The Importance of Bequest Motives: Evidence from Long-term Care Insurance and the Pattern of Saving*

Lee M. Lockwood

lockwood@nber.org

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Abstract

Many households spend their wealth slowly during retirement, holding much of their wealth into old age. Determining why they do so is made difficult by a fundamental identification problem: retirees' saving decisions reflect the combined strength of precautionary and bequest motives. Given the substantial medical spending and mortality risks that retirees face, savings are spent primarily on precautionary needs in some states and on bequests in others. In this paper, I use people's decisions about whether to buy long-term care insurance and the pattern of saving across the wealth distribution to separately identify precautionary and bequest motives. Estimations based on the Method of Simulated Moments identify modest precautionary motives and widespread, important bequest motives. The estimates imply that among 65–69-year-old single retirees in the U.S., bequest motives increase

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bequests from 28 percent to 57 percent of initial non-annuity wealth and reduce the long-term care insurance ownership rate from 41 percent to 6 percent.

1 Introduction

A repeated finding is that people typically spend down their wealth slowly during retirement.[1] Yet the reason that retirees spend their wealth slowly remains poorly understood, largely due to a fundamental identification problem. 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). Due to the presence of significant uninsured risks, neither high saving nor large realized bequests necessarily imply strong bequest motives, as they could instead reflect precautionary saving against medical spending and lifespan risks. Resolving this identification problem is important to formulate good policy. The consequences of various taxes and social insurance programs, for example, depend crucially on the nature and strength of precautionary and bequest motives.

In this paper, I use two strategies to separately identify bequest and precautionary motives. My main strategy is to consider long-term care insurance purchasing decisions in addition to saving. The risk of someday requiring costly long-term care, such as a prolonged stay in a nursing home, is the largest financial risk facing retirees and is the primary driver of precautionary saving in calibrated life cycle models. Moreover, both precautionary saving and the demand for long-term care insurance depend crucially on the same feature of these models: the utility cost of running out of wealth and receiving means-tested social insurance, especially when requiring care in a nursing home. The greater is this utility cost, the greater is the incentive to buy long-term care insurance and

[1] For recent evidence on the evolution of wealth during retirement in the U.S., see Poterba et al. (2010).

to engage in precautionary saving. So although several combinations of bequest and precautionary motives may be similarly consistent with retirees' saving decisions, many of these combinations are unlikely to be consistent with the low demand for long-term care insurance, owned by only about 10 percent of U.S. retirees.

In addition to being informative about the precautionary motive, long-term care insurance decisions are also informative about the nature and strength of bequest motives. In general, bequest motives can either increase or decrease the value of long-term care insurance depending on the relative importance of two opposing effects. On the one hand, bequest motives tend to increase the value of long-term care insurance because long-term care insurance insures bequests. On the other hand, bequest motives tend to decrease the value of long-term care insurance because long-term care insurance frees people from the need to save for possible future care costs and, thus, allows people to consume more aggressively—and leave smaller bequests—if they wish. The value of this aspect of long-term care insurance is inversely related to the strength of bequest motives: people with stronger bequest motives gain less from the opportunity to increase their consumption at the expense of bequests.[2] The net effect of bequest motives on the demand for long-term care insurance therefore depends on the strength of bequest motives as well as on attitudes toward risk in bequests. People who are highly risk averse over bequests are likely to value long-term care insurance more than similar people without bequest motives. People who value bequests but are not very risk averse over bequests are likely to value long-term care insurance less than similar people without bequest motives.

My second strategy to separately identify bequest and precautionary motives is to compare the saving decisions of retirees across the wealth distribution. When bequests are luxury goods, as much evidence suggests they are, bequest motives have a greater effect on the saving of the rich than of the poor. Precautionary motives, on the other hand, are generally stronger for people with less wealth because they run a greater risk of having

[2]The value people place on the opportunity to increase their consumption at the expense of bequests is also a key determinant of the value of life annuities (Lockwood, 2010).

their wealth exhausted by a spending shock.

I use the Method of Simulated Moments to estimate bequest and precautionary motives in a life cycle model of retirement with medical spending and lifespan risk. The estimation is based on the wealth and long-term care insurance ownership of single retirees in the Health and Retirement Study. The limited demand for long-term care insurance and the pattern of saving across the wealth distribution indicate widespread, important bequest motives. The model matches 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 estimates are robust to different estimating moments and modeling assumptions. Statistical tests strongly reject the model without bequest motives. Moreover, the model with bequest motives comes much closer to matching the limited demand for life annuities than the model without bequest motives.

The estimates indicate that bequest motives significantly increase saving, even among people in the bottom half of the wealth distribution. Bequest motives also significantly reduce the demand for long-term care insurance and annuities, especially by people in the top half of the wealth distribution. The estimates imply that bequests are luxury goods: with full, actuarially fair insurance only about half of single retirees would even leave a bequest. Yet with actual insurance markets, the effects of the estimated bequest motive are more widespread. The estimated bequest motive more than doubles bequests by retirees in the second and third quartiles. Moreover, the bequest motive has larger effects than medical spending risk on saving, even among retirees in the second quartile of the wealth distribution, and on the demand for annuities.

Both main identification strategies indicate that precautionary saving due to long-term care and mortality risks is modest and that bequest motives in which bequests are luxury good are widespread. First consider the combination of the slow wealth spend down by most retirees and the low ownership of long-term care insurance. Low ownership of long-term care insurance significantly limits the extent to which precautionary motives can

explain retirees' saving because precautionary motives strong enough to match the saving of middle-class retirees produce far greater long-term care insurance ownership than is observed. Given this constraint on the precautionary motive, the model requires a strong bequest motive to match the saving decisions of middle-class and richer retirees. Low ownership of long-term care insurance also suggests that people are not very risk averse over bequests, or, equivalently in the model, that bequests are luxury goods. The estimated bequest motive encourages people to self-insure their long-term care risks because they value the large bequests that often accompany such a strategy and because they can partially insure their consumption by adjusting their bequests based on how their risks unfold. By consuming for themselves most or all of their wealth in states with large spending needs and leaving bequests in states with lower spending needs, people can insure their consumption with their bequests. Of course, this strategy of self-insurance leaves bequests at risk, but my estimates, as well as other evidence such as the high wealth elasticity of bequests (Auten and Joulfaian, 1996; Hurd and Smith, 2002), suggest that bequest insurance is not valuable enough to justify buying available long-term care insurance.[3]

The pattern of saving across the wealth distribution also indicates modest precautionary motives and important bequest motives. Except when experiencing large medical spending shocks, people throughout the wealth distribution typically spend their wealth slowly during retirement (Poterba et al., 2010), and richer people generally save at higher rates than the poor (Dynan et al., 2004). Models in which saving is driven primarily by precautionary motives predict roughly the opposite. Strong precautionary motives encourage people to hold a stock of wealth in order to support themselves in high-cost states, and building a given stock of wealth requires greater saving by people who have less wealth to begin with.[4] Models in which saving is driven largely by bequest motives in

[3]Buying long-term care insurance involves two main costs: insurance loads (18 percent on average in the U.S. market Brown and Finkelstein, 2007) and reduced eligibility for means-tested social insurance (Pauly, 1990; Brown and Finkelstein, 2008).

[4]Of course, people who are sufficiently poor are likely to be better off relying on social insurance than trying to pay for their own expenses in high-cost states (Hubbard et al., 1995). Precautionary saving therefore tends to be greatest among people who are neither so poor as to prefer to rely on means-tested

which bequests are luxury goods, on the other hand, match the higher rates of saving by richer retirees relative to poorer ones.

2 Relationship to the Literature

This paper is most closely related to the literature that seeks to understand why many retirees spend their wealth slowly during retirement (e.g., Palumbo, 1999; Dynan et al., 2002; Ameriks et al., 2009; De Nardi et al., 2010). The key feature that distinguishes my approach is that I model retirees' choices about long-term care insurance, whereas the rest of the literature takes risk exposure as given. Given the large spending risks that retirees face, models with strong enough precautionary motives can match the slow wealth spend down by middle-class retirees even without bequest motives. This has led many to conclude that bequest motives have little effect on most retirees' saving. Dynan et al. (2002), for example, suggest that with the substantial uninsured risk that people face, policies that effectively shut down bequest motives, such as (successfully enforced) confiscatory transfer taxes, would have little effect on most people's saving.[5] My findings, however, suggest that bequest motives are both an important determinant of saving and an important reason why people face so much uninsured risk in the first place. Bequest motives appear to significantly reduce purchases of long-term care insurance and annuities by making self-insurance more attractive.

In addition to providing new evidence on the importance of bequest motives for saving, this paper also helps explain the low ownership of long-term care insurance, especially among the rich. The leading explanations for the limited ownership of long-term care insurance are: crowd-out by Medicaid (Pauly, 1990; Brown and Finkelstein, 2008) or by

social insurance nor so rich as to already have a sufficient buffer against high expenses (Ameriks et al., 2009). But from the perspective of the debate about precautionary and bequest motives, the relevant population is those people whose saving suggests that they are not planning to rely on social insurance. Among this group, a given precautionary motive has a greater effect on the saving of those with less wealth.

[5]This is not to say that confiscatory transfer taxes would have little effect on the economy. The very rich hold a large share of total wealth, so policies that affect their saving have potentially large effects on aggregate wealth.

informal care (Pauly, 1990; Zweifel and Struwe, 1996); high prices, perhaps due to adverse selection; and systematic mistakes, perhaps due to a lack of planning. Although these theories have some empirical support, they have difficulty explaining why long-term care insurance ownership is so low even among rich retirees. Retirees in the upper part of the wealth distribution are poorly insured by Medicaid, use relatively little informal care (Kemper, 1992; Ettner, 1994), and are more likely to plan for their retirement (Lusardi and Mitchell, 2007). Yet even among the richest retirees, it is difficult to find a group in which the long-term care insurance ownership rate exceeds 20 percent. My results show why people who understand the risks they face and who do not wish to rely on Medicaid or on their families may prefer to self-insure their long-term care risk.

Other than strategic bequest motives, which refer to situations in which people exchange bequests for services from their heirs (Bernheim et al., 1985), the literature has mostly ignored bequest motives as a factor in long-term care insurance purchasing decisions. When non-strategic bequest motives are discussed, they are often assumed to *increase* the demand for insurance because long-term care insurance insures bequests (e.g., Pauly, 1990). In this paper, I find that bequest motives that are consistent with saving decisions reduce the demand for long-term care insurance because they make self-insurance more attractive. The self-insurance role of wealth held in old age also underlies Davidoff's suggestion that housing wealth can substitute for long-term care insurance (Davidoff, 2009, 2010). In his model, people consume their housing wealth if and only if they require long-term care, so home equity insures consumption. Bequest motives can explain why people might consume their housing wealth only in high-cost states, and can therefore explain the limited market for reverse mortgages, which is puzzling in the context of selfish life cycle models.

