), Ameriks et al. (2011), and De Nardi et al. (2010). (I do not show results based on Hurd's (1989) bequest motive because they are very similar to those from a model without bequest motives, which has already been discussed.) The table shows each paper's parameter estimates in 2010 dollars and the resulting simulated outcomes.[30] Parameters other than the key preference parameters come from my baseline parameterization.

My estimates appear in the first column. The other estimates are ordered by the average share of wealth bequeathed were medical spending risk fully insured at actuarially fair rates and actuarially fair annuities available. Broadly speaking, my results are fairly similar to those of Hurd and Smith (2002), De Nardi (2004), and Kopczuk and Lupton (2007); are less similar to those of Ameriks et al. (2011); and are different from those of Hurd (1989) and De Nardi et al. (2010). Ameriks et al. (2011) estimate a stronger bequest motive and a stronger aversion to public care than I do on the basis of spending data and responses to survey questions that ask respondents to choose between larger bequests and higher-quality long-term care. I discuss why I arrive at different conclusions from Hurd (1989) and De Nardi et al. (2010), who both estimate weaker bequest motives than I do, in Section 5.6.

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[30]Comparing public care aversion across papers is harder than comparing bequest motives because the models are somewhat different. My model is fairly similar to Ameriks et al.'s (2011) but less similar to De Nardi et al.'s (2010). De Nardi et al. (2010) do not distinguish between facility- and community- based care and have a single consumption floor for everyone. Strictly speaking, there is no public care aversion in their model. But the difference between a general consumption floor and a consumption-equivalent of publicly-financed nursing care is smaller than it first appears, because in these models social insurance is primarily used by individuals who experience costly nursing home stays. More important, the c_{pub} equivalent for De Nardi et al. (2010) appears to generate saving decisions in my model that are similar to those in their paper.

