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INCIDENTAL BEQUESTS: BEQUEST MOTIVES AND THE CHOICE TO SELF-INSURE LATE-LIFE RISKS

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ABSTRACT

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Abstract

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

1 Introduction

Retirees face significant uncertainty about how long they will live and how much money they will spend coping with bad health. Among 65-year-olds in the U.S., for example,

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

In this paper, I propose and test a new explanation for why many retirees self-insure: bequest motives. Bequest motives are often thought to increase the demand for products that insure bequests, such as long-term care insurance. But the type of bequest motive that appears to be widespread among U.S. retirees—in which bequests are luxury goods—tends to decrease the demand for insurance against late-life risks. Bequest motives reduce the demand for insurance by reducing the opportunity cost of precautionary saving. Without long-term care insurance, people who wish to avoid relying on Medicaid or their families must set aside substantial wealth in case they will require costly care. This greatly limits how much they can consume. Such limits on consumption are much more costly to people without bequest motives, who would like to consume all of their wealth, than they are to people with bequest motives, who value the prospect of leaving wealth to their heirs. For people with bequest motives, self-insurance has a major advantage that is absent for people without bequest motives: Only people with bequest motives value the large bequests that arise incidentally from self-insuring late-life risks.

I estimate several versions of a life cycle model of retirement to answer two main questions. First, can a standard life cycle model match retirees' saving and long-term care insurance choices? Second, can the model match the data without a bequest motive? I solve the problem of separately identifying precautionary and bequest motives by analyzing long-term care insurance decisions together with saving and by comparing the saving behavior of retirees with different levels of wealth. Both of these identification strategies produce the same conclusion: Standard models with bequest motives match retirees' behavior well while models without bequest motives miss badly.

I use the Method of Simulated Moments to estimate bequest and precautionary motives in a model that nests as special cases models with a wide range of bequest motives, including no bequest motive. This enables me to perform statistical tests of the model's fit and of the restrictions implicit in nested versions of the model. At the core of the model are rich approximations of U.S. social insurance programs and of the medical spending and lifespan risks facing single retirees in the U.S. The estimation is based on the saving and long-term care insurance choices of single retirees in the Health and Retirement Study, a panel study of people over the age of 50.

Without bequest motives, the model is highly inconsistent with two major patterns in the data and is strongly rejected by over-identification tests of the model's fit. One pattern that the model without bequest motives cannot match is the pattern of saving across the wealth distribution. In the model without bequest motives, middle-class retirees save too much relative to both richer and poorer retirees. Middle-class retirees tend to be the ones most affected by the precautionary motive since they are neither so rich as to be well-protected from costly medical needs nor so poor as to be well-insured by means-tested social insurance programs.

Another pattern that the model without bequest motives cannot match is the combination, among middle-class and richer retirees, of low long-term care insurance coverage and slow drawdown of wealth. Previous research has established that standard life cycle models without bequest motives can match the low rates of long-term care insurance coverage among middle-class retirees (Brown and Finkelstein, 2008) and, separately, the slow drawdown of wealth among middle-class retirees (e.g., Palumbo, 1999; De Nardi, French and Jones, 2010; Ameriks et al., 2011). I find, however, that models without bequest motives cannot match both decisions simultaneously. To match the saving decisions of middle-class retirees, the model without bequest motives requires a strong precautionary motive: retirees must be highly risk averse or highly averse to relying on means-tested social insurance programs. But to match the long-term care insurance decisions of middle-class retirees, the model without bequest motives requires that people have a weak precautionary motive. As a result, models without bequest motives that match the long-term care insurance coverage of middle class retirees predict far too little saving and models that match the saving of middle-class retirees predict far too much long-term care insurance coverage.

With bequest motives, by contrast, the model matches retirees' saving over the life cycle and throughout the wealth distribution, and it matches the limited demand for long-term care insurance, including by the rich. The estimated bequest motive, in which bequests are luxury goods, increases the saving of richer retirees relative to poorer ones and encourages people to self-insure their late-life risks. Although buying long-term care insurance would allow people to consume more of their wealth by reducing their need to engage in precautionary saving, my estimates indicate that most retirees are not willing to pay available insurance prices in order to increase their consumption at the expense of leaving smaller bequests. Buying long-term care insurance would also protect bequests from the risk of being depleted by costly care episodes, but my estimates—as well as other evidence such as the high wealth elasticity of bequests (Auten and Joulfaian, 1996; Hurd and Smith, 2002)—indicate that most retirees are not sufficiently risk-averse over bequests to justify buying available long-term care insurance contracts. For most people, the benefits of buying long-term care insurance are outweighed by the costs, which are comprised of the loads on these contracts (which in the U.S. average 18 percent of premiums [Brown and Finkelstein (2007)]) and the reduced eligibility for means-tested social insurance (Pauly, 1990; Brown and Finkelstein, 2008).[1]

My results suggest that bequest motives are central for understanding retirees' saving and insurance decisions. This finding is important because much of the literature on saving and insurance decisions relegates bequest motives to a secondary role or ignores them altogether. One fact that has been cited as evidence against bequest motives is the low rate of long-term care insurance coverage, since (non-strategic) bequest motives are generally thought to increase the demand for long-term care insurance.[2] My results suggest instead that low rates of long-term care insurance coverage, especially among retirees in the top half of the wealth distribution and especially in combination with the slow drawdown of wealth, are more likely to be evidence in favor of bequest motives. Bequest motives, which primarily affect relatively wealthy retirees, naturally complement Medicaid (Pauly, 1990; Brown and Finkelstein, 2008) and other factors that reduce rates of long-term care insurance coverage primarily among people with little wealth to help explain the low rates of insurance coverage throughout the wealth distribution.[3,4] The estimated bequest motive also makes the model-predicted annuity ownership rate match closely the low ownership rate observed empirically, despite not targeting this fact.

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

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

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

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

What is likely a more important reason for the relegation of bequest motives to a secondary role is that standard life cycle models without bequest motives can (separately) match the saving and long-term care insurance decisions of non-rich retirees. A standard finding in the large literature that analyzes saving during retirement (e.g., Hubbard, Skinner and Zeldes, 1995; Palumbo, 1999; De Nardi, French and Jones, 2010; Ameriks et al., 2011; Kopecky and Koreshkova, 2014) is that, given the significant medical spending risk faced by retirees, even models without bequest motives can match well the slow drawdown of wealth by middle-class retirees. Although this finding is sometimes interpreted as evidence against the importance of bequest motives, it actually just reflects the difficulty—due to the uncertainty facing retirees and the nature of non-contingent wealth—of interpreting retirees' saving. My strategies for separately identifying precautionary and bequest motives—analyzing long-term care insurance decisions together with saving and comparing the saving behavior of retirees with different levels of wealth—complement those of two recent papers that also analyze late-life saving together with other empirical patterns in order to obtain sharper identification. Ameriks et al. (2011) use responses to survey questions about people's state-contingent plans, and De Nardi, French and Jones (2013) use Medicaid recipiency rates. Both conclude that bequest motives play an important role in retirees' choices.

Understanding retirees' saving and insurance decisions may be more important now than ever before. Individuals have become increasingly responsible for providing for their own retirement—especially with the decline of employer-directed retirement plans—even as medical spending growth and lifespan improvements have made retirement planning more difficult. Retirees' choices about how much to save and whether to buy insurance already have significant effects on government budgets and the broader economy, and these effects will grow in importance as the population ages. People aged 55 and older hold roughly 70 percent of the world's non-human wealth (The Economist, 2007). In 2009, Medicaid, the safety-net health insurance program in the U.S., spent more than $100 billion on long-term care—43 percent of all spending on long-term care (Kaiser Commission on Medicaid and the Uninsured, 2011). A better understanding of the determinants of retirees' saving and insurance decisions can improve the design and evaluation of several important policies, including policies to encourage private insurance coverage; policies to provide social insurance; and policies regarding the tax treatment of savings, insurance, and inter-household transfers.

2 Model

The model follows closely those in Brown and Finkelstein (2008) and De Nardi, French and Jones (2010) in their analyses of the demand for long-term care insurance and saving, respectively. A single retiree decides how much to consume each period and whether to buy long-term care insurance at the beginning of retirement. Each period is one year.

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

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

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

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

Utility from bequests is

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

$v(b) = c_b^{-\sigma} b$ if $\phi = 1$, and $v(b) = 0$ if $\phi = 0$. This is a re-parameterized version of a commonly-used functional form (e.g., De Nardi, 2004; De Nardi, French and Jones, 2010; Ameriks et al., 2011), which nests as special cases nearly all of the functional forms used in the literature, including linear (e.g., Hurd, 1989; Kopczuk and Lupton, 2007) and constant relative risk aversion (e.g., Friedman and Warshawsky, 1990). This parameterization has good numerical properties and easy-to-interpret parameters. $c_b \geq 0$ is the threshold consumption level below which, under conditions of perfect certainty or with full, fair insurance, people do not leave bequests: $v'(0) = c_b^{-\sigma} = u'(c_b)$. Smaller values of c_b mean the bequest motive "kicks in" at a lower rate of consumption. If $c_b = 0$, preferences over consumption and bequests are homothetic and people are equally risk-averse over consumption and bequests. If $c_b > 0$, bequests are luxury goods and people are less risk-averse over bequests than over consumption. $\phi \in [0,1)$ is the marginal propensity to bequeath in a one-period problem of allocating wealth between consumption and an immediate bequest for people rich enough to consume at least c_b.[5] Larger values of ϕ mean

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

that people leave a larger fraction of the wealth left over after buying c_b worth of consumption as bequests. As ϕ approaches one, the bequest motive approaches a linear bequest motive with a constant marginal utility of bequests equal to $c_b^{-\sigma}$.

