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ABSTRACT

Strong bequest motives can explain low retirement spending, but so equally can strong precautionary motives. Given this identification problem, the recent tradition has been largely to ignore bequest motives. We develop a rich model of spending in retirement that allows for both motives, and introduce a "Medicaid aversion" parameter that plays a key role in determining precautionary savings. We implement a "strategic" survey to resolve the identification problem between bequest and precautionary motives. We find that strong bequest motives are too prevalent to be ignored. Moreover, Medicaid aversion is widespread, and helps explain the low spending of many middle class retirees.

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1 Introduction

Many retirees spend far less than predicted by the standard life cycle model of Modigliani and Brumberg [1954]. Even those with high net worth generally dissave little, as a result leaving significant bequests.[1] Noting this, Kotlikoff and Summers [1981] argued that the bequest motive was the primary driver of savings behavior. Yet the research focus recently has moved in a different direction, with bequest motives downplayed in favor of precautionary motives (Hurd [1987] and Dynan, Skinner, and Zeldes [2002]). Models that rule out bequest motives altogether have now been shown capable of explaining major patterns in the spending behavior of both retirees (De Nardi, French, and Jones [2006]) and those of working age (Scholz, Seshandri and Khitatrakun [2006]).

While the research emphasis has shifted away from bequest motives, the empirical evidence motivating this shift is thin. Dynan, Skinner, and Zeldes [2002] set bequest motives low based on the observation that more HRS respondents cite "emergencies and illness"as motives for saving than did "children and estates". De Nardi, French, and Jones [2006] use a low consumption floor in bankruptcy to motivate high precautionary savings, corresponding essentially to public long term care being seen as a poor substitute for private care. Empirical confirmation of such "Medicaid aversion" is lacking. Indeed, the opposite assumption wherein Medicaid is a perfect substitute for private long term care has been invoked by Pauly [1990] to explain low take-up of long-term care insurance.

Given the limitations of the underlying evidence, it is hardly surprising that recent studies leave unresolved the fundamental identification problem as between bequest and precautionary motives. Indeed Dynan, Skinner, and Zeldes highlight this problem:

> "A dollar saved today simultaneously serves both a precautionary life-cycle function (guarding against future contingencies such as health shocks or other emergencies) and a bequest function because, in the likely event that the dollar is not absorbed by these contingencies, it will be available to bequeath to children or other worthy causes."Dynan, Skinner, and Zeldes [2002], p. 274.

In this paper we develop a new model and a novel estimation procedure designed to separately identify the factors motivating retirees to spend at such low levels. As detailed in section 3, we follow De Nardi, French, and Jones in treating health expenses in later life as a crucial driver of precautionary savings. We separate out costs associated with long term care from other medical expenses, and incorporate Medicaid aversion as a free parameter. Hence our model opens up a new decision making margin by enabling households to choose whether or not to keep resources for

[1] Dynan, Skinner, and Zeldes [2004] and De Nardi, French, and Jones [2006] show that assets of the old decrease slowly if at all.

long term care expenses based on personal long term care preferences. In section 4 we show that the indivisibility associated with long term care expenses induces those with low wealth to give up entirely on gaining access to private long term care. At the other end of the spectrum, many of those with high wealth levels will never be at risk of needing to rely on Medicaid, again having no incremental incentive to save for this purpose. Medicaid aversion induces additional precautionary savings only for those in the middle classes. Just such a non-monotone pattern was described by Robert Hershey Jr. in a New York Times article of February 25 2007 concerning the incentives to consider long-term care insurance:

> "If you're wealthy enough, of course, there may be little need for this coverage. If you're poor enough, Medicaid will pick up the bill."

In section 5 we introduce a customized survey designed for purposes of model estimation, and to pinpoint the identification problem as between bequest and precautionary motives. Having anticipated such problems, we used the survey to pose "strategic" survey questions as part of our identification strategy.[2] Such questions represent natural thought experiments concerning behavior in contingencies selected for their informational complementarity with standard behavioral data. The precise questions that we posed and the procedures by which we incorporate them in the estimation are detailed in section 6. The responses themselves appear highly reasonable both in terms of internal consistency and in terms of external credibility.

Section 7 outlines results of the estimation procedure with strategic survey responses included. Our estimates suggest that bequest motives are more prevalent than currently believed, and that they are not the sole province of the very wealthy, but instead spread deep into the middle class. The distribution of Medicaid aversion parameters appears to be bimodal, with substantial minorities having both minimal such aversion and very high such aversion. Our estimates imply that Medicaid aversion plays a significant role in explaining the low rate of spending of many middle class retirees. We estimate Medicaid aversion to be higher for those without than for those with children, possibly reflecting the lack of implicit insurance from the family. What makes this so important is the evidence of Hurd [1997] concerning a close parallel between spending patterns of otherwise similar retired households with and without children. In prior work, this has generally been interpreted as evidence against bequest motives. Our estimates suggest that the similarity in spending behavior may mask a significant difference in motivation, in which those without children save relatively more for precautionary rather than for bequest related reasons.

In the wider context, we see strategic surveys as a potentially important tool for improving policy analysis. Households subjected to unprecedented policy interventions are by definition

[2]Similar shortcomings in purely behavioral data motivated earlier survey research aimed explicitly at parameter identification, such as Holland [1969], Ljunqvist [1993], Barsky, Juster, Kimball, and Shapiro [1997], Kimball and Shapiro [2003], Ameriks, Caplin, and Leahy [2004], and Kimball, Sahm, and Shapiro [2005]. Of these, those by Kimball and Shapiro [2003] and Kimball, Sahm, and Shapiro [2005] are closest in spirit to our approach.

faced with novel decision making environments, about which contingent survey responses may be informative. For many such changes, particularly those in national policy, field experiments are either impossible or prohibitively expensive. Survey data have the potential to help fill the informational gap, provided these data are consistent with the underlying economic theory. By limiting the new evidence to narrowly specified hypothetical choices, Caplin [2007] argues that the strategic survey methodology will evolve to match the "revealed preference" approach to economic theory in the letter, not merely in the spirit.[3]

2 Background

2.1 Precautionary Motives and Long Term Care

De Nardi, French, and Jones [2006] use panel data from the AHEAD (Assets and Health Dynamics of the Oldest Old) Survey to establish that assets decrease slowly over time if at all. Yet as noted above, the extent to which the low spending rate is driven by bequest motives is much debated. Even simple accounting measures of the aggregate importance of bequests produce wildly inconsistent results (Kotlikoff and Summers [1981], Menchick and David [1983]; Modigliani [1988]; Gale and Scholz [1994]; Laitner and Juster [1996]).

One clear fact concerning bequest motives is their heterogeneity. Whereas many wealthy households fail to pursue such obvious tax avoidance strategies as inter-vivos giving (McGarry [1999] and Poterba [2001]), others take great pains to maximize bequests.[4] In an effort to exploit individual differences of this type for estimation purposes, Hurd [1987] established that otherwise similar retired households with and without children decumulate wealth at roughly the same pace, casting doubt on the power of the bequest motive. Yet Kopczuk and Lupton [2005] challenged the assumption that family status is tightly connected with the bequest motive, and introduced an alternative estimation strategy according to which many households have substantial bequest motives.

While the debate on the importance of bequests remains unresolved, there is a consensus emerging on the dominant factor motivating precautionary savings. In contrast with early analyses that stressed longevity risk as the main driver of precautionary savings (Yaari [1965]), recent work

[3]The idea underlying this approach, which was initiated by Samuelson [1938] and reinvigorated by Gul and Pesendorfer [2007], is that, in order to retain discipline, economic theories should be tightly matched to choice data. Yet, as Savage [1971] and Aumann [1998] have argued, it is hypothetical rather than actual choices that are the raw material on which revealed preference theories are built, opening the methodological door to this form of survey evidence. Our ongoing research in this ares concerns how best to design questions that have maximal predictive power in relation to subsequent choices.

[4]Strategies employed apparently include not only using inter-vivos transfers to decrease tax liabilities involved in transferring funds to heirs (Bernheim et al. [2001]; Page [2003]; Bernheim et al. 2004; Joulfaian [2004]), but also offsetting increased public transfers by purchasing life insurance and selling annuities (Bernheim [1991]), and even delaying (or accelerating) death to take advantage of changes in estate-tax law (Slemrod and Kopczuk [2001]).

has emphasized late in life medical expenses (Palumbo [1999]). French and Jones [2004] used the AHEAD data to present the most realistic picture to date of late in life health-related expenses, which turn out to be far higher than earlier estimates had suggested. In their work, De Nardi, French, and Jones [2006] use these data to detail the risks associated with mortality and out-of pocket medical expenditures as functions of gender, health, permanent income, and age for single retirees. They incorporate these estimates into a standard life cycle model, and succeed in closely fitting individual spending despite the absence of bequest motives.

Actual and potential long term care expenses are the crucial driver of precautionary savings in the work of De Nardi, French, and Jones [2006]. Brown and Finkelstein [2004] apply the medical transition model of Robinson [2002] to suggest that a 65 year-old man has a 27 percent chance of entering a nursing home at some future point, while a 65 year-old woman has a 44 percent chance. Men who enter a nursing home spend on average 1.3 years there, while women spend on average 2 years. Moreover the price for obtaining care is potentially massive. Data from the Metlife Market Survey national data (MetLife [2006]) indicate that the national average annual cost of nursing home care in 2006 was $66,800 for a semi-private room and $75,200 for a private room. Under the current Medicare rules, fully $58,000 of the expenses for a semi-private room are paid for out of pocket. In general, the share of out of pocket expsenses as a fraction of the total in long-term care is double the share in the health sector as a whole (CBO [2004], National Center for Health Statistics [2002]).

2.2 Medicaid and Medicaid Aversion

Given their potentially massive scale, the bulk of precautionary savings in the De Nardi, French and Jones [2006] framework are used to guard against high long term care costs. They show that these expenses are significantly impacted by the subject's level of wealth: a sick 95-year-old woman at the 80th percentile of the permanent income distribution can expect to spend $16,000 p.a. on out-of-pocket medical costs, while a sick 95-year-old woman at the 20th percentile of the permanent income distribution expects to spend only $2,700. Such differences in care expenses by wealth class are accounted for in large part by differences in the way in which long term care is paid for, and are associated with the role of Medicaid as long term care provider of last resort. Hence the important assumption underlying the De Nardi, French and Jones estimation procedure is that Medicaid is a very poor substitute for private long term care. It is precisely the fear of being driven to this low level of consumption that provides the key motivation for precautionary savings.

To understand the key role that Medicaid aversion plays in end of life behavior, consider the optimal spending strategy of a wealthy, high income household with no bequest motive and with no Medicaid aversion. Their ideal strategy would be to spend rapidly so as to run down wealth, and thereby to qualify to take advantage of the cost savings deriving from subsidized high quality

long term care. Just such a "spend down" strategy features in the model of Hubbard, Skinner, and Zeldes [1994].

One piece of empirical evidence that has been invoked by those who believe there to be low Medicaid aversion is the fact that only 10-15% of the elderly population has an LTC insurance policy (Finkelstein and McGarry [2006]). Yet in practice, there are several potential explanations for the small size of the existing LTC insurance (LTCI) market that are largely independent of the level of Medicaid aversion. Relatively standard explanations relate to the significant pricing loads and insurance costs (Brown and Finkelstein [2007]), as well as potential problems stemming from asymmetric information in the market (Finkelstein and McGarry [2006]). In addition to financial disincentives, many believe that there are deeper reasons for limited market acceptance based on contractual problems that bedevil the market. A recent article in the New York Times of March 26, 2007, illustrated the many problems with LTCI quite well. Another article in Consumer Reports which reviewed 47 policies concluded that, for most, LTCI was too risky and too expensive. Among the chief problems, these articles mention that many claims for reimbursement are contested, the risk that the company may no longer be around when reimbursement is needed, the fact that continued payment of the premium is needed to keep the policy alive, etc. Hence the structure of typical policies is such that promised benefits could reasonably be seen by individuals as subject to a variety of unrelated, additional risks. Overall, the currently small size and apparent dysfunctionality of the LTCI insurance market is not a sufficient reason to ignore the potential importance of Medicaid aversion.

On the other side of the coin, most of the evidence in favor of high Medicaid aversion is informal. There is anecdotal evidence concerning the relatively limited nature and low perceived quality of Medicaid as opposed to privately provided long term care.[5] There may also be social stigma associated with allowing oneself or a loved one to end life bankrupt as a "Ward of the State." Additional arguments suggesting that Medicaid is a poor substitute for private care are financial in nature. An individual who qualifies for Medicaid coverage is allowed to keep very little in the way of income and assets to finance non-care consumption or to bequeath. Married households are allowed to retain only their housing wealth, while single households must essentially deplete all assets before qualifying for Medicaid.[6] It is also harder to use Medicaid for home health care than for nursing home care. Yet hard evidence is lacking. The best evidence to date is that of Norton [1995], who finds that many private patients who enter nursing homes end up staying in private care and avoiding use of Medicaid for substantially longer than their assets alone would provide for, suggesting that relatives pay for incremental private care. Presumably, this reflects a

[5]For evidence of inadequate protection from fire and other hazards at U.S. nursing home facilities, see U.S. Government Accountability Office [2003].

[6]State Medicaid programs impose a 3 to 5 year look back period on assets to make it more difficult for individuals to hide assets by transferring them to a spouse or children.

discomfort with the results of the change of status from private client to client of public care.

Given its importance as a determinant of spending, and given how little is known about it, we allow in our model for all possibilities, from Medicaid being a perfect substitute for private care to its being the ultimate in punishment. The model opens a new decision making margin by enabling households to choose whether or not to keep resources for long-term care expenses based on personal long term care preferences.[7]

2.3 Accidental Costs of Care?

It is by now clear that Kotlikoff and Summers [1981] prejudged the issue when they inferred high bequest motives merely from the high level of realized bequests. The subsequent literature has shown that bequests may in fact be largely "accidental", as the indirect result of wealth kept aside against longevity and health risk. The work of De Nardi, French and Jones [2006] is particularly important in this respect, since it shows that the level of health expenses is significant enough in quantitative terms by itself to explain the low spending of many retirees. Yet, just as high observed bequests do not necessarily imply a high bequest motive, so high realized medical costs do not necessarily imply high precautionary motives. Instead, these high medical costs may be "accidental"in exactly the same way as may high bequests.

To see how accidental medical costs may arise, note that an individual with a high bequest motive will choose to spend slowly out of wealth even if Medicaid is regarded as a perfect substitute for private care. The only way for such a household to leave a reasonable bequest is to hold enough wealth to pay for possible high health costs. Yet if there is particular misfortune in regard to care costs, bequests may turn out to be low based on the unexpectedly large diversion of resources that this creates. Since households holding wealth are not allowed by the rules to take advantage of publicly funded long term care, care costs may absorb resources that were intended to form part of the bequest. Again, this precise phenomenon was highlighted in the recent New York Times article (Hershey [2007]) as an explanation of the large incentive that middle class households have to consider LTCI if they have high bequest motives.

> "A couple with $1 million, for example, may want to be sure that they leave a legacy large enough to put a grandchild through college, rather than risk draining all their funds if they need care for a long time."

[7]Note that in limiting attention to only these two options, we are greatly simplifying the actual choice process. In principle, a third possibility would be to rely on children to provide the bulk of care. The nature of the family interactions in long term care situations may be highly complex. Kohara and Ohtake [2006] show that, even in Japan where it is common for children to provide long-term in-home care for their parents, children are far more likely to provide this parental care when their parents are wealthy enough to meet the costs of nursing. We ignore this in the current treatment, largely for the sake of simplicity. We ignore also the possibility of buying long term care insurance (LTCI). See previous footnote.