3 Model

The model and parameterization follow closely Brown and Finkelstein (2008), who study the demand for long-term care insurance.[6] A single retiree who faces medical spending and lifespan risk decides how much to consume and whether to buy long-term care insurance. Each period is one year.

Preferences.— A t-year-old maximizes expected utility from consumption and bequests,

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

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

$$v(b) = \left(\frac{m}{1-m} \right)^{\sigma} \frac{\left(\frac{m}{1-m} c_0 + b \right)^{1-\sigma}}{1-\sigma} \text{ if } m \in (0,1),$$

$v(b) = c_0^{-\sigma} b$ if $m = 1$, and $v(b) = 0$ if $m = 0$. This is a re-parameterized version of a commonly-used functional form (e.g., De Nardi, 2004; Ameriks et al., 2009; De Nardi et al., 2010), which nests as special cases nearly all of the bequest motives commonly-used in the literature. This parameterization has good numerical properties and easy-to-interpret parameters. $c_0 \geq 0$ is the threshold consumption level below which, under conditions of perfect certainty or with full, fair insurance, people do not leave bequests: $v'(0) = c_0^{-\sigma} = u'(c_0)$. $m \in [0,1)$ is the marginal propensity to bequeath in a one-period problem of allocating wealth w between consumption and an immediate bequest for people rich enough to consume at least c_0 ($w \geq c_0$).[7] Smaller values of c_0 mean the bequest motive

[6] The main differences between my model and Brown and Finkelstein's (2008) aside from my inclusion of bequest motives are that I use year-long rather than month-long time periods and that I abstract from medical cost growth. These choices significantly reduce computation time, which is especially important given the computation-intensive estimation strategy. Both assumptions are standard in the saving literature.

[7] With these utility functions, the optimal bequest by someone maximizing $\max\{u(c) + v(b)\}$ subject to

"kicks in" at a lower rate of consumption. If $c_0 = 0$, preferences over consumption and bequests are homothetic and people are equally risk averse over bequests and consumption. If $c_0 > 0$, bequests are luxury goods and people are relatively less risk averse over bequests than over consumption. Larger values of m mean that people bequeath a larger fraction of the wealth left over after buying c_0 worth of consumption. As m approaches one, the bequest motive approaches a linear bequest motive with a constant marginal utility of bequests equal to $c_0^{-\sigma}$. Together with a parameter governing the strength of the precautionary motive to be introduced shortly, the bequest motive parameters, m and c_0, are the main objects of interest in the estimation.

Health and medical spending risks.— At any time, the individual is in one of five health states: healthy (he), requiring home health care (hhc), living in an assisted living facility (alf), living in a nursing home (nh), or dead (d). The (Markov) transition probabilities across these states depend on the individual's current health status and age, $Pr(h_{t+1} = h'|h_t, t)$. I take these transition probabilities from a widely-used actuarial model developed by James Robinson.[8]

The costs of the long-term care services required in each health state are equal to U.S. averages in 2002 (MetLife Mature Market Institute, 2002a,b). Nursing homes cost $52,195 per year ($143 per day), assisted living facilities cost $26,280 per year ($72 per day), skilled home health care (provided by a registered nurse) costs $37 per hour, and unskilled home health care costs $18 per hour. I convert the hourly costs of home health care into yearly costs by using Robinson's (2002) estimates of average utilization as a function of age. 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

$c + b = w$ is $b^*(w) = \max\{0, m(w - c_0)\}$.

[8]Insurance companies and governments use this model to predict reimbursement-eligible long-term care usage (see Robinson, 2002; Brown and Finkelstein, 2004). Although Robinson (2002) estimates separate models for men and women, I use the model for women in the simulations for both men and women because it better approximates the long-term care risk of single individuals. Wives typically outlive their husbands and provide them significant informal care as their health deteriorates. Population averages of formal long-term care use by men therefore understate the risk faced by single men who have less access to informal care.

Medicare-covered (short-term) stays in skilled nursing facilities. Based on these prices and usage rates, a 70-year-old who needs home health care incurs about $5,133 of home health care costs, and a 90-year-old incurs about $11,927. I focus on long-term care spending because this is the main risk facing the elderly in the U.S. and the dominant driver of precautionary saving in life cycle models.[9]

Long-term care insurance.— A long-term care insurance contract specifies benefit eligibility rules, maximum daily benefits, and a state-contingent premium schedule. I model 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 $36,500 in years in which they are sick ($h \in \{hhc, alf, nh\}$) (which corresponds to a maximum daily benefit of $100). Premiums exceed expected discounted benefits by 18 percent, the average load on long-term care insurance policies held for life in the U.S. (Brown and Finkelstein, 2007). Individuals make a once-and-for-all choice about whether to buy long-term care insurance at the beginning of retirement. Those who buy it continue paying premiums and receiving benefits for life.

Timing, budget sets, and social insurance.— People receive a constant (real) stream of non-asset income, y, as long as they live. Assets earn a certain, after-tax real return r. A t-year old enters the period with wealth $w_t = (1 + r)s_{t-1} \geq 0$, where $s_{t-1} \geq 0$ is total savings at age $t - 1$. Health status is realized at the beginning of each period. People who die leave bequests $b_t = w_t \geq 0$. People may not die in debt or, equivalently, leave negative bequests. Together with mortality risk, this amounts to a no-borrowing constraint. People who live receive their income and realize their net medical spending (including long-term care insurance premiums and benefits) before receiving government transfers and deciding how much to consume. Net wealth before government transfers is

$$\hat{x}_t = w_t + y - m(h_t, t, ltci),$$

[9]Net of Medicare, medical spending on acute illnesses is much smaller than spending on long-term care for chronic illnesses. According to the National Center for Health Statistics, average out-of-pocket medical spending by non-institutionalized people (including those receiving home health care) over age 65 in the U.S. in 2004 was just $600 (Ameriks et al., 2009).

where $m(h_t, t, ltci)$ is total medical spending, which equals the sum of uninsured medical spending and long-term care insurance premiums, less long-term care insurance benefits. Wealth before transfers may be negative, as net medical spending may exceed the value of income and assets.

Public programs or private charities 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 one's medical needs. People who do not require institutional care ($h \in \{he, hhc\}$) and cannot afford to consume at least \$6,200 receive transfers that enable them to consume exactly this amount. Their net wealth after government transfers is $x_t = \max\{\hat{x}_t, \$6,200\}$. \$6,200 was roughly the consumption floor provided to single elderly individuals in 2000 by the Supplemental Security Income (SSI) program, which is meant to provide a subsistence level of food and housing.

People who require facility-based care ($h \in \{alf, nh\}$) can have part of their care paid for by Medicaid if they satisfy income- and assets-based means tests. To qualify for Medicaid coverage of institutional costs, people must exhaust all but \$2,000 of their assets ($\hat{x} \leq \$2,000$) and have no more than \$360 of income net of medical spending ($\hat{y}_t \equiv y - m_t \leq \$360$). These were the modal income and asset eligibility requirements employed by U.S. states in 1999 (Brown and Finkelstein, 2008). People who cannot afford to pay for their own care ($\hat{x}_t < 0$) must claim Medicaid benefits to help finance their care. People who qualify for Medicaid but can afford to pay for their care privately ($\hat{x}_t \in [\$0, \$2,000]$ and $\hat{y}_t \leq \$360$) can choose whether to accept Medicaid support or, if Medicaid-financed care is sufficiently less attractive than privately-financed care, to pay for their care themselves. People who receive Medicaid support have net wealth after transfers of $x_t = \min\{w_t, \$2,000\} + \min\{y, \$360\}$. People who pay for their own care have net wealth of $x_t = \hat{x}_t$.

The consumption value of long-term care, Medicaid aversion, and the precautionary

motive.— 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 (typically severe) chronic illnesses. I capture these facts by assuming that residents of nursing homes and assisted living facilities receive a certain amount of consumption from their long-term care and that they cannot buy additional consumption beyond that. Individuals in the model receiving home health care, on the other hand, neither receive consumption from their care nor have their other consumption opportunities limited.

An important determinant of saving and insurance decisions is the extent to which people prefer privately-financed care to Medicaid-financed care. Institutional care that is at least partly financed by Medicaid may be less desirable than privately-financed care for several reasons. For example, Medicaid recipients may stay in lower-quality nursing homes, it may be costly to file for Medicaid benefits, or people may feel a stigma of receiving government support. A preference for privately-financed care over Medicaid-financed care would give people an additional reason to save or buy insurance beyond a desire to smooth their marginal utility over time and across states. Medicaid aversion, i.e., the extent to which people prefer privately-financed care to Medicaid-financed care, is therefore the other object of interest in the estimation in addition to bequest motives.

The estimation recovers the utility penalty of staying in a Medicaid-financed care-giving facility as opposed to a privately-financed facility, $\Delta u \equiv u_{priv} - u_{med}$. To facilitate interpretation of the results and comparison with other studies, I report Medicaid aversion as a Medicaid consumption-equivalent, c_{med}, relative to a private facility baseline, c_{priv}. For my main baseline, I follow Brown and Finkelstein (2008) and use the same food and housing value that social insurance provides for people living outside care facilities, $c_{priv} = \$6,200$. Different c_{priv} benchmarks simply shift the implied c_{med} to maintain the same utility advantage of privately-financed care, $u(c_{med}(c_{priv})) = u(c_{priv}) - \Delta u$.

Solution method, value functions, and consumption and long-term care insurance choices.— Given a set of parameter values, I solve the model numerically by backward induction from a maximum age of 105 to a minimum age of 65, with and without long-term care insurance. As long-term care insurance is purchased once-and-for-all, long-term care insurance ownership, $ltci \in \{0, 1\}$, is a state variable in every period other than the purchasing period, in which it is a control variable. The other state variables are age (t), health (h_t), and wealth (w_t). People die by age 105 with probability one, and leave any remaining wealth as a bequest, $V_{105}(w_{105}) = v(w_{105})$. 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 for optimal Medicaid-claiming by people who are Medicaid-eligible. The problem can be written recursively in terms of value functions as

$$V_t(w_t, h_t, ltci) = \begin{cases} \max\limits_{\hat{c}_t \in \Gamma(x_t, h_t)} \Big\{ u\big[\hat{c}_t + c_m(h_t, med_t(w_t, h_t, ltci))\big] \\ \qquad\qquad +\beta E_t V_{t+1}(w_{t+1}, h_{t+1}, ltci) \Big\} & \text{if alive}, \\ v(w_t) & \text{if dead}, \end{cases}$$

where $med_t(w_t, h_t, ltci)$ is an indicator of whether the individual claims Medicaid, and next-period wealth is $w_{t+1} = (1 + r)(x_t - \hat{c}_t)$. Utility-producing consumption is the sum of consumption spending, $\hat{c}$, and the consumption value of long-term care services, $c_m(h, med)$, which potentially depends on whether the care is at least partly financed by Medicaid. Consumption spending is zero if the individual resides in an assisted living facility or a nursing home, $\Gamma(x_t, h_t \in \{alf, nh\}) = \{0\}$, and is limited to net wealth after transfers otherwise, $\Gamma(x_t, h_t \in \{he, hhc\}) = [0, x_t]$. The individual makes a once-and-for-all choice about whether to buy long-term care insurance at age 67. He or she buys insurance if and only if at $t = 67$ $V_t(w_t, h_t, ltci = 1) > V_t(w_t, h_t, ltci = 0)$.