Health and medical spending risks.— The individual faces uncertainty about how long he or she will live and how much acute medical care and long-term care he or she will require. At any time, the individual is in one of five health states: healthy (he), requiring home health care (hhc), requiring assisted living facility care (alf), requiring nursing home care (nh), or dead (d). The individual's future health prospects depend probabilistically on the individual's current age and health status as well as on the individual's sex (s) and (permanent) income (y), $Pr(h_{t+1} = h'|h_t, t; s, y)$. The cost of the individual's long-term care requirements is a deterministic function of the individual's current age and health status, $ltc(h_t, t)$. The cost of the individual's acute medical care requirements is log-normally distributed with mean μ_m and variance σ_m^2, $m_t \sim \log N(\mu_m, \sigma_m^2)$.

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

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

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

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

Social insurance programs ensure that people enjoy at least a minimum standard of living after paying for any medical care. The consequences of having too little wealth to achieve a minimum standard of living after paying for medical care depend on whether the individual requires institutional care. Individuals who do not require institutional care ($h_t \in \{he, hhc\}$) and who have their wealth fall below $\bar{c}$ receive transfers to top up their wealth to $\bar{c}$. Long-term care insurance premiums are paid after receiving transfers. Net wealth after transfers is

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

Individuals who require institutional care ($h_t \in \{alf, nh\}$) can have part of their care paid for by the government if they satisfy income- and assets-based means tests. To qualify for public coverage of institutional costs, people must exhaust all but $\bar{x}$ of their assets ($\hat{x}_t \leq \bar{x}$) and have no more than $\bar{y}$ of income net of medical spending and insurance transfers ($\hat{y}_t \equiv y - ltc_t + \lambda_t \leq \bar{y}$). Individuals who qualify for public coverage but can afford to pay for their care privately ($\hat{x}_t \in [0, \bar{x}]$ and $\hat{y}_t \leq \bar{y}$) can choose whether to accept public support or, if publicly-financed care is sufficiently less attractive than privately-financed care, to pay for their care themselves. These eligibility rules are modeled on those of the U.S. Medicaid program (Brown and Finkelstein, 2008; De Nardi et al., 2012). Net wealth after transfers is

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

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

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

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

Residents of nursing homes and assisted living facilities receive a certain amount of consumption from their long-term care, $c_m(h_t \in \{alf, nh\}, Pub_t) > 0$ and they cannot buy additional consumption beyond that: $\hat{c}_t = 0$ if $h_t \in \{alf, nh\}$. These assumptions reflect the fact that residents of nursing homes and assisted living facilities receive some non-medical goods and services, such as food and housing, bundled with their long-term care. Many also have limited opportunities to buy additional consumption, both because care-giving facilities provide for many of their needs and because of their (usually severe) chronic illnesses. Individuals who are healthy or who are receiving home health care, on the other hand, neither receive consumption from their care, $c_m(h_t \in \{he, hhc\}, Pub_t) = 0$, nor have their other consumption opportunities limited except by their net wealth after transfers, $\hat{c}_t \in [0, x_t]$ if $h_t \in \{he, hhc\}$. Assets earn a real, after-tax rate of return of r. Next-period wealth is

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

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

Solution method and value functions.— Given a set of parameter values, I solve the model numerically by backward induction from the maximum age T. As long-term care insurance is purchased once-and-for-all, long-term care insurance ownership, $ltci \in \{0, 1\}$, is a fixed characteristic in every period other than the purchasing period, in which it is a control variable. The other fixed individual characteristics are sex (s) and retirement income (y). The state variables are age (t), health (h_t), and wealth after acute medical spending ($\hat{w}_t$). The individual dies by age $T+1$ with probability one, and leaves any remaining wealth as a bequest, $V_{T+1}(\hat{w}_{T+1}) = v(\hat{w}_{T+1})$. For younger ages, I discretize wealth into a fine grid and use piecewise cubic hermite interpolation to evaluate the value function between grid points. At each age-health-wealth node, I solve for optimal consumption and optimal claiming of public support for institutional care. The problem can be written recursively in terms of the value function as

$$V(\hat{w}_t, h_t, t; s, y, ltci) = \begin{cases} \max\limits_{\hat{c}_t \in \Gamma(x_t, h_t)} \Big\{ u\big[\hat{c}_t + c_m(h_t, Pub_t(\hat{w}_t, h_t, t; s, y, ltci))\big] \\ \qquad\qquad + \beta E_t V(\hat{w}_{t+1}, h_{t+1}, t+1; s, y, ltci) \Big\} & \text{if alive}, \\ v(\hat{w}_t) & \text{if dead}, \end{cases}$$

where consumption spending is zero for individuals living in assisted living facilities or nursing homes, $\Gamma(x_t, h_t \in \{alf, nh\}) = \{0\}$, and is otherwise limited to net wealth after transfers, $\Gamma(x_t, h_t \in \{he, hhc\}) = [0, x_t]$. The individual makes a once-and-for-all choice about whether to buy long-term care insurance at age l. The individual buys insurance if and only if $V(\hat{w}_l, h_l, t = l; s, y, ltci = 1) > V(\hat{w}_l, h_l, t = l; s, y, ltci = 0)$.

3 The Method of Simulated Moments and the Key Parameters in the Estimation

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.[6] MSM estimations of life cycle models typically proceed in two stages (e.g., Gourinchas and Parker, 2002; Cagetti, 2003). 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 second stage of the estimation attempts to recover the values of all of the preference parameters: the strength and curvature of bequest motives, ϕ and c_b; the consumption value of publicly-financed nursing care, c_{pub}; the discount factor, β; the coefficient of relative risk aversion, σ; and the consumption value of the consumption floor for people who do not require nursing care, $\bar{c}$. The parameter estimates, $\hat{\theta} \equiv (\hat{\phi}, \hat{c}_b, \hat{c}_{pub}, \hat{\beta}, \hat{\sigma}, \hat{\bar{c}})$, minimize the distance between simulated and empirical wealth and long-term care insurance moments, as evaluated by a classical minimum distance-type criterion function. Appendix A contains details about the asymptotic distribution of the parameter estimates and over-identification tests of the model's fit.

4 Data and Parameterization

4.1 Data and Sample Selection Procedure

I use the Health and Retirement Study (HRS), a longitudinal survey of a representative sample of the U.S. population over 50 years old.[7] The HRS surveys more than 22,000 Americans every two years. It is a rich dataset with especially detailed information about

[6] 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.

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

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 six waves, which occur in even-numbered years from 1998–2008. Individuals in my sample are therefore covered for up to ten years. I restrict the analysis to single retirees who are at least 65 years old in 1998 and who do not miss any of the 1998–2008 interviews while they are alive. The resulting sample contains 3,386 individuals. Where possible, I use the RAND version of the variables.[8]

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

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

Table 1 presents summary statistics from the HRS. The first column corresponds to the population of people aged 65 and over in the U.S., and the second column corresponds to

[8] I restrict to retirees by dropping individuals who earn more than $3,000 dollars in any wave 1998–2008. I exclude waves that occur before 1998 due to sample size issues and problems with certain key variables. The first two waves of the HRS cohort (1992 and 1994) contain individuals who are too young. The first wave of the AHEAD cohort (1993) has inaccurate data on wealth (Rohwedder, Haider and Hurd, 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 exclude waves after 2008 because my sample becomes quite small due to mortality. I convert all dollar variables to constant 2010 dollars using the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W), the price index that the Social Security Administration uses to adjust Social Security benefits.

the population of single retirees aged 65 and over, who are the focus of the analysis. The population of single retirees is older, more female, and poorer than the overall elderly population. Only about ten percent of each group owns long-term care insurance and only about six percent owns life annuities. The vast majority of both samples have children; even among the sample of single retirees, 85 percent have children. Slightly more than two-thirds of the people in each group (and more than half of people without children) report that it is somewhat or very important to leave an inheritance to their heirs.[9]

4.2 First-Stage Parameter Values

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

Health and lifespan risk.— The (Markov) transition probabilities across health states are based on a widely-used actuarial model developed by James Robinson (see Robinson, 2002; Brown and Finkelstein, 2004). I use Robinson's model for women for both men and women because it better approximates the long-term care risk facing single individuals, who receive much less informal care than the typical (married) man. I adjust the model to match De Nardi, French and Jones's (2010) estimates of life expectancy conditional on reaching age 70 for different sex and income groups. Women live longer than men, and richer retirees live longer than poorer ones. Details are available in Appendix B.[10]

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

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

[10] The major advantage of basing the model of long-term care risk on observed patterns of utilization as opposed to spending is that it captures the care paid for by all sources, not just the care paid for out-of-pocket by households. This is important because Medicaid assists 70 percent of nursing home residents and even higher shares of poorer retirees (Kaiser Commission on Medicaid and the Uninsured, 2013).

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

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

timing of nursing home usage by members of the sample, for example, the average price that members of the sample will pay for each year of nursing home care is \$69,500, roughly the average price of a year in a semi-private room in a nursing home in 2008 (MetLife Mature Market Institute, 2009).

Long-term care insurance.— The long-term care insurance contract, $\lambda(h_t, t; ltci)$, is a simplified version of a typical contract. In exchange for paying annual premiums when healthy ($h = he$), people with insurance have their long-term care costs covered up to a maximum of \$44,350 in years in which they are sick ($h \in \{hhc, alf, nh\}$) (which corresponds to a maximum daily benefit of \$100 in 2002 expressed in 2010 dollars). 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).[11]

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

Social insurance and public care aversion.— To qualify for public coverage of nursing care, people must exhaust all but $\bar{x} = \$2,650$ of their assets and $\hat{y}_t \equiv y - m_t \leq \$450$ of their income. These figures are the modal income and asset eligibility requirements employed by U.S. states in 1999 (Brown and Finkelstein, 2008), expressed in 2010 dollars. The estimation recovers the utility penalty from staying in a publicly-financed care-giving facility as opposed to a privately-financed facility, $PCA \equiv [u(c_{priv}) - u(c_{pub})]$. To facilitate interpretation of the results and comparison with other studies, I follow Brown and Finkelstein (2008) by setting the benchmark value of privately-financed care to $c_{priv} = \$7,800$, which is roughly the consumption level that the Supplemental Security Income (SSI) program (which is meant to provide a subsistence level of food and housing) provided to single elderly individuals in 2000, expressed in 2010 dollars. Estimating public care aversion is then equivalent to estimating the consumption-value of publicly-financed care, c_{pub}. Different c_{priv} benchmarks simply shift the implied c_{pub} to maintain the same utility advantage of privately-financed care.