The difficulty in determining the extent to which medical costs and bequests are accidental provides another angle on the identification problem that bedevils the literature in this area, and that is the main focus of the current work.

3 The Model

3.1 Utility

For simplicity, the unit of analysis is the household consisting of a single individual who has just retired. The first period of observation occurs when the individual is m years old and entering retirement. The model consists of a series of one-year periods, starting at the age of retirement and ending at the year of death, which is restricted to occur by maximum age $M = 100$. The maximum length of the retirement period is $T = M - m$. Periods are indexed by t, the number of years into the retirement period, starting at zero at age m, so that overall $0 \leq t \leq T$. There is a stochastic death rate δ_t in year t of retirement that evolves in a matter defined below.

The agent maximizes a standard time-separable utility function with exponential discounting. In each period of life, agents receive utility from consumption in excess of a subsistence level, c^{SUB}:

$$u(c_t) = \frac{(c_t - c^{SUB})^{1-\gamma}}{1-\gamma}. \tag{1}$$

Agents also receive end-of-life utility from bequests defined by the function $v(b)$. Hence the agent maximizes,

$$E_0 \sum_{t=0}^{T} \beta^t \left(\prod_{j=0}^{t-1} (1-\delta_j) \right) \left\{ (1-\delta_t) u(c_t) + \delta_t v(b_t) \right\}. \tag{2}$$

This method of modeling the utility from the bequest matches the "warm glow" specification of Andreoni [1989] with a CES parameter matching that for consumption rather than the dynastic altruistic formulation implied by concern with children's utility per se.[8] With respect to functional form, we follow De Nardi [2004] in parameterizing the bequest utility with two parameters, one to control the strength of the bequest motive (ϖ) and one to measure the degree to which bequests are a luxury good (ϕ). However, we redefine the place of these parameters in the bequest utility function so as to allow for a clear interpretation of their values. An agent leaving a bequest b receives direct utility:

$$v(b) = \frac{\varpi}{1-\gamma} \left((\phi - c^{SUB}) + \frac{b}{\varpi} \right)^{1-\gamma}. \tag{3}$$

[8] Kopczuk and Lupton [2005] provide reasons for researchers' preference for direct utility of bequest models over altruistic models, such as the finding by Altonji, Hayashi and Kotlikoff [1997] that parents do not offset inter-vivos transfers given an increase in their children's permanent income.

If wealth is negative upon death, the agent is credited with having left a bequest of zero. The same curvature parameter governs risk aversion over bequests and over own consumption.

To understand the motivation for this choice of $v(b)$, consider a simple model in which an agent starts with wealth X dollars, lives for exactly n years and then dies. In each year of life, the agent consumes c dollars, deriving annual utility $u(c) = (c - c^{SUB})^{1-\gamma}/(1-\gamma)$. Upon death, the agent bequeathes the remaining $b = X - nc$, receiving the utility specified by equation (3). The agent's problem is to choose the bequest that maximizes total utility. The solution is to choose an annual consumption c^* such that bequest satisfies $b^* \equiv X - nc^* = \varpi(c^* - \phi)$. In other words, the agent leaves an inheritance to cover ϖ years of spending at an annual expenditure level $(c^* - \phi)$, the amount by which life time consumption exceeded the threshold ϕ. If X is insufficient to allow the agent to consume more than ϕ dollars each year, no bequest is left. In future research we will explore different formulations of this bequest function, allowing for variations in risk aversion, and also allowing for elements of altruism.

The parameter ϕ plays a role similar to one introduced by Henin and Weitzenblum [2003] who use the form,

$$v(b) = \varpi_1 \left(\bar{\phi} + \frac{b - t(b)}{\varpi_2} \right)^{1-\rho}, \tag{4}$$

where $t(b)$ is the estate tax, which is absent in our model, and $\bar{\phi}$ is the expected annual consumption of the heir. Our ϕ parameter mirrors their $\bar{\phi}$, but we do not restrict ourselves to this interpretation of the parameter's value. Our choice to use the same parameter ϖ where they have two parameters, ϖ_1 and ϖ_2, is a simplification suggested by De Nardi [2004] and also motivated by the explanation in the preceding paragraph.

3.2 Technology

Households enter retirement with wealth $X_0 \geq 0$, and wealth at the beginning of time t is denoted X_t. We assume a deterministic stream of annual income y_t for as long as the retiree lives, and taxes are ignored. There is no income in the year of death. We assume that there is one composite risky asset in which the household can invest and which yields a rate of interest r_t. Households are not allowed to take a negative position in assets (no-borrowing constraint).

3.3 Health Dynamics and Health Costs

Our treatment of health dynamics and death is crucial to the precautionary motive, given the high expenses associated with bad health. There are four health states modeled. State 1 is a state of good health. State 2 is a state in which there are medical problems but no need for long term care. State 3 is a state in which long term care of some form is required, and state 4 is death. In

period 0, the individual is in health state $s_0 \in \{1, 2, 3\}$. The health state follows a Markov chain with age-varying one-period state transition matrix $\mathcal{P}(t)$. In each year t, this is a 4×4 matrix. Retirees reaching age $M - 1$ die with probability one the following year.

Together the initial health state and the Markov transition matrices $\mathcal{P}(t)$ enable us to compute future probabilities attached to all health states, including death. Given the initial health state s_0, the transition matrix is applied repeatedly to derive the probability $\pi_t(s_t)$ that a retiree is in health state $s \in \{1, 2, 3, 4\}$ at time $t \geq 1$. This means that the death probability δ_t can be computed as $\delta_t = \pi_t(4)$.

We have not included the health state directly in the utility function. Rather, we focus on the costs associated with the various health states. Each live state $s \in \{1, 2, 3\}$ has associated with it a necessary and deterministic health cost, $h(s)$. Paying these costs entirely removes any utility penalty that would otherwise be associated with the health state. Death expenses in state 4 are also deterministic, at level $h(4)$, and are subtracted from the bequest.

3.4 Bankruptcy and Medicaid

Given the risk of substantial medical expenses which may exceed available wealth, there is need to include a bankruptcy mechanism. Agents are forced to declare bankruptcy when they cannot afford to pay for medical costs and a level of consumption above c^{SUB}. We model bankruptcy as affecting only a single period, in which the agent's consumption and end-of-period wealth are determined as described below. In the period following bankruptcy, the agent's income continues on its deterministic path and there are no further implications of having been previously bankrupt.

What happens in bankruptcy depends on the health state. In states 1 and 2, an individual who declares bankruptcy is left with sufficient assets to consume at a minimum level $c^{BR} > c^{SUB}$, with end of period wealth remaining at zero. In state 3, the long-term-care state, treatment of bankruptcy is related to the institutional reality of Medicaid. An individual declaring bankruptcy in the long term care state forfeits all wealth to the government (end of period wealth is zero) and enters a Medicaid facility, receiving in that period the Medicaid level of consumption $c^{MED} > c^{SUB}$. The Medicaid level of consumption is an important parameter in what follows, since its level reflects Medicaid aversion. If the Medicaid consumption level is very close to subsistence, this will produce a strong incentive for households to retain sufficient wealth to retain the private care option. If it is closer to annual consumption in the pre-Medicaid period, then the incentive will be to run down wealth and use the Medicaid subsidy in place of savings. The value of c^{MED} therefore has powerful impact on the strength of the precautionary motive.

3.5 The Optimization Problem

The household enters the period t with health state s_t and wealth X_t. The timing of events is as follows:

1. If $s_t = 4$ so that the individual is deceased, no income is received, health costs $h(4)$ are paid and the bequest b_t equals the remaining net resources, down to a minimum of zero,

$$b_t = \max[X_t - h(4), 0]. \tag{5}$$

2. Otherwise, if $s_t < 4$, period t income of y_t is accrued, and the health costs $h(s_t)$ are incurred. A consumption decision is made. The agent may choose any level of consumption c_t that exceeds the subsistence level c^{SUB} and satisfies the budget constraint,

$$X_t + y_t - h(s_t) - c_t > 0 \tag{6}$$

   If no consumption level $c_t > c^{SUB}$ satisfies Equation 6, the agent must declare bankruptcy. If $s_t = 1$ or 2, bankruptcy means consuming $c_t = c^{BR}$. If $s_t = 3$, the agent must receive care under Medicaid and $c_t = c^{MED}$.

3. At the end of the period, the agent is left with the unspent portion of assets, which earn a risky return r_t. If bankruptcy was declared in the period, wealth in the next period is zero. Letting I_t^{BR} be the indicator variable for bankruptcy in period t, the following period's wealth level obeys:

$$X_{t+1} = \begin{cases} (X_t + y_t - h(s_t) - c_t)r_{t+1} & \text{if } I_t^{BR} = 0; \\ 0 & \text{if } I_t^{BR} = 1. \end{cases} \tag{7}$$

4. Finally, the new health state s_{t+1} is drawn according to the state transition probabilities $\mathcal{P}(s_{t+1}|s_t)$. If $t + 1 = T$, the final period, $s_{t+1} = 4$.

The household maximizes expected utility of the remaining life time consumption (2) subject to the budget constraint (6) along with the bankruptcy provision. The Bellman equation is

$$V_t(s_t, X_t) = \begin{cases} \max_{c_t \in B(s_t, X_t)} \{u(c_t) + \beta E_t V_{t+1}(s_{t+1}, X_{t+1})\} & \text{if } s_t \neq 4, B(s_t, X_t) \neq \emptyset \\ u(c^*(s_t)) + \beta E_t V_{t+1}(s_{t+1}, 0) & \text{if } s_t \neq 4, B(s_t, X_t) = \emptyset \\ v(b_t) & \text{if } s_t = 4 \end{cases} \tag{8}$$

subject to equations (3), (5) and (7), where the budget set is

$$B(s_t, X_t) = (c^{SUB}, X_t + y_t - h(s_t)], \tag{9}$$

$c^*(1) = c^*(2) = c^{BR}$ and $c^*(3) = c^{MED}$.

To compute optimal strategies, we first discretize the state space and the control space. The model is then solved by backwards induction. At time T (age 100), the household dies with probability one. Its value function is the instantaneous utility over bequests, $V_T(s_T, X_T) = v(b_T)$. In every prior period t, the Bellman equation (8) is used to solve for $V_t(s_t, X_t)$. We use a fine grid for X and for consumption, and linear interpolation to compute continuation values for points that are not on the grid. The choice variables ruled out by the budget constraint (6) are given large negative values.

3.6 Calibration

The central issue of this paper is how separately to identify the c^{MED} parameter which impacts precautionary savings, and the bequest motive, ϖ. To this end, we fix all remaining preference parameters at conventional values, while wealth and income numbers are individual specific and derived from survey evidence.

Preference Parameters We note that payments under the government's Supplemental Security Income (Office of Beneficiary Determinations and Services [2005]) were \$579 per month in 2005, or approximately \$7K per year. For a subsistence level of consumption, we choose a value slightly below this, $c^{SUB} = 5$, measuring dollar amounts in thousands. Standard values for the coefficient of relative risk aversion parameter in life-cycle models are between 2-6.[9] We follow Brown and Finkelstein [2004] who cite a number of papers that rely on "a long line of simulation literature" that use $\gamma = 3$ as a baseline value. The subjective time discount factor is $\beta = 1/.05 = .952$. The hardest parameter to pin down is ϕ, which measures the consumption level above which one considers bequests. We set it equal to 6, which implies that bequests as low as \$1K above the subsistence level deliver utility. Simultaneously, a choice for ϕ strictly above c^{SUB} avoids a zero bequest generating a utility of minus infinity.[10]

Technology Parameters The agent can invest in a single risky asset, which we take to be a portfolio consisting of 50% stocks and 50% bonds. We assume the return is normally distributed with a mean of 5% and a standard deviation of 11%. These numbers are based on the historical average returns on the CRSP value-weighted stock market portfolio and the three-month Treasury-bill rate. We use three-point Gaussian quadrature for numerical integration. For the level of

[9] Based on the life-cycle of risky asset positions, some research has argued that older investors are more risk averse (Morin and Suarez [1983]), but there is debate about their findings (Wang and Hanna [1997] and Bajtelsmit and Bernasek [2001]).

[10] We are sensitive to the possibility that this value may be too low, especially under the interpretation of Henin and Weitzenblum [2003] that this parameter corresponds to the expected annual consumption of ones' heirs.

consumption available under bankruptcy, we use a value slightly higher than the Supplemental Security Income figure: $c^{BR} = 8$.

Health and Longevity Dynamics The role of health costs is central to our analysis, especially the possibility of high costs associated with long-term care. The distribution of these costs in our model is controlled by the medical costs associated with each health state and by the one-period 4×4 state transition matrix $\mathcal{P}(t)$. This matrix is parameterized by twelve parameters, nine that determine the value of $\mathcal{P}(0)$ (of the sixteen elements, four are fixed by the death state being absorbing and there are three further restrictions so that each row sums to one) and three that control the flow of probability from greater health to poorer health as age (t) increases. We select values for these parameters to match four age-dependent mortality rates and eight statistics on long-term-care utilization from Brown and Finkelstein [2004]. We do this exercise once for men and once for women. The latter not only live longer, they also face much higher long-term care risk. This calibration is described in detail in the appendix and the longevity and long-term care moments that are matched are listed in rows 1-12 in Table 1.

[Table 1 about here.]

Health Costs Each health state is associated with a (deterministic) medical expense. Health state 1 (good health) has no costs: $h(1) = 0$. To calibrate the medical costs associated with health state 2, we identify the mean annual out-of-pocket medical costs for non-institutionalized individuals over 65. The National Center for Health Statistics [2004] reports that in 2004, that average out-of-pocket medical expense was \$600. Using our calibrated health-transition matrix, we find that among the periods our simulated retirees spend out of long term care (health states 1 and 2), they spend 10.5% in state 2 so that $h(1) = 0$ and $h(2) = 6$ reproduces this average. For the long-term-care state 3, we use Brown and Finkelstein's estimation that a semi-private room in a private LTC facility costs \$143 per day. In 2004, Medicare covered the full cost of LTC for 20 days each year and the daily costs in excess of \$109.50 for an additional 80 days. This leaves an annual out-of-pocket expense for a full year of LTC for an individual without LTCI at \$46.7K. We take $h(3) = 50$.[11] We ignore costs associated with death by setting $h(4) = 0$.

With these values, and the health and longevity dynamics described above, the median value for life-time medical expenses is \$18K for men (\$56K for women), while the mean is \$79K (\$137K). See rows 13 and 14 of Table 1. Long-term care costs dominate our model, making up 92% of all medical expenses. For the 61% of males who do not enter long term care, the mean health cost in retirement is only \$8K. Men (women) face a 26% (41%) chance of facing health costs greater than \$100K and a 10% (20%) chance of costs greater than \$250K.[12]

[11] By 2006, out-of-pocket expenses for a semi-private room had increased to \$57.2K, as mentioned above.

[12] Results of simulations not shown here suggests that behavior may be somewhat sensitive to the exact proba-

4 Model Properties

The estimation strategy that we adopt below is based on individual data, and hence a critical issue concerns how informative are the behavioral data on spending levels out of wealth and income in terms of separating out Medicaid aversion and the bequest motive. In this section we summarize the identification problem associated with the simplest possible statistic, consumption in the first year out of a given wealth and income.

