

# Illiquid Housing as Self-Insurance: The Case of Long-Term Care

Thomas Davidoff  
Haas School of Business, UC Berkeley

January 9, 2008

## Abstract

Long-term care is one of the few observable triggers for home sale among the elderly. Combined with a thin reverse mortgage market, this helps rationalize weak demand for long-term care insurance (LTCI). Home equity tapped in the event of long-term care reduces the gain to insurance transfers from healthy states, in which home equity typically goes unspent. The Health and Retirement Study provides empirical evidence supporting this mechanism. Households exposed to large increases in home equity in the recent housing boom were relatively unlikely to add LTCI coverage and relatively likely to drop coverage.

## 1 Introduction

The risk of large medical expense associated with long-term care is widely viewed as an important driver of the financial behavior of the elderly. Out of pocket long-term care expenses in the US can easily rise to \$50,000 per year, a large amount relative to typical wealth levels among the elderly. This risk has been cited as a cause both for puzzlingly weak demand for illiquid annuities and for slow disposal of liquid assets among the elderly.<sup>1</sup>

Given these large potential expenses and collateral disruptions to consumption smoothing associated with long-term care, one might expect to see a large market for private long-term

---

<sup>1</sup>See, for example, Turra and Mitchell (2004) and De Nardi et al. (2006).

care insurance (LTCI). The US private market, however, remains small. In recent waves of the Health and Retirement Study (HRS), for example, only approximately 10% of individuals close to or above retirement age held LTCI policies.

The most prominent explanations for the smallness of the market for LTCI relate to market failure and government intervention. As with most insurance markets, there may be adverse selection and moral hazard: those with greater risk of long-term care need may be those who choose coverage, and those covered may use more care and undertake less prevention. However, Finkelstein and McGarry (2003) show that on average, those who take on LTCI do not use long-term care more than those who do not have private coverage, and cite favorable selection on risk aversion as a reason.

A second explanation for the US LTCI market's smallness is the presence of Medicaid insurance for long-term care. Households who spend down their non-housing savings become eligible for publicly provided care through Medicaid. Thus in the absence of a bequest motive, and anticipating little probability of survival following long-term care, it may be rational not to pay for insurance that essentially transfers assets to one's estate. This argument, put forward by Pauly (1990) has been shown to justify absence of coverage up to a high wealth level by Brown and Finkelstein (2007).

The Medicaid explanation surely has considerable merit, as LTCI coverage is sharply rising in income and wealth. At high wealth and income levels, though, running down assets to qualify for Medicaid is difficult and would seem an unappealing prospect. However, in the HRS, coverage even at the highest wealth and income percentiles is below 40%. The quality of care that Medicaid will cover is lower than wealthy individuals may be willing to tolerate, and Ameriks et al. (2007) present survey evidence suggesting that the elderly are highly motivated to avoid lower quality care in the event of illness.

This paper offers a rationalization for weak LTCI demand that relates to the puzzling thinness of another old-age actuarial market: that for reverse mortgages. A very large fraction of older Americans own homes with minimal mortgage debt. Fewer than one-third

of retired homeowners in the HRS owe any mortgage debt, and the mean equity to home value ratio in this group was 89% in 2004. The elderly rarely cash out home equity except for in ill health (see, e.g. Venti and Wise (2000)). With home equity untapped while healthy but spent when in long-term care, it is plausible that the marginal utility of cash while in long-term care may not be much greater than the marginal utility of cash while at home. In this case, even fairly priced LTCI need not be appealing to consumers who seek to smooth consumption across states of nature.

That a high marginal utility of wealth while healthy and still at home might help explain absence of demand for smoothing medical expenses invites a question: why is home equity borrowing itself so limited? As with LTCI, moral hazard and adverse selection on the dimensions of home maintenance and length of stay at home have been put forward as explanations, but the actuarial performance of reverse mortgages in the US has been very strong to date.<sup>2</sup> The pricing of reverse mortgages suggests that there is a fear of poor actuarial performance in the event of weak home price appreciation, but because modern reverse mortgages have almost all been under contract in a period of rapid price appreciation, it is difficult to form an expectation of future losses based on past performance. For purposes of this paper, I take the thinness of the reverse mortgage market, and the absence of a variety of fractional ownership contracts, as given. A companion paper, Davidoff (2007), considers the involved demand interactions among annuities, LTCI, and home equity borrowing.