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

Rate of return.— The real, after-tax rate of return that retirees expect to earn on their wealth is four percent per year, $r = 0.04$. (As discussed below, the return that a particular retiree actually earns each year in the simulations is based on his or her portfolio allocation and the realized returns on different assets in that year.) Four percent is roughly the average real, after-tax return on a "typical" retiree's portfolio during the 38 years immediately preceding the sample period (3.9 percent from 1960–1997) or during the 51-year period including the sample period (4.0 percent from 1960–2010).[12]

4.3 Second-Stage Moments: Wealth and Insurance

Empirical wealth moments.— The wealth moments track the evolution of wealth over time as members of the sample age. I split the sample into six 5-year birth cohorts. The age ranges of these cohorts in 1998 are 65–69, 70–74, 75–79, 80–84, 85–89, and 90–94. For each cohort, I calculate the median of the wealth distribution in each wave *after* 1998—2000, 2002, 2004, 2006, and 2008—in which there are at least 100 surviving members of the cohort. Thus there are potentially 30 wealth moments: one median for each of five waves for each of six cohorts. Discarding the cohort-waves with fewer than 100 surviving members eliminates the 2008 observations of five of the six cohorts, which leaves 25 wealth moments.[13] Each cohort's wealth moments trace the evolution over time of the median wealth of its surviving members. Later waves contain fewer people due to deaths. Of the 3,386 individuals in the sample in 1998, 1,183 (34.9 percent) were still alive in the last wave in 2008. The measure of wealth is the total value of non-annuity wealth including housing.

Empirical long-term care insurance moment.— The empirical long-term care insurance moment is the ownership rate among the subset of the sample who were 70–79 years old in 1998, weighted by the 1998 HRS individual sample weights. This ownership rate is 5.6 percent. This calculation counts an individual as owning long-term care insurance if he or she owns a long-term care insurance policy that covers both nursing home care and home care in at least half of the waves in which information on his or her long-term care insurance is available.[14]

Policies that cover both nursing homes and home health care are the most popular type

[12] Retirees' portfolios, though not without risk, are roughly an order of magnitude less volatile than the stock market. Over the past 51 years (1960–2010), the standard deviation of the rate of return based on the average portfolio shares of my sample of single retirees was about 3.3 percent. In Section 5.4 I show that adding rate-of-return risk has little effect on the results. Additional details of the rate-of-return calculations are available in Appendix C.

[13] The estimates are not sensitive to whether these moments are excluded.

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

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.[15] The subset of the sample who were 70–79 years old in 1998 completed their prime buying years, age 65–69 (Brown and Finkelstein, 2007), immediately before the sample period, 1998–2008.

4.4 Simulation Procedure and Estimation

For each candidate parameter vector θ, I solve the model separately for men and women, different income groups, and people with and without long-term care insurance. I use the resulting value functions and optimal choice rules to simulate the wealth path and long-term care insurance ownership status of each individual in the simulation sample, which is described below. I use the resulting simulated data to calculate the simulated moments, using the same procedure as that used to calculate the empirical moments from the actual data. Finally, I evaluate the goodness of fit of the simulated moments at this particular set of parameter values θ to the empirical moments using a classical minimum distance-type objective function. Details of the simulation procedure are available in Appendix D.

To create the simulation sample, I draw with replacement 10,000 individuals from the sample of single retirees in the HRS. To ensure that the resulting population is representative of the population of single retirees in the U.S., the probability that individual i in the sample of single retirees is chosen on any draw is proportional to i's 1998 person-level weight, $\frac{weight_i}{\sum_{j=1}^{3,386} weight_j}$. For each individual in the simulation sample, the simulation uses: three fixed individual characteristics (sex, average retirement income, and long-term care insurance ownership status), three initial state variables (age, health, and wealth in 1998), health status in 1999–2008, and portfolio shares in 1998–2006.[16] The simulation uses each individual's health status in 1999–2008 to ensure that individuals contribute to the same wealth moments in the simulation as in the data—individuals who

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

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

die in 2001 in the data also die in 2001 in the simulation. This protects against bias from the model of health transitions not matching perfectly the true risk facing retirees.

The simulation uses individuals' portfolio shares in 1998–2008 together with Baker, Doctor and French's (2007) estimates of the annual returns on various assets to construct person-year-specific realized rates of return on wealth, $r_{i,t}$. Details are available in Appendix C. Estimating person-wave-specific rates of return protects against two potential sources of bias. One potential source of bias is that the sample period, 1998–2008, was characterized by unusually high rates of return on many assets. The average real return earned by a portfolio that matches the asset allocations of retirees around the middle of the wealth distribution was about 6 percent per year over the period, compared to about 4 percent in the three-and-a-half decades leading up to the sample period. Failing to account for the unusually—and probably unexpectedly—high rates of return could bias the results; the naive estimation would attribute wealth outcomes as arising solely from purposeful saving behavior whereas unusual capital gains or losses may have been important as well (Baker, Doctor and French, 2007). The other source of bias that this procedure protects against is that retirees' portfolios vary systematically across the wealth distribution. Retirees in the middle of the wealth distribution, for example, hold more of their wealth in housing than richer and poorer retirees, and the average return on housing wealth was especially high (7.9 percent per year) over the sample period. Ignoring the differences in retirees' portfolios could bias the results by leading the estimation to wrongly attribute differences in wealth as arising solely from differences in saving behavior whereas differences in realized returns may have been important as well.

Estimation.— The baseline estimation of $\theta \equiv (\phi, c_b, c_{pub}, \beta, \sigma, \bar{c})$ is based on 26 moment conditions: one long-term care insurance moment and 25 wealth moments. The baseline weighting matrix is the inverse of the estimated variance-covariance matrix of the second-stage moment conditions, $W = \hat{\Omega}_g^{-1}$. More-precisely estimated moments receive greater weight in the estimation. I estimate the variance-covariance matrix of the second-stage moment conditions 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 moment conditions as the weighting matrix, $W_{robust} = [diag(\hat{\Omega}_g)]^{-1}$.

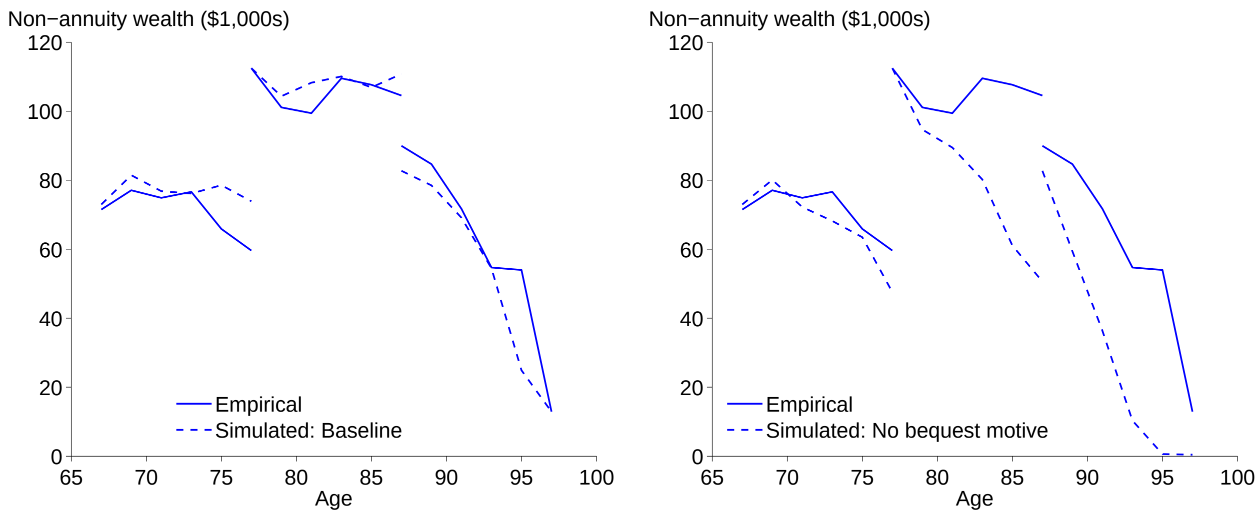
	Baseline model (1)	Robust weighting matrix (2)	No bequest motive ($\phi = 0$) (3)
Parameter estimates, $\hat{\theta}$			
$\hat{\phi}$: bequest motive	0.83	0.90	0
	(0.06)	(0.08)	-
$\hat{c}_b$: bequest motive ($)	7,219	14,883	-
	(2,983)	(5,430)	-
$\hat{c}_{pub}$: public care value ($) ($c_{priv} = \$7,800$)	7,625	7,750	7,750
	(4,409)	(3,507)	(477)
$\hat{\sigma}$: risk aversion	2.00	2.50	2.62
	(0.16)	(0.15)	(0.29)
$\hat{\underline{c}}$: c floor in community ($)	5,000	3,559	7,750
	(5,393)	(1,792)	(1,447)
$\hat{\beta}$: discount factor	0.94	0.94	1.01
	(0.04)	(0.03)	(0.01)
Goodness-of-fit			
χ^2 stat	15.1	16.6	131.5
p-value of model	0.77	0.68	<2.3e-16
p-value of no-bequest motive restriction	-	-	<2.3e-16
Simulated LTCI (%)	5.9	6.0	15.9
(Empirical LTCI = 5.6%)			

Table 3: Estimation results based on the baseline weighting matrix, the robust weighting matrix, and from estimating the nested version of the model without a bequest motive ($\phi = 0$). Standard errors appear in parentheses.