4 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.[10] 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 first-stage parameter estimates.

The remaining first-stage parameters not set in Section 3 are the interest rate, r, the discount factor, β, and the coefficient of relative risk aversion, σ. For the baseline model, I again follow Brown and Finkelstein (2008) in adopting standard, widely-used values for these parameters and later test the sensitivity of the estimation to these values. The coefficient of relative risk aversion is 3, $\sigma = 3$, and the real interest rate and the rate of time preference are both 3 percent per year, $r = 0.03$ and $\beta = \frac{1}{1.03} \approx 0.97$.

The second stage of the estimation procedure attempts to recover the strength and curvature of bequest motives and the consumption value of Medicaid-financed nursing care, $\theta \equiv (m, c_0, c_{med})$, 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. The appendix contains details about the asymptotic distribution of the parameter estimates and over-identification tests of the model's fit.

[10] 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.

5 Second-Stage Moments: Wealth and Insurance

This section describes how I estimate the empirical moments, simulate the simulated moments, and estimate bequest motives and Medicaid aversion using the MSM.

5.1 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.[11] 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 five most recent waves in which final versions of the RAND release are available, which occur in even-numbered years from 1998–2006. Individuals in my sample are therefore covered for up to eight years. I restrict the analysis to single retirees who are at least 65 years old in 1998 and who do not miss any of the 1998–2006 interviews while they are alive. The resulting sample contains 3,446 individuals. I use the RAND version of all variables.[12]

Empirical wealth moments.— The wealth moments track the wealth distributions of different cohorts as they 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 four percentiles of the wealth distribution—the 25th, 50th (median),

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

[12] I restrict to singles by dropping individuals who lived in households with more than one member in any wave 1998–2006. I restrict to retirees by dropping individuals who earn more than $3,000 dollars in any wave 1998–2006. I exclude earlier waves 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 2000 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.

75th, and 90th—in each wave *after 1998*: 2000, 2002, 2004, and 2006. Thus there are 96 wealth moments: four percentiles in four 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. The measure of wealth is the total value of non-annuity wealth including housing.

Empirical long-term care insurance moment.— An individual owns 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. 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.[13]

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.[14] 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, 1998–2006.

5.2 Simulation Procedure and Estimation

For each candidate parameter vector θ, I solve the model for individuals with different income levels and with and without long-term care insurance coverage. I use the resulting value functions and optimal choice rules to simulate the wealth path of each individual in

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

[14]For comparison, the same group's point-in-time ownership rate in 1998 is 8.8 percent, compared to the 5.6 percent rate found by averaging each individual's reported ownership over time. The estimation results are not very sensitive to the precise ownership rate.

the simulation sample and to estimate the demand for long-term care insurance by a subset of the simulation sample. Finally, I calculate aggregate statistics based on the simulated data using the same procedure as for the actual data.

To create the simulation sample, I draw with replacement 10,000 individuals from the sample of single retirees in the HRS. 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, $\frac{weight_i}{\sum_{j=1}^{3,446} weight_j}$. The simulation uses individuals' age in 1998, their total non-annuity wealth in 1998, their health status in every year 1998–2006, their average retirement income, and their long-term care insurance ownership status.[15]

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, $\hat{c}_t(w_t, h_t, ltci)$. Given these consumption functions and each individual's wealth in 1998, health status in 1998–2006, income, and long-term care insurance coverage, I simulate the wealth of each individual in the simulation sample in 1999–2006. Age, health, wealth, and long-term care insurance coverage, together with the optimal Medicaid claiming rule if the individual is eligible for Medicaid, give net wealth after government transfers, x_t. Wealth at age $t+1$ is then

$$w_{t+1} = (1+r)(x_t - \hat{c}_t(w_t, h_t, ltci)),$$

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

[15]Retirement income equals the simple average of the individual's real non-asset income between 1998 and 2006. 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 Robinson model health transition probabilities and Bayes' rule.

Because I condition on each individual's initial wealth in 1998, all of the identification comes from the panel aspect of the data. Using the empirical health and mortality realizations to construct the simulated moments reduces the mortality bias from richer people living longer: individuals who die in 2001 in the data also die in 2001 in the simulation and thus contribute to exactly the same moment conditions in the simulation and in the 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, $V_t(w_t, h_t, ltci)$. 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 is zero otherwise,

$$ltci_i^s = \mathbb{1}\left\{V_{t_i}(x_{i,t_i}, h_{i,t_i}, ltci = 1) > V_{t_i}(x_{i,t_i}, h_{i,t_i}, ltci = 0)\right\}.$$

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 it is computationally costly to model the demand for realistic long-term care insurance contracts at multiple purchasing ages, I simulate the demand for long-term care insurance only at age 67, the average age at which people buy long-term care insurance (Brown and Finkelstein, 2007). To increase the sample size, I simulate the demand for long-term care insurance by all 65–69-year-olds in the simulation sample, treating each of them for this purpose as a healthy 67-year-old.

Estimation.— The baseline estimation of $\theta = (m, c_0, c_{med})$ is based on 97 moment conditions: one long-term care insurance moment and 96 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.[16] 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, $W_{robust} = diag(\hat{V}(\hat{\pi}))^{-1}$.

6 Results

6.1 Baseline Results

Estimation Results

	Baseline		Robust		No LTCI	
Parameter estimates, $\hat{\theta}$						
$\hat{c}_{med}$	5.861	6.200	5.889	6.200	5.098	4.350
	(0.13)	(0.01)	(0.23)	(0.02)	(0.37)	(0.15)
$\hat{c}_0$	18.024	-	20.828	-	20.549	-
	(1.30)	-	(1.17)	-	(0.74)	-
$\hat{m}$	0.956	0	0.969	0	0.968	0
	(0.01)	-	(0.01)	-	(0.01)	-
Goodness-of-fit						
χ^2 stat	94.9	1160.5	95.5	1160.5	91.8	152.6
p-value	0.45	<1e-10	0.44	<1e-10	0.51	2e-4
Simulated LTCI	5.8%	27.3%	5.5%	27.3%	24.8%	58.0%

Table 1: Estimation results based on the baseline weighting matrix, the robust weighting matrix, and the baseline weighting matrix except with zero weight on the long-term care insurance moment. Standard errors appear in parentheses. The second column of each set of results comes from estimating the model with no bequest motive. Medicaid consumption-equivalents are reported relative to a private consumption-equivalent of $6,200. The empirical long-term care insurance ownership rate is 5.6 percent.

The first column of Table 1 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

[16] Although the wealth moments far outnumber the single long-term care insurance moment, the insurance moment still carries some weight in the estimation because it is much more precisely estimated and because each age cohort's 24 wealth moments are fairly correlated with each other. With the baseline weighting matrix, the objective function penalty for over- or under-predicting long-term care insurance ownership by 5 percent (e.g. predicting a 10.6 percent ownership rate when the actual rate is 5.6 percent) is roughly equal to the penalty for over- or under-predicting every wealth moment by 10 percent.

chi-squared test of over-identifying restrictions is 0.45, which means that the model cannot be rejected at any standard confidence level. The results imply modest Medicaid aversion and important bequest motives in which bequests are luxury goods. The estimate of the consumption value of Medicaid-financed facility care, $\hat{c}_{med} = \$5,861$, is similar to the baseline consumption value of privately-financed care, $c_{priv} = \$6,200$.

The estimate of c_0, $\hat{c}_0 = \$18,024$, implies that with actuarially fair insurance, only people who could afford to consume more than $\$18,024$ per year would leave bequests. Were long-term care costs fully insured at actuarially fair rates and actuarially fair annuities available, 53.8 percent of the individuals in the sample and 49.4 percent of those aged 65–69 would leave bequests. The estimate of m, $\hat{m} = 0.956$, implies that among people rich enough to leave bequests, the marginal propensity to bequeath is high. The marginal propensity to bequeath out of wealth above the $18,024 threshold for people with one year to live is 0.956. The marginal propensity to bequeath for 65-year-olds with fully-insured long-term care costs and with access to actuarially fair annuities is 0.45. As Section B of the appendix shows, the estimated bequest motive closely resembles an altruistic baseline. In particular, the head of an infinitely-lived dynasty who placed the same weight on his heirs' utility as on his own and whose heirs earned income of $\$18,024$ per year would have $c_0 = \hat{c}_0$ and $m = 0.972$, compared to $\hat{m} = 0.956$.

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 5.8 percent, compared to 5.6 percent in the data. Figure 1 plots the simulated and empirical wealth moments, with the even- and odd-numbered cohorts separated for clarity. The model reproduces the main patterns in the wealth data and therefore in consumption and saving decisions. Moreover, as the third and fifth columns of Table 1 show, estimations based on the robust weighting matrix and on only the wealth moments (excluding long-term care insurance) produce similar results.