Our focus is on observed consumption levels and their ability to discriminate between the two savings motives. We have repeated the exercise for several other observables, such as expected consumption growth over the next five years, the variability of consumption, and bequest levels. None of these alternatives fundamentally alters the inference problem.

The pictures that follow show iso-consumption lines. On the horizontal axis, we plot the intentional bequest parameter ϖ. The bequest motive strengthens reading from the left to the right. To illustrate the meaning of this parameter, consider a simple special case with no discounting, no returns on assets, and no uncertainty (hence no precautionary motive). In such a deterministic world, consider a single retiree of age 65 with \$200K in wealth and \$30K in annual income, who will live a known 18 years, and face \$100K in long term care expenses at the end of life. If this retiree has a bequest motive of $\varpi = 5$, the final bequest is \$116K, which corresponds to roughly 4 years of optimal retirement consumption. As ϖ increases, so correspondingly does the bequest: with $\varpi = 10$, the bequest is \$190K, which is roughly 7.5 years of (lower) optimal retirement consumption; with $\varpi = 30$, the bequest is \$332K which is 19.5 years of retirement consumption; and with $\varpi = 50$, the bequest is \$397K, roughly 28.5 years of (lower) optimal retirement consumption. On the vertical axis of these figures, we plot $\log\left(u'\left(c^{MED}\right)\right)$, a decreasing function of c^{MED}. The precautionary savings motive strengthens reading from bottom to top. To interpret this axis, note that a value of zero corresponds to a low value for c^{MED} of \$6K, or only \$1K above the subsistence level; a value of -5 indicates a value for c^{MED} of just over \$10K; and a value of -10 indicates a value for c^{MED} of some \$30K. We have chosen a wide range for both parameters, having no strong priors on the bounds of the ranges.

4.1 Iso-Expenditure: Medium Wealth

We illustrate iso-expenditure contours in parameter space for optimal current consumption for a woman at age 65, in good health, with disposable income of \$25K, and with wealth equal to \$80K (see Figure 1). This profile roughly describes the median respondent in the survey we describe below. The left panel is for a wide set of parameters; the right panel zooms in on the bottom left

bilities of realizing these unlikely but expensive scenarios. Nevertheless, the key to all simulations is the dominance of LTC expenses that occur late in life. We note that the health transition probabilities are determined only by the agent's age and current health state, so that expected future costs do not depend on prior medical history.

part of the figure. The iso-consumption contours go from the top left to the bottom right. For example, a consumption level of \$12K, is consistent either with a strong bequest motive (high ϖ on the horizontal axis) and a weak precautionary motive (low $u'\left(c^{MED}\right)$ on the vertical axis) or with a strong precautionary motive (high on the vertical axis) and a weak bequest motive (to the left on the horiontal axis). This is the basic identification problem. Annual consumption is higher for a household with a low bequest motive and/or low aversion to Medicaid.

[Figure 1 about here.]

With lower consumption profiles consistent with high levels of Medicaid aversion, the iso-consumption line becomes close to horizontal. Such cases are of particular interest, since the inference problem in terms of bequests is particularly severe. In essence, the bequest motive here is infra-marginal. It is a region in which two individuals with very different bequest motives behave in an identical fashion, differing only in the extent to which their actual bequests are accidental.

At the other end of the spectrum, we find very high consumption; the iso-consumption contours become nearly vertical. The right panel of Figure 1 zooms in on that area of weak bequest and precautionary motives (low ϖ and low $u'\left(c^{MED}\right)$). There is a maximum consumption level that the model can explain (\$32K in this figure). In this area the consumption level exactly pins down the bequest motive, and it pins it down close to zero. The precautionary motive is infra-marginal. We note the quick decrease in consumption as Medicaid aversion (the precautionary saving motive) increases. The sudden increase in savings incentives associated with increasing Medicaid aversion may be important in understanding the highly unequal distribution of wealth among retirees (Castaneda et al [2003]).

4.2 Iso-Expenditure: High Wealth

The shape of the iso-expenditures is very different for those with high wealth. What we have drawn below are contours for optimal current consumption for a woman at age 62, in good health, with disposable income of \$50K, and with higher wealth of \$475K. This person roughly corresponds to the 90^{th} percentile of the income- and wealth distribution. Note that the right panel of Figure 2 looks qualitatively similar to the medium wealth figure. What is new is the left panel of the figure in which we have a very high lower bound on the bequest motive for many levels of consumption. It is simply not possible to explain low spending (e.g., \$30K) by a very wealthy person based on Medicaid aversion, since they are not at risk. In terms of the model, such low spending completely implicates bequests. Note that correspondingly there is a lesser identification problem in terms of the bequest motive. It is Medicaid aversion that is totally unidentified instead.

[Figure 2 about here.]

4.3 Middle Class Precautionary Savings

The above results suggest that for high wealth individuals, the only reason for saving is the bequest motive. For very low wealth individuals, private long-term care is out of reach, no matter how much they save. A high savings rate therefore also implicates the bequest motive. Disentangling motives for savings therefore is a relevant issue only for the middle class. Figure 3 illustrates.

It varies income for a 62 year old woman with good health. Along with income, wealth is varied in a matter consistent with the observed joint wealth-income distribution (not shown). We note that the model-implied saving rate is hump-shaped in income (and wealth). The saving rate is highest for the middle class. The reason is that both the precautionary and the bequest motives are operative in full force for this group. The different lines indicate different precautionary savings motives. The stronger the precautionary motive (top line, low c^{MED}), the larger the saving rate.

[Figure 3 about here.]

5 The Survey

5.1 The Sample

Our survey was conducted in September 2006 by Greenfield Online, a major provider of web-based surveys. Any respondent living without a partner was ruled out if: born before 1917 and after 1951; working full-time or looking for work; having total household income from work in 2005 of more than $25,000; being in need of long-term care; having children at home. For respondents living with partners, we added the condition that the partner could not be working full time or looking for work, born before 1917 or after 1966, or in long term care.

We imposed sampling restrictions on various demographic and wealth groups to obtain a representative sample.[13] We obtained 1085 responses that passed the sample selection stage. We excluded 147 respondents on the basis of clearly flawed responses, leaving us with a sample of 938 respondents.[14] Table 2 describes the key features of our sample. The mean and median age of

[13]We allowed no more than 40% of our sample in each of the 1947-51, 1941-46, 1936-40, and 1930-35 cohorts. We allowed no more than 35% of couples whose children left the home (*) and couples with no children in order to end up with sufficient singles. We allowed no more than 40% of respondents with retirement wealth below $25K (*) and 90% below $75K. Finally, we allowed no more than 40% of respondents with financial non-retirement wealth below $25K (*) and 90% below $100K. These last two criteria ensured us to have at least a substantial portion of wealthy respondents. (*) indicates whether the restriction ends up binding in our ultimate sample of 938 respondents.

[14]We removed 23 with both no financial wealth (neither dedicated retirement assets nor liquid financial assets) and total income in 2005 (labor income plus retirement income) less than $2400 ($200 per month); 13 with total spending of $1; 13 with spending more than the sum of assets and thirty years worth of income; 38 with living expenses less than $500 per year; 6 who spend the same amount on all six spending categories; 32 who are homeowners and report a home value less than $10K; 9 who are home owners with mortgage debt more than twice the home value; 57 who said they are not homeowners but spend nothing on rent; 5 who report a complete preference

respondents was 64, with 90% in the 56-76 range. Nearly two-thirds of respondents were female. More than 80% were retired and almost 70% were in good health. With respect to household status, almost 55% comprise single households and 45% are couples. There is wide dispersion in the number of children and of grandchildren, with a substantial minority in each case having none, and another substantial group having four or more. Finally, 76% of respondents were homeowners.

[Table 2 about here.]

A key premise of the model is that many face high private costs of LTC, and we set the costs of private care at \$50K as a fixed parameter in the model. In fitting with the low level of use in the general population, in only 14.3% of the households in our sample is there a member that has taken out a long-term care insurance policy that would provide benefits or reimbursement for LTC expenses. When we explicitly ask respondents to think of the costs of one year of private LTC absent any LTC insurance coverage, the median estimate is \$35K, and 10% of respondents think the one-year stay will cost \$100K or more. The claim that private LTC is seen by many as involving high private costs appears warranted.

5.2 Wealth

We asked respondents for measures of assets and debts in 2005, and as with all other numerical dollar values, we asked respondents to first answer questions concerning the range of values in which the corresponding variable lay, and then asked them to make a precise estimate within this range.[15]

With respect to wealth categories in 2005, median retirement assets held in tax-favored dedicated retirement accounts (such as 401(k), IRA, 403(b), or other accounts) are \$13.8K, with an inter-quartile range of 0-\$115K. Median financial wealth (bank accounts, money market accounts, stocks and shares, bonds, etc. excluding any assets held in dedicated retirement accounts) is \$15K, with an interquartile range of \$0.5K-\$125K. The median self-reported home value *among home owners* is \$160K, with interquartile range \$85K-\$289K. For 63% of homeowners, the primary mortgage is fully paid off. Median mortgage debt among home owners is \$48K; median home equity is \$137K. Table 2 reports home values, mortgage debt, and home equity for the entire population, including renters. The median level of "other assets" (e.g secondary home, cars, boats, art, private business assets) is \$20K, with an interquartile range of \$4K-\$70K, and ten percent own more than \$270K. On the debt side, more than half of the respondents have no credit card debt and the same

switch between the \$100K LTC box and the \$250K LTC box questions; and 17 who complete the survey in less than nine minutes. The median respondent took more than 20 minutes to complete the survey, and 10% or spent more that 40 minutes.

[15]We used this procedure to mimic as best we could the procedures employed by the Michigan Survey Research Center. However we accept that there are likely still to be significant inaccuracies in the measures that follow.

is true for "other debt beside primary mortgage and credit card". Among the credit card debt holders, the median debt is $2K, while among those with other debt, the median debt is $1K.

To estimate our model, we need a total wealth measure for all respondents, taking care to keep the number of state variables to a minimum. While liquid wealth, retirement wealth, and free standing debt categories largely speak for themselves, there are trickier issues associated with assets such as housing and life insurance. With respect to housing, the historical real returns on housing are below the 5% average return we assume on the portfolio of stocks and bonds in the model. Aggregation at current value would overstate the contribution of housing to net worth. To account for its lower return, we decrease the contribution of housing wealth to total wealth.[16] Note that implicitly this is treating the house as an asset than will be used late in life, which is empirically accurate (Venti and Wise [1989]). Finally, we asked those with partners to specify life insurance receipts due to each partner in event of the other's death.[17] We do not include these life insurance payouts in our wealth measure, given our focus on singles.

5.3 Income and Spending

We asked respondents for total spending in 2005, and also for a breakdown into six categories: (a) all mortgage and debt payments except credit card payments; (b) maintenance, improvement and taxes on owned real estate or rent; (c) purchases of major durable goods such as cars, boats, etc; (d) out of pocket health care expenses; (e) income or other taxes other than real estate taxes; (f) all other living expenses.[18] Table 2 reports the distribution of these expenses in our sample.

We are interested in constructing a series for total non-durable and services consumption that excludes health care spending to be consistent with the model, yet include consumption of housing services. For renters, housing consumption is given by their rent. For home-owners, we set the housing consumption equal to the "imputed rent", the self-reported home value times the nationwide rent-price ratio in 2005.[19] Non-durable and services (NDS) consumption is then defined as the sum of all other living expenses and housing services consumption: the median is approximately

[16] More precisely, we use a simple procedure in which we associate with each individual an expected longevity, and take the present value of the house assuming that it grows at only 2% p.a. The reduced housing wealth we obtain is such that, when it grows at 5%, it results in the same future value as the observed housing wealth under an 2% growth rate.

[17] We asked the couples for life insurance proceeds payable to the spouse upon the respondent's death and vice versa. 65% of couples have a policy that pays out upon their own death and 60% have a policy that pays out upon the spouse's death. Over half of all couples have both policies.

[18] A check was instituted to ensure that category responses added up to within 10% of total expenses.

[19] The rent-price ratio in 2005 was equal to 3.8% nationwide, where rents are measured based on the rental price index of the BLS and house prices based on the repeat-sales index of the OFHEO. Since we do not have geographic information on our respondents, we are forced to use the nationwide number. We computed also an alternative "user cost" of housing as the sum of the mortgage payment, maintenance and home improvement, and property taxes (sum of consumption categories a and b). The user cost and the imputed rent have a 40% correlation (measured precisely).

$15K and the average approximately $20K per year. We define consumption as the sum of NDS consumption, durables spending, and health care spending. When so defined, consumption has a median of $17.8K and mean of $24.1K. We use 2005 non-durable consumption as our measure of consumption in the model.

The survey also gathered income in 2005 from Social Security, government pensions, and regular employer pensions. The median respondent has $16K and the mean is $24K. The distribution of total income, defined as the sum of labor income and pension income, has a median of $26K, and an interquartile range of $16-39K (see Table 2). We also asked for expected income in 2010 in the labor income and pension income categories. Our model calls for a measure of permanent income, since it assumes that income is constant during the retirement period. Therefore, we use 2010 income, and apply the 2005 income tax rate to get an after-tax measure.[20] Finally, to avoid the possibility that respondents report pension income both as income from work and as retirement income, we set labor income to zero for individuals that report that they are retired.

Risk-Sharing Our income and expenditure data display various patterns familiar from prior literature. For example we find what looks like a standard consumption function: a strong, positive cross-sectional correlation between total consumption and 2005 total income. Annual changes in spending and income have a cross-sectional correlation of 10%.[21] This is consistent with the literature that documents imperfect risk-sharing at the individual level (Cochrane [1991], Mace [1991], Nelson [1994]). As evidence against the null of perfect insurance in our data, a regression of the total (living expenses) spending change on the total income change and a constant, the slope coefficient is a statistically robust 0.077, a value in the range typically found in prior literature.

5.4 Comparison with Survey of Consumer Finance Data

We compare our data with the 2004 Survey of Consumer Finance (SCF) data. Just as for our own survey, we exclude respondents below the age of 54, where either spouse works full-time or expects to work full-time, with combined household income from work above $25K, and with children at home. This guarantees we are comparing mostly retirees to a sample of mostly retirees. The resulting sample consists of 3,018 individuals.[22] Half are married; 81.3% of the sample are homeowners, compared to 76% in our sample. The right column of Table 2 reports summary

[20]The reported annual income changes between 2005-2010 are modest: $1K is the median and $2K is the mean.

[21]To construct the growth rate in consumption, we use responses to a question concerning by what percentage total spending in 2010 was anticipated to differ with that in 2005, absent inflation. We then asked for an annual percentage change between 2005 and 2010 from a menu of options ranging from -10% to +10% by 1% increments. The median total spending change is 0, the mean is 1.7%. Less than one percent of respondents expects to reduce consumption by 10%, whereas eight percent expected to increase it by 10%. The observations on 2005 and 2010 income allow us to construct an annual percentage change in income, censoring the answers at .10 and -.10, for consistency with the consumption growth questions above.

[22]The SCF weighting scheme means that the number of replicates we use is five times that (15090).

statistics that are defined in a parallel fashion to those on the same row in the left column (our sample). They use the SCF weighting scheme.

The SCF has a slightly older age distribution. It has an income and wealth distribution that looks remarkably similar to ours.[23] While SCF spending data are limited, they still allow for a few important sanity checks on our data: (i) SCF food spending is lower than our living expenses, (ii) SCF spending on rent and real estate taxes is lower than our category of maintenance, rent, and real estate taxes, and (iii) mortgage payments are on the same order. We conclude that our sample seems broadly representative of the retiree group in terms of income and wealth.