5 Results

5.1 The Baseline Model Matches Retirees' Choices

The first column of Table 3 contains the results of the baseline estimation. The overall fit of the model is good. The p-value of the chi-squared test of over-identifying restrictions is 0.77, which indicates a good fit for a model of this kind. The estimates of the bequest motive parameters indicate important bequest motives in which bequests are luxury goods. The estimates imply that people are only moderately risk-averse over bequests and, equivalently, that among people rich enough to leave bequests, the marginal propensity to bequeath out of wealth is fairly high. The estimated bequest motive is similar to those estimated by Ameriks et al. (2011) and De Nardi, French and Jones (2013). The estimate of the consumption value of publicly-financed facility care indicates that public care aversion



(a) Baseline model

(b) No bequest motive

Figure 1: Empirical wealth moments (solid lines) and simulated wealth moments (dashed lines) for odd-numbered cohorts. (Even-numbered cohorts are excluded to avoid overlapping lines.) In panel (a), the simulated moments come from the baseline model. In panel (b), the simulated moments come from the model without bequest motives. The x-axis shows the average age of surviving members of the cohort. The y-axis shows total non-annuity wealth in $1,000s. Of the 3,386 individuals in the sample, all of whom were alive in 1998, 1,183 (34.9 percent) were still alive in the last wave in 2008. The empirical and simulated wealth moments do not coincide in 1998 (the left-most of each set of moments) due to sampling error from drawing a finite sample for the simulation.

is modest, though this estimate has a large standard error. The estimates of the discount factor and the coefficient of relative risk aversion yield fairly standard values ($\hat{\beta} = 0.94$ and $\hat{\sigma} = 2.00$). The estimate of the consumption floor for people who do not require nursing care is somewhat less than the floor provided to single elderly people by the SSI program ($5,000vs. about $7,800). This may indicate a modest aversion to claiming this form of welfare, but as in the case of public care this parameter is estimated imprecisely and the hypothesis that people value these transfers at their full value cannot be rejected.

The good fit of the model revealed by the over-identification test is also apparent in the long-term care insurance ownership rate and the wealth moments. Simulated long-term care insurance ownership is 5.9 percent, compared to 5.6 percent in the data. Panel (a) of Figure 1 plots the empirical and simulated wealth moments of the odd-numbered cohorts (the results for even-numbered cohorts, which look similar, are excluded for readability). The model reproduces the main patterns in the wealth data and therefore in consumption and saving decisions. Moreover, as the second column of Table 3 shows, the estimation based on the robust weighting matrix produces qualitatively similar results.

5.2 The Model Without Bequest Motives is Strongly Rejected

The third column of Table 3 shows results from estimating the model without bequest motives, i.e., under the restriction that $\phi = 0$. The model without bequest motives fits the data poorly and the restriction of no bequest motive is rejected at the one percent confidence level. The key failing of the model without bequest motives is that it predicts too little saving relative to long-term care insurance ownership. Table 3 shows that its simulated long-term care insurance ownership rate is almost 3 times too high (15.9 percent vs. 5.6 percent in the data), and Panel (b) of Figure 1 shows that it predicts much more rapid drawdown of wealth than is observed empirically, especially at older ages. Improving the model's fit to either retirees' saving or their long-term care insurance choices worsens the model's fit to the other dimension. For example, if the model without bequest motives is estimated to match saving, the predicted long-term care insurance ownership rate is 47.3 percent, over eight times the empirical ownership rate.[17] Although the model without bequest motives can match either the slow drawdown of wealth or the low rate of long-term care insurance ownership, it cannot match both simultaneously. Long-term care insurance ownership is too low—both absolutely and, especially, relative to saving—to be consistent with the model without bequest motives.

Identification of the model.— Within the context of the standard life cycle model, retirees' saving and long-term care insurance choices indicate that important bequest motives in which bequests are luxury goods are widespread. As Section 5.4 and Appendix E show in detail, the model is well-identified and the identification is not driven by any particular moment or set of moments. Non-poor retirees buy too little long-term care insurance relative to how much they save and retirees in the middle of the wealth distribution save too little relative to poorer and richer retirees to be explained by versions of the model in which bequests are not valuable luxury goods.

5.3 Bequest Motives Encourage Retirees to Self-Insure

Figure 2 shows simulated and empirical long-term care insurance ownership rates. The three simulated ownership rates correspond to three different sets of preferences: the baseline estimates, the baseline estimates except with the bequest motive turned off, and the estimates from fitting a model without a bequest motive to the wealth moments.

One way to judge the effect of the bequest motive on the demand for long-term care insurance is to turn off the bequest motive while holding constant the other preference

[17] The results of this estimation are shown in Table 5.

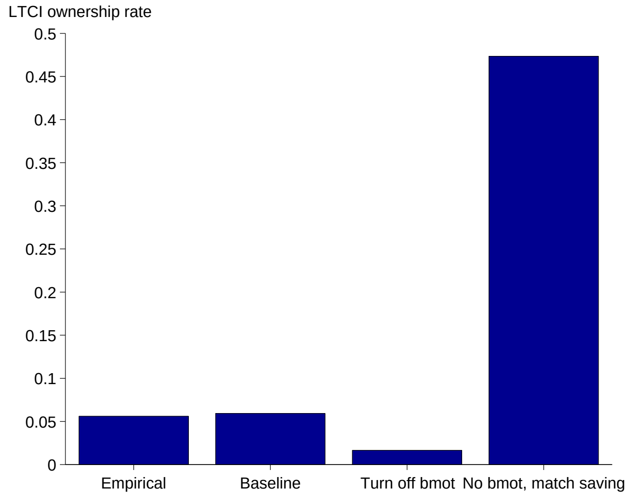


Figure 2: Simulated and empirical long-term care insurance ownership rates. The empirical ownership rate corresponds to the fraction of single retirees aged 70–79 in 1998 who report owning long-term care insurance that covers both nursing homes and home health care in at least half of the waves between 1998 and 2008 in which they report their ownership status, weighted by HRS respondent weights. The simulated ownership rates are based on three sets of preferences: the baseline estimates, the baseline estimates except with the bequest motive turned off, and estimates from the model without bequest motives fitted to the (median) wealth moments.

parameters. This experiment gives the model's forecast of the effect on long-term care insurance coverage of 100 percent estate (and gift) taxes, if such taxes were levied successfully. Figure 2 reveals the results of such an experiment in the second and third bars. These reveal that the bequest motive slightly *increases* long-term care insurance ownership, from 1.7 percent to 5.9 percent.

One major disadvantage of this counterfactual of shutting down the bequest motive is that it conflates the effects of two separate factors that affect the value of long-term care insurance: the value that people place on bequests and the "implicit tax" on private insurance from means-tested programs like Medicaid (Brown and Finkelstein, 2008). The implicit tax from Medicaid is much greater in the model in which the bequest motive is turned off since in this case individuals spend down their wealth much more rapidly and thus qualify for greater transfers from Medicaid. An alternative counterfactual that controls (albeit imperfectly) for the implicit tax from Medicaid to produce a cleaner measure of the effect of bequest motives on the value of insurance involves comparing predicted long-term care insurance ownership in the baseline model to insurance ownership in a model without bequest motives that matches retirees' saving. Figure 2 reveals the results of such an experiment in the second and fourth bars. This comparison suggests that among similar-saving retirees, the bequest motive significantly reduces the demand for insurance. Long-term care insurance coverage is more than eight times greater in the model without bequest motives than in the baseline model (47.3 percent compared to 5.9

	Baseline preferences		Baseline preferences, but turn off bequest motive		No bequest motive, match saving	
	No LTCI	Effect of LTCI	No LTCI	Effect of LTCI	No LTCI	Effect of LTCI
Expected consumption ($)	333,461	-17,232	384,372	-30,296	309,690	20,946
Expected bequest ($)	59,024	-2,971	22,507	832	80,176	-37,266
Willingness to pay for long-term care insurance ($)						
Average load (18%)	-3,625	-	-18,337	-	61,968	-
Actuarially fair	5,809	-	-6,227	-	75,443	-

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

percent). Among people who draw down their wealth at similar rates, long-term care insurance is much less attractive to someone with the estimated bequest motive than to someone without a bequest motive.[18]

To clarify why the estimated bequest motive reduces the demand for long-term care insurance, Table 4 shows, for a healthy 67-year-old around the 75th percentile of the wealth distribution, expected consumption and bequests without long-term care insurance, the effect of buying insurance on expected consumption and bequests, and the willingness to pay for long-term care insurance. These outcomes are simulated using the three sets of preferences just discussed. With the baseline preferences, the individual is better off not buying long-term care insurance at available prices: The individual would have to be paid more than $3,500 to be induced to buy (and hold for life) the typical long-term care insurance contract. Although the individual values the bequest insurance that long-term

[18] These results highlight the difficulty of interpreting comparisons of long-term care insurance ownership rates across groups with different values of proxies for bequest motives. There are at least two major issues. First, both bequests and long-term care insurance appear to be luxury goods (bequests due to preferences and long-term care insurance due to Medicaid). For this reason, the model predicts a *positive* relationship between desired bequests and long-term care insurance coverage, despite predicting that bequest motives reduce long-term care insurance coverage relative to the case of similar-saving people without bequest motives. Second, with heterogeneity in risk aversion over bequests, bequest motives might increase the demand for insurance among people who are especially risk averse over bequests while reducing it for others. Consistent with this, survey evidence suggests that the desire to insure bequests contributes to some people's purchasing decisions (LifePlans, 2004). These considerations might explain why comparisons of long-term care insurance ownership rates across groups with different values of proxies for bequest motives sometimes yield inconsistent results. For example, Sloan and Norton (1997) find no significant relationship between long-term care insurance ownership and reported preferences for leaving bequests, while Brown, Goda and McGarry (2011) find a positive relationship.

care insurance provides and would be willing to pay almost $6,000 for actuarially fair insurance, the individual does not value bequest insurance enough to justify paying the loads on available contracts and losing access to means-tested benefits in some states. Together, the loads on the typical contract and the loss of means-tested benefits from buying insurance mean that by self-insuring the individual can consume over $17,000 more and leave almost $3,000 more wealth as bequests on average than he or she could by buying insurance. These considerations are similar but even stronger for the individual with the baseline preferences except with the bequest motive turned off. Such an individual dissaves aggressively, and as a result can consume on average over $30,000 more over his or her lifetime without long-term care insurance than with it. Such an individual strongly prefers remaining uninsured to buying long-term care insurance—even if it is actuarially fair,—since by remaining uninsured the individual can benefit from much greater transfers from Medicaid.