The home equity rationalization of weak LTCI demand is consistent with other analyses of how the illiquidity of housing wealth affects risk attitudes. Chetty and Szeidl (2007) demonstrate that, in general, if housing is adjusted upward or downward only when large gains or losses occur, then kinks in indirect utility occur, consumers will not exhibit global risk aversion, and they may be more averse to moderate risks than large risks. Shore and Sinai (2005) show that couples who face particularly wide variance in unemployment shocks (through sharing an occupation) purchase larger homes than couples facing less variance

---

<sup>2</sup>See Davidoff and Welke (2006) for a longer discussion.

in unemployment outcomes. Shore and Sinai take this fact as evidence that cashing out otherwise illiquid home equity acts as a form of insurance against major risks.

Section 2 of this paper presents a simple model that illustrates how home equity liquidated only in the presence of medical shocks can crowd out demand for long-term care. Section 3 provides evidence that home equity really does attenuate demand for LTCI. Using HRS data, I find that households exposed to large potential increases in home value between 1998 and 2004 were relatively unlikely to add LTCI over this period and were relatively likely to drop insurance. The structure of the HRS (including restricted geographic data) allows me to use a sort of “triple difference.” I compare the difference in LTCI changes between households who rented homes in 1998 to those who owned their homes in 1998. I find that homeownership was associated with the most negative relative changes in coverage in metropolitan areas with relatively large rates of home price growth.

If a causal role is to be assigned to self-insurance through home equity in reducing LTCI demand, consideration of Medicaid’s role is critical. Medicaid’s treatment of home equity is complicated and varies across states as well as across time within states. In general, Medicaid allows spouses and qualified relative caretakers of institutionalized homeowners to retain home equity at least up to death, and some states allow the home to be passed on as part of an estate. By contrast, Medicaid recipients are allowed to retain very little non-housing wealth or income.<sup>3</sup> Medicaid thus receives considerable attention in both Sections 2 and 3. Because home equity may make both self-insurance and Medicaid relatively more attractive than private insurance, the empirical task is to determine if home equity has a negative effect on LTCI demand even among groups unlikely to find Medicaid appealing.

---

<sup>3</sup>These issues are taken up in some detail in Thompson/Medstat (2005).

## 2 Home Equity and Long-Term Care Insurance Demand in Theory

Consider a retiree who derives utility from consumption of housing and a composite other good in a single future period. This consumer's non-housing income and savings sum to  $w$  and she may own a home of quality  $h$ . Taking the absence of home equity borrowing among the elderly to an extreme, for homeowners,  $h$  is equal to housing consumption, and  $hp$  is equal to home equity, where  $p$  is a market price per unit of housing quality that is exogenously given to consumers. A renter with non-housing wealth  $w$  allocates this amount optimally between rental housing and the other good given the problem's parameters.

For homeowners, the only way to spend any of the  $hp$  in home equity is to sell the home, but selling generates so much disutility that homeowners only sell when hit with an adverse health shock that requires long-term care.<sup>4</sup> The health shock may trigger sale due both to the financial burden and loss of self-sufficiency associated with illness.

After wealth, housing owned, and home prices are determined, but before uncertainty over health is played out, the consumer decides on an optimal level  $t$  of private LTCI coverage. Each unit of insurance converts  $\pi$  units of non-housing wealth from the healthy state into one unit of non-housing wealth in the long-term care state.

Homeowners enjoy utility  $u(w - t\pi, h, 1)$  if healthy, with  $u_1 > 0$ ,  $u_{11} < 0$ ,  $u_2 > 0$ , and  $u_{22} < 0$ . A critical derivative that is unsigned by primitives is  $u_{12}$ . Healthy renters enjoy utility  $u(w - t\pi, p, 0)$ .  $u$  is a direct utility function for owners and an indirect utility function for renters (the third argument shapes the derivatives of  $u$  with respect to the first two arguments). The signs and magnitudes of  $u_2$  and  $u_{12}$  for renters are not easy to think about: a change in home prices may reflect only a change in discount rates, rather than rents, as seemed to be the case for much of the period 1998-2004 considered below. Himmelberg et al. (2005) discuss the celebrated gap between the growth of prices and rents over this period.