5.5 The Behavioral Identification Problem

Dynan, Skinner, and Zeldes [2002] argued that bequest and precautionary motives were hard to separate out. We confirm that using consumption data alone, separating motives is difficult. It is useful to study three cases where the identification problem is distinct. Figure 1 illustrates. First, households with sufficiently high consumption are identified as having an upper bound on their bequest motive. Their iso-consumption lines are curved (e.g. $c = 12$). The lower bound on ϖ is zero in case their (low) savings can be entirely explained by the precautionary motive. Second, for households with lower consumption, the iso-consumption lines become flatter, and in the limit horizontal (e.g., $c = 10$). The lower bound on their bequest parameter remains zero, while the upper bound becomes larger than the maximum value we consider. For this group, the bequest motive is completely unidentified. A third group of wealthy savers have a strictly positive lower bound on the bequest motive (see Figure 2). Their iso-consumption lines are (almost) vertical and intersect the bottom of the box at some intermediate ϖ. These households have such high wealth that they face virtually no Medicaid risk. Their savings can only be explained by a strong bequest motive and their precautionary motive is completely unidentified.

In the estimation section (section 7 below), we follow De Nardi, French and Jones [2006] and focus on single respondents due to the many additional intricacies involved in simulating end of life spending of those with partners. In fact we focus attention in terms of the formal estimation on 268 of our 498 single respondents from our survey with an interesting identification problem.[24] Of

[23] By comparing our sample to the weighted and the non-weighted SCF sample, we are able to conclude that our respondents are somewhat wealthier than the US population as a whole. The SCF is known to over-sample the wealthy, relative to other surveys such as the Panel Study of Income Dynamics (PSID) or the Asset and Health Dynamics of the Oldest Old (AHEAD).

[24] We have 498 non-married respondents. Of these, we exclude 51 respondents for whom consumption is lower than our model's subsistence level and 26 respondents for whom consumption is lower than the model predicts even under the maximal values of both savings motives. We exclude 104 respondents for whom consumption is larger than the model predicts even with both savings motives removed. Finally, we exclude an additional 38 respondents for whom estimation would be primarily driven by the treatment of non-Medicaid bankruptcy ($c < 6$ or $y < 6$) and 11 outliers of high wealth and income ($y > 73$ or $x > 1,200$). Note that while these are excluded in the estimation, we analyze all survey responses in section 6, and reincorporate many of the remaining 230 single respondents to

these 268, 78% are in the first group with lower bounds of zero on ϖ and a range of upper bounds, 16% belong to the second group with completely unidentified bequest parameters, and 6% are in the third group, with lower bounds on ϖ substantially greater than zero.

In what follows we argue that the use of strategic survey questions together with consumption data will substantially improve the inference about the separate roles of bequest and precautionary motives, compared to only using consumption data. We first turn to the formulation of the survey questions.

6 Strategic Survey Questions

There were two distinct types of strategic survey questions posed, differing in when the proposed contingency would play out. Our first question was to play out "immediately following survey completion", as in Barsky, Juster, Kimball, and Shapiro [1997] and Kimball and Shapiro [2003]. The subtlety in posing questions of this form is to provide commitment devices sufficient to prevent continuation strategies from undoing the supposed impact of the immediate choice on the ultimate level of bequests. Our second question placed respondents close to the end of life precisely in order to simplify the interpretation and limit the scope for continuation strategies. The difficulty in posing a question with such a trivial follow-up strategy is that specifying the decision node precisely runs the risk of heightening the degree of complexity and of artificiality. One reason that we posed these two very different questions was to allow each question to generate information of independent value in the final estimation.

6.1 The Immediate Prize

Our immediate prize scenario involved the respondent winning a prize (either \$100K or \$250K) that had to be divided up between a bequest locked box and a long term care locked box, where the idea of using the locked box was precisely to provide an appropriate commitment device. More precisely, we specified that money placed in the bequest box could not be accessed during the lifetime, but would be passed on in whole to beneficiaries (who could not be told of this) upon death. Money in the long term care box could be accessed only to pay for private long term care (stated as costing \$50K a year) for the respondent (and partner if applicable), and would not be available to bequeathe. We randomized the order of bequests and long term care in these questions to allow for possible order effects, which in practice turned out to be insignificant.

Figure 4 shows that the single largest group of respondents would split the money 50-50. If the prize is \$100K (two years of LTC), then 32% would split it evenly; if the prize is \$250K (five years of LTC) only 17% percent would split it evenly. The second most common answer is a polar

rebuild a profile of the entire set of sampled singles in section 7.

answer: 0 or 100%. This is the first evidence suggestive of our basic finding, which is that both bequest motives and Medicaid aversion are important for a significant set of retirees. The second question with a $250K prize has a more even distribution across answers than the first; it is more discriminating. There is a large positive correlation between the two questions: A regression of the $100K answer on the $250K answer reveals a correlation of 80%. 126 respondents answer 0 to both questions (13.4%), 124 answer 50% to both, and 120 answer 100% to both questions.[25]

[Figure 4 about here.]

6.2 The End of Life

In posing the end of life question, we asked all respondents to place themselves in a hypothetical situation in which they were: of age 85 and the sole surviving member of their household; in need of long term care (LTC) yet had absolutely no long term care insurance; knew that they had exactly one year left to live and would need to spend it in a long term care facility; and had sold their home and had total available wealth that is worth $200K at today's prices and final year income net of taxes worth $25K in terms of current prices. They were then offered the choice between LTC that was privately financed and government provided LTC that is financed through Medicaid. This choice was described as impacting their LTC options and the bequest that they would leave as follows:

1. Option A: Use Medicaid funded LTC. The government will pay for your LTC, allowing you to leave all $200,000 as a bequest. However, using Medicaid restricts your choice of facility, on average results in inferior care, and requires you to surrender all income to the government.[26]

2. Option B: Use private LTC. Pay $50,000 for private LTC. You would only leave $150,000 as a bequest but would have your choice of facility and would have your income available for spending as you wish during that year (unspent income would be forfeited).

Following this yes/no question, we followed up with a quantitative question designed to pin down how much of the $200,000 that would be willingly foregone to stay in a private LTC facillity rather than use Medicaid funded LTC.

[25] We experimented with randomizing the order of the answers to the survey questions to detect anchoring effects. We found that the answers from the group that was presented the "100% in LTC" answer first were no different from the answers given by the group that was presented the "0% in LTC" answer first.

[26] Note that our question asserts directly that Medicaid on average results in inferior care, which we see as uncontroversial "folk wisdom" designed to frame the question appropriately. There is no evidence suggesting that this framing had any effect. First, respondents had all answered the locked box question (which made no comments on Medicaid quality) before seeing this second question. Second, we show below that the answers to this question suggest a *lower* aversion to Medicaid than do the responses to the earlier locked-box questions.

The response to the qualitative question was clear-cut. An overwhelming majority (83%) of respondents preferred to go to a private facility over a Medicaid facility if the cost is a reduction in bequest of \$50K. This is strong evidence for Medicaid aversion, the key driver of the precautionary savings motive in our model. Yet there is also evidence that many attach great importance to bequests. With respect to the quantitative follow-up, the median response was \$50K, with an IQR of \$20-100K. As an indication of coherence in responses, the median willingness to pay was only \$10K for the 17% respondents who chose the Medicaid facility in the first part of the question, while it was \$50K for the other remaining respondents. Figure 5 plots the distribution of willingness to pay for a private facility for those who prefer to avoid Medicaid.

[Figure 5 about here.]

6.3 Modeling the Response

Figure 6 illustrates the informational content of the two strategic survey questions for the two parameters of interest. It plots iso-response lines for the end-of-life survey question (left panel) and the lock box question (right panel) for a hypothetical 65 year old woman in good health with annual income of \$40K and wealth of \$230K in our model.[27] These iso-response lines are upward sloping. For example, if the respondent answers that she would be willing to forgo only 10% of \$200K to avoid going to a Medicaid facility, than she has weaker Medicaid aversion than a respondent who is willing to forgo 90%, for a given bequest parameter. The same is true for the lock box questions, though the contours have a somewhat different shape. For example, if the respondent answers that she would put all the money in the LTC box (the 99% line), then we can bound the bequest motive from above (at 40 in this example). Just like the iso-consumption lines, the iso-response lines alone do allow to separately identify both precautionary and bequest motives.

[Figure 6 about here.]

It is important to understand that the interpretation of the locked box question in terms of model parameters depends on wealth, income, health status, age, and gender. A fixed survey response will have entirely different interpretation in terms of model parameters depending on the other data that describe this respondent. However this is not true for the end-of-life question, since all respondents answer from precisely the same hypothetical situation.

Figure 7 shows how to combine the iso-consumption lines with the iso-response lines from the end of life question to pin down both parameters for the same 65 year old woman. At their

[27] The response to the end-of-life question has a closed-form solution in our model. The answer to the locked box question is based on simulation, as the money remaining in the locked box becomes an additional state variable in the dynamic programming problem.

intersection (the red circle at the intersection of the \$22K iso-consumption line and the 30% iso-response line), we find the bequest parameter ϖ and the precautionary savings parameter c^{MED} for this individual. Below, we repeat this exercise for the respondents to our survey for each question separately, and pooling information across responses.

[Figure 7 about here.]

6.4 Preliminary Response Analysis

While our ultimate estimation relates only to 268 of our 498 singles, we provide in this section an analysis of all 938 respondents. In this respect, what stands out is that the strategic survey responses provide a unique and rich source of insight into the extent of the motives that drive wealth accumulation at the end of life. We define the survey variables *pctltc*1 and *pctltc*2 as the fraction of the \$100K and \$250K locked boxes respectively dedicated to long term care, and *pctltc*3 as the fraction of \$200K dedicated to avoid Medicaid at the end-of-life.

Children In confirmation of the generally sensible nature of the survey responses, we find that respondents with children (80% of the sample) uniformly display a greater concern with bequests. The average fraction of the \$100K lock box (250K box) allocated to LTC, *pctltc*1 (*pctltc*2), is 68.5% (64%) for respondents without children, while it is 51.5% (47%) for those with children. The same comparison but for the median instead of the average fraction is 80% (70%) versus 50% (50%). Likewise, for the end-of-life question, the fraction allocated towards (private) LTC is 42.5% for those without children and 31.5% for those with children. The null hypotheses that the sample means are the same in the group with and without children are strongly rejected for all three variables.[28] Figure 8 shows that there are not only different means and medians for the survey answer distributions, but that the entire distribution looks different. The left panel plots *pctltc*2, the right panel *pctltc*3. For example, there is a much higher propensity to allocate nothing to bequests for those without children. Vice versa, there is a much higher propensity to allocate everything to bequests to those with children.

[Figure 8 about here.]

Wealth and Income Table 3 shows the pairwise correlation matrix between the strategic survey answers, net worth, permanent income, and the number of children. Note that while the two types of survey answers have a positive correlation of 0.27 (*pctltc*1 and *pctltc*3) and 0.28 (*pctltc*2 and

[28]The number of children is also negatively related with the *pctltc* variables. However, what matters is whether the respondent has children or not. In a regression of the *pctltc* variables on both the *withkids* dummy and the discrete *numkid* variable, the dummy *withkids* drives out *numkid*.

*pctltc*3), there is certainly independent information in each question. A striking finding in this regard is that assets, net worth, and permanent income are positively correlated with the answer to the lock box questions, but negatively with the end-of-life question. It appears that wealthier households allocate more of the locked box to bequests, but they dislike Medicaid LTC more as well. This is intuitively reasonable. Consider a high wealth individual with dominant Medicaid aversion. In answer to the former question on the marginal allocation of a lottery win, such a respondent may elect to use all or most for a bequest. Indeed, the wealthy respondent is not at risk of needing the LTC money, and allocating the money to the bequest box assures that the heirs will receive the money. However, if pushed to the wall with little wealth left, as in the end of life question, they would elect private LTC. It is a measure of the seriousness with which these questions were taken that there is some evidence of differences in responses along precisely these lines.

[Table 3 about here.]

While there are no formal findings to this effect, the "folk wisdom" in the area of bequest motives is that they are minimal for all but the wealthiest households. Our survey results provide no support for this view. If one aggregates across the sample as a whole, there is no systematic relationship whatever between economic variables and survey responses. What is nevertheless interesting is that such a relationship can be identified if one conditions on whether or not there are children. We ran both OLS regressions and Tobit regressions which take into account that the dependent variable (*pctltc*) is bounded between zero and one. The right-hand side variables are net worth and net worth interacted with the *withkids* dummy. The coefficient on the first regressand is the effect of net worth on the fraction allocated to LTC for those without children; the coefficient on the second regressand is the same effect but for those with children. The main message from Table 4 is that respondents without children allocate more money towards LTC (and less towards bequests) the wealthier they are. The exact opposite is true for respondents with children. The wealthier they are, the more they allocate towards a bequest. Each \$10K in income or \$100K in net worth *increases* the fraction allocated to the bequest by 2-4% for those with children and *reduces* that same fraction by about 1% for those without children. The difference between these groups is highly statistically significant.[29]

[Table 4 about here.]

[29]We also asked our respondents for their willingness to pay for perfect LTC insurance. We regress the survey answers *pctltc*1, *pctltc*2, and *pctltc*3 on net worth, net worth interacted with the *withkids* dummy, and the willingness to pay for perfect LTCI. We find that the results from Table 4 remain unaffected, and that in addition, the willingness to pay enter significantly positively. An extra \$1000 willingness to pay increases *pctltc* by an additional 1.17-1.64%.

Planning-Type Questions Further support for the plausibility of these results derives from the relationship between the survey answers and planning-type questions. We asked the respondents whether they own a long-term care insurance policy (LTCI); 14.3% of our respondents do. Those with LTCI have a lower propensity to allocate money to the LTC locked box than those without a policy. At the same time, when faced with a contingency without LTC at the end-of-life, they are more likely to pay to avoid having to go to a Medicaid facility. We asked the remaining 85.7% of the sample whether they had seriously considered taking out LTCI. The 27% of those that had considered it allocate a significantly larger fraction of the lock box to LTC and do the same at the end-of-life. Next, we asked all respondents how much they think a year in LTC would cost out-of-pocket given all the insurance they have in place. We find that the more they think it will cost, the more they allocate to LTC in the strategic survey questions. Again, these results are highly significant. We also asked the respondents whether they had (i) a written will, (ii) established a trust, or (iii) consulted with a financial planner. All three variables are significantly negatively correlated with *pctltc*1 and *pctltc*2 (at the 1% level), and negatively but insignificantly related to *pctltc*3. Again, this finding makes considerable sense. Those with demonstrated intentional bequest motives end up allocating more towards bequests. However, when faced with a potentially very different wealth level at the end-of-life, they still care more about their heirs, but Medicaid remains an unpleasant prospect.

Singles The results above are for the full sample of singles and couples. To close the section, we zoom in on the 498 singles in the sample. As for the larger sample, singles with children allocate less to the LTC box (and more to the bequest box) than those without children. Figure 9 also shows that the percent allocated to LTC (vertical axis) has no strong pattern across wealth deciles (horizontal axis). In particular, there does not seem to be a strong and monotonically increasing relationship between wealth and the fraction allocated to the bequest (negative relationship with *pctltc* variables in the figure).

[Figure 9 about here.]