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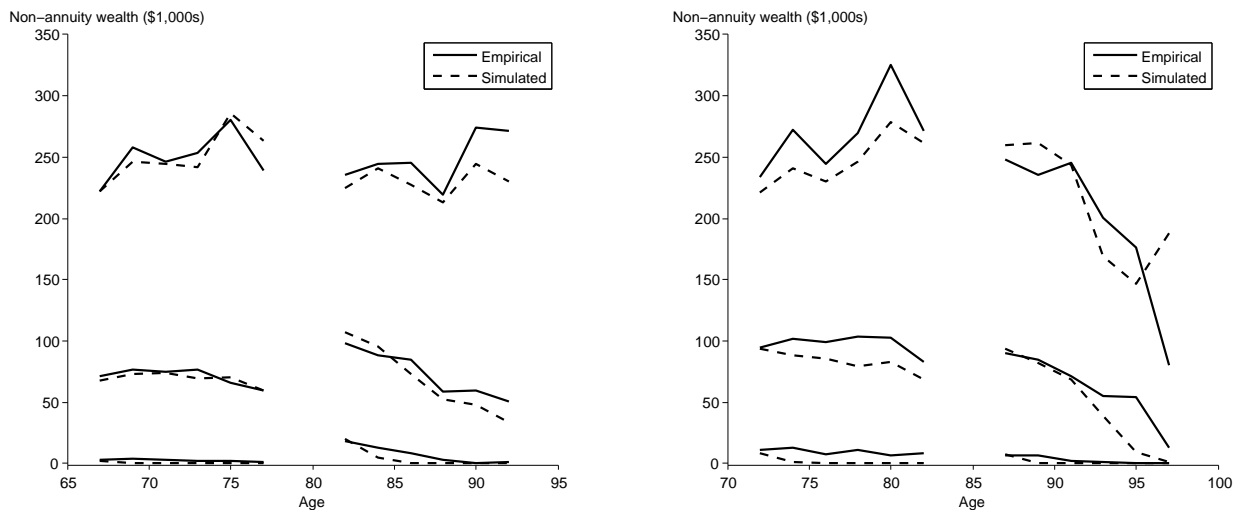
Figure 1: Empirical wealth moments (solid lines) and simulated wealth moments at the baseline estimates (dashed lines). Cohorts one and four are on the left and two and five are on the right. (Cohorts three and six are excluded to avoid overlapping lines.) The x-axis shows the average age of surviving members of the cohort. The y-axis shows total non-annuity wealth. Of the 3,386 individuals in the sample, all of whom were alive in 1998, 1,183 (34.9 percent) were still alive in the last wave in 2008. The empirical and simulated wealth moments do not coincide in 1998 (the left-most of each set of wealth moments) due to sampling error from drawing a finite sample for the simulation.
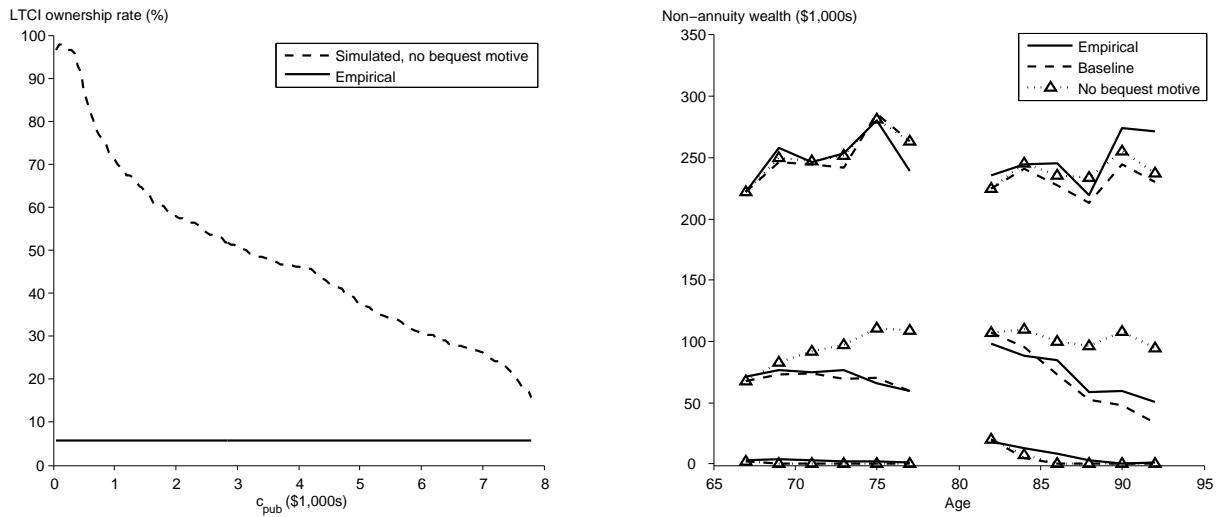
Figure 2: Simulated outcomes in the model without bequest motives. Left panel: Empirical long-term care insurance ownership rate (solid line) and simulated ownership rate as a function of the consumption value of publicly-financed nursing care (dashed line). The consumption value of privately-financed nursing care is $7,800. Right panel: Empirical wealth moments (solid lines), simulated moments from the baseline model (dashed lines), and simulated moments from the model without bequest motives fitted to the 25th and 75th percentiles (dotted lines with triangles; $\hat{c}_{pub} = \$2,500$).
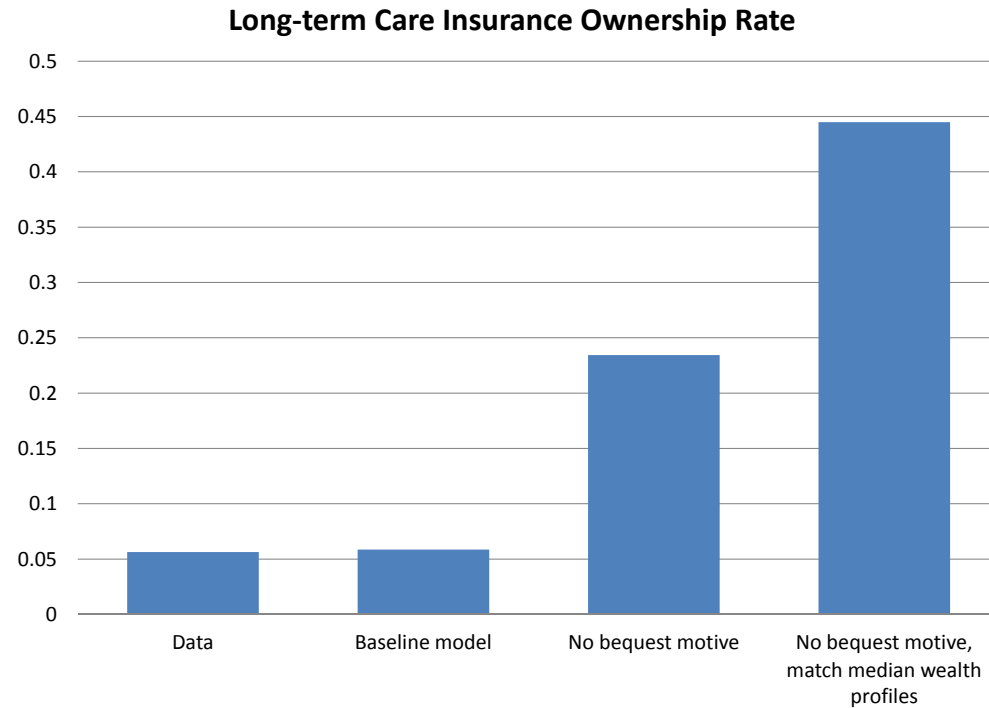
Figure 3: Simulated and empirical long-term care insurance ownership rates. The empirical ownership rate corresponds to the fraction of single retirees aged 70–79 in 1998 who report owning long-term care insurance that covers both nursing homes and home health care in at least half of the waves between 1998 and 2008 in which they report their ownership status, weighted by HRS respondent weights. The simulated ownership rates are based on three sets of preferences: the baseline estimates, the baseline public care aversion with no bequest motive, and a model without bequest motives fitted to the median wealth moments ($\hat{c}_{pub} = \$4,300$).
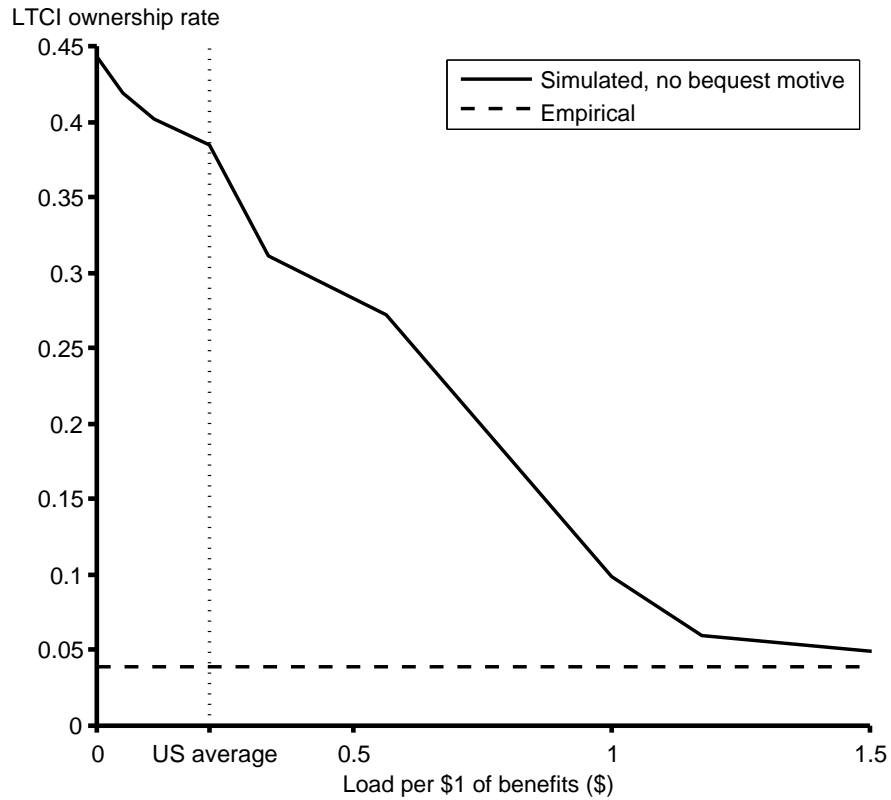