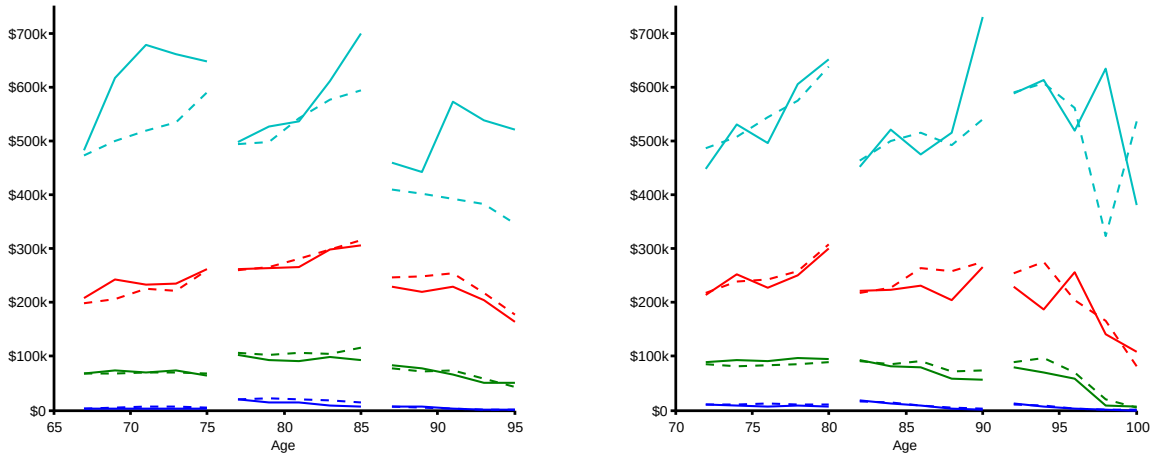


Figure 1: Empirical wealth moments (solid lines) and simulated wealth moments at the baseline estimates (dashed lines). Odd-numbered cohorts are on the left; even-numbered cohorts are on the right. The x-axis shows the average age of the cohort in each wave.

6.2 Identification

In this section, I briefly highlight which features of the data are most informative about the key parameters of the model. But as Section C of the appendix shows in more detail, the model is well-identified and the identification is not driven by any particular moment or set of moments. Retirees' saving and long-term care insurance decisions are much more consistent with the combination of modest Medicaid aversion and important bequest motives in which bequests are luxury goods than with any other combination of bequest motives and Medicaid aversion.

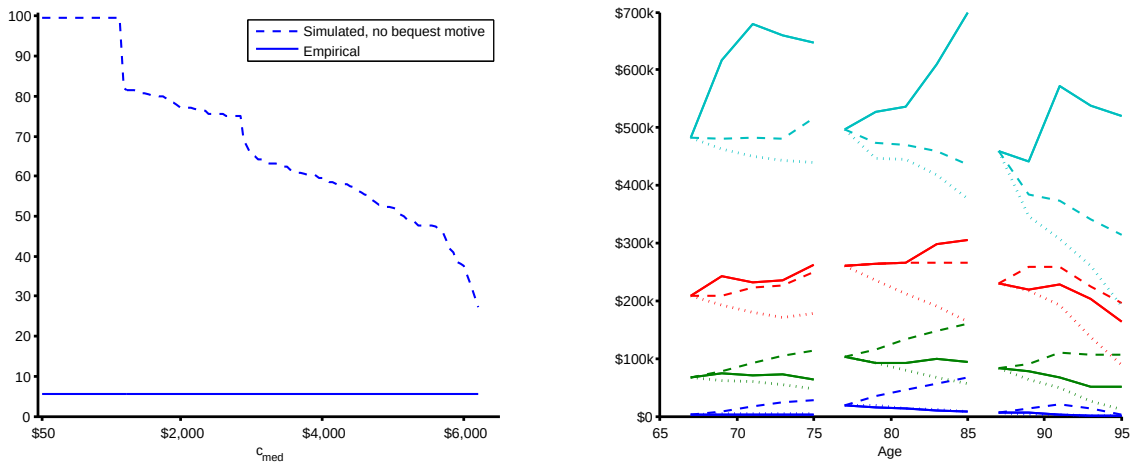
Medicaid aversion is modest (c_{med} not too low), and bequests are luxury goods (c_0 not too low).— Saving by people in the bottom and middle of the wealth distribution and the long-term care insurance ownership rate both suggest that Medicaid aversion is modest and that bequests, to the extent that they are valued, are luxury goods. People in the bottom and middle of the wealth distribution have relatively little wealth and are therefore at high risk of having their wealth exhausted by uninsured long-term care costs. If receiving Medicaid support or failing to leave at least a small bequest carried a high utility cost, people would buy long-term care insurance or accumulate a large stock of wealth to reduce

the chances of these outcomes. That few people with little wealth rapidly accumulate wealth and that few people buy long-term care insurance suggests that most people are not highly averse to Medicaid and that most people, to the extent that they care about bequests, are not too concerned about the prospect of being unable to leave bequests in some states.

Important bequest motives: m close to one and c_0 not too high.— Saving by people in the upper part of the wealth distribution and the long-term care insurance ownership rate indicate important bequest motives. Like other authors (e.g., Carroll, 2000; Dynan et al., 2004), I find that people in the upper part of the wealth distribution save too much, especially relative to poorer people, for their saving to be driven by precautionary motives. A more novel finding is that the limited demand for long-term care insurance, especially among the rich, suggests important bequest motives. The rich are poorly insured by Medicaid, so they must choose between buying long-term care insurance and self-insuring.[17] Self-insuring means holding a large stock of wealth to be spent only if costly care is required. Buying insurance, on the other hand, allows people to consume more aggressively (and leave smaller bequests) if they wish, but only at the cost of thousands of dollars worth of insurance market loads and lost eligibility for means-tested social insurance benefits.[18] People without bequest motives tend to be better off buying available long-term care insurance because they gain so much from increasing their consumption at the expense of bequests. People who wish to leave bequests, however, clearly gain less from increasing their consumption at the expense of bequests and would instead use long-term care insurance mostly to insure their bequests. With the estimated bequest motive, as well as with altruistic and other bequest motives in which bequests are luxury goods, bequest insurance is typically not sufficiently valuable to justify paying the loads on available

[17]Medicaid provides very incomplete insurance because its means tests require people to spend down nearly all of their wealth before qualifying for support. People whose health improves enough to move back into the community after receiving Medicaid-financed care are therefore left with little wealth to support their consumption. According to the Robinson model, about two-thirds of people who at some point use a nursing home are able to leave the nursing home for other living arrangements at least once (Brown and Finkelstein, 2008).

[18]In the model, expected premiums paid by a 67-year-old buyer of a typical long-term care contract exceed expected benefits received by over $6,300.



(a) **(b)**

Figure 2: Panel (a): Simulated long-term care insurance ownership in the model without a bequest motive as a function of the consumption value of Medicaid-financed nursing care (dashed line). The solid line is the empirical ownership rate, 5.6 percent. The consumption value of privately-financed nursing care is $6,200. Panel (b): Empirical wealth moments (solid lines) and simulated moments for the odd-numbered cohorts. The simulated moments come from the model without a bequest motive when the precautionary motive is strong (dashed lines) or weak (dotted lines).

long-term care insurance contracts.[19] Both the giver of the bequest and his or her heirs are likely to prefer the higher-variance, higher-mean distribution of bequests from self-insuring than the lower-variance, lower-mean distribution from buying available long-term care insurance. As Section D of the appendix shows in more detail, bequest motives in which bequests are luxury goods encourage self-insurance.

One way to see the importance of bequest motives is to test how well a model without bequest motives can match saving and long-term care insurance decisions. The estimation results in Table 1 reveal a very poor fit for the model without bequest motives. The restriction of no bequest motives is in all cases easily rejected at the 1 percent confidence level. Figure 2 shows why. Panel (a) shows simulated long-term care insurance ownership as a function of the consumption value of Medicaid-financed long-term care, and Panel (b) shows for odd-numbered cohorts the empirical wealth moments (solid lines) and the simulated wealth moments when Medicaid aversion is strong (dashed lines) or weak (dotted

[19]Similarly, Lockwood (2010) finds that only people who are unusually risk averse over bequests would find it worthwhile to use available annuities to insure their bequests.

lines). As is clear from the results, the model without bequest motives cannot match:

- The low demand for long-term care insurance: Even without Medicaid aversion ($c_{med} = c_{priv} = \$6,200$), the model predicts 27.3 percent ownership, almost five times the observed rate of 5.6 percent.[20] With seemingly modest Medicaid aversion ($c_{med} = \$5,000$), the model predicts over 50 percent ownership.

- The pattern of saving across the wealth distribution: Although the model can roughly match the saving of retirees at a particular point in the wealth distribution, the model over-predicts the saving of poorer retirees and under-predicts the saving of richer retirees. For example, the model with strong Medicaid version (dashed lines) roughly matches the 75th wealth percentiles but over-predicts the 25th and 50th percentiles and under-predicts the 90th percentiles. More generally, the model requires progressively stronger levels of Medicaid aversion to match the saving decisions of people at progressively higher points in the wealth distribution.

- The combination of the saving and long-term care insurance decisions of middle-class retirees: the model that matches the saving decisions of middle-class retirees predicts far too much long-term care insurance ownership. Long-term care insurance ownership is too low—both absolutely and, especially, relative to the saving of all but the poorest retirees—for saving to be due primarily to precautionary motives.

6.3 Robustness

Table 2 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 saving decisions alone; increasing long-term care costs by 50 percent; equating the simulated rate of return on wealth in each year to Baker et al.'s (2007) estimates of median returns, updated by De Nardi et al.

[20] This is consistent with Brown and Finkelstein's (2008) finding that Medicaid alone would not eliminate long-term care insurance ownership by people in the upper part of the wealth distribution.

Robustness

	Baseline	Wealth only	Greater LTC risk	Higher returns	Non-housing	$\sigma = 5$	C in NHs & ALFs
Parameter estimates, $\hat{\theta}$							
$\hat{c}_{med}$	5.86	5.10	5.90	6.18	6.14	6.18	5.87
	(0.13)	(0.37)	(0.50)	(0.17)	(0.12)	(0.10)	(0.23)
$\hat{c}_0$	18.02	20.55	17.38	22.54	22.48	15.82	17.11
	(1.30)	(0.74)	(1.12)	(1.36)	(0.61)	(0.94)	(0.60)
$\hat{m}$	0.96	0.97	0.98	0.94	0.93	1.00	0.99
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Goodness-of-fit							
χ^2 stat	94.9	91.8	118.9	97.7	142.8	156.7	136.7
p-value	0.45	0.51	0.04	0.38	9e-4	1e-4	2.7e-3
Simulated LTCI	5.8%	24.8%	6.2%	6.5%	5.5%	8.2%	7.1%

Table 2: Robustness of results to different parameter values and estimating moments. The first column reproduces the baseline estimates. The second column shows results based only on the wealth moments, excluding long-term care insurance ownership. The third column shows results based on a model with 50 percent higher long-term care costs. The fourth column shows results based on a model in which the simulated rate of return on wealth each year equals the median returns estimated by Baker et al. (2007). The fifth column shows results based on non-housing wealth instead of total wealth. The sixth column shows results based on a model with a coefficient of relative risk aversion of 5 instead of 3. The final 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.