7 Estimation

7.1 Computational Strategy

The model identifies each potential respondent "type" by gender, age, health, wealth and income, and by two preference parameters, ϖ and c^{MED}. For each type, the model predicts current-period consumption and answers to each of the strategic survey questions. For each respondent of a given type, our approach is to identify the values of ϖ and c^{MED} that best explain the reported

consumption and answers to the strategic survey questions, holding constant gender, age, health, wealth and income.

For each single respondent in the sample, we identify the demographic variables from the survey data, using definitions of income and wealth described in section 5. With all other model parameters fixed, we identify the values of ϖ and c^{MED} for which the model's prediction of consumption match the 2005 consumption calculated from the data. These values define a curve in the (ϖ, c^{MED}) plane. For each candidate parameter pair (ϖ, c^{MED}) on this curve, the model also predicts a theoretical answer to the strategic survey question.[30] We select the parameter pair for which the model's prediction most closely matches the respondent's actual answer. (Recall Figure 7 for a graphical description.) This procedure thus associates to each respondent an estimated bequest motive and Medicaid aversion.

7.2 The Estimates

Figure 10 plots the parameter estimates for the bequest motive and Medicaid aversion in three different ways. The top left hand panel combines consumption data with the end-of-life strategic survey question. The top right panel combines consumption data with the \$250K lock box question, and the bottom left panel uses consumption data and both survey questions. In each of the three panels, most respondents have iso-response and iso-consumption curves that intersect in one location and we are able to obtain precise estimates of both parameters (indicated by circles).[31] For other respondents, the survey response was at an extreme (corresponding to full two dimensional iso-response sets). Hence, even in combination with consumption data, a range of parameter estimates is left open, so that we can only place upper or lower bounds on the bequest motive (indicated by triangles pointing to the left or right). In the third panel which uses both questions, the estimate is the point on the iso-consumption line that minimizes the sum of the squared differences between the predicted and actual answers to the two survey questions. This is equivalent to a maximum likelihood estimation where we assume that survey responses represent the truth plus a zero-mean, normally distributed error, as in Kimball, Sahm, and Shapiro [2005].[32] There is a range of estimates for the pooled questions only if both questions produce consistent bounds, in which case the intersection of the bounds is applied.

[Figure 10 about here.]

[30] In advance of the estimation, we calculate optimal policies for consumption and the lock-box question response for demographics and values of the preference parameters lying on a grid. During the estimation routine, predicted answers are calculated by linear interpolation from this grid. The optimal response to the end-of-life survey question has a simple closed-form solution and *is* calculated for each parameter pair.

[31] There are also cases in which they do not intersect within the range of parameters we allow for, in which case the estimate is the point on the iso-consumption curve closest to the iso-response curve.

[32] Lillard and Willis [2001] have developed an intriguing model of systematic biases in response to probabilistic survey questions, opening an important direction for future research.

To understand how the information content of the unified estimate differs from those of the two questions individually, Figure 11 compares estimates from the two survey questions. The left panel contrasts the estimate for ϖ from the left and the right panels of Figure 10. The right panel does the same for the estimate of c^{MED}. While many of the estimates are identical, some respondents for which the end-of-life questions implies a zero bequest motive give answers to the lock-box question that imply a positive bequest motive (along the vertical axis of the left panel). There are also cases in which the end-of-life questions implies a maximal bequest motive and the lock-box question does not. Finally, there are a number of observations for which the lock-box question implies no bequest motive and the end-of-life question does not. Observations in this group are all cases in which all the lock-box money is allocated to LTC, but the end-of-life question indicates a strong interest in leaving a bequest. Overall, we regard the two survey questions as having not only differences in response error, but also differences in meaning that make them to some extent complementary. For this reason, it is the combined estimate in the lower panel that we treat as definitive.

[Figure 11 about here.]

Figure 10 shows that the survey questions are very useful in separating motives. In the vast majority of cases, we are able to pin down the two motives or bound them in a narrow range. With respect to the bequest motive in particular, the strategic survey data has, in most cases, changed the estimates of ϖ from a wide range to a point estimate and, in all cases, narrowed the range. Of the 268 respondents in the estimation, we obtain point estimates for 238. For the remaining 30 respondents, we reduce the size of the average range for ϖ from 74 down to 4.

Before discussing the results in more detail, we report some preliminary checks on the estimation. When we perform the estimation using the end-of-life question, we find that on average, for every additional \$10K of bequest the respondent would forgo to avoid the Medicaid facility, the estimated bequest motive decreases by 2.1 and the estimated Medicaid aversion increases by 0.10. When we use the lock-box question, each additional \$25K less in the LTC lock box increases the estimated bequest motive by 4.0 and decreases the estimated Medicaid aversion by 0.24. This suggests that the parameter estimates are reasonably capturing the preferences revealed by these answers.

7.3 Estimated Bequest Motives

The first crucial finding is that there is tremendous heterogeneity in bequest motives, and for many they are too strong to ignore. To highlight this point, we plot in Figure 12 the cumulative distribution function of the minimum value of the bequest motive consistent with the behavioral data alone, as opposed to that consistent with the combination of behavioral and strategic survey data. The striking observation is that one could explain the behavioral data perfectly well in

principle with a bequest motive set at or close to zero for more than 90% of respondents. Moreover one would necessarily infer a high bequest motive ($\varpi > 40$) for only five respondents. Yet once we include the strategic survey responses, very few are assigned a non-existent bequest motive and it is weak ($\varpi < 10$) for less than 50% of the population. High bequest motives ($\varpi > 40$) are estimated for more than 25% of the population, with very strong bequest motives ($\varpi > 90$) estimated for some 10 percent of the sample.

[Figure 12 about here.]

Our findings suggests that the current default of setting bequest motives at or close to zero in life cycle models is in need of revision. We identify a significant group of retirees who are spending at a low rate out of their wealth, and who consistently answered questions on late in life priorities in a manner that displayed a desire to leave a high bequest, as opposed to spend on private long term care. While these answers are doubtless subject to many biases, there is no reason to believe that they are disconnected from the underlying motivations, especially given the apparent willingness of many others to express the opposite priorities. Our concern in future work will be to understand in more detail the nature and significance of bequest motives in patterns of retirement spending rather than to downplay them.

With respect to identifying characteristics that are correlated with inferred bequest motives, we consider a regression of the form

$$\varpi_i = \beta X_i + \epsilon_i$$

where ϖ_i is the estimated value for respondent i and X_i is a vector of demographic variables for the same respondent. The first column of Table 5 reports the maximum likelihood estimates for β, based on consumption alone.[33] We repeat the estimation using the updated estimates of ϖ_i from combining consumption with the two strategic survey questions (Column 2). Only income, age, and to a lesser extent gender generate statistically significant relationships, and these results are already suggested by the consumption data.

[Table 5 about here.]

The fact that wealth does not relate in any significant way to the estimated bequest motive again emphasizes our crucial finding that bequest motives extend well into the middle class. As one measure of this, we calculate the "net worth-weighted" and an "equal-weighted" bequest motive $\widehat{\varpi}$ for these 268 singles. They turn out to be essentially identical, at 25.8 (net worth) and 27 (equal).

[33] Using only the consumption data, the observation of ϖ_i typically consists of an interval $[\underline{\varpi_i}, \overline{\varpi_i}]$. We estimate β using STATA's 'intreg' command, which is designed to deal with dependent variables for which only a range is measured.

7.4 Estimated Medicaid Aversion

As with bequest motives, there is great heterogeneity in our estimates of the Medicaid aversion parameter. Figure 13 shows the cumulative distribution function (CDF) of estimated Medicaid aversion scaled back in the original consumption measure. The distribution appears bimodal. More than 25% of respondents regard Medicaid as so bad that it exceeds subsistence income of \$5K by less than \$1K. The consumption equivalent of Medicaid is below \$10K for more than 50% of respondents. On the other hand, some 30% or so of respondents display little or no such aversion, treating a year in a Medicaid facility as equivalent to an annual consumption of \$20K or above.

[Figure 13 about here.]

Results of regressing these estimates on a number of demographics yields are shown in rightmost column of Table 5. Respondents with greater wealth and income are estimated to be more Medicaid averse. Older respondents are estimated to be less Medicaid averse. This not because older respondents differ in their responses to the survey questions. Rather, it is driven by the fact that the consumption data alone indicates weaker savings motives among older respondents. An intriguing result is that people without kids have higher Medicaid aversion. Hurd [1997] identified a close parallel between spending patterns of otherwise similar retired households with and without children. In prior work, this has generally been interpreted as evidence against bequest motives. While we find a similar pattern of spending in our respondents, our estimates suggest that the similarity in spending behavior between those with and without children may mask a significant difference in motivation. Those without children appear more motivated to save for precautionary reasons than those with children, possibly due to the lack of the safety net that family provides. Two otherwise similar individuals with and without children may be spending at a similar rate, yet may be motivated in a quite different manner.[34]

7.5 Adding Back Excluded Singles

While making no claim as to representativeness of our sample, we want to get a broader picture of the distribution of parameters across all surveyed singles, since those who were excluded from the estimation are systematically different than those who were included. Table 6 describes some of the differences between the included and excluded subsamples of singles. The main difference is that the included sample has higher after-tax permanent income and especially higher wealth. The wealth difference are present in all wealth subcategories. For example, the home ownership rate is 71% for the included and 51% for the excluded sample. Yet there is little difference in

[34] In future research, we plan to enrich our model to allow for family interactions to further our understanding of this finding.

terms of family status or in terms of the answers to the strategic survey questions. Those included in the estimation have a slightly higher average fraction allocated to the LTC lock box, but that difference is not statistically significant. The average answer to the end-of-life question is about the same.

[Table 6 about here.]

In what follows we will try to create a ball-park "population average" bequest parameter for all 498 single respondents. The 268 for which we proceeded with formal estimation account for 59% of aggregate wealth; the 11 outliers of high wealth or income (permanent income above \$73K or net worth above \$1,700K) who are "off the grid"of our computations account for 16% of total wealth; the 115 respondents for whom consumption is very low (51 for whom consumption is lower than our model's subsistence level, 26 for whom consumption is lower than the model predicts even under the maximal values of both savings motives, and 38 respondents for whom estimation would be primarily driven by the treatment of non-Medicaid bankruptcy) account for 17% of wealth; while the remaining 104 who have consumption that is larger than the model predicts even with both savings motives removed account for 8% of aggregate wealth. To derive a wealth-weighted bequest motive, the critical issue is how we treat the wealthy and the low spenders. For all of these, a high bequest motive is at least plausible, even though it cannot be estimated. We consider a low scenario where we assign the 11 rich outliers and the 115 with low consumption either a bequest motive of 10.5 (the median bequest motive estimated from the 268) and a high scenario where we assign them a bequest motive of 89.70 (the 90^{th} percentile of the bequest motive distribution estimated from the 268). With respect to the 104 over-spenders, we can safely assign them a zero bequest parameter.

The population-average bequest motives are reported in the bottom panel of Table 6. In the low scenario, we end up with an equally-weighted average of 17.4 and a wealth-weighted average of 18.6 for the entire sample of 498 singles. In the high scenario, the equally-weighted average bequest motive is 37.5 and the wealth-weighted average is 44.7. Our estimated wealth-weighted and equally-weighted average bequest motives of 27.4 and 25.8 for the sample of 268 are right in between the low and the high scenario. Again, the difference between the equal-weighting and the wealth-weighting scheme is small in the larger sample of 498, reinforcing our finding that bequest motives are not confined to those with high wealth.

8 Concluding Remarks

We have outlined a strategic survey methodology designed to shed new light on the relative importance of bequest and precautionary motives for wealth accumulation in retirement. We have argued that strategic survey questions that place respondents in informative contingencies can be useful complements to behavioral data. We have formulated such contingent questions in the context of the trade-off between saving for bequests versus precautionary motives. When combined with standard behavioral data, these strategic survey questions greatly improved our understanding of the strength of the bequest and precautionary motives.

We find many households to have significant bequest motives. Similarly, many households are very Medicaid averse, and this plays a significant role in explaining the low rate of spending of many middle class retirees. Ameriks, Caplin, Laufer, and Van Nieuwerburgh [2007] use these findings to characterize the potential interest among retirees in annuities, long-term care insurance, and various new financial products.

A Appendix 1: Health Transition Calibration

The distribution of medical costs in our model is controlled by the medical costs associated to each health state and by the one-period 4×4 state transition matrix $\mathcal{P}(a)$, where a denotes age in excess of 62. This matrix is parameterized by twelve parameters, nine that determine the value of $\mathcal{P}(0)$ (of the sixteen elements, four are fixed by the death state being absorbing and there are three further restrictions so that each row sums to one) and three that control the flow of probability from greater health to poorer health as age increases. We calibrate these 12 parameters to match 8 moments related to long-term care utilization (Brown and Finkelstein [2004], Table 1, males), and 4 moments related to longevity (National Center for Health Statistics, Vital Statistics [1999], Table 2 for males). Table 1 in the main text shows the moments we match, their target value, and our best fit. The last 4 rows show some features of the distribution of medical costs. More precisely, the 1-period ahead transition matrix at age $62 + a$ is given by $\mathcal{P}(a) =$

$$\begin{bmatrix} p_{11} & p_{12} & p_{13} & 1-p_{11}-p_{12}-p_{13} \\ p_{21} & p_{22} & p_{23} & 1-p_{21}-p_{22}-p_{23} \\ p_{31} & p_{32} & p_{33} & 1-p_{31}-p_{32}-p_{33} \\ 0 & 0 & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1-c_1a^e & c_1a^e\left(\frac{c_2c_3}{1+c_2+c_3c_2}\right) & c_1a^e\left(\frac{c_3}{1+c_2+c_3c_2}\right) & c_1a^e\left(\frac{1}{1+c_2+c_3c_2}\right) \\ 0 & 1-c_1a^e & c_1a^e\left(\frac{c_2}{1+c_2}\right) & c_1a^e\left(\frac{1}{1+c_2}\right) \\ 0 & 0 & 1-c_1a^e & c_1a^e \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

The second matrix is the age-adjustment. It shifts probability mass from the left (better health states) towards the right (worse health states and death), relative to the transition matrix at age 62, $\mathcal{P}(0)$. The 3 parameters c_1, c_2, and c_3 control how fast this shifting occurs. Loosely speaking, the parameter c_1 controls the transition from LTC to death as age increases; c_2 determines how much more likely death is relative to LTC when in health state 1 or 2, and c_3 determines how much likely state 2 is when in good health. The exponent e allows for faster than linear shifting as the agent becomes older. It is held fixed at $e = 1.5$. We note that there is no unique solution to the system of 12 equation and 12 parameters because the system is highly non-linear. Using a non-linear lest squares procedure, the best fit is obtained for $p_{11} = .9600$, $p_{12} = 0.0308$, $p_{13} = .0013$, $p_{21} = .3855$, $p_{22} = .6435$, $p_{23} = .0695$, $p_{31} = .0246$, $p_{32} = .1335$, $p_{33} = .7468$, $c_1 = .0016$, $c_2 = .8887$, and $c_3 = .5570$. To scale the moments to the same units, and to attach more importance to matching some moments than others, we use the following weights on the 12 moments: 100, 5, 10, 100, 100, 100, 100, 1, 4, 5, 6, and 7.