Figure 4: Long-term care insurance ownership among the middle quintile of the wealth distribution in the model without bequest models fitted to the median wealth moments ($\hat{c}_{pub} = \$4,300$ relative to $c_{priv} \equiv \$7,800$). The load is measured as dollars of load per dollar of benefits. Actuarially fair insurance corresponds to a load of zero. The vertical dotted line shows the average load on contracts in the U.S. market, which is about 22 cents per dollar of benefits (which corresponds to the 18 percent load as a fraction of premiums found by Brown and Finkelstein (2007)).
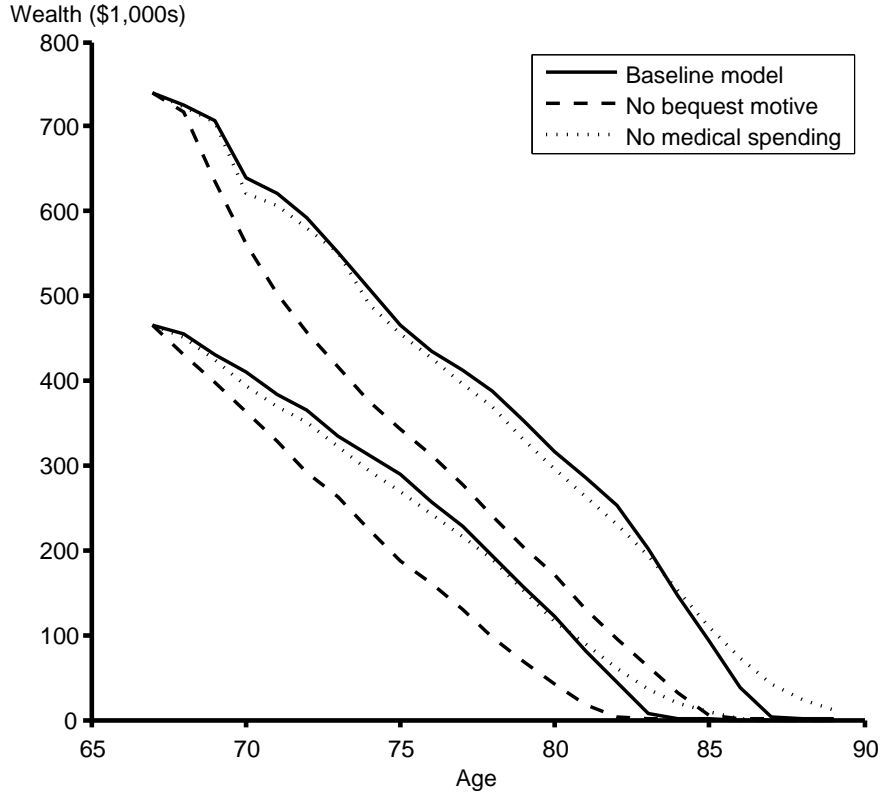
Figure 5: Simulated evolution of the median and 5th percentile of the distribution of non-annuity wealth among members of the first cohort (aged 65–69 in 1998) who remain alive for at least 23 years into their simulated future (at which time their average age is 90). The solid lines track the wealth distribution in the baseline model. The dashed lines track the wealth distribution if the bequest motive is shut down. The dotted lines track the wealth distribution if medical spending, including spending on both acute and long-term care, is shut down. Specifically, the decision rules come from a model without any long-term care or acute medical care costs ($ltc(h_t, t) = m_t = 0 \ \forall h_t, t$), but the simulation of wealth profiles includes medical costs. (Differences in wealth therefore reflect differences in saving behavior rather than differences in realized medical expenses.) Individuals in the simulation are assigned their reported (empirical) long-term care insurance ownership status.
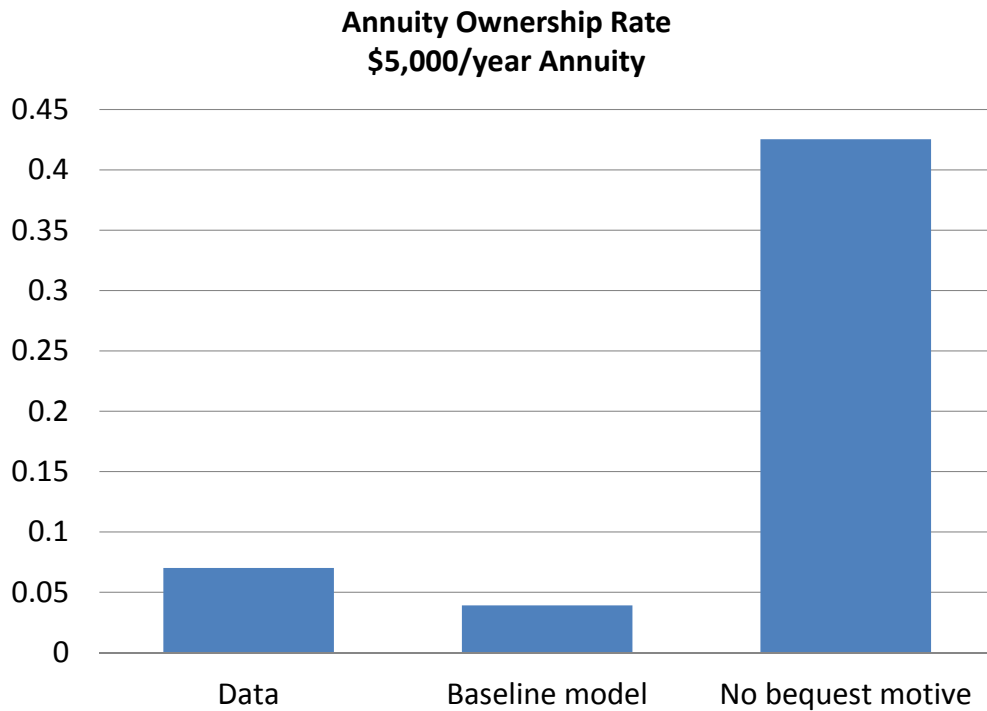
Figure 6: Empirical and simulated ownership rates of life annuities. The empirical annuity ownership rate corresponds to the fraction of single retirees aged 70–79 in 1998 who in the 1998 wave report owning an annuity that lasts for life, weighted by HRS respondent weights. The simulated annuity ownership rates are based on an annuity that pays the annuitant $5,000 of real income each year for life and has a ten percent load, typical of the U.S. private market (Brown, 2007).