(2009); excluding housing wealth; increasing the coefficient of relative risk aversion, σ, from 3 to 5; and allowing residents of nursing homes and assisted living facilities to buy additional consumption beyond what they receive from their care. Although most of the alternative versions of the model do not fit the data nearly as well as the baseline specification, the parameter estimates are fairly robust across specifications, and the qualitative conclusions—that retirees' decisions favor models with important bequest motives and modest Medicaid aversion—are even more robust. In every specification, the model without bequest motives badly misses at least some of the main features of the data.

The main reason the results are so robust is that both of the main identification strategies yield similar results. First, the pattern of saving, ignoring long-term care insurance decisions, reveals modest precautionary motives and important bequest motives. The

results from estimating the model based on wealth alone are very similar to the baseline results and the restriction of no bequest motives is rejected at high levels of confidence. Richer retirees save too much relative to poorer retirees for saving to be primarily driven by precautionary motives.

Second, the saving and long-term care insurance decisions of particular groups of retirees, ignoring the decisions of richer and poorer retirees, also reveal modest precautionary motives and important bequest motives. For both rich and poor retirees, their saving decisions alone reveal much of what can be learned about their preferences. Including their long-term care insurance decisions contributes relatively little to learning about their preferences; it merely reinforces the conclusions drawn from their saving decisions.[21] But, as Ameriks et al. (2009) emphasize, saving decisions alone are not very informative about the bequest motives and Medicaid aversion of middle-class retirees. It is only together with their low ownership rate of long-term care insurance that their saving decisions reveal important bequest motives and modest Medicaid aversion.

To test the robustness of the conclusion that bequest motives have important effects on the decisions of middle-class retirees, I test how much less attractive long-term care insurance would have to be to allow a model without bequest motives to match the saving and insurance decisions of middle-class retirees. Table 3 shows simulated long-term care insurance ownership rates in a model without bequest motives in which Medicaid aversion is estimated based on the median wealth moments. The table shows that models without bequest motives that roughly match the saving decisions of middle-class retirees require extremely high loads to match the observed long-term care insurance ownership rates. Even with 54 percent loads, three times the average load in the U.S. market, simulated ownership in the second and third wealth quartiles is over ten times greater than is observed. With 65 percent loads—in which case expected premiums are almost three times

[21] The saving decisions of the poor indicate that neither motive is very strong for them, which is consistent with their low rate of long-term care insurance ownership. The saving decisions of the rich indicate that they have important bequest motives but is not very informative about Medicaid aversion because the rich are unlikely to ever receive Medicaid support. A better indication that the rich are not strongly averse to Medicaid is that only a small fraction of them buy long-term care insurance.

Long-term Care Insurance Ownership Rates

	Simulated				Empirical
	18% load	54% load	65% load	70% load	
Overall	60.3	43.5	11.1	0.0	5.6
Bottom wealth quartile	8.9	2.2	2.2	0.0	1.2
2nd wealth quartile	48.3	32.8	10.0	0.0	2.5
3rd wealth quartile	85.9	57.1	28.8	0.0	5.5
Top wealth quartile	98.1	81.9	3.3	0.0	12.5

Table 3: Simulated and empirical long-term care insurance ownership rates. Simulated rates come from a model without bequest motives in which Medicaid aversion was estimated to match the median wealth moments.

expected benefits—the model still predicts more than four times more ownership among retirees in the middle two wealth quartiles than is observed. The model 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 would not overturn the result that bequest motives are important determinants of the decisions of middle-class retirees. Middle-class retirees buy far too little long-term care insurance, especially relative to how much they save, to be explained by the model without bequest motives.

That both identification strategies produce the same results makes the conclusions very robust. Many of the factors that could weaken one of the identification strategies either do not affect or reinforce the other. The identification strategy based on the pattern of saving, for example, would be weakened by important un-modeled heterogeneity in preferences that leads the rich to save more than the poor, such as greater patience, greater risk aversion, greater aversion to Medicaid, or a greater demand for medical care. Yet if richer retirees saved more because they were more patient, more risk averse, or more averse to Medicaid, or because they had a greater demand for medical care, they would place a very high value on long-term care insurance if they did not value bequests.[22] Rather than

[22]Although the significant heterogeneity in retirement wealth or in average medical spending across income groups might appear to reflect significant heterogeneity in preferences, such heterogeneity arises naturally in representative-agent life-cycle models. Scholz et al. (2006) find that a life cycle model with uncertainty and can account for more than 80 percent of the variation in retirement wealth without heterogeneity in preferences. Similarly, as Section E of the appendix shows, I find that 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 everyone has the same (exogenous) demand for

Effect of bequest motives and long-term care risk on saving

Model:	Baseline		No LTC	
Bequest motive:	Base	None	Base	None
Bequests, share of initial non-annuity wealth				
Full sample	0.63	0.38	0.60	0.31
65–69-year-olds				
Overall	0.52	0.28	0.49	0.23
Bottom wealth quartile	4.46	0.61	2.95	0.30
2nd wealth quartile	0.44	0.15	0.33	0.11
3rd wealth quartile	0.49	0.22	0.41	0.15
Top wealth quartile	0.53	0.30	0.51	0.25
Medicaid share of nursing home costs				
Full sample	0.37	0.42	0.39	0.49
65–69-year-olds				
Overall	0.42	0.49	0.44	0.55
Bottom wealth quartile	0.79	0.80	0.80	0.81
2nd wealth quartile	0.58	0.67	0.61	0.69
3rd wealth quartile	0.27	0.41	0.31	0.51
Top wealth quartile	0.03	0.08	0.04	0.19

Table 4: Simulated shares of initial non-annuity wealth bequeathed and nursing home costs paid by Medicaid. Simulated outcomes are based on simulations of the baseline model in which individuals have their reported (empirical) rather than their simulated insurance ownership. The average Medicaid share of nursing home costs over the period 2000 to 2003 for everyone age 65 and over (a broader population than my sample of single retirees) was 45 percent (Kopecky and Koreshkova, 2009).

undermining the conclusion that bequest motives are important determinants of retirees' behavior, these considerations make bequest motives even more necessary to explain the low demand for long-term care insurance.

6.4 Implications of Results

Saving.— Table 4 shows the effects of bequest motives and long-term care costs on simulated saving outcomes. The measures of saving are expected discounted bequests as a share of baseline (1998) non-annuity wealth and the expected share of nursing home spending paid by Medicaid. The estimated bequest motive significantly increases saving.

medical care.

The bequest motive increases the average share of baseline (1998) non-annuity wealth left as bequests from 38 percent to 63 percent, and almost doubles the share of wealth bequeathed by 65–69-year-olds, from 28 percent to 52 percent. This is not driven solely by the rich: the bequest motive roughly doubles the share of wealth bequeathed by people in the third quartile and roughly triples the share of wealth bequeathed by people in the second quartile. The bequest motive has a more modest effect on the share of nursing home costs paid by Medicaid, reducing the overall share from 42 percent to 37 percent.[23]

Compared to bequest motives, medical spending has little effect on saving. The third and fourth columns show results from simulations in which the decision rules come from a model without any long-term care costs. Eliminating long-term care has a modest effect on saving given the estimated bequest motive, reducing expected bequests from 63 percent to 60 percent of baseline non-annuity wealth and increasing Medicaid's share of nursing home costs from 37 percent to 39 percent. Eliminating long-term care has a larger effect in the model without bequest motives, reducing expected bequests from 38 percent to 31 percent of baseline non-annuity wealth, but this effect is small compared to the effect of bequest motives.

Long-term care insurance.— Table 5 shows the effects of bequest motives and long-term care costs on simulated insurance ownership. Bequest motives significantly reduce long-term care insurance ownership (from 41.0 percent to 5.8 percent), mostly by reducing ownership in the top half of the wealth distribution. The bequest motive reduces ownership in the third quartile from 61.2 percent to 4.4 percent and in the fourth quartile from 91.9 percent to 18.6 percent. The simulation mostly matches the pattern of ownership across the wealth distribution, though it predicts a slightly greater wealth elasticity than is observed empirically. The model without bequest motives, on the other hand, not only predicts too much long-term care insurance ownership overall, it also predicts a much stronger wealth elasticity than is observed empirically. The model without bequest motives

[23]Empirically, Medicaid pays a similar share (45 percent) of total nursing home costs for the entire elderly population, but this is not directly comparable to my results because I limit my sample to single retirees.

Effect of bequest motives and long-term care risk on insurance purchases

Model:	Baseline		No LTC		Data
Bequest motive:	Base	None	Base	None	
LTCI ownership					
Overall	5.8%	41.0%	-	-	5.6%
Bottom wealth quartile	0.0%	0.0%	-	-	1.2%
2nd wealth quartile	0.0%	10.8%	-	-	2.5%
3rd wealth quartile	4.4%	61.2%	-	-	5.5%
Top wealth quartile	18.6%	91.9%	-	-	12.5%
Annuity ownership					
Overall	14.5%	46.5%	4.4%	46.5%	7.2%
Bottom wealth quartile	0.0%	0.0%	0.0%	0.0%	0.3%
2nd wealth quartile	0.0%	0.0%	0.0%	0.0%	4.6%
3rd wealth quartile	31.0%	87.8%	10.5%	87.8%	8.4%
Top wealth quartile	26.9%	98.1%	7.2%	98.1%	14.7%
Can afford	30.9%	99.0%	9.5%	99.0%	-

Table 5: Simulated and empirical ownership rates of long-term care insurance and annuities. The empirical long-term care insurance ownership rates correspond 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 2006 in which they report their ownership status. The empirical annuity ownership rates correspond to the fraction of the same group who in the 1998 wave report owning an annuity that lasts for life. Both are weighted by HRS household weights.

predicts over seven times too much ownership in the third and fourth wealth quartiles. In the top quartile it predicts ownership of 91.9 percent whereas actual ownership is 12.5 percent. The estimated Medicaid aversion has a modest impact on the demand for long-term care insurance. Eliminating Medicaid aversion (not shown) causes long-term care insurance ownership to fall from 5.8 percent to 1.9 percent.

Annuities.— The last rows of Table 5 show how bequest motives and long-term care costs affect the demand for annuities that pay $5,000 (real) per year for life and have a ten percent load, which is typical of the U.S. private market. The estimated bequest motive significantly reduces the demand for annuities. Whereas 46.5 percent of the sample buys this annuity in the models without bequest motives—basically everyone who can afford the premium—only 14.5 percent do in the baseline model. Yet the baseline model does not fully explain why so few people buy annuities, as empirically only 7.2 percent of the sample

owns life annuities. The model over-predicts demand for annuities mostly among people in the third wealth quartile, who are rich enough to afford the annuity but not so rich that the estimated bequest motive significantly reduces their desire to increase consumption at the expense of bequests.