An individual without bequest motives whose saving is similar to the median retiree, by contrast, is much better off buying available long-term care insurance. Whereas the individual with the baseline preferences is better off not buying long-term care insurance at typical loads, an individual without bequest motives who saves a similar amount is willing to pay over $60,000 for access to long-term care insurance—almost one-third of his or her initial non-annuity wealth. Long-term care insurance is so valuable in this case because, by reducing the individual's need to engage in precautionary saving, it allows the individual to enjoy a higher rate of consumption. Without insurance, the individual's strong desire to avoid running out of wealth forces him or her to consume much less—and leave much larger bequests on average—than the individual would otherwise like. The individual leaves bequests of more than $80,000 on average without insurance—over 40 percent of initial wealth—despite not valuing bequests at all. Buying long-term care insurance allows the individual to convert much of these bequests into greater consumption, which allows the individual to consume over $20,000 more on average with insurance than without it, despite the loads on insurance and the foregone Medicaid benefits.

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

5.4 The Results are Robust to Many Alternative Assumptions

Table 5 presents results from estimating the model with different "first-stage" parameter values and different estimating moments. The estimations based on different first-stage parameter values include: introducing uncertainty into the returns that retirees expect to earn on their wealth; allowing residents of nursing homes and assisted living facilities to buy additional consumption beyond what they receive from their care; and increasing long-term care costs by 50 percent. Although most of the alternative versions of the model do not fit the data as well as the baseline specification does, the parameter estimates are fairly similar across specifications, and the qualitative conclusions—that retirees' decisions favor models with important bequest motives and modest precautionary motives (the combination of public care aversion and risk aversion)—are extremely robust. In every specification, the model without bequest motives is highly inconsistent with some of the main features of the data and can be rejected at the one percent confidence level.[19]

Although the conclusion that the model requires a bequest motive to match retirees' saving and insurance choices is quite robust, the model does *not* require a bequest motive to match retirees' saving decisions alone, at least not the saving decisions of retirees around the middle of the wealth distribution. The fifth column of Table 5 shows that the model without bequest motives can match the saving of middle class retirees extremely well—about as well as the model with bequest motives can. This is a manifestation of the identification problem that arises when analyzing the saving decisions of retirees at a particular point in the wealth distribution (Dynan, Skinner and Zeldes, 2002); retirees' saving behavior is consistent with a wide range of combinations of bequest motives and precautionary motives, so long as the combined motive is strong enough to match the slow rates of wealth drawdown observed empirically. One implication of this result is that the low rate of long-term care insurance ownership observed in the data plays a key role in identifying the bequest motive in the baseline estimation. This raises the concern that

[19] An important reason for the robustness of the main conclusion that the model requires a bequest motive to match retirees' choices is that many of the factors that would help the model without bequest motives match the slow rates at which retirees draw down their wealth would hurt that model's ability to match the low rates of long-term care insurance ownership. For example, suppose retirees think that Medicare covers more long-term care expenses than it does, underestimate the cost of or risk of requiring long-term care, or are more myopic than is allowed by the model of exponential discounting. Although any of these factors would improve the ability of the model without bequest motives to match the low rate of long-term care insurance ownership, these same factors would hurt the ability of that model to match the slow drawdown of wealth.

		Different first-stage parameter values			No bequest motive, wealth only	
	Baseline model (1)	Higher LTC costs (2)	Consume in nursing facilities (3)	Uncertain returns (4)	Wealth only (5)	More wealth (25th, 50th, & 75th %iles) (6)
Parameter estimates, $\hat{\theta}$						
$\hat{\phi}$: bequest motive	0.83	0.90	0.90	0.80	0	0
	(0.06)	(0.04)	(0.04)	(0.04)	-	-
$\hat{c}_b$: bequest motive ($)	7,219	6,516	8,477	8,375	-	-
	(2,983)	(2,449)	(4,353)	(3,249)	-	-
$\hat{c}_{pub}$: public care value ($) ($c_{priv} = \$7,800$)	7,625	7,500	5,500	7,063	7,750	7,750
	(4,409)	(4,356)	(4,124)	(2,739)	(355)	(118)
$\hat{\sigma}$: risk aversion	2.00	2.00	2.00	1.71	3.86	4.15
	(0.16)	(0.13)	(0.12)	(0.08)	(0.87)	(0.13)
$\hat{\bar{c}}$: c floor in community ($)	5,000	3,500	5,309	4,684	5,000	2,125
	(5,393)	(4,450)	(4,790)	(4,852)	(1,432)	(201)
$\hat{\beta}$: discount factor	0.94	0.90	0.90	0.97	0.98	0.88
	(0.04)	(0.03)	(0.04)	(0.02)	(0.03)	(0.01)
Goodness-of-fit						
χ^2 stat	15.1	19.3	23.3	14.4	8.6	106.2
p-value of model	0.77	0.50	0.28	0.81	0.99	<2.3e-16
p-value of no-bequest motive restriction	<2.3e-16	<2.3e-16	<2.3e-16	<2.3e-16	1.0	<2.3e-16
Simulated LTCI (%) (Empirical LTCI = 5.6%)	5.9	7.2	6.1	5.7	47.3	63.8

Table 5: Robustness of results to different first-stage parameter values and estimating moments. The first column reproduces the baseline estimates. The next set of columns shows results based on different values of some of the important first-stage parameters. The final set of columns shows results based on estimating the model without bequest motives based on different sets of wealth moments. The second column shows results based on a model with 50 percent higher long-term care costs. The third column shows results based on a model that allows residents of nursing homes and assisted living facilities to buy consumption over and above the consumption they receive from their long-term care. The fourth column shows results when retirees anticipate uncertainty in the returns on wealth, which matches the standard deviation in the typical retiree's portfolio (details in Appendix C). The fifth column shows results from estimating the model without bequest motives using only the wealth moments, excluding long-term care insurance. The sixth and final column shows results from estimating the model without bequest motives using a broader set of wealth moments—the 25th, 50th, and 75th percentiles of the wealth distribution instead of just the median,—excluding long-term care insurance. Standard errors appear in parentheses.

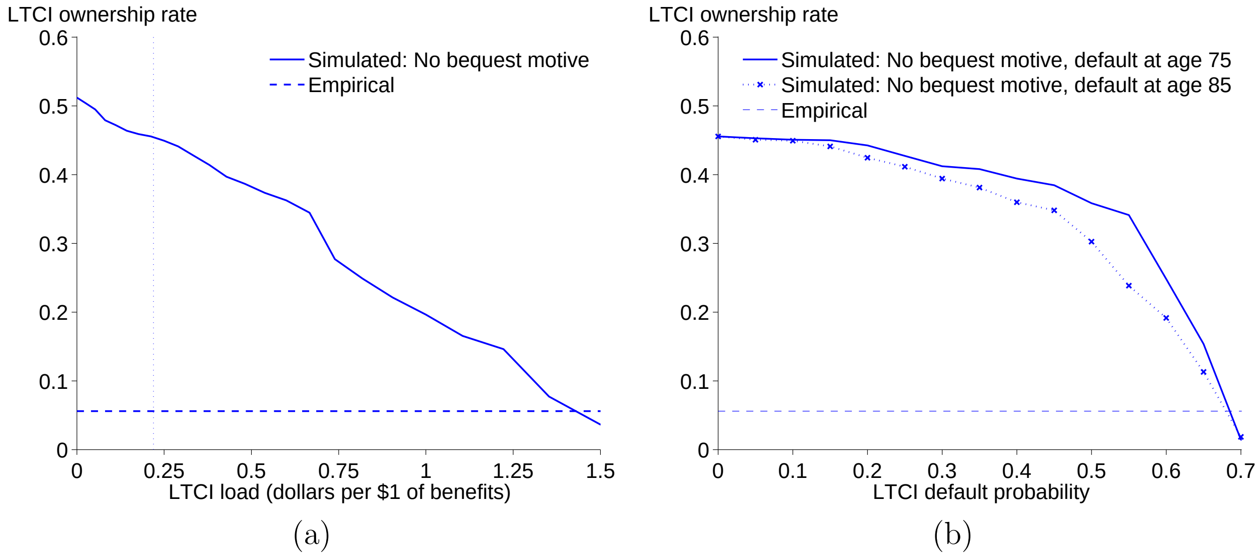


Figure 3: Long-term care insurance ownership rate in the model without bequest models fitted to the (median) wealth moments.
Panel (a): Ownership rate as function of load. Load is measured in dollars of load per dollar of benefits. Actuarially fair insurance corresponds to a load of zero. The vertical dotted line shows the average load on contracts in the U.S. market, about 22 cents per dollar of benefits (which corresponds to the 18 percent load as a fraction of premiums found by Brown and Finkelstein (2007)).
Panel (b): Ownership rate as function of default probability. Default means that the contract vanishes at the specified age.

un-modeled factors that might reduce the demand for long-term care insurance could lead the estimation to mistakenly attribute the low demand for long-term care insurance to bequest motives when it is actually due to one or more un-modeled factors. The rest of this section presents three tests of the robustness of the conclusion that bequest motives play a central role in retirees' saving and insurance decisions, given that in the baseline model this conclusion relies on long-term care insurance coverage decisions.