Increase in LTCI Ownership Rate, Selected Policies
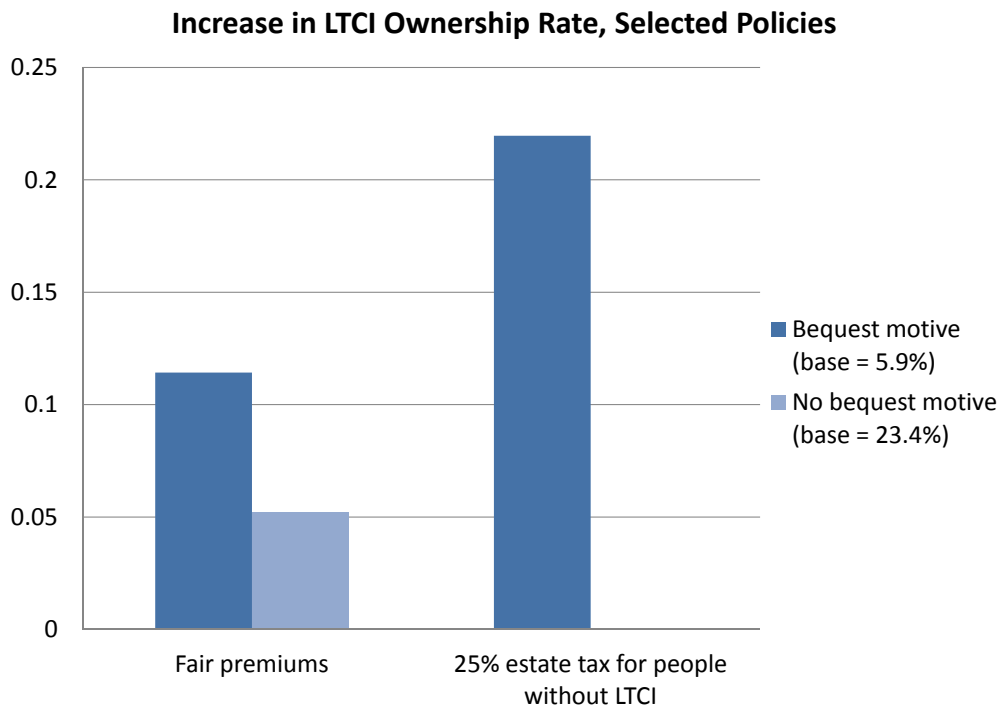
Figure 7: Increase in the simulated long-term care insurance ownership rate from two policies: subsidies for long-term care insurance that make its after-tax price actuarially fair, and long-term care insurance-contingent estate and gift taxes, under which people without long-term care insurance pay 25 percent tax rates on their transfers. The simulated ownership rates under the baseline policies are 5.9 percent for the model with a bequest motive and 23.4 percent for the model without a bequest motive.