---

<sup>4</sup>Owners do "spend" some of the home equity in the sense that utility is increasing in housing consumption. However, the present value of implicit rent while the consumer is alive is less than the value of the home.

In the event of sickness, the consumer may be covered by Medicaid. This results in a particular level of care, and utility  $z(w + t, hp) + m$ . The marginal utility of non-housing wealth  $z_1$  is likely to be small or zero, since Medicaid requires that recipients spend down almost all non-housing wealth, leaving only a small monthly expenditure allowance. If  $z_1 > 0$ , then  $z_{11} < 0$ . I assume that the timing is such that wealth can be spent down quickly enough so that Medicaid is available at any wealth level.

Even if there is no consumption of the original home, or real estate in general, while in long term care, the marginal utility of non-housing wealth  $z_2$  is likely to be greater than  $z_1$ . This is because for married couples, non-institutionalized spouses and qualified caretaking relatives may be allowed to remain in the home until death. A lien is sometimes placed on proceeds from sale of the home, but the free rent up until sale has economic value, too. For renters, the second argument in  $z$  takes the value zero. Medicaid treatment of singles' homes is typically less generous. A special case subsumed in this formulation is that  $z$  takes as a single argument all wealth,  $w + t + hp$ . In any event, concavity of utility in wealth implies  $z_{12} < 0$ .

$m$  is an uninsurable continuous random variable, with c.d.f.  $F(m)$  and p.d.f.  $f(m)$ , realized if and when the health shock occurs, but before the choice of Medicaid or private care is made.  $m$  affects the consumers' taste for publicly available care, and is introduced to simplify the application of calculus to the comparative static effects of  $h$  and  $p$  on the optimal choice of  $t$ .

The alternative to Medicaid is private care, funded by a combination of liquid wealth, home equity, and private insurance proceeds. Assuming that the home is always sold (with no transaction costs) in the event of sickness without Medicaid, utility in the state of ill health without Medicaid can be written  $v(w + hp + t)$ . Naturally,  $v' > 0$  and  $v'' < 0$ . That housing prices affect  $z$  only through wealth implies a simplifying assumption that long-term care costs do not change with home prices.

Consumers who realize low values of  $m$  will be less likely to choose Medicaid. For given

$h$ ,  $w$ , and  $p$ , there is a critical level of tolerance for Medicaid-funded care,  $m^*$ , above which the consumer chooses Medicaid, and below which the consumer chooses private care:

$$m^* = v(w + hp + t) - z(w + t, hp). \quad (1)$$

Subsuming the probabilities of good and ill health in the subutility functions  $u$  and  $v$ , recognizing that  $h = 0$  for renters, and denoting by  $i$  an indicator for homeownership, expected utility  $U$  can be written:

$$U = u(w - t\pi, h + [1 - i]p, i) + F(m^*)v(w + hp + t) + [1 - F(m^*)]z(w + t, hp) + \int_{m^*}^{\infty} m dF(m). \quad (2)$$

The first order condition for insurance can be written:

$$-\pi u_1(w - t\pi, h + [1 - i]p, i) + F(m^*)v'(w + hp + t) + [1 - F(m^*)]z_1(w + t, hp) = 0. \quad (3)$$

Differentiating (3), we have the following comparative statics for owners:

$$\frac{dt}{dp} = -h \frac{F(m^*)v'' + [1 - F(m^*)]z_{12} + f(m^*)[v' - z_2][v' - z_1]}{\pi^2 u_{11} + F(m^*)v'' + [1 - F(m^*)]z_{11} + f(m^*)[v' - z_1]^2}, \quad (4)$$

$$\frac{dt}{dh} = -\frac{-\pi u_{12} + p[F(m^*)v'' + [1 - F(m^*)]z_{12} + f(m^*)[v' - z_2][v' - z_1]]}{\pi^2 u_{11} + F(m^*)v'' + [1 - F(m^*)]z_{11} + f(m^*)[v' - z_1]^2}. \quad (5)$$

We thus have:

**Result 1.** *If  $\frac{f(m^*)}{F(m^*)}$  is sufficiently small and either  $v$  is sufficiently risk averse or  $z_1 < v' < z_2$ , then an increase in  $p$  reduces owners' demand for insurance. If also  $u_{12}$  is not too negative, then an increase in  $h$  also reduces owners' demand for insurance.*

*Proof.* Follows from equations (4) and (5); the negativity of  $v''$ ,  $z_{12}$ ,  $u_{11}$ ; and weak negativity

of  $z_{11}$ . □

From the discussion above, the conditions in Result 1 for  $\frac{dt}{dp}$  and  $\frac{dt}{dh}$  to be negative are not terribly strong. The assumption that the hazard rate  $\frac{f(m^*)}{F(m^*)}$  is small guarantees that the consumer's problem is globally concave in insurance. Local convexity could arise because increasing insurance both makes private care more comfortable and increases the benefit of all spending on private care by raising the probability of private care.

Inspection of equation (4) suggests that the negative effect of a price increase on insurance demand will be greater in magnitude for those with greater housing wealth. This does not follow from easily signed primitives alone, however, because third derivatives of the utility functions with respect to wealth are presumably positive.

For renters, the effect of  $p$  on optimal choice of  $t$  is signed by  $-u_{12}(w, p, 0)$ . Under the reasonable assumption that the marginal utility of wealth increases with housing cost, we would not expect this effect to be positive. However, as discussed above, the relationship between price  $p$  and renters' cost of housing consumption is not clear, particularly over the period considered empirically below. Also, the rental cost of housing may affect long-term care prices. The net effect on renters' demand is thus ambiguous.

### **3 Home Equity and Long-Term Care Insurance Coverage in the Health and Retirement Study**

Theoretical considerations discussed in Section 2 suggest that older homeowners with higher quality homes conditional on price, and higher price homes conditional on quality, should have weaker demand for LTCI, all else equal. That analysis was for a continuous choice of LTCI coverage, here the focus is on a discrete choice of having any coverage or having no coverage.

The HRS is a natural data set with which to explore the relationship between home equity and LTCI coverage. The HRS reports panel data on older households over seven



waves. Starting with the fourth wave in 1998, several different cohorts have been pooled, so I use observations starting as early as 1998 and as late as the last available wave in 2004. In each wave, respondents are asked a large number of questions about their financial, health, and family characteristics, including whether or not they hold an insurance policy that covers long-term care. This LTCI may be employer-provided and only partly elective, a fact that should presumably only serve to attenuate any observed relationship between LTCI and home equity.<sup>5</sup>

### 3.1 Econometric Specification

With cross sectional data, it is easy to explore the relationship between home equity and LTCI coverage. An earlier version of this paper showed that in the 2004 wave of the HRS, LTCI coverage is decreasing in the ratio of housing wealth to other wealth. The negative relationship between the housing to wealth ratio and LTCI coverage in the cross section is no weaker at high wealth levels than at low wealth levels. This provides some comfort that it is not Medicaid’s friendly treatment of housing alone that drives the negative relationship. In terms of the discussion in Section 2, we expect the wealthy to have low values of  $\frac{f(m^*)}{F(m^*)}$ .

A problem with cross sectional evaluation of the relationship between LTCI and home equity is that both LTCI coverage and the ratio of housing to other wealth are nonlinearly related to wealth. Wealthier households have lower ratios of housing wealth to total wealth than other households in the HRS. The presence of polynomial terms in wealth thus reduces (but does not eliminate) the estimated magnitude of the negative cross sectional relationship between the housing to wealth ratio and LTCI coverage. A further problem is that home equity is partly a matter of choice for older homeowners, so that a variety of unobserved characteristics may simultaneously drive LTCI and home equity decisions. Coe (2007) provides a discussion and some evidence. For these reasons, the cross sectional results may be taken

---

<sup>5</sup>The question asked of respondents is: “Not including government programs, do you now have any insurance which specifically pays any part of long-term care, such as, personal or medical care in the home or in a nursing home?”

as suggestive of the mechanism proposed here operating, but not as conclusive evidence.