The first two tests answer the question: How much less attractive would long-term care insurance have to be in order to allow the model to match the saving and insurance decisions of middle-class retirees without bequest motives? The two panels of Figure 3 show two possible answers to this question. Panel (a) shows, in a model without bequest motives that is fitted to the median wealth moments, the simulated long-term care insurance ownership rate as a function of the load on the contract. At the average load in the U.S., predicted ownership is 47.3 percent, more than eight times greater than the 5.6 percent empirical ownership rate. To match both the saving and long-term care insurance decisions of middle-class retirees, the model without bequest motives requires extremely high loads on long-term care insurance, far higher than those observed in the U.S. market. Whereas the average load on long-term care insurance contracts in the U.S. requires people to pay about 22 cents of loads per dollar of benefits (corresponding to an 18 percent load as a fraction of premiums, $\frac{\$0.22}{\$1.22} = 0.18$), the model without bequest motives requires a load of more than $1.40 per dollar of benefits—over six times the market average.

Panel (b) shows, in the same model without bequest motives fitted to the median wealth moments, the simulated long-term care insurance ownership rate as a function of the probability that the insurance contract vanishes at some point in the future. The risk that the contract vanishes is meant to capture in a simple way the possibility that the insurer defaults on its obligations to the insured or the possibility that the individual, for one reason or another, allows his or her contract to lapse and thus loses coverage thereafter. The results show that in order to simultaneously match retirees' saving and long-term care insurance decisions, the model without bequest motives requires extremely high probabilities of long-term care insurance vanishing at about the worst possible time.[20] Even with a 50 percent probability that long-term care insurance vanishes in the middle of retirement, the predicted ownership rate is roughly one-third, about six times greater than the observed rate of 5.6 percent. These results suggest that default risk and other un-modeled potential disadvantages of long-term care insurance are unlikely to overturn the result that the model without bequest motives is inconsistent with the behavior of middle-class retirees. Middle-class (and richer) retirees buy far too little long-term care insurance relative to how much they save to be consistent with the model without bequest motives.

The third test of the robustness of the conclusion that bequest motives play a central role in retirees' saving and insurance decisions focuses only on saving and ignores long-term care insurance. Given the identification problem that occurs when focusing on the saving of retirees at a particular point in the wealth distribution, I estimate the model on the basis of the evolution of the 25th, 50th, and 75th percentiles of the wealth distribution, instead of just the 50th percentiles as before. The results appear in column 6 of Table 5. Both the model without a bequest motive itself and the test of the restriction to the baseline model of shutting down the bequest motive are strongly rejected. The model with a bequest motive, by contrast, matches the pattern of saving fairly well, with a p-value of 0.17 on the over-identification test of its fit. Although the saving behavior of retirees at a particular point in the wealth distribution cannot separately identify bequest motives and precautionary motives, the pattern of saving across retirees at different points in the wealth distribution can, and it strongly rejects the model without bequest motives. Retirees in the

[20] These simulations are based on two ages at which long-term care insurance potentially vanishes, 75 and 85. Because of the front-loading of premiums in long-term care insurance contracts, these ages are about the worst time for long-term care insurance to vanish. Healthy 65-year-olds tend to remain healthy for several years, during which time they would pay premiums, before becoming sick and collecting benefits. The worst time for a contract to vanish is immediately after the "premiums phase" and before the "benefits phase."

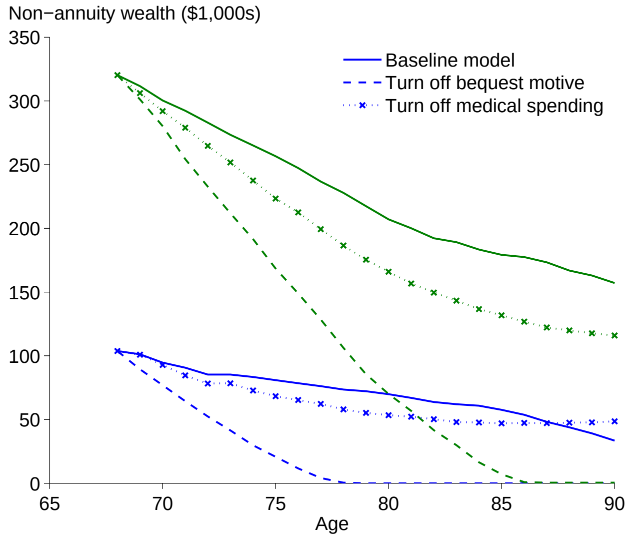


Figure 4: Simulated evolution of the median and 75th percentile of the distribution of non-annuity wealth among members of the first cohort (aged 65–69 in 1998) who remain alive for at least 23 years into their simulated future (at which time their average age is 90). The solid lines track the wealth distribution in the baseline model. The dashed lines track the wealth distribution if the bequest motive is turned off. The dotted lines with x markers track the wealth distribution if medical spending, including spending on both acute and long-term care, is shut down. Specifically, the decision rules come from a model without any long-term care or acute medical care costs ($ltc(h,t) = m_t = 0 \ \forall h, t$), but the simulation of wealth profiles includes medical costs. Differences in wealth therefore reflect differences in saving behavior rather than differences in realized medical expenses. Individuals in the simulation are assigned their reported (empirical) long-term care insurance ownership status.

middle of the wealth distribution save too little relative to both richer and poorer retirees for saving to be driven primarily by medical spending and lifespan risk.[21] Middle-class retirees are particularly sensitive to precautionary concerns because they have too much wealth to be well-insured by means-tested programs yet too little wealth to pay for especially costly health problems. Further discussion of identification in this model appears in Appendix E.

5.5 Implications of the Results

Bequest motives increase saving significantly; medical spending has a smaller effect.— Figure 4 shows, for three different simulations, the simulated evolution of the median and 75th percentile of the distribution of total non-annuity wealth for a balanced panel of retirees in the first cohort (aged 65–69 in 1998, with an average age of 67).[22] Bequest motives significantly slow the speed at which retirees' draw down their wealth: Wealth declines more slowly in the baseline model (solid lines) than in the model without bequest motives (dashed lines). The bequest motive-induced slowing of the drawdown of wealth leads to significantly greater wealth holdings among the oldest retirees and significantly larger bequests. Medical care costs (including both long-term care and acute medical care) have a smaller effect on saving. Wealth paths in the model without medical spending risk (dotted lines with x markers) are only somewhat below those in the baseline model (solid lines) and are well above those in the model without bequest motives.

Bequest motives significantly reduce purchases of annuities.— Figure 5 shows how the estimated bequest motive affects purchases of an annuity that pays $5,000 of (real) income per year for life and has a ten percent load, which is a typical load in the U.S. private market (Brown, 2007). The estimated bequest motive significantly reduces the demand for annuities. Whereas 42.0 percent of the sample buys the annuity in the model without bequest motives—virtually everyone who can afford the premium,—only 2.1 percent buys the annuity in the baseline model, much closer to the empirical ownership rate of 7.1 percent. This is consistent with Lockwood's (2012) conclusion that relatively modest bequest motives can significantly reduce the demand for available annuities.

Bequest motives increase the scope for and effectiveness of policies to encourage private long-term care insurance coverage.— Several U.S. states have implemented policies designed to increase private insurance coverage, presumably with the goal of reducing

[21] Although the significant heterogeneity in wealth at retirement or in average medical spending across income groups probably at least partly reflects heterogeneity in preferences, such heterogeneity in outcomes arises naturally in life-cycle models with homogeneous preferences. Scholz, Seshadri and Khitatrakun (2006) find that a life cycle model with homogeneous preferences can account for over 80 percent of the variation in retirement wealth. Similarly, my model predicts a strong relationship between income and out-of-pocket medical spending—similar to that found by De Nardi, French and Jones (2010) in the Health and Retirement Study—despite its assumption that, conditional on health, the (exogenous) demand for medical care is independent of income.

[22] Constructing the figure involves three main steps. First I clone each member of the first cohort ten times to increase the sample size. Then I simulate each clone's subsequent health realizations over the next 23 years (at which time the average age of the cohort is 90), and simulate the wealth paths of only those clones who live at least 23 years. Finally, I calculate the median and 75th percentile of the simulated wealth distribution in each of those years and plot it against the average age of the cohort on the x-axis. The figure therefore shows the evolution of the wealth distribution as the cohort ages of only those cloned members of the first cohort that survive at least 23 years. This balanced panel construction avoids the bias that can result from selective mortality.

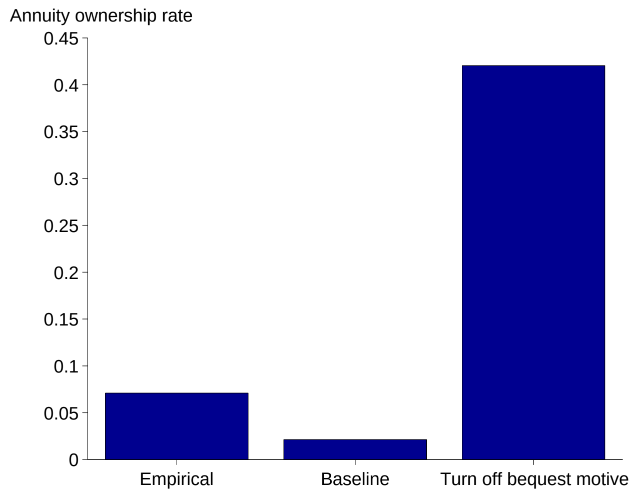


Figure 5: Empirical and simulated ownership rates of life annuities. The empirical annuity ownership rate corresponds to the fraction of single retirees aged 70–79 in 1998 who in the 1998 wave report owning an annuity that lasts for life, weighted by HRS respondent weights. The simulated annuity ownership rates are based on an annuity that pays the annuitant $5,000 of real income each year for life and has a ten percent load, typical of the U.S. private market (Brown, 2007).