(a)

(b)

(c)

(d)
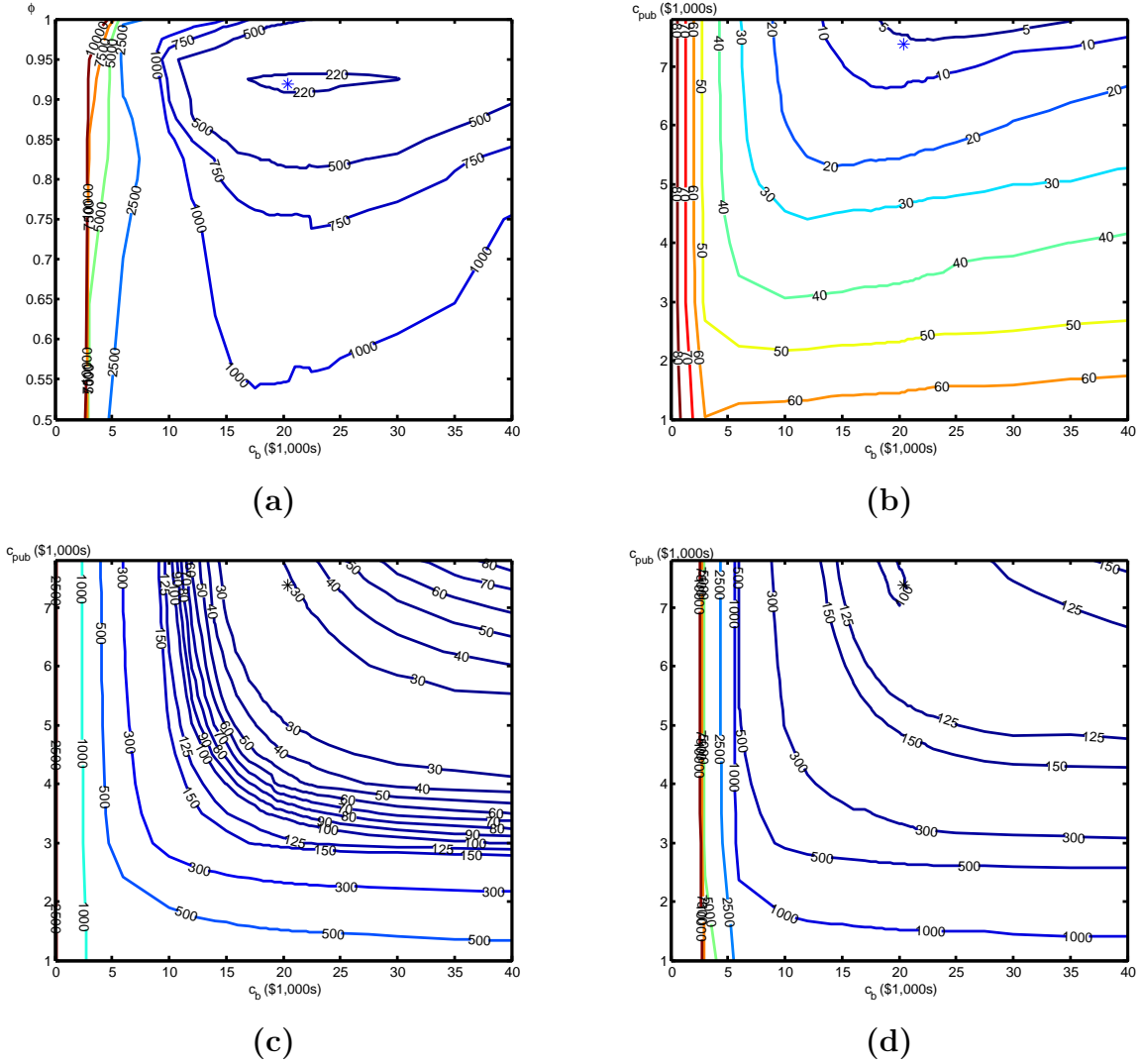
Figure 8: Panel (a): Contour plot of the objective function in (c_b, ϕ)-space with $c_{pub} = \hat{c}_{pub} = \$7,375$. Higher contours indicate greater mismatch between the simulated and empirical moments.
Panel (b): Contour plot of the simulated long-term care insurance ownership rate in (c_{pub}, c_b)-space with $\phi = \hat{\phi} = 0.919$. The empirical ownership rate is 5.6 percent.
Panel (c): Contour plot of the objective function based on the median wealth moments in (c_{pub}, c_b)-space with $\phi = \hat{\phi} = 0.919$.
Panel (d): Contour plot of the objective function based on all of the wealth moments in (c_{pub}, c_b)-space with $\phi = \hat{\phi} = 0.919$.
All panels: The asterisk marks the baseline estimates.