Table 5 also reveals that at the estimated parameters, long-term care risk *increases* the demand for annuities. Only 4.4 percent of retirees buy the annuity in the model without long-term care costs compared to 14.5 percent in the baseline model. Long-term care costs increase the demand for annuities in this model mostly because long-term care expenses tend to occur late in life and thereby effectively reverse some annuitization.[24] These two factors suggest that among people with enough non-annuity wealth to potentially benefit from annuities, bequest motives rather than long-term care risk appear to be the main reason for annuities' unpopularity. As with long-term care insurance, a crucial determinant of the gain from annuities is the value of increasing consumption at the expense of bequests (Lockwood, 2010).

6.5 Relationship to Other Estimates

This section shows how my estimates relate to six of the main estimates in the literature: Hurd (1989), Hurd and Smith (2002), De Nardi (2004), Kopczuk and Lupton (2007), Ameriks et al. (2009), and De Nardi et al. (2010). Table 6 shows estimates and simulated outcomes under the different preferences. My estimates appear in the first column. The other estimates are ordered by the fraction of 65–69-year-old single retirees who would leave a bequest were risks fully insured at actuarially fair rates. I do not show results based on Hurd's (1989) bequest motive because they are virtually identical to those from a model without bequest motives, which has already been discussed.

Broadly speaking, my estimates are very similar to those of three papers that use a wide

[24] Another reason that long-term care costs increase the demand for annuities is that Medicaid means testing allows people to keep their annuity wealth (though not their annuity income) while receiving Medicaid support, which makes annuities an attractive way to preserve wealth.

Comparison to Other Estimates

	This Paper	DFJ 2010	HS 2002[a]	KL 2007	D 2004	ACLV 2009	Data
Fraction who leave bequest with full, fair insurance							
	49.4%	23.7%	34.0%	38.1%	49.1%	91.1%	
Bequest motive							
$\hat{c}_0$ ($1,000s)	18	36.1	25.5	23[b]	18.4	5.1	
$\hat{m}$	0.96	0.88	1	1	0.95	0.94	
Precautionary motive							
$\hat{c}_{med}$ ($1,000s)	5.9	≈ 2.7[c]	N/A	N/A	N/A	≈ 4.4[d]	
Bequests, share of initial non-annuity wealth							
Overall	0.52	0.50	0.79	0.84	0.49	0.67	
Bottom w quart	4.46	35.60	2.12	3.52	2.79	47.79	
2nd w quart	0.44	1.30	0.26	0.37	0.27	1.69	
3rd w quart	0.49	0.72	0.48	0.58	0.41	0.92	
Top w quart	0.53	0.41	0.86	0.90	0.51	0.56	
Medicaid share of nursing home costs							
	0.37	0.27	0.39	0.38	0.40	0.26	0.45[e]
Long-term care insurance ownership							
	5.8%	78.2%	8.6%	4.4%	0.0%	41.1%	5.6%
Moments	Wealth change, LTCI	Wealth change	Antic. bequests	Wealth change	Wealth & Bequest dists.	Spending, Survey	

Table 6: Comparison of results to other studies. DFJ = De Nardi et al. (2010), HS = Hurd and Smith (2002), KL = Kopczuk and Lupton (2007), D = De Nardi (2004), ACLV = Ameriks et al. (2009). All statistics are simulated for 65–69-year-old single retirees.
(a) HS is the bequest motive estimated by Lockwood (2010) to match Hurd and Smith's (2002) estimate of the average anticipated bequest in the Health and Retirement Study.
(b) KL estimate a switching regression model, which indicates that about three-quarters of single retirees have this bequest motive.
(c,d) These Medicaid consumption-equivalents are only approximate because DFJ, ACLV, and I use slightly different models.
(e) The data on Medicaid's share of nursing home costs are for all people age 65 and older, not just the single retirees included in the simulation.

variety of data and approaches. Hurd and Smith (2002) construct measures of anticipated bequests using subjective probability questions in the Health and Retirement Study, which Lockwood (2010) uses to estimate a bequest motive. De Nardi (2004) calibrates a bequest motive to match the prevalence of small bequests and the distribution of wealth in the U.S. and Sweden. Kopczuk and Lupton (2007) estimate a bequest motive using a switching regression model based on saving by single retirees. Their results indicate that about three-fourths of single retirees have the estimated bequest motive. Simulations based on these three bequest motives match well the pattern of saving across the wealth distribution, long-term care insurance ownership, and Medicaid's share of nursing home expenses.

Among the three papers that reach different results, Hurd (1989) and De Nardi et al. (2010) estimate weaker bequest motives, and Ameriks et al. (2009) estimate a stronger bequest motive. Hurd (1989) estimates a very weak bequest motive based on a comparison of the saving decisions of households with and without children.[25] Like the model without bequest motives, this model predicts too little saving by richer retirees relative to poorer retirees and too much ownership of long-term care insurance. Ameriks et al. (2009) estimate a very strong bequest motive and moderate Medicaid aversion based on spending data and responses to survey questions that ask respondents to choose between larger bequests and higher-quality long-term care. De Nardi et al. (2010) estimate a weak bequest motive and the equivalent of very strong Medicaid aversion based on an approach very similar to mine, except without long-term care insurance.[26] Simulations based on Ameriks et al.'s (2009) preferences or on De Nardi et al.'s (2010) preferences predict too much saving by the poor, too little saving by the rich, too little spending by Medicaid (Medicaid

[25]Hurd's (1989) identifying assumption is that households without children lack bequest motives. More recent evidence on saving decisions Kopczuk and Lupton (2007), inter-household transfers (Gale and Scholz, 1994), annuity guarantee choices (Laitner and Juster, 1996), and survey questions about the importance of leaving bequests (Lockwood, 2010) appears at odds with this assumption.

[26]Comparing Medicaid 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 (2009) 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 Medicaid aversion in their model. But the difference between a general consumption floor and a consumption-equivalent of Medicaid nursing homes is smaller than it first appears, because in these models social insurance is primarily used by individuals who experience costly nursing home stays. More importantly, the c_{med} equivalent for De Nardi et al. (2010) appears to generate saving decisions in my model that are similar to those in their paper.

shares of nursing home costs of 26 percent and 27 percent versus 45 percent), and too much long-term care insurance ownership (41.1 percent and 78.2 percent versus 5.6 percent).

It is relatively unsurprising that Hurd (1989) and Ameriks et al. (2009) reach results different from mine given Hurd's (1989) identifying assumption and Ameriks et al.'s (2009) unique approach. It is more surprising that De Nardi et al. (2010) reach results so different from mine given our similar estimation strategies and similar data. Our results are even more different than they appear in Table 6. Although De Nardi et al.'s (2010) point estimates indicate a moderate bequest motive, their model matches saving decisions about equally well without a bequest motive.

The differences in our results appear to be attributable to two main factors, aside from the fact that I require the model to be consistent with the low demand for long-term care insurance. First, my estimation includes richer retirees. Including richer retirees helps identify bequest motives because richer retirees save more than can be explained by even very strong Medicaid aversion. Second and more important, De Nardi et al.'s (2010) model understates the medical spending risk faced by people with little wealth, both absolutely and relative to the risk faced by people with more wealth. In Section E of the appendix, I show that this can explain why De Nardi et al. (2010) are able to match the saving of poor (and middle-class) retirees in a model with strong precautionary motives and weak bequest motives.

7 Conclusion

Rather than buying insurance against the main risks they face, most retirees self-insure by holding much of their wealth into old age. This paper shows that in the context of a standard life-cycle model these choices indicate widespread, important bequest motives. The evidence in favor of bequest motives is perhaps surprisingly strong given that models without bequest motives can roughly match either the saving or long-term care insurance

decisions of most retirees and also given the elusive nature of bequest motives in which bequests are luxury goods. By their nature, such bequest motives tend to have marginal rather than decisive impacts on most decisions; few choices involve a clear tradeoff between bequests and other goods.[27] Despite this, the effects of bequest motives can be seen clearly in the *combination* of retirees' saving and insurance decisions.

My results indicate the importance of including bequest motives in life-cycle models of retirement. Not only do my results imply that bequest motives have important effects on many retirees' decisions, my results also call into question what has arguably been the main justification for excluding bequest motives from life-cycle models of retirement: the finding that models without bequest motives can roughly match the saving decisions of middle-class retirees. I find that models without bequest motives can be made to match the saving of middle-class retirees only at the expense of missing several other patterns of behavior, such as the saving of poorer retirees and the low demand for long-term care insurance. Rather than justifying the exclusion of bequest motives from life-cycle models, retirees' saving decisions constitute important evidence in favor of bequest motives.

My findings are consistent with a variety of other evidence that suggests that bequest motives are widespread, such as the prevalence and size of inter-household transfers during life (e.g., Gale and Scholz, 1994), the lack of demand for annuities (Lockwood, 2010), and survey responses about the importance of leaving bequests (e.g., Laitner and Juster, 1996). But while much evidence suggests that bequest motives are widespread, some evidence appears to reveal significant heterogeneity in the strength and perhaps even the nature of bequest motives. Ignoring this heterogeneity is a limitation of my representative-agent approach, and it may be especially costly in the present case because different types of bequest motives can have opposite effects on the demand for long-term care insurance. In

[27] Perhaps the main decision that involves a clear tradeoff between bequests and other goods is the choice of how much life insurance to buy. But life insurance purchases, other than those done by the rich to reduce their tax burden, would only register much stronger bequest motives than those identified in this paper. 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. By contrast, I find that about half of retirees would leave *no* bequest were fair insurance available. My results are consistent with Brown's (2001) conclusion that few retirees buy life insurance to increase their bequests.

contrast to the main effect revealed by the estimation, whereby bequest motives encourage people to self-insure late-life risks, among people who are very risk averse over bequests bequest motives are likely to *increase* the demand for long-term care insurance. Indeed, according to a survey of long-term care insurance owners, the desire to insure bequests contributes to some purchasing decisions (LifePlans, 2004). Weighing against this desire to insure bequests, however, is the desire to leave larger bequests (on average) by self-insuring and thereby avoiding insurance loads and remaining eligible for more means-tested transfers.[28] As my results show, bequest motives that match the pattern of saving tend to reduce the value of long-term care insurance by making self-insurance—and the large bequests that often accompany it—more attractive. Together with the fact that so few people buy long-term care insurance, my results suggest that more people *do not* buy long-term care insurance as a result of their bequest motive than *do* buy long-term care insurance as a result of their bequest motive.