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Table 1: Calibration of Health Transition Probability Matrix

The first column shows the moment, the second column the target from the data, and the last column shows our calibrated value at the chosen parameters. The first 8 moments capture aspects related to long-term care (LTC); the data are from Brown and Finkelstein [2004] Table 1 for males and females. The next 4 moments relate to longevity; the data are from the National Center for Health Statistics, Vital Statistics (2006), Table 2 for males and table 3 for females (2003 Life Tables). The last 4 moments show features of the distribution of medical costs. These are not used in the calibration. Details of the calibration exercise are in the appendix. The small discrepancies between the simulation and the data in row 3 arises from the fact that our model is cast in years. The data on the other hand were compiled on a monthly basis. We interpret more than one year as at least two years, and that leads to an upward bias in the average.

	Moment	Males		Females	
	Long-Term Care	Data	Calibration	Data	Calibration
1	Probability ever use LTC	.40	.39	.54	.53
2	Average age of first use (among users)	80	78.1	82	80.1
3	Cond. Avg. years spent in care	2.9	3.4	4.2	4.6
4	Cond. Prob. use more than 1 year	.77	.73	.85	.80
5	Cond. Prob. use more than 3 year	.37	.37	.53	.51
6	Cond. Prob. use more than 5 year	.17	.18	.31	.31
7	Cond. Prob. ever exit to non-death state	.33	.36	.35	.35
8	Cond. Avg. number of spells	1.20	1.20	1.27	1.24
	Longevity				
9	Life expectancy at age 62	18.9	18.2	22.1	22.1
10	Life expectancy at age 75	10.5	9.8	12.6	12.4
11	Life expectancy at age 85	6.0	6.0	7.2	7.4
12	Life expectancy at age 95	3.2	3.2	3.7	3.8
	Total Medical Expenses during Retirement				
13	Avg. lifetime medical expenses ($k)		79.4		136.8
14	Median lifetime medical expenses ($k)		18		56
15	Prob lifetime medical expenses > $100k		.26		.41
16	Prob lifetime medical expenses > $250k		.10		.20

Table 2: Summary Statistics Sample

	Moment	Our 2005 Survey					SCF 2004				
	Percentile:	5	25	50	75	95	5	25	50	75	95
Demographics											
	Age	55	59	64	69	77	59	67	74	80	87
	Age Spouse	54	62	66	72	79	58	65	70	76	82
	Number of children	0	1	2	4	5+	0	2	3	4	7
	Number of grandchildren	0	0	3	6	10+					
Income	(× $1000)										
	Labor income	0	0	2.1	13.5	22	0	0	0	0	11
	Retirement income	0	10	16	29	75	2.1	11	18	30	62
	Total income	6.5	16	26	39	76	6	12	19	32	64
	After-tax income	5	15.3	25	36.1	69.8					
Spending	(× $1000)										
	Total spending	5	11	18	32	72					
	Mortgage Debt (a)	0	0	0	4.8	16	0	0	0	0	10.2
	Maintenance and Rent (b)	0	1	2.5	5	12	0	.7	1.8	4	9
	Durables (c)	0	0	0.5	2	10					
	Health (d)	0	0.2	1.0	2.5	7					
	Income Taxes (e)	0	0	0.1	2.0	12					
	Living expenses (f)	1	4.1	8.9	15.5	33.5	1	2.6	3.6	5.8	10.4
	Housing consumption	1	3	5.7	9.6	23					
	NDS consumption	4.3	8.9	14.9	26.1	50					
	Total consumption	5.1	11	17.8	31.2	61.3					
Wealth	(× $1000)										
	Retirement assets	0	0	13.8	115	605	0	0	0	20	268
	Liquid financial assets	0	0.5	15	125	500	0	1.5	23	130	697
	Primary home	0	15	120	240	605	0	26	103	224	500
	Other assets	0	4	20	70	500	0	2.8	9.6	31.1	431.2
	Total assets	0.1	54.4	241.5	681	1,700	1.8	64.1	203.4	510.3	1,624
Debt	(× $1000)										
	Primary mortgage	0	0	0	8	125	0	0	0	0	95
	Credit card	0	0	0	1.7	12	0	0	0	0	5
	Other debt	0	0	0	0.3	14	0	0	0	0	23
	Total liabilities	0	0	2	28	139	0	0	0	11.5	112
Net Worth	(× $1000)										
	Home equity	0	5	90	210	550	0	20	100	200	500
	Total net worth	-3.3	35.5	225	648	1,651	0.1	54.6	182.5	505	1,616

Table 3: Correlation Matrix

This table presents the correlation between the answers to the strategic survey questions, the net worth, assets, permanent income ($inc10$), and number of children ($numkid$) for the 938 respondents in our survey. The survey answers indicate the fraction of the \$100K lock box that the respondent would allocate to long-term care ($pctltc1$), that same fraction but for the \$250K lock box $pctltc2$, and the fraction of \$200K the respondent would be willing to spend to avoid a Medicaid facility at the end-of-life at the expense of the bequest ($pctltc3$).

	pctltc1	pctltc2	pctltc3	networth	assets	inc10	numkid
pctltc1	1.0000						
pctltc2	0.8018	1.0000					
pctltc3	0.2672	0.2841	1.0000				
networth	-0.0706	-0.1027	0.0834	1.0000			
assets	-0.0720	-0.1003	0.0817	0.9942	1.0000		
inc10	-0.1379	-0.1509	0.0605	0.6057	0.6091	1.0000	
numkid	-0.1386	-0.1438	-0.1199	-0.0187	-0.0156	0.0664	1.0000

Table 4: Tobit Estimates

This table presents OLS and Tobit regressions of the survey answers (*pctltc*1, *pctltc*2, *pctltc*3) on net worth or income and their interaction with a dummy measuring whether the respondent has children. The top panel uses net worth, the bottom panel uses permanent income (measured as after tax income in 2010). The left panel reports OLS regression results. *** denotes significance at the 1% level according to robust standard errors. The right panel reports Tobit regressions. Net worth is expressed in units of $100,000. Permanent income is expressed in units of $10,000. Each regression contains 938 observations.

	OLS Regressions			Tobit Regressions		
	pctltc1	pctltc2	pctltc3	pctltc1	pctltc2	pctltc3
constant	0.567***	0.532***	0.316***	0.607***	0.542***	0.313***
networth	0.012***	0.011***	0.014***	0.023***	0.018***	0.017***
networth × withkids	-0.020***	-0.021***	-0.011***	-0.037***	-0.032***	-0.014***
R^2	2.91%	4.03%	1.73%	1.57%	2.89%	1.67%
constant	0.604***	0.562***	0.321***	0.681***	0.588***	0.324***
income	0.011	0.012	0.027***	0.018	0.016	0.030***
inc × withkids	-0.038***	-0.037***	-0.026***	-0.066***	-0.054***	-0.030***
R^2	3.68%	4.23%	1.33%	2.04%	2.92%	1.11%

Table 5: Regressions of Parameter Estimates on Demographics

This table reports regressions of estimated bequest motives (first four columns) or estimated Medicaid aversion (last two columns) on demographics. In the first column, we perform maximum likelihood estimation using individual-specific estimates $\hat{\varpi}^i$ that are based on the restrictions imposed by the consumption data alone. In the other two columns, the regressands are parameter estimates, obtained from combining both survey questions with consumption data. Using only a single question produces similar results. Respondents who choose the most extreme answers on both questions have chosen corner solutions and are treated as censored observations. The t-statistics are shown in parentheses and statistical significance is denoted by *10%, **5%, ***1%.

	Bequest Motive				Medicaid Aversion	
	(consumption only)		(with Survey)		(with Survey)	
const	26.37	(3.98***)	92.18	(4.80***)	15.23	(3.63***)
wealth	.00415	(1.18)	-.00642	(-.063)	.00261	(1.20)
income	.566	(7.60***)	.616	(2.87***)	.119	(2.59**)
withkids	-1.45	(-.87)	-2.26	(-0.48)	-2.07	(-2.05**)
male	3.88	(2.38**)	8.19	(1.77*)	.347	(.34)
age	-.453	(-4.50***)	-1.20	(-4.05***)	-.322	(-4.93***)
R^2			.012		.023	

Table 6: Comparison of Singles: Included vs. Excluded in Estimation

This table presents demographics of two groups of singles: the ones we use in estimation and the ones we do not. Together they make up the entire population of singles in our survey (498 respondents). The numbers in brackets are the 25^{th}, 50^{th}, and 75^{th} percentile of the distributions. The last two lines denote the average number of children, and the fraction of the subsamples with children. The survey answer variables *pctltc*1, *pctltc*2, and *pctltc*3 are defined in the main text. The last panel pertains to the parameter ϖ, which measures the strength of the (intentional) bequest motive. The first row displays the 25^{th}, 50^{th}, and 75^{th} percentile of the distribution of estimated $\widehat{\varpi}$ for the 268. The second and third rows give the equally-weighted average of $\widehat{\varpi}$ across respondents under two scenarios (low and high, described in the main text). The fourth and fifth rows are the corresponding wealth-weighted averages. The last two rows report medians rather than averages.

	included	excluded	all
number	268	230	498
income 10	[14,18,29]	[9,13,20]	[11,16,25]
net worth	[34,158,357]	[0,23,150]	[5,88,290]
withkids	0.694	0.700	0.697
numkid	1.92	1.97	1.95
pctltc1	.618	.563	.593
pctltc2	.564	.528	.547
pctltc3	.350	.357	.353
$\widehat{\varpi}$	[2.3,10.5,42.8]		
equal-weighted avg. - low	27.42	5.75	17.41
equal-weighted avg. - high	27.42	49.14	37.45
wealth-weighted avg. - low	25.80	8.40	18.64
wealth-weighted avg. - high	25.80	71.80	44.72
median - low	10.52	10.50	10.50
median - high	10.52	89.70	14.62

Figure 1: Iso-Expenditure Lines: Medium Wealth

The figure describes iso-consumption lines in (ϖ, c^{MED}) space for a hypothetical single woman, aged 65, in good health, with total wealth equal to \$80K, and annual income of \$25K. This hypothetical person corresponds to the 50^{th} wealth and income percentile of our sample, to be defined below.

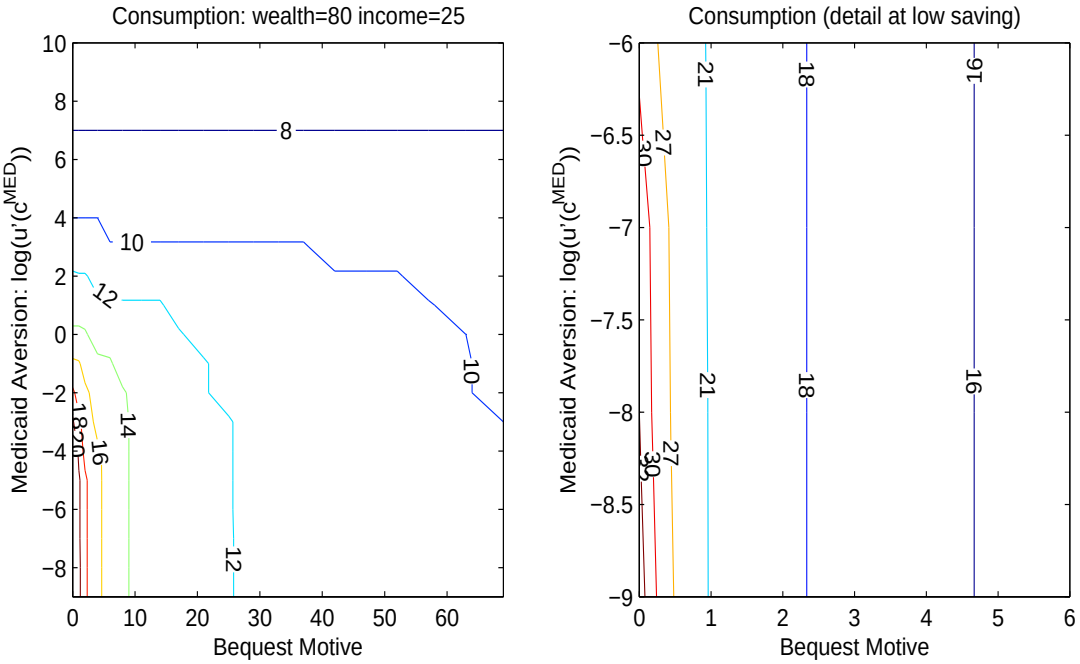

Figure 2: Iso-Expenditure Lines: High Wealth

The figure describes iso-consumption lines in (ϖ, c^{MED}) space for a hypothetical single woman, aged 65, in good health, with total wealth equal to \$475K, and annual income of \$50K. This hypothetical person corresponds to the 90^{th} wealth and income percentile of our sample, to be defined below.

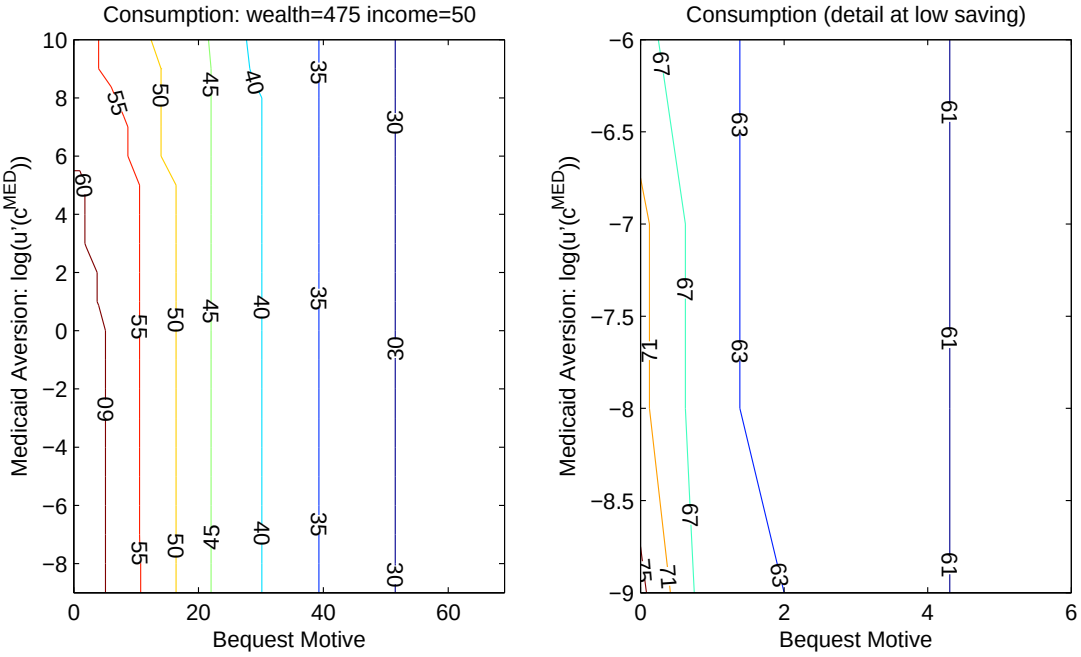

Figure 3: Middle Class Precautionary Savings

The figure plots the savings rate, defined as consumption over income (on the vertical axis) against income (on the horizontal axis). The figure is for a hypothetical single female, age 62, in good health. As we vary income, we simultaneously vary wealth, to capture the positive cross-sectional correlation between income and wealth. The various lines are for different precautionary savings parameters $\log(u'(c^{MED}))$, with the strongest precautionary motive being the highest line.