	HRS 65+	Single retirees 65+
Female	0.58	0.78
Age	74.4	77.5
Wealth	$419,086	$238,643
Income	$33,891	$18,360
Own LTCI	0.10	0.09
Own annuity	0.06	0.06
Have children	0.91	0.85
Widowed	0.33	0.79
Never married	0.03	0.07
Importance of leaving a bequest		
Very	0.22	0.24
Somewhat	0.46	0.43
Not	0.32	0.32
Sample size	19,951	3,386

Table 1: Summary statistics of the sample of people aged 65 and over in the HRS and only those who are single retirees (my sample). The statistics reported are means and are weighted by HRS respondent-level weights. The annuity ownership rate corresponds to annuities whose income stream continues as long as the individual lives. The values of all variables other than the importance of leaving a bequest variable come from the 1998 wave. The question about the importance of leaving a bequest was asked only in the 1992 wave, which primarily sampled cohorts younger than those in my sample, who are aged 65 and over in 1998. Among my sample of single retirees, less than nine percent answered this question.

Parameter	Source	Value in source	Value in this paper
Health states and transition probabilities: h_t, $Pr(h_{t+1} = h'\|h_t, t; s, y)$	Robinson (2002), Brown and Finkelstein (2008), author's calculations	h_t: healthy (he), home health care (hhc), assisted living facility (alf), nursing home (nh), dead (d). $Pr(h_{t+1} = h'\|h_t, t; s, y)$: Robinson model for females	Adjust health transitions to match life expectancies by sex and income quintile in De Nardi et al. (2010) (see Appendix B); maximum age (T) is 104
Long-term care costs: $ltc(h_t, t)$	MetLife Mature Market Institute (2002a,b), Robinson (2002), Brown and Finkelstein (2008), author's calculations	U.S. averages in 2002: $ltc(nh, t) = \$52,195 \ \forall t$, $ltc(alf, t) = \$26,280 \ \forall t$, $ltci(hhc, t) = \$37 * Q_s(t) + \$18 * Q_u(t)$, where $Q_s(t)$, $Q_u(t)$ from Robinson model[a]	Inflate value in source to reflect growth in spending, timing of care use: $ltc(nh, t) = \$69,500 \ \forall t$, $ltc(alf, t) = \$34,850 \ \forall t$, $ltci(hhc, t) = \$48 * Q_s(t) + \$23 * Q_u(t)$ (e.g., $ltc(hhc, 80) = \$10,800$)
Acute medical care costs: m_t	Author's estimates based on HRS	m_t distribution $(\forall t, h)$: $\log N(\$2,407, (\$9,374)^2)$	Inflate value in source to reflect growth in spending, timing of care use: $m_t \sim \log N(\$2,825, (\$11,003)^2)$
Long-term care insurance: $\lambda(h_t, t; ltci)$	Brown and Finkelstein (2007): Typical contract, average load on policies held for life[b]	Pay premiums when healthy, receive benefits up to \$36,500 when require LTC (\$100/day benefit cap); 18% load	Inflate value in source to 2010 dollars: maximum benefit = \$44,350
Social insurance for people in community ($h_t \in \{he, hhc\}$): $\bar{c}$	Brown and Finkelstein (2008): Supplemental Security Income floor for single elderly in 2000	$\bar{c} = \$6,180$	Inflate value in source to 2010 dollars: $\bar{c} = \$7,800$
Asset and income tests for publicly-financed institutional care: $\bar{x}$, $\bar{y}$	Brown and Finkelstein (2008): Medicaid modal state thresholds in 1999	$\bar{x} = \$2,000$, $\bar{y} = \$360$	Inflate value in source to 2010 dollars: $\bar{x} = \$2,650$, $\bar{y} = \$450$
Consumption value of privately- and publicly-financed institutional care: c_{priv}, c_{pub}	Brown and Finkelstein (2008): c_{priv} normalization	$c_{priv} = \$6,180$, c_{pub} estimated in second stage	Inflate value in source to 2010 dollars: $c_{priv} = \$7,800$
Discount factor: β	Brown and Finkelstein (2008)	$\beta = 1/1.03$	Same as source, test robustness
Coefficient of relative risk aversion: σ	Brown and Finkelstein (2008)	$\sigma = 3$	Same as source, test robustness
Anticipated rate of return: r	Author's estimates (see Appendix C)	$r = 0.04$	Same as source, test robustness

Table 2: Baseline values of first-stage parameters. Notes:
(a) Medicare covers 35 percent of home health care spending in the model but none of the costs of nursing homes or assisted living facilities, as the Robinson model excludes Medicare-covered (short-term) stays in skilled nursing facilities.
(b) In calculating long-term care insurance premiums, future benefits and premiums are discounted at the risk-free interest rate, assumed to be 2 percent per year. The 18 percent load means that on average people receive 82 cents worth of benefits for each \$1 of premiums paid.