The panel nature of the HRS allows estimation of the relationship between changes in LTCI coverage and changes in home equity. Changes in home equity come from four major sources: exogenous changes in the market value of consumers' homes, home maintenance and improvement, changes to mortgage debt, and housing sales and purchases. If change in home equity is measured as the realized difference in home equity between two waves of a panel, then all of the identification problems associated with cross sectional analysis, and more, will arise in the panel specification. The identification problem is worse in the panel than in the cross section in that the older subjects of the HRS have typically lived in their homes for a long time. Given the general reluctance on the part of the elderly to tap home equity, the cross sectional levels of home equity may be shaped largely by past decisions that were unlikely affected by LTCI considerations. A larger fraction of wave-to-wave variation in individual housing wealth may be determined by mortgage, home maintenance, and mobility choices made at a time of life when LTCI may be central to decision making.

Fortunately for identification purposes, households were exposed to a wide range of plausibly exogenous market changes to home values during the period 1998 to 2004. During this period, homeowners in metropolitan areas with rapidly increasing prices had the potential for much greater increases in home equity than homeowners in metropolitan areas with weaker price appreciation. For example, over these years, the federal Office of Federal Housing Enterprise Oversight (OFHEO) estimates based on repeated sales that home prices in the San Diego, California, metropolitan area more than doubled, whereas prices in Provo, Utah, increased by less than 15 percent.

Given Result 1, a natural conjecture is that conditional on a range of covariates, LTCI coverage for homeowners should have increased less (or decreased more) in metropolitan areas like San Diego than in areas like Provo. This suggests a simple exploration of the relationship between changes in metropolitan level home price changes and changes in homeowner LTCI coverage.

An obvious objection to this means of verifying whether the home equity crowd out explanation for low LTCI coverage has merit is this: changes in metropolitan area home prices might be associated with changes in LTCI coverage through other characteristics of metropolitan areas or their older residents that happen to be correlated with home price changes. For example, wealthier areas with more educated citizens generally saw greater price increases. Given the normality of LTCI coverage, this might lead to an upward biased estimate of the effect of home price increases on demand for LTCI.

The absence of a clear theoretical effect of home *price* increases on insurance demand among renters presents a clear opportunity for improved identification of a crowd-out role for home equity. Many confounding factors can be eliminated by evaluating the “triple difference” in:

1. changes in LTCI coverage between 1998 and 2004,
2. between owners and renters,
3. across metropolitan areas with different realized price appreciation.

With this “triple difference” approach, the common effect of home price appreciation on all retirees can be controlled for in evaluating the effect of appreciation on owners’ LTCI demand. Likewise the fact that renters have lower levels and growth of LTCI in general than homeowners can be controlled for.

The main equation to be estimated is:

$$\Delta LTCI_i = f(\beta_0 + \beta_1 H_i + \beta_2 g_m + \beta_3 H_i g_m + \epsilon_i). \quad (6)$$

In equation (6),  $H_i$  indicates whether or not individual  $i$  owns their home, and  $g_m$  is the rate of home price appreciation in the metropolitan area  $m$  in which  $i$  lives.  $\beta_3$  is coefficient of interest, and measures the extent to which homeownership has a more negative effect on changes in LTCI coverage where price appreciation is greater. Confidential HRS data, to

which I was granted access, includes a report of each respondent’s 1998 county of residence. Metropolitan areas (and states) are uniquely identified by this county. OFHEO produces estimates of quarterly home price changes based on repeated transactions at the state and metropolitan level. I drop non-metropolitan observations from the analysis.  $g_m$  is determined by a merge of the microdata from HRS with the OFHEO macro data.

In the HRS, we observe an indicator variable for LTCI coverage. There are two ways that this indicator can change, and two ways in which the indicator can fail to change. The ordinal variable  $\Delta LTCI_i$  takes the value -1 if an individual reports LTCI coverage in 1998 but reports no coverage in 2004.  $\Delta LTCI_i$  is set to one if  $i$  reports no coverage in 1998 but reports coverage in 2004.  $\Delta LTCI_i$  is set to zero if  $i$  reports coverage in both 1998 and 2004 or in neither 1998 nor 2004. With this ordinal ranking, a natural way to estimate equation (6) is an ordered probit.