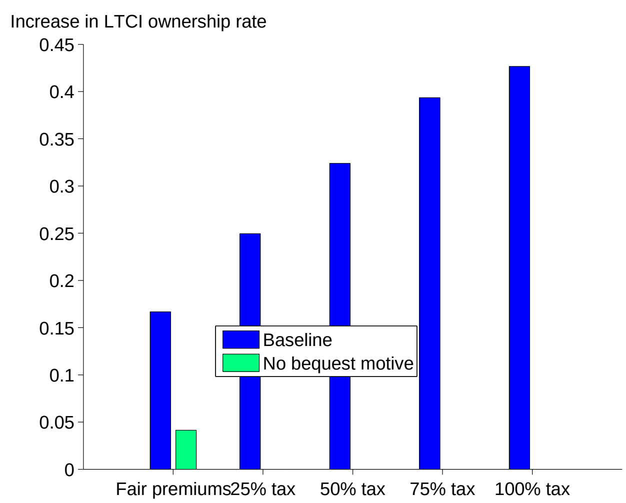


Figure 6: Percentage point increase in the simulated long-term care insurance ownership rate from two types of policies. The first set of bars shows the increase in insurance ownership from a subsidy for long-term care insurance that makes its subsidy-inclusive price actuarially fair. The second set of bars shows the increase in insurance ownership from long-term care insurance-contingent estate and gift taxes at various rates, under which only people *without* long-term care insurance pay taxes on their gifts and estates (people with long-term care insurance pay no transfer tax). The estate and gift tax has no effect in the model without a bequest motive.

spending by means-tested programs. There are at least two reasons why the role of bequest motives in reducing private long-term care insurance coverage could be of interest to policymakers who wish to increase private insurance coverage. First, as Brown and Finkelstein (2008) show, to the extent that means-tested programs like Medicaid explain the low rates of private insurance coverage, the potential for premium subsidies to expand coverage are extremely limited, since the "net load" on insurance, inclusive of public benefits foregone, remains large even if policies such as premium subsidies reduce the "gross load" on private contracts. But bequest motives, by increasing saving, reduce Medicaid's implicit tax on long-term care insurance and increase the own-price elasticity of demand for long-term care insurance. Consistent with this logic, I find that premium subsidies have a larger effect on private insurance coverage with bequest motives than without. The first two bars in Figure 6 show the increase in the simulated long-term care insurance ownership rate, in the baseline model and in the model without bequest motives, from a premium subsidy that reduces the after-tax price of insurance exactly enough to make the policy actuarially fair. This subsidy increases predicted coverage by over four times as much in the model with bequest motives as in the model without bequest motives (16.7 vs. 4.1 percentage points).[23]

The second reason that the role of bequest motives in reducing private long-term care insurance coverage could be of interest to policymakers who wish to increase private insurance coverage is that it admits new possibilities for the types of policies that could encourage private coverage. One such policy is a long-term care insurance-contingent estate and gift tax. Under this policy, only people *without* long-term care insurance must pay taxes on their gifts and bequests; buying (qualifying) long-term care insurance allows one to escape transfer taxation. As Figure 6 shows, an insurance-contingent transfer tax of 25 percent increases predicted insurance ownership in the baseline model by almost 50 percent more than the premium subsidy (25.0 vs. 16.7 percentage points), and a 75 percent tax increases predicted insurance ownership by 39 percentage points. (Estate and gift taxes have no effect on behavior in the model without bequest motives.) Such a policy could partly correct the externality that, because of Medicaid, taxpayers at large benefit from the decision of any individual to buy insurance.

6 Conclusion

Rather than buy insurance against some of the main risks they face, many retirees self-insure by holding much of their wealth into old age. Although the choice of many retirees to self-insure is often viewed as evidence against the importance of bequest motives since it exposes bequests to significant risk, I find that the choice to self-insure constitutes

[23] Although the subsidy is more effective in increasing private insurance coverage in the model with bequest motives, Medicaid still severely limits the market for private insurance, as even with actuarially fair insurance only about one in every five single retirees is predicted to buy insurance. Moreover, and consistent with Goda's (2011) empirical findings, the subsidies increase coverage primarily among rich retirees. The subsidies are therefore unlikely to pay for themselves by reducing Medicaid expenditures, since the rich seldom rely on Medicaid even without insurance.

evidence in favor of bequest motives. Bequest motives reduce the demand for insurance by reducing the opportunity cost of precautionary saving; setting aside wealth to pay for possible future contingencies is much more costly for people without bequest motives who would otherwise like to consume all of their wealth.[24]

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 given the elusive nature of bequest motives in which bequests are luxury goods. By their nature, such bequest motives tend to have a marginal rather than a decisive impact on most decisions: Few choices involve a clear tradeoff between bequests and other goods.[25] Despite this, several patterns in the data are much more consistent with a standard life cycle model with bequest motives than with a model without bequest motives.

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

My results suggest that the term *accidental bequests*, which is used to describe bequests that arise as a byproduct of precautionary saving against uninsured risks, may be misleading in its connotation that such bequests are neither intended nor valued. Although

[24]To understand saving decisions, it can be useful to think of bequest motives as effectively extending an individual's lifespan. To understand insurance decisions, however, this analogy is much less useful. The reason that bequest motives are central for decisions about how much to insure against late-life risks is that they smooth the marginal utility of wealth across states. Bequest motives disproportionately increase the marginal utility of wealth in short-lifespan, low-medical spending states—exactly those states that would otherwise have especially low marginal utility levels. The low marginal utility levels of these states without bequest motives explain the high valuation in models without bequest motives of insurance products like long-term care insurance and annuities that shift wealth out of these states and into others.

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

self-insurance tends to produce bequests that are both larger on average and more variable than those that would occur under full insurance, my results suggest that the value people place on these *incidental bequests* plays a key role in their decisions of how much risk to bear in the first place. Even individuals who would leave small bequests or even no bequest if perfect insurance were available, may—because of the value they place on bequests—choose far less insurance coverage than they would if insurance markets were perfect (Lockwood, 2012). If bequests were accidental in the sense that people did not value bequests, realized bequests would likely be much smaller, both because people would save less and, even more important for the non-rich, because people would buy more insurance.

My results highlight the importance of accounting for bequest motives in evaluating policies that affect people's exposure to late-life risks. The decision about how to model bequest motives can have first-order consequences for estimates of the welfare and other impacts of changes to insurance-related policies such as Social Security, Medicare, and Medicaid. Policies that affect the behavior of retirees, owners of much of the world's non-human wealth, are likely to have significant effects on the economy, especially through their effects on the budgets of means-tested social insurance programs and on the size, distribution, and risk of bequests received by future generations. My results suggest that taxes on saving and inter-household transfers are likely to affect bequests by affecting retirees' decisions about their insurance coverage as well as their saving. The induced changes in insurance coverage can change not only the magnitude but even the direction of policies' effects on bequests.

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Appendices

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

Pakes and Pollard (1989) and Duffie and Singleton (1993) 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

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

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

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

$$\hat{\varphi}(\hat{\theta}, \chi_0)' \; R^{-1} \; \hat{\varphi}(\hat{\theta}, \chi_0)$$

converges in distribution to 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. In this formula, $\hat{\varphi}(\hat{\theta}; \chi_0)$ is the vector of moment conditions and

$$R = P \left(\frac{\Omega_g}{N_d} + \frac{\Omega_g}{N_s} + G_\chi \Omega_\chi G_\chi' \right) P,$$

where $P = I - G_\theta (G_\theta' W G_\theta)^{-1} G_\theta' W$, except if $W = \Omega_g^{-1}$, in which case $R = \left(\frac{\Omega_g}{N_d} + \frac{\Omega_g}{N_s} + G_\chi \Omega_\chi G_\chi' \right)$. I use this matrix for all of the results in the paper.

I estimate Ω_g and W from the data. Because I adopt many of the first-stage parameter values from other sources rather than estimating them, I treat χ as if it were known with certainty, $G_\chi = 0$. Excluding the correction for the uncertainty in the first-stage parameters tends to make the second-stage parameter estimates appear more precise than they actually are and makes the fit of the model (measured by the chi-squared test) appear worse than it actually is. To estimate G_θ, I follow the procedure for analyzing moment conditions of non-smooth functions (Pakes and Pollard, 1989; Newey and McFadden, 1994; Powell, 1994), since the functions inside the moment conditions $\varphi(\theta; \chi)$ are non-differentiable at certain points. This involves estimating the derivatives of the simulated moments with respect to the parameters θ. The procedure approximates the change in the fraction of people with wealth no larger than a threshold level by assuming that the density of the wealth distribution is constant within a small neighborhood of that threshold.

B Heterogeneity in Life Expectancy

	Healthy males			Healthy females		
		Life expectancy at 70			Life expectancy at 70	
Income quintile	Age adjustment to Robinson, Δ	De Nardi et al. (2010)	Adjusted Robinson	Age adjustment to Robinson, Δ	De Nardi et al. (2010)	Adjusted Robinson
1	15	7.6	7.7	5	12.8	12.6
2	13	8.4	8.6	3	13.8	13.8
3	12	9.3	9.0	2	14.7	14.4
4	10	10.5	9.9	0	15.7	15.7
5	8	11.3	10.9	-2	16.7	17.2

Table 6: Adjustments to the Robinson model of health transitions for females to match life expectancy differences across sex and income groups documented by De Nardi, French and Jones (2010).