| | Baseline model (1) | Robust weighting matrix (2) | Restricted models | | |
			No bequest motive ($\phi = 0$) (3)	Strong public care aversion ($c_{pub} = \$5,000$) (4)	Near-homothetic bequest motive ($c_b = \$5,000$) (5)
Parameter estimates, $\hat{\theta}$					
$\hat{c}_{pub}$: public care value (\$)	7,375	7,769	7,800	5,000	7,791
($c_{priv} = \$7,800$)	(394)	(409)	(40)	-	(89)
$\hat{c}_b$: bequest motive	20,416	16,704	-	20,183	5,000
curvature (\$)	(1,982)	(1,579)	-	(1,090)	-
$\hat{\phi}$: bequest motive	0.919	0.920	0	0.971	0.013
strength	(0.02)	(0.02)	-	(0.01)	(0.03)
Goodness-of-fit					
χ^2 stat	74.5	77.1	388.1	159.9	380.0
p-value	0.85	0.79	<2.2e-16	4.3e-6	<2.2e-16
Simulated LTCI (%)	5.9	5.9	15.7	8.6	15.8

Table 3: Estimation results based on the baseline weighting matrix and the robust weighting matrix, as well as results from estimating three restricted versions of the model: no bequest motive ($\phi = 0$), strong public care aversion ($c_{pub} = \$5,000$), and near-homothetic bequest motives ($c_b = \$5,000$). Standard errors appear in parentheses. The empirical long-term care insurance ownership rate is 5.6 percent.

	Baseline preferences		No bequest motive		No bequest motive, match saving of middle-class	
	No LTCI	Effect of LTCI	No LTCI	Effect of LTCI	No LTCI	Effect of LTCI
Expected consumption (\$)	320,957	-10,950	350,740	-15,491	283,535	36,367
Expected bequest (\$)	71,058	-8,161	46,866	-7,645	105,078	-52,108
Willingness to pay for long-term care insurance (\$)						
Average load (18%)	-2,513	-	4,618	-	86,098	-
Actuarially fair	6,765	-	16,385	-	96,580	-

Table 4: Long-term care insurance demand and simulated outcomes with and without long-term care insurance. Expected discounted consumption, expected discounted bequests, and the willingness to pay for long-term care insurance are simulated for a healthy 67-year-old near the 75th percentile of the wealth distribution ($N = \$200,000$, $y = \$20,000$) with one of three sets of preferences: the baseline preferences, the baseline but with no bequest motive, and a model without bequest motives fitted to the median wealth moments. The first column in each pair shows the values of the outcomes for someone without long-term care insurance. The second column in each pair shows the effect of buying long-term care insurance on these outcomes.

	Baseline model (1)	Wealth only (2)	More patient ($\beta = 1.01$) (3)	Middle-class only (4)	Uncertain returns (5)	Consume in nursing facilities (6)	Higher LTC costs (7)	More risk-averse ($\sigma = 5$) (8)
Parameter estimates, $\hat{\theta}$								
$\hat{c}_{pub}$: public care value ($)	7,375	7,779	7,787	7,380	7,518	7,657	7,636	7,789
($c_{priv} = \$7,800$)	(394)	(991)	(371)	(433)	(582)	(613)	(893)	(224)
$\hat{\phi}$: bequest motive	0.919	0.776	0.939	0.805	0.917	0.981	0.954	0.976
strength	(0.017)	(0.029)	(0.008)	(0.064)	(0.017)	(0.011)	(0.008)	(0.007)
$\hat{c}_b$: bequest motive	20,416	10,506	26,685	10,894	20,247	27,591	21,285	18,209
curvature ($)	(1,982)	(809)	(2,121)	(3,009)	(2,136)	(1,819)	(2,020)	(1,191)
Goodness-of-fit								
χ^2 stat	74.5	70.1	80.1	16.8	74.2	105.6	119.9	156.9
p-value	0.85	0.91	0.71	0.95	0.85	0.10	0.01	<2.2e-16
p-value of no-bequest-motive test	<2.2e-16	4.98e-6	<2.2e-16	<2.2e-16	<2.2e-16	<2.2e-16	<2.2e-16	<2.2e-16
Simulated LTCI (%)	5.9	22.7	6.6	3.9	6.0	6.8	6.4	7.9
Bequests with full, fair insurance								
Average share of wealth left as bequest	23.6	18.7	20.3	20.8	23.3	28.5	29.4	42.4
Fraction who leave bequest	45.7	61.9	37.2	61.0	46.0	36.4	44.4	48.8