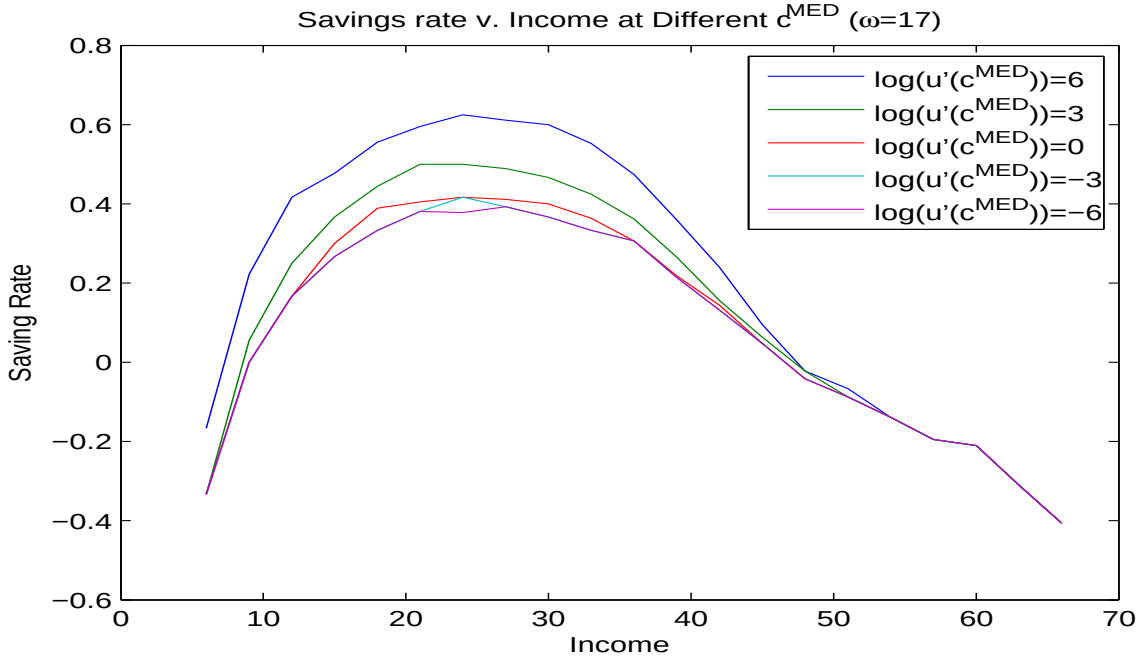

Figure 4: Trading off Long-Term Care and Bequests at the Current Moment

The figure shows a histogram of responses to survey question 18b. The question asks what fraction of $250K prize the respondent would devote to a lock LTC box. The complementary fraction would go to the bequest box. The sample consists of 938 respondents.

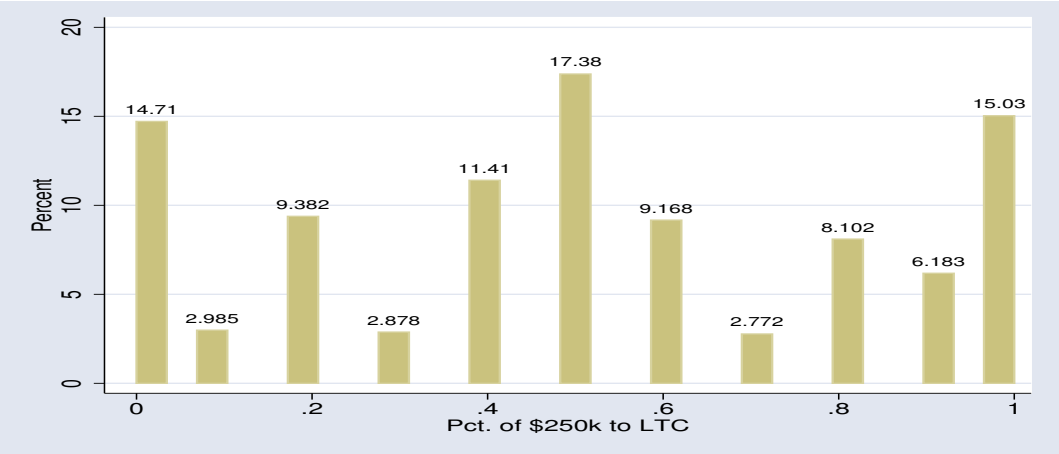

Figure 5: Trading off Long-Term Care and Bequests at the End-of-Life

This graph shows a histogram of responses to survey question 20b. The question asks what fraction of $200K in remaining wealth the respondent would forgo to avoid a Medicaid facility when LTC in his/her last year of life were unavoidable. The sample consists of 938 respondents.

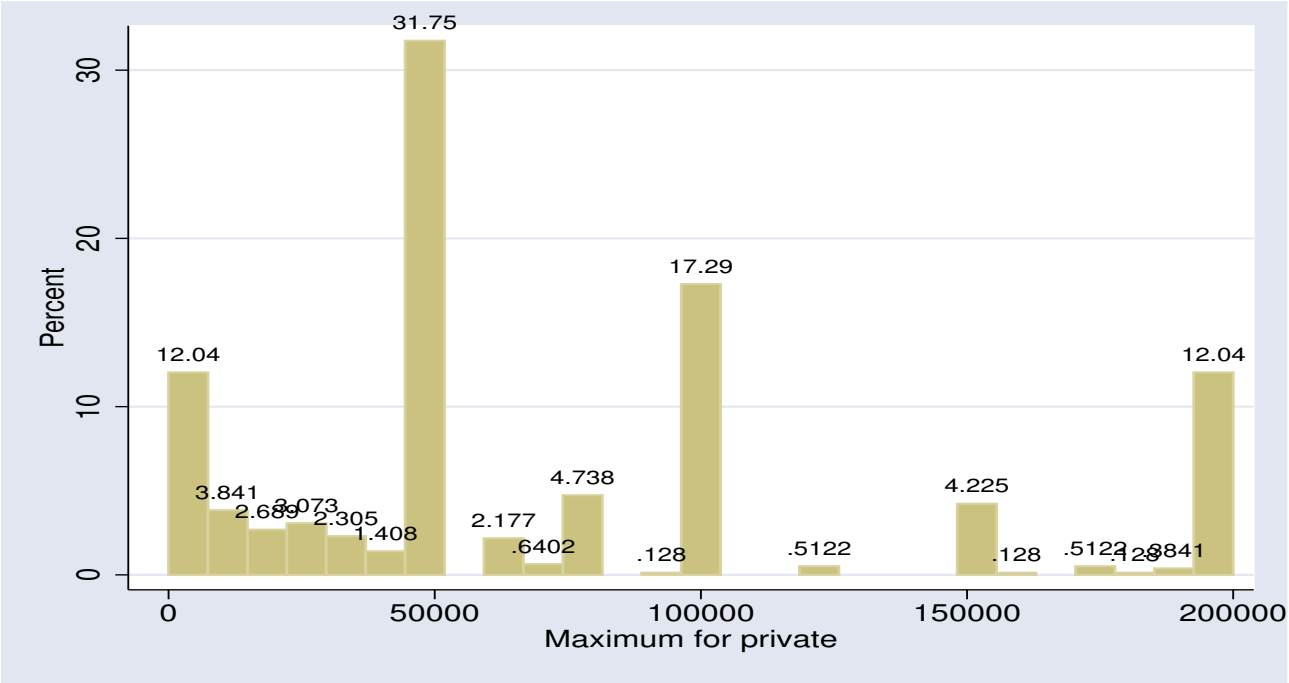

Figure 6: Iso-Response Lines to Strategic Survey Questions

The figure describes iso-response lines for the two strategic survey questions. The left panel plots the iso-response lines in $(\varpi, \log(u'(c^{MED})))$ space; the responses vary from 1% of the \$200K that respondents would be willing to forgo to avoid LTC in a Medicaid facility to 99% of \$200k. This end-of-life question is the same for all demographics. The right panel plots iso-response lines to the lock box question. It plots what fraction of the \$250K prize the respondent is willing to allocate to the LTC lock box. The figure plots responses ranging from 1% to 99% for a hypothetical single female, aged 65, in good health, with total wealth of \$230K, and annual income of \$40K.

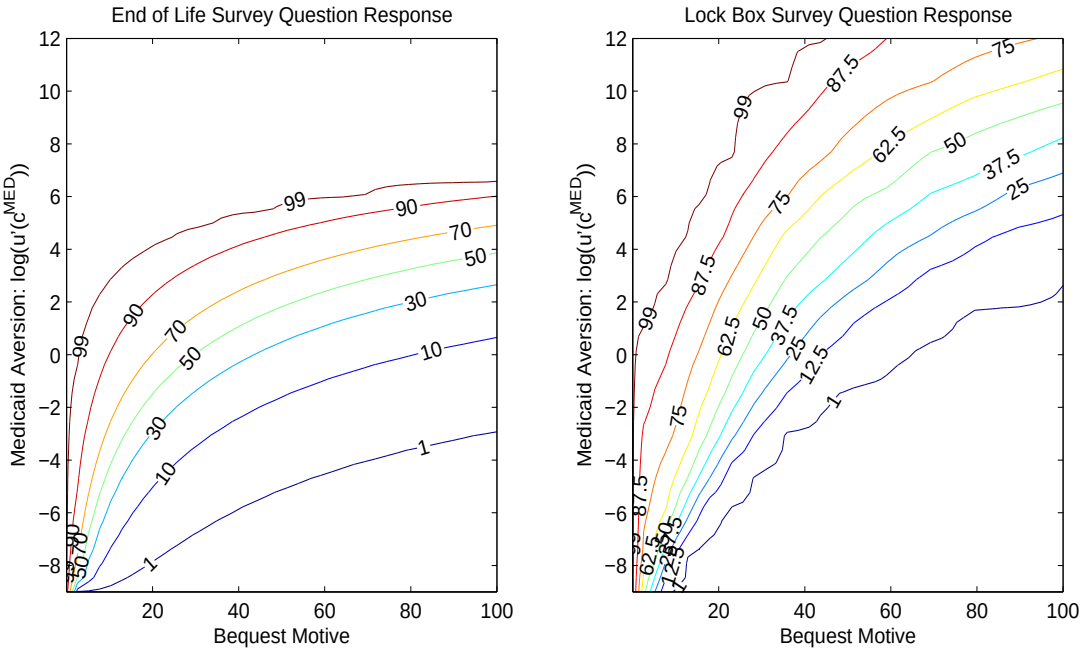

Figure 7: Identifying Bequest and Precautionary Motives

The figure illustrates our identification strategy. It compares iso-consumption and iso-response lines to the end-of-life strategic survey question in (ϖ, c^{MED}) space. This figure is for a hypothetical single female, aged 65, in good health, with total wealth of \$230K, and annual income of \$40K.

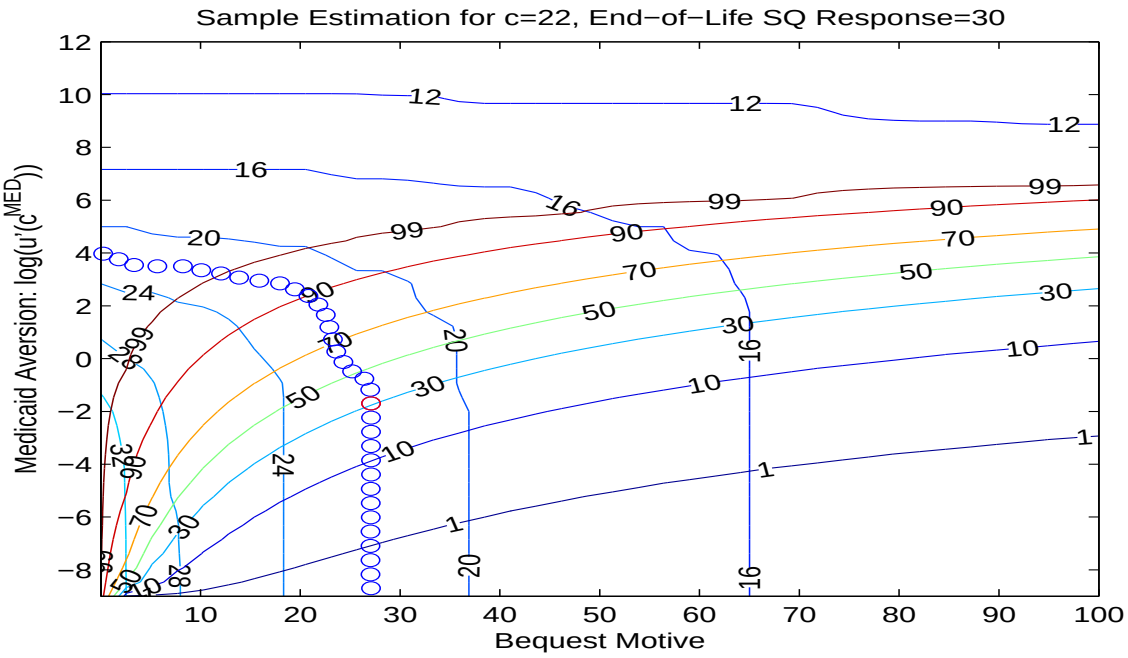

Figure 8: Strategic Survey Questions for Respondents With and Without Children

The top panel plots the distribution of survey answers to the \$250K lock box question (*pctltc*2). The answers range from 0% to 100% allocated to the LTC lock box. The bottom panel plots the answer to the end-of-life survey question (*pctltc*3). Both panels are based on the entire sample of 938 respondents.

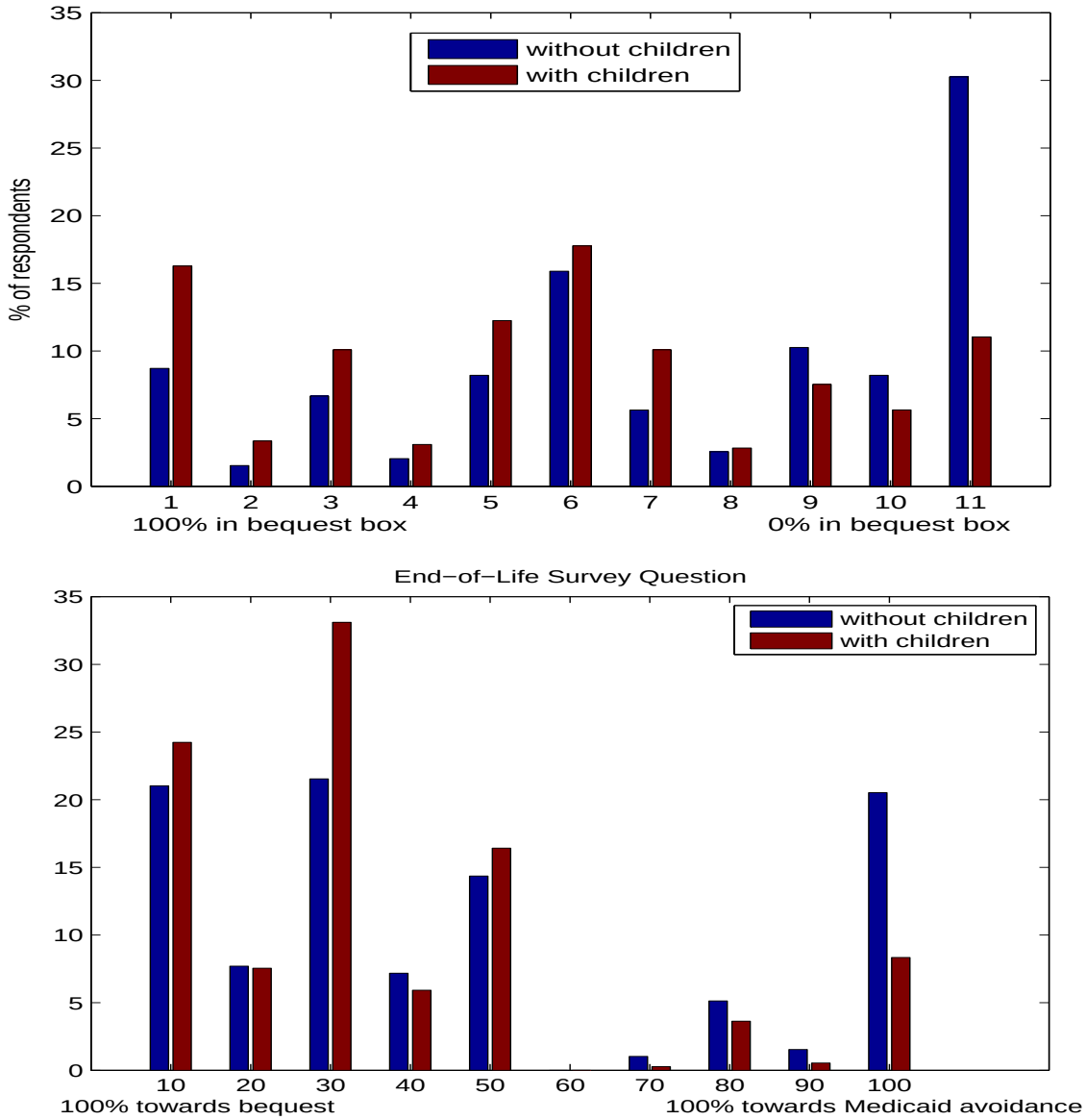

Figure 9: Survey Questions for Single Respondents

This figure plots the survey answers by net worth decile. The net worth deciles are the same in all three panels and the decile cutoffs are based on all 498 singles. The first panel is for those with children (347), the second panel for those without children (151), and the last panel for all singles (498). The singles without children tend to be wealthier on average, so that relatively more of them are present in the higher wealth deciles.