My results highlight the importance of accounting for bequest motives in evaluating policies, especially social insurance policies and taxes on saving and inter-household transfers. People age 55 and older hold roughly 70 percent of the world's non-human wealth (The Economist, 2007). Policies that affect their saving and insurance decisions therefore have important effects on the economy, especially on the budgets of means-tested social insurance programs and 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 retirees' insurance purchases as well as their saving. Accounting for the effects on insurance purchases may be important for predicting not only the magnitude but also the sign of the effects of policy changes on means-tested programs and bequests, as the effects of the induced changes in insurance coverage may reinforce or offset the effects of the induced changes in saving.

APPENDIX

[28]The contrasting effects of different types of bequest motives on the demand for long-term care insurance may help explain why Sloan and Norton (1997) find no significant relationship between insurance ownership and reported preferences for leaving bequests.

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 replace the derivatives with numerical approximations. The square roots of the diagonal entries of Ω_θ are the standard errors of the second-stage parameter estimates, $\hat{\theta}$.

The baseline weighting matrix, $W = V(\hat{\pi})^{-1}$, would be optimal were it not for uncertainty in the first-stage parameter estimates. Because optimally-weighted minimum distance estimators sometimes perform poorly in small samples (e.g., Altonji and Segal, 1996), as a robustness check I use an alternative weighting matrix suggested by Pischke (1995), $W_{robust} = diag(\hat{V}(\hat{\pi}))^{-1}$.

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 because I adopt first-stage parameter values from other sources rather than estimating them, $\Omega_\chi = 0$. 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 in 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 Relationship to Altruistic Bequest Motives

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

$$v(b) = a \sum_{i=1}^{T_h} \beta^{i-1} u(c_i^h(b)) = a \left(\sum_{i=1}^{T_h} \beta^{i-1} \right) \frac{\left(y_h + \frac{b}{\sum_{i=1}^{T_h} (1+r)^{-(i-1)}} \right)^{1-\sigma}}{1-\sigma}.$$

The heir consumes her income, y_h, plus the annuity value of any bequest she receives and has the same constant elasticity preferences for consumption as the altruist. When the discount rate equals the interest rate, $\beta = \frac{1}{1+r}$, this 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

$$c_0 = \frac{y_h}{a^{1/\sigma}},$$
$$m = \frac{a^{1/\sigma} p_h}{1 + a^{1/\sigma} p_h}.$$

m is greater for altruists with stronger altruism or longer-lived heirs. c_0 is greater for altruists with weaker altruism or richer heirs. 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.

C Identification of the Model

Panel (a) of Figure 3 shows a contour plot of the objective function in (c_0, m)-space with c_{med} fixed at its estimated value, $c_{med} = \hat{c}_{med} = 5.861$. 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 Medicaid aversion and important bequest motives in which bequests are luxury goods than with any other combination of bequest motives and Medicaid aversion. The remaining panels, which show contour plots in (c_{med}, c_0)-space with m fixed at its estimated value, $m = \hat{m} = 0.956$, show how each set of moments contributes to the identification of the key parameters of the model.

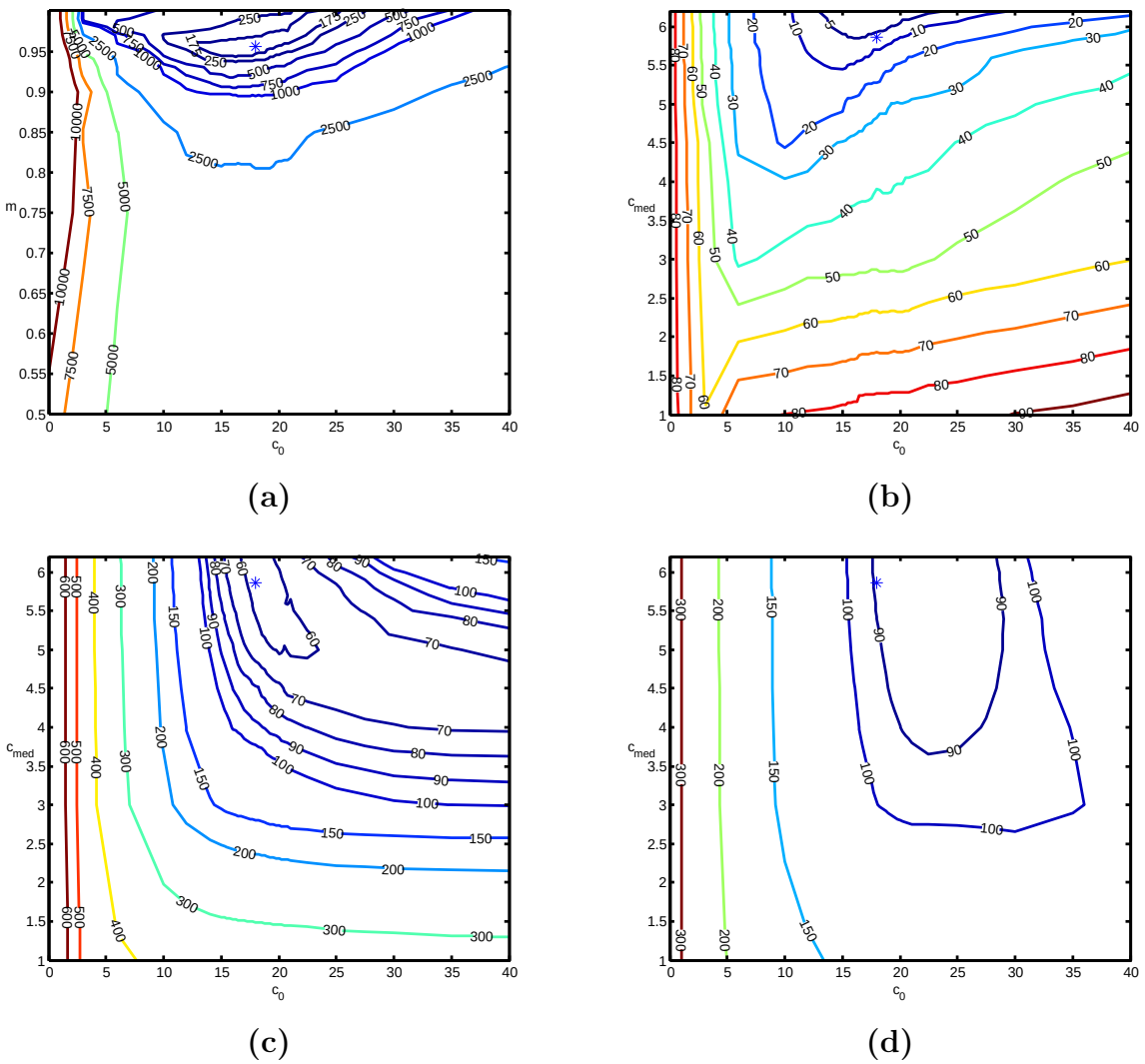


Figure 3: Panel (a): Contour plot of the objective function in (c_0, m)-space with $c_{med} = \hat{c}_{med}$. Higher contours indicate greater mismatch between the simulated and empirical moments.
Panel (b): Contour plot of the simulated long-term care insurance ownership rate in (c_{med}, c_0)-space with $m = \hat{m}$. The empirical ownership rate is 5.6 percent.
Panel (c): Contour plot of the objective function based on the 25th and 50th wealth percentiles in (c_{med}, c_0)-space with $m = \hat{m}$.
Panel (d): Contour plot of the objective function based on the 75th and 90th wealth percentiles in (c_{med}, c_0)-space with $m = \hat{m}$.
All panels: The asterisk marks the baseline estimates.

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 Medicaid aversion ($c_{med} \in [5.8, 6.2]$) and moderate to strong bequest motives ($c_0 \in [12.5, 25]$).

Panel (c) shows an objective function based on the 25th and 50th wealth percentiles.[29] Saving by people around the 25th and 50th wealth percentiles is inconsistent with very strong bequest motives ($c_0 < 15$), very strong Medicaid aversion ($c_{med} < 4$), and the combination of weak bequest motives and weak Medicaid aversion ($c_0 > 35$ and $c_{med} > 5.5$). Their saving is most consistent with a combination of fairly strong bequest motives and modest Medicaid aversion ($c_0 \in [17, 22]$ and $c_{med} \in [4.7, 6.2]$), but the identification problem is apparent: models with no bequest motive and moderate Medicaid aversion ($c_0 = \infty$ and $c_{med} = 4.5$) fit the data almost as well as models with moderate bequest motives and no Medicaid aversion ($c_0 = 20$ and $c_{med} > 6.2$).

Panel (d) shows an objective function based on the 75th and 90th wealth percentiles. Saving by people around the 75th and 90th wealth percentiles is inconsistent with weak bequest motives ($c_0 > 35$) and strong bequest motives ($c_0 < 15$), and is somewhat inconsistent with extremely strong Medicaid aversion ($c_{med} < 3.5$). Their saving therefore identifies bequest motives fairly precisely (indicating $c_0 \in [17.5, 27.5]$) but is almost completely uninformative about Medicaid aversion.

D Bequest Motives and the Demand for Long-term Care Insurance

Depending on their type, bequest motives can either increase or decrease the demand for long-term care insurance. This section explains how different types of bequest motives

[29] The weighting matrix is the baseline weighting matrix with the rows and columns corresponding to the moments other than the 25th and 50th wealth percentiles zeroed out.

Bequest motive	None ($m = 0$)		None ($m = 0$)		Risk averse ($c_0 = 1, m = 0.74$)		Luxury good ($c_0 = 18, m = 0.99$)	
Medicaid aversion	None ($c_{med} = 6.2$)		Strong ($c_{med} = 2.5$)		None ($c_{med} = 6.2$)		None ($c_{med} = 6.2$)	
	No LTCI	Effect of LTCI	No LTCI	Effect of LTCI	No LTCI	Effect of LTCI	No LTCI	Effect of LTCI
WTP(LTCI)	9.1	-	96.8	-	67.6	-	-5.6	-
EDV(c)	433.4	-10.5	362.9	60.0	348.3	44.1	285.5	-1.0
EDV(b)	42.2	-2.1	106.4	-66.3	121.1	-50.4	183.8	-5.3
E(Med days)	213	-213	11	-11	6	-6	1	-1

Table 7: Willingness to pay for long-term care insurance, expected discounted consumption, expected discounted bequests, and expected days in Medicaid facilities for healthy 67-year-olds around the 75th percentile of the wealth distribution ($N = \$200,000,\ y = \$22,500$) with various preferences. All dollar amounts are in thousands. The first column in each pair shows values of key 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. The parameters of the two bequest motives were chosen to hold fixed the strength of the bequest motive. With either of these preferences, people around the 75th percentile of the wealth distribution would leave $50,000 of bequests with full insurance.

affect the value of long-term care insurance by decomposing the value of long-term care insurance into four components: consumption insurance, bequest insurance, avoiding Medicaid-financed care, and increasing consumption at the expense of bequests.