Table 5: Robustness of results to different parameter values and estimating moments. The first column reproduces the baseline estimates. The other columns are ordered by the average share of wealth left as bequests were medical expenses fully insured and actuarially fair annuities available. The second column shows results based only on the wealth moments, excluding long-term care insurance from the estimation. The third column shows results when individuals are more patient ($\beta = 1.01$ instead of 0.97). The fourth column shows results from estimating the model based only on the "middle-class": the median wealth moments and the long-term care insurance ownership rate among the middle quintile of the wealth distribution. The fifth column shows results when retirees anticipate uncertainty in the returns on wealth, which matches the standard deviation in the typical retiree's portfolio (details in Appendix C). The sixth column shows results based on a model that allows residents of nursing homes and assisted living facilities to buy consumption over and above the consumption they receive from their long-term care. The seventh column shows results based on a model with 50 percent higher long-term care costs. The final column shows results based on a model with a coefficient of relative risk aversion of 5 instead of 3. Standard errors appear in parentheses. The empirical long-term care insurance ownership rate is 5.6 percent for the full sample and 3.8 for the middle quintile of the wealth distribution (column four).

| Healthy males | | | Healthy females | | |
| Life expectancy at 70 | | | Life expectancy at 70 | | |
Age adjustment to Robinson, Δ	De Nardi et al. (2010)	Adjusted Robinson	Age adjustment to Robinson, Δ	De Nardi et al. (2010)	Adjusted Robinson
15	7.6	7.7	5	12.8	12.6
13	8.4	8.6	3	13.8	13.8
12	9.3	9.0	2	14.7	14.4
10	10.5	9.9	0	15.7	15.7
8	11.3	10.9	-2	16.7	17.2

Table 6: Adjustments to the Robinson model of health transitions to match life expectancy differences across sex and income groups documented in De Nardi et al. (2010).

| Asset | Data source | Taxation | Return, 1998–2008 (%) | | Portfolio |
			Mean	Std. dev.	share (%)
Occupied housing	OFHEO, Baker et al. (2007)	0% on capital gains, 1%/yr property tax	7.9	3.2	54.8
Stocks	CRSP	0% on capital gains, 20% on div yield (assume 2% yield)	2.6	16.9	9.3
Bonds	AAA long bonds yield to maturity	20%	3.2	1.0	2.2
Liquid (CDs)	Treasury	20%	1.2	1.4	6.9
Unoccupied housing	OFHEO	0%	4.3	3.2	1.5
Debt	Baker et al. (2007)	20%	2.4	-	-16.9

Table 7: Data sources and assumptions underlying the calculations of the expected and realized rates of return on wealth. The mean returns are the geometric averages of annual real, after-tax returns. The portfolio shares are the average shares of net wealth held in each asset in 1998 by the sample of single retirees, weighted by HRS respondent-level weights. The assumption of zero taxation of capital gains comes from the assumption that a large fraction of retirees' capital gains are not realized (by asset sales) during the sample period. Additional details about the data sources can be found in Baker et al. (2007).

	This paper	De Nardi et al. (2010)	De Nardi (2004)	Hurd & Smith (2002)[a]	Kopczuk & Lupton (2007)	Ameriks et al. (2011)	Data
Bequest motive							
$\hat{\phi}$: strength	0.92	0.88	0.95	1	1	0.94	
$\hat{c}_b$: curvature ($1,000s)	20.4	48.4	27.0	34.1	31.9[b]	5.3	
Public care aversion							
$\hat{c}_{pub}$ ($1,000s) ($c_{priv} = 7.8$)	7.4	$\approx 3.6^c$	N/A	N/A	N/A	$\approx 4.7^d$	
Bequests with full, fair insurance							
Average share of wealth bequeathed	0.24	0.06	0.23	0.27	0.30	0.65	
Fraction who leave bequest	0.46	0.21	0.37	0.30	0.32	0.73	
Bequests, share of initial non-annuity wealth							
Overall	0.45	0.48	0.49	0.77	0.80	0.69	
Bottom wealth quartile	4.48	11.90	1.64	2.46	2.62	23.24	
2nd quartile	0.26	0.71	0.18	0.27	0.31	1.14	
3rd quartile	0.36	0.61	0.30	0.40	0.44	0.83	
Top quartile	0.48	0.44	0.55	0.86	0.89	0.63	
Medicaid's share of nursing home costs	0.47	0.39	0.50	0.48	0.48	0.36	0.45^e
Long-term care insurance (%)	5.9	59.1	0.2	0.1	0.1	35.6	5.6
Moments	Wealth change, LTCI	Wealth change	Wealth & bequest dists.	Antic. bequests	Wealth change	Spending, survey	

Table 8: Comparison of results to other studies. All statistics are simulated for 65–69-year-old single retirees other than Medicaid's share of nursing home costs which is simulated for the entire sample to make it more comparable to the data. Parameters other than the key preference parameters (bequest motives, the consumption-equivalent of publicly-financed nursing care, and the coefficient of relative risk aversion) come from my baseline parameterization.
(a) Hurd and Smith (2002) is the bequest motive estimated by Lockwood (forthcoming) to match Hurd and Smith's (2002) estimate of the average anticipated bequest in the Health and Retirement Study.
(b) Kopczuk and Lupton (2007) estimate a switching regression model, which indicates that about three-quarters of single retirees have this bequest motive.
(c,d) These public care consumption-equivalents are only approximate since my model is not identical to De Nardi et al.'s (2010) or Ameriks et al.'s (2011).
(e) The data on Medicaid's share of nursing home costs are for all people aged 65 and older, whereas only single retirees are included in the simulation.