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

C Expected and Realized Rates of Return on Wealth

Table 7 lists the historical returns data that I use to estimate the expected and realized rates of returns on retirees' portfolios. I follow Baker, Doctor and French (2007) and French and Benson (2011) in terms of data sources and assumptions.[26] Using data from

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

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

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

the HRS, I classify retirees' assets into the six categories shown in the table as well as a residual "Other" category (which includes vehicles, for example) that I assume earns 0 percent real, after-tax returns. Following Baker, Doctor and French (2007), I assume that Individual Retirement Account (IRA) assets are allocated 60 percent to stocks and 40 percent to bonds and that the rate of return on business assets is a weighted average of the returns on housing and stocks, with an 85 percent weight on housing.

Expected returns, $r = 0.04$.— Four percent is roughly the average real, after-tax return on a "typical" retiree's portfolio during the 38 years immediately preceding the sample period (3.9 percent from 1960–1997) or during the 51-year period including the sample period (4.0 percent from 1960–2010). The portfolio shares in the "typical" portfolio are the average shares in 1998 among the retirees in my sample between the 45th and 55th percentiles of the wealth distribution.[27]

Simulated returns, $r_{i,t} = \sum_j \alpha_{i,j,t} r_{j,t}$.— Retiree i's realized rate of return in year t is the weighted average of the realized rates of returns on different assets j in year t ($r_{j,t}$), weighted by i's portfolio shares in that year ($\alpha_{i,j,t}$). The portfolio shares of retirees with zero or negative net wealth are set equal to the median shares among people with between

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

$5,000 and $15,000 of net worth. I assume that individuals' portfolio shares are the same in years between interviews as they were in the previous year.

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

D Simulation Procedure

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

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

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

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

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

Simulated long-term care insurance moment.— The simulated long-term care insurance moment is the long-term care insurance ownership rate among the subset of the simulation sample who were 65–69 years old in 1998. Given a vector of parameter values, θ, I solve the model to find the value functions, $V_t(\hat{w}_t, h_t, t; s, y, ltci; \theta)$. Simulated long-term care insurance ownership by individual i is one if i would be better off buying long-term care insurance given his or her state variables and zero otherwise,

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

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

Because the model must be solved separately for each long-term care insurance premium schedule, which is computationally costly, I simulate the demand for long-term care insurance only among 65–69-year-olds, and treat them for this purpose as if they were all healthy 67-year-olds, the average age at which people buy long-term care insurance (Brown and Finkelstein, 2007). Everyone therefore faces the same load on long-term care insurance; there is no adverse selection in the model.[28]

E Identification of the Model

This section shows which features of the data are most informative about the key parameters of the model. Panel (a) of Figure 7 shows a contour plot of the objective function in (c_b, ϕ)-space with the rest of the preference parameters held fixed at their estimated values. The figure reveals that the bequest motive 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 more consistent with models that have important bequest motives in which bequests are luxury goods than with any other type of bequest motive, including no bequest motive. The remaining panels, which show contour plots in (c_{pub}, c_b)-space with the other parameters held fixed at their estimated values, show how different moment conditions contribute to the identification of the key parameters of the model.

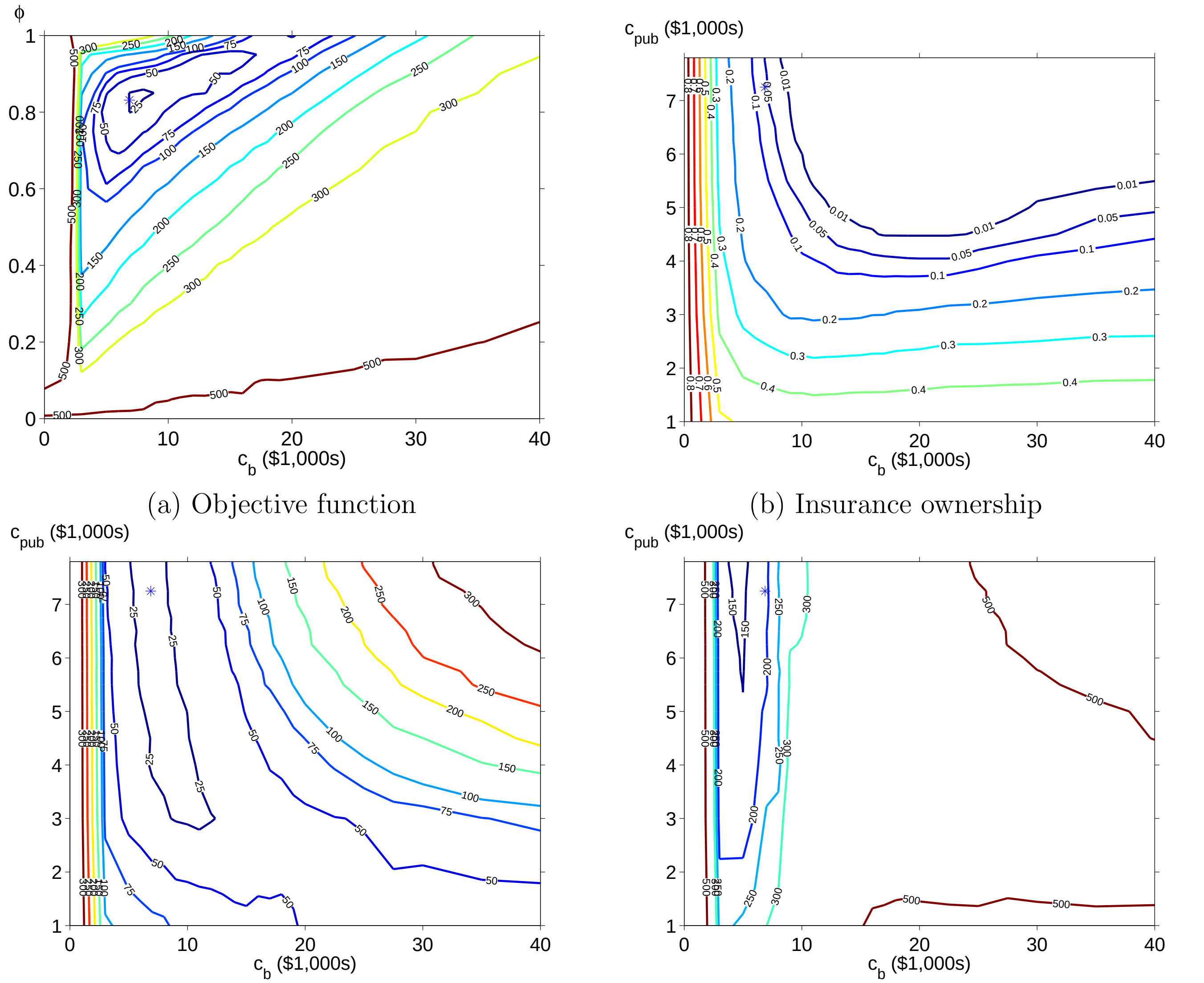
Panel (b) shows the simulated long-term care insurance ownership rate. The 5.6 percent empirical long-term care insurance ownership rate suggests a combination of modest to no public care aversion ($c_{pub} \in [\$4,000, \$7,800]$) and luxury bequest motives ($c_b \geq \$6,000$).

Panel (c) shows an objective function based on the wealth moments. Saving by people in the middle of the wealth distribution is most consistent with fairly strong bequest motives ($c_b \in [\$5,000, \$12,000]$) and weak to intermediate public care aversion ($c_{pub} \geq \$3,000$) but can be matched fairly well by many different combinations of bequest motives and public care aversion. This illustrates the identification problem that arises when focusing only the saving of middle-class retirees.

Panel (d) expands the set of wealth moments to include not only the medians but also the 25th and 75th percentiles, which are not included in the main estimation. This broader set of wealth moments leads to a fairly tight identification of the bequest motive and strongly rejects combinations of bequest motives and public care aversion with weak bequest motives or no bequest motive. In other words, and as discussed in Section 5.4, although the saving of retirees at a particular point in the wealth distribution can be matched well

[28] In practice, insurance companies limit adverse selection by denying coverage to people with certain health conditions (Murtaugh et al., 1997; Hendren, 2013) and by front-loading premiums to minimize policy lapsation by people who remain healthy (Hendel and Lizzeri, 2003). In long-term care, Finkelstein and McGarry (2006) find that average long-term care usage is roughly equal for the insured and uninsured population, though Finkelstein, McGarry and Sufi (2005) find that people who become healthier than average are more likely than others to drop their coverage.

by the model without bequest motives, the pattern of saving across the wealth distribution is highly inconsistent with the model without bequest motives but is matched well by the model with bequest motives. Even if long-term care insurance choices are ignored, retirees' saving decisions suggest that bequest motives in which bequests are luxury goods are widespread.



(a) Objective function

(b) Insurance ownership

(c) Objective function: no insurance

(d) Objective function: no insurance & more wealth

Figure 7: Panel (a): Contour plot of the objective function in (c_b, ϕ)-space with the other parameters held fixed at their baseline estimated values. Higher contours indicate greater mismatch between the simulated and empirical moments.

Panel (b): Contour plot of the simulated long-term care insurance ownership rate in (c_{pub}, c_b)-space with the other parameters held fixed at their baseline estimated values. The empirical ownership rate is 5.6 percent.

Panel (c): Contour plot of the objective function based on only the wealth moments in (c_{pub}, c_b)-space with the other parameters held fixed at their baseline estimated values.

Panel (d): Contour plot of the objective function based on the 25th percentile, median, and 75th percentile wealth moments in (c_{pub}, c_b)-space with the other parameters held fixed at their baseline estimated values.

All panels: The asterisk marks the baseline estimates.