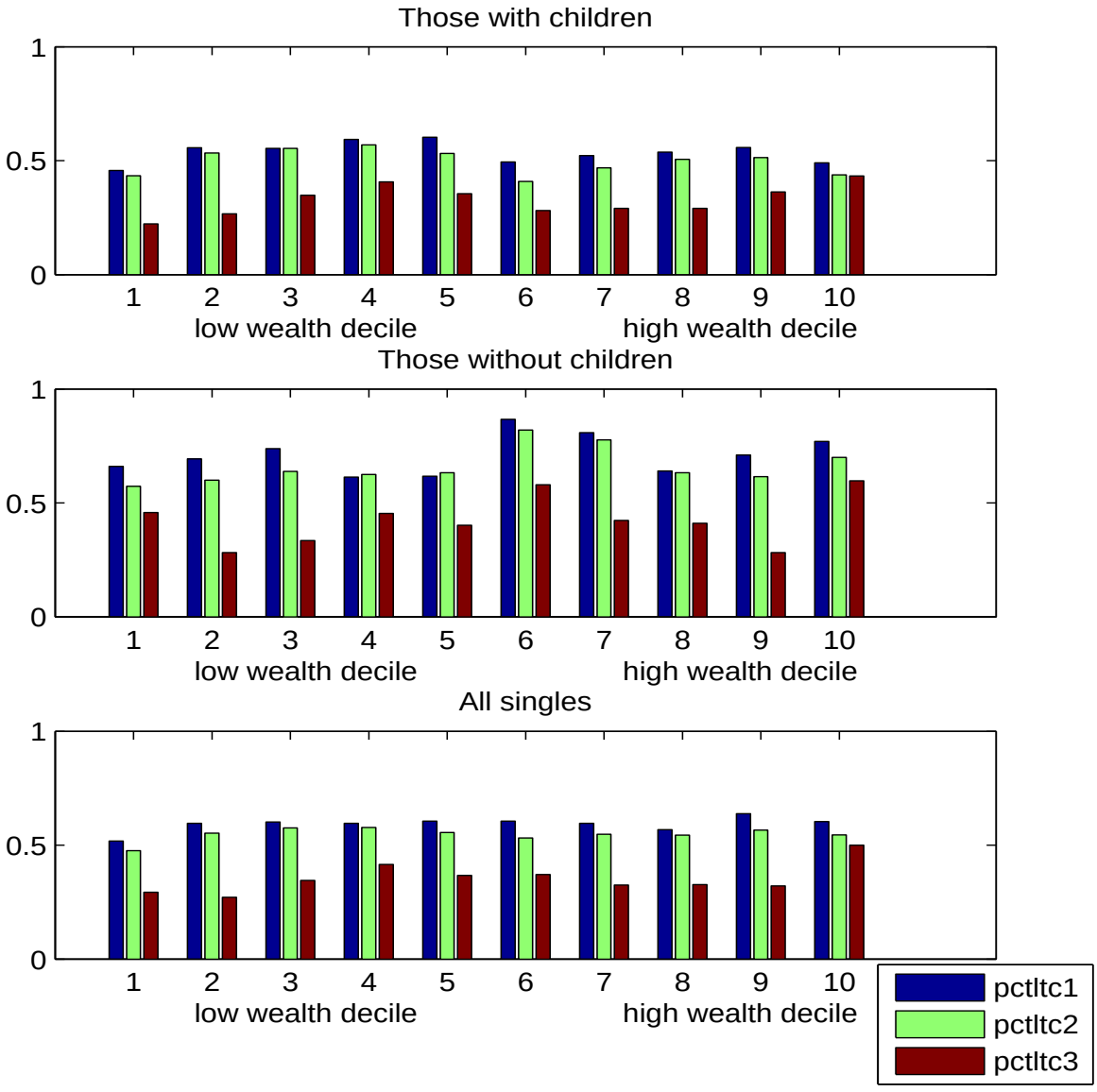

Figure 10: Estimating Motives in the Cross-Section of Respondents

The distribution of individual specific parameter estimates based on responses to the two survey questions and the combination. The top left panel combines data on consumption with the end-of-life question. The top right panel combines data on consumption with the $250K lock box question. The bottom left panel combines data on consumption with both strategic survey questions. The legend is explained in the bottom right panel. Circles (in blue) represent point estimates of the parameters for respondents who did not choose either of the two extreme responses. Arrows indicate that respondent did choose one of the extreme responses. These are corner solutions from which we can only conclude that the parameters lie to the right (in green) or left (in red) of the point along the iso-consumption curve. The estimates are for 268 single respondents.

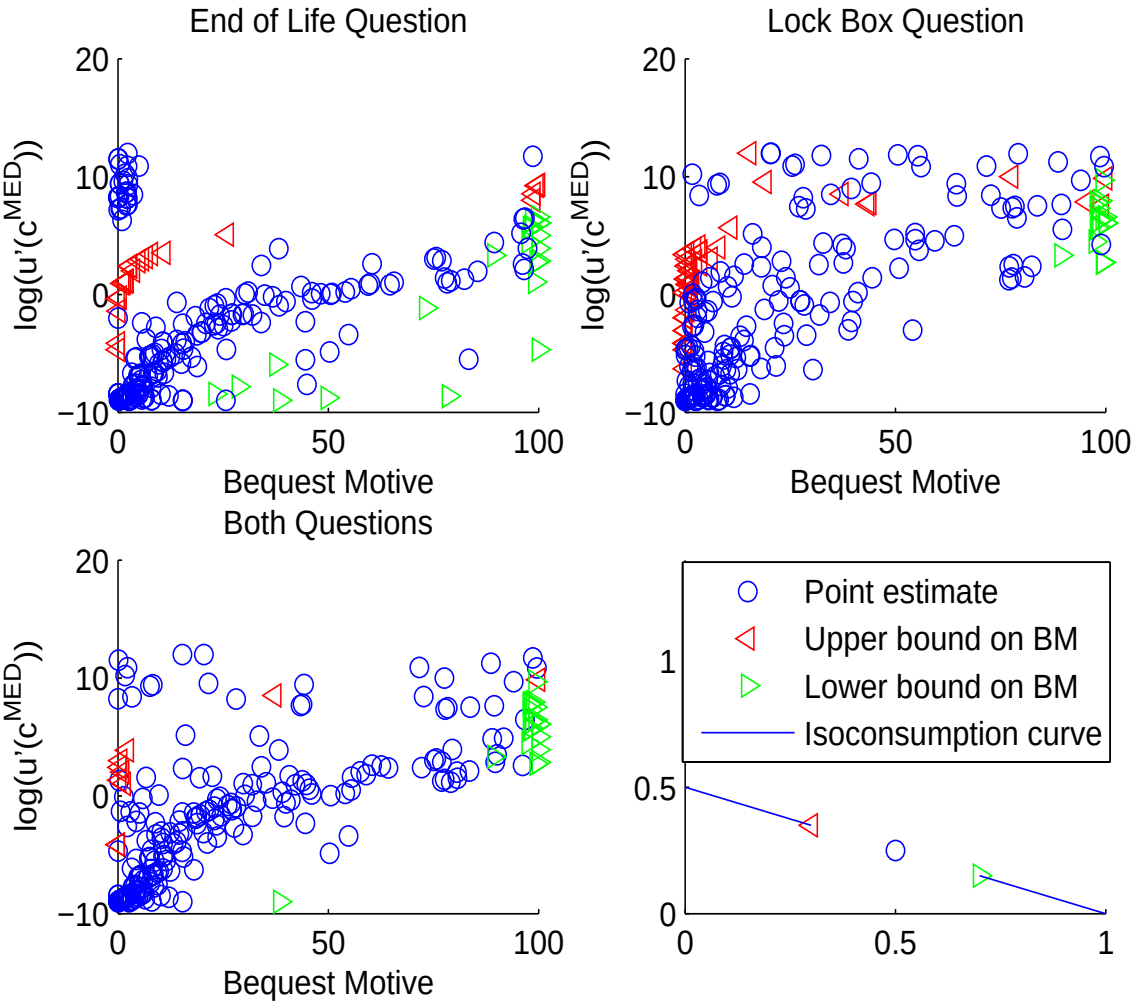

Figure 11: Comparing Survey Questions

The convention of circles and arrows is the same as in the previous figure. When arrows that point towards the 45 degree line, the two estimates are consistent. If the arrow points away, they are not. The estimates are for 268 single respondents.

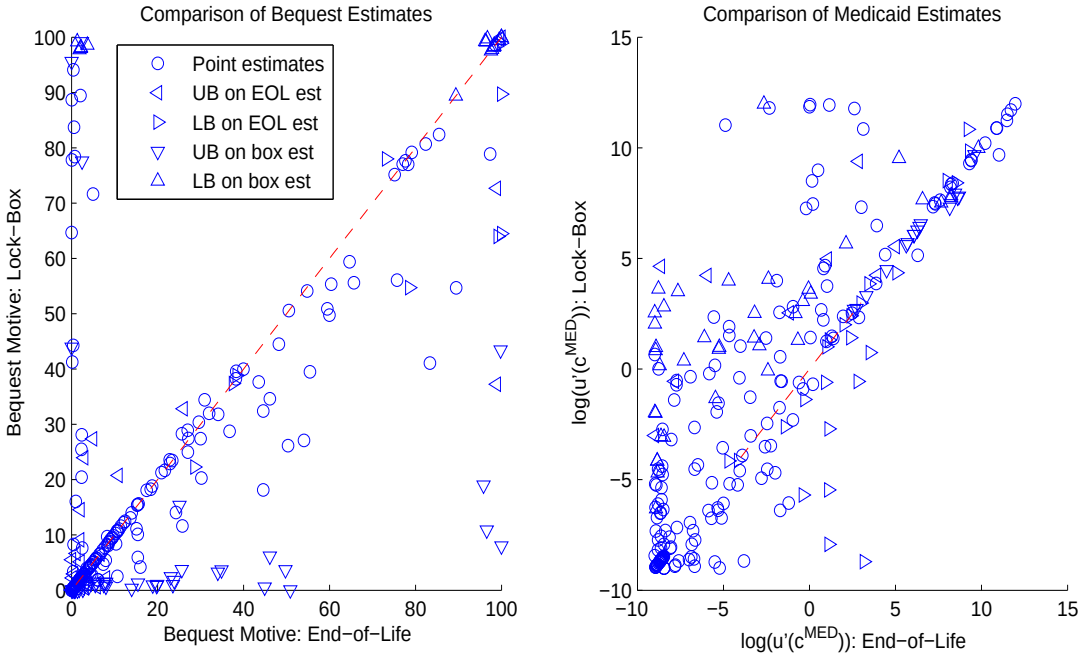

Figure 12: Cumulative Distribution Function of Bequest Motive Estimates

This figure shows two empirical cumulative distribution functions for ϖ. The dashed red line refers to the lowest values of the bequest motive consistent with the consumption data alone. The solid blue line shows the distribution of estimates from combining consumption data with both strategic survey responses. The estimates are for 268 single respondents.

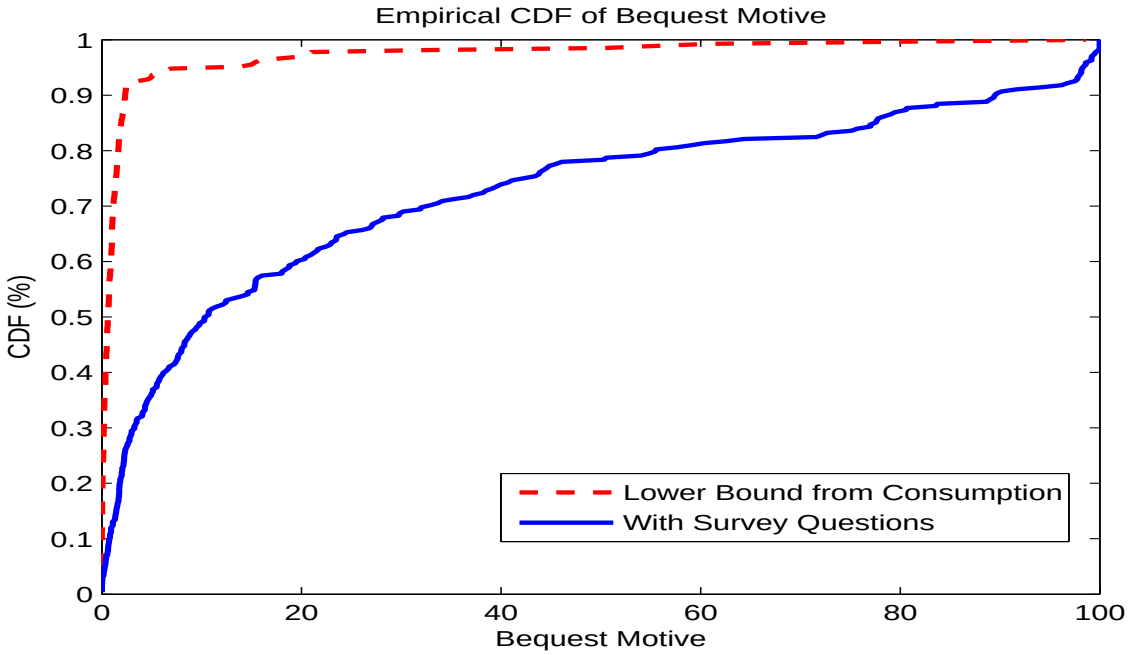

Figure 13: Cumulative Distribution Function of Medicaid Aversion Estimates

This figure shows the empirical cumulative distribution functions for c^{MED}. The solid blue line shows the distribution of estimates from combining consumption data with both strategic survey responses. The estimates are for 268 single respondents.