Table 7 shows the willingness to pay for long-term care insurance, the effect of buying insurance on several key outcomes, and the components of the gain from insurance for healthy 67-year-olds around the 75th percentile of the wealth distribution with various preferences.[30] Consider the components of the value of long-term care insurance for each set of preferences in turn.

No bequest motive, no Medicaid aversion.— This individual is willing to pay about $9,100 for access to long-term care insurance. Long-term care insurance is mainly valuable as consumption insurance. Without insurance, the individual consumes aggressively and relies on social insurance should he require costly care. With insurance, the individual chooses a smoother consumption profile and is able to consume more if he requires costly care.

[30]The long-term care insurance contract under consideration is the one from the baseline model, which covers all forms of long-term care, has a $100 maximum daily benefit, and whose expected discounted premiums exceed expected discounted benefits by 18 percent, or about $6,300. The individual begins with $200,000 in non-annuity wealth and real annuity income of $22,500 per year for life.

No bequest motive, strong Medicaid aversion.— This individual is willing to pay about $96,800—almost half of his wealth—for access to long-term care insurance. Long-term care insurance is so valuable for two reasons. First, buying insurance reduces the risk that the individual will exhaust his wealth and receive Medicaid-financed care. Expected time spent in Medicaid-financed facilities falls from 11 days to zero days. Second, buying insurance allows the individual to consume more. Without insurance, the individual consumes little—and leaves large bequests on average—in an effort to avoid using Medicaid-financed care. With insurance, the individual can consume more aggressively and thereby convert most of his "incidental" bequests into greater consumption. With insurance, the individual leaves $66,300 less as bequests and consumes $60,000 more on average.

Risk averse bequest motive, no Medicaid aversion.— This individual is willing to pay $67,600 for access to long-term care insurance—over seven times more than an otherwise-identical individual without bequest motives. Long-term care insurance is so valuable for two reasons. First, it insures bequests: it reduces the risk that costly care requirements will deplete the individual's wealth and prevent him from leaving his desired bequest. Second, like the case with strong Medicaid aversion, it allows the individual to consume more. Without insurance, the individual consumes little—and leaves large bequests on average—in an effort to leave bequests even if he requires costly care. This desire leads the individual to consume less and leave larger bequests on average than he would had he access to fair insurance. With insurance, the individual can consume more aggressively and thereby achieve a more desirable mix of consumption and bequests. With insurance, the individual leaves $50,400 less as bequests and consumes $44,100 more on average.

Luxury bequest motive, no Medicaid aversion.— This individual is better off not buying available long-term care insurance; he would have to be compensated $5,600 to be no worse off were he forced to buy long-term care insurance. People with these preferences value the prospect of leaving bequests but are not overly concerned that their bequests may be depleted by long-term care costs. Their low risk aversion over bequests means that they

gain little from the bequest insurance aspect of long-term care insurance. It also means that they can use their bequests to insure their consumption; by leaving smaller bequests in high-cost states, they can support their own standard of living. As a result, they gain little from the consumption insurance aspect of long-term care insurance. They also gain little from the opportunity to increase their consumption at the expense of bequests. Finally, due to their high saving, they are unlikely to exhaust their wealth and have to rely on Medicaid, so they gain less from this aspect of long-term care insurance, too.

E Comparison of Results to De Nardi et al. (2010)

This section tests the hypothesis that De Nardi et al. (2010) (hereafter, DFJ) and I reach different conclusions because their model understates the medical spending risk facing the poor. DFJ estimate separate models of medical spending risk for each permanent income quintile using HRS data on out-of-pocket medical spending. This approach has many advantages, but a significant limitation is that the appropriate input into the model is not out-of-pocket but total medical spending, including long-term care insurance benefits and spending by Medicaid. Figure 4 shows average total medical spending and average out-of-pocket medical spending, by age and income quintile, simulated in my baseline model, $\overline{totm}(t, y)$ and $\overline{oopm}(t, y)$. Due to means-tested Medicaid benefits, out-of-pocket medical spending is in many cases significantly less than total medical spending, especially among low-income retirees.[31]

To see how using out-of-pocket medical spending in place of total medical spending would affect the estimation results, I apply a simplified version of DFJ's procedure to the simulated data displayed in Figure 4. I scale down the prices of long-term care services by

[31] The out-of-pocket spending profiles simulated by my baseline model are similar to those DFJ estimate using out-of-pocket spending data in the HRS. This is reassuring as an out-of-sample test of my estimates. It is also reassuring as a test of whether the Robinson model of long-term care risk—in which all individuals face the same risk—can match the strong empirical relationship between income and out-of-pocket medical spending. The profiles simulated by my model tend to imply less medical spending than those based on the HRS, which may be due to out-of-pocket medical spending being overstated in the HRS (Hurd and Rohwedder, 2009).

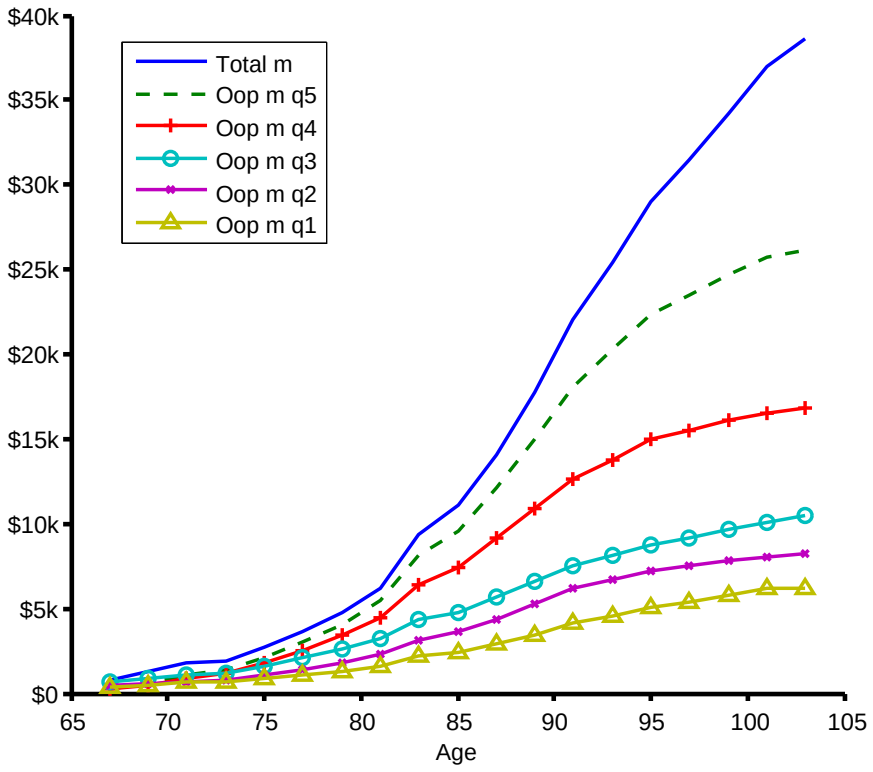


Figure 4: Simulated average total and out-of-pocket medical spending by age for members of the first cohort (age 65–69 in 1998), separated by income quintile.

each income quintile group at each age by that income-age group's average share of out-of-pocket spending in total medical spending, $\hat{m}(t,h,y) = \frac{\overline{oopm}(t,y)}{\overline{totm}(t,y)} m(t,h)$. This creates a medical spending risk model similar to what would be estimated based on out-of-pocket spending data.

Figure 5 shows empirical (solid lines) and simulated wealth moments for odd-numbered cohorts. The dashed lines show simulated moments based on DFJ's preferences and total medical spending risk. Given the strong Medicaid aversion and weak bequest motive, these preferences predict too much saving by the poor and too little saving by the rich. The dotted lines show simulated moments based on DFJ's preferences and out-of-pocket medical spending risk. Despite the strong Medicaid aversion, these preferences are able to roughly match the saving of poor retirees.

These results suggest that DFJ and I reach different conclusions largely because their

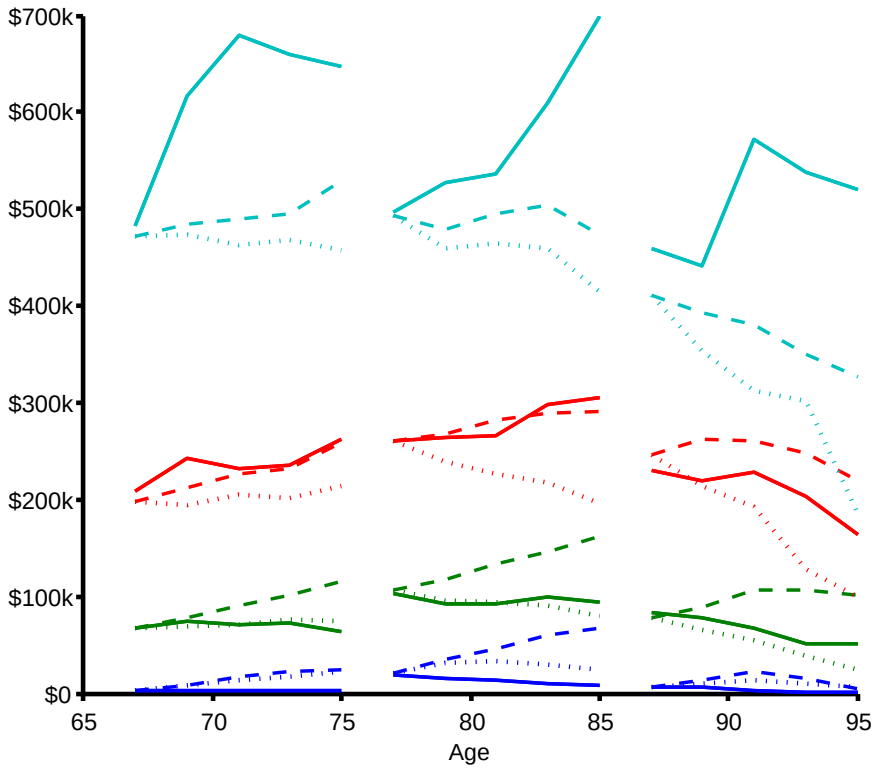


Figure 5: Wealth moments for odd-numbered cohorts. Solid lines are empirical moments, dashed lines are simulated moments based on DFJ's preferences and total medical spending risk, and dash-dotted lines are simulated moments based on DFJ's preferences and out-of-pocket medical spending risk.

model understates the medical spending risk facing the poor, both absolutely and relative to the rich. Understating the risk facing the poor allows the model to match the saving of the poor with a strong precautionary motive. And the strong precautionary motive allows the model to roughly match the saving of upper-middle class retirees with weak bequest motives.

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