An important identification question is whether there are explanations for renters having disproportionately high demand for LTCI in areas with rapidly increasing prices, other than home equity as self-insurance. It is not obvious what such reasons might be, but the possibility is readily addressed. Characteristics that are likely associated with both rental status and LTCI demand, such as household size, income, assets, education, and health can be included both as direct controls and interacted with  $g_m$ . Finding that the presence of these controls does not significantly reduce the estimated coefficient on the interaction  $\beta_3$  provides comfort that the estimated relationship is not spurious.

Friendly Medicaid treatment of home equity under time- and state-varying regulations presents an important challenge to identification of a home equity crowd-out of LTCI demand. A first concern is that an interaction between homeownership and state appreciation rates might relate to the extent or growth of state Medicaid preferences for home equity. These differences across states would likely generate a relationship between changes in LTCI and the interaction  $Hg_m$ . A simple way to address this possibility is to directly include the level  $g_s$  of state-level OFHEO-estimated appreciation and the interaction  $Hg_s$  of homeown-

ership status and state-level appreciation. This is feasible because there are typically parts of multiple metropolitan areas within states.<sup>6</sup>

A further robustness check on the results is to ask whether a negative relationship between LTCI and homeowners' exposure to home price growth extends to groups unlikely to face temptation by Medicaid's treatment of home equity. Two groups to consider are: the wealthy, who should find unattractive the diminution of assets and possibly poor quality of care required for Medicaid coverage, and unmarried individuals, who receive no benefit from Medicaid's general allowance of spouses to retain home equity. Since children and siblings residing with singles may also gain home equity benefits, and because long-term care patients on Medicaid in some cases are able to retain home equity, the restriction of the analysis to the wealthy may be of greater interest.

Generalizing equation (6), I present results of ordered probits with some or all of the following right hand side terms:

$$\Delta LTCI_i = f(\beta_0 + \beta_1 H_i + \beta_2 g_m + \beta_3 H_i g_m + x_i \gamma_0 + g_m x_{i1} \gamma_1 + \gamma_2 g_s + \gamma_3 g_s H_i + \epsilon_i). \quad (7)$$

The ordered probit procedure estimates underlying demand for insurance as the linear function within  $f$  on the right hand side of (7).

An alternative way of classifying changes to LTCI is to consider the changes of adding or dropping coverage separately. In Table 3, I report the estimated effect of right hand side variables on indicators for adding or dropping coverage between 1998 and 2004. In these cases, I estimate a linear probability models. While these separate analyses throw away data, the coefficient estimates are somewhat more readily interpreted than the coefficients in the ordered probit, which describe the effects of variables on an estimated latent demand for coverage. Given the infrequency of LTCI changes and the importance of dynamic portfolio considerations, in no event do I attempt to uncover underlying preference parameters. Fi-

---

<sup>6</sup>Standard errors become very large if  $g_s$  is replaced with a state fixed effect in this control strategy.

nally, I limit the sample to older individuals living in metropolitan areas for which OFHEO estimates a home price index.

### 3.2 HRS Data

The HRS distributions of the main variables of interest as well as the controls for 1998 characteristics  $x$  that are included in different specifications of equation (7) are summarized in Table 1. The controls  $x$  are: age, sex, marital status, household income, household total wealth, number of children, years of education, and indicators for race and Hispanic status. Dollar values are divided by 100,000. Also included are three measures of health used in Finkelstein and McGarry (2003): number of drinks per day, an indicator for smoking, and the score on a Center for Epidemiologic Studies Depression scale. I do not include a test of cognition because of a very large number of missing values in 1998 for this test. All control values are 1998 levels. 2004 factors only in the changes in LTCI coverage and the OFHEO estimated home appreciation rates. I suppress the estimated effects of the financial, demographic, and health controls and their interactions with  $g_m$  in the tables.

I exclude a large number of individuals from the estimation for a variety of reasons. First, I exclude the approximately 12% of individuals reporting any limitations in “Activities of Daily Living” or “Instrumental Activities of Daily Living”, as these households are particularly likely to have made housing decisions that reflect an imminent need for care. For similar reasons, I exclude the small number of households that were in long-term care as of 1998. To avoid any relationship between increasing home prices and increasing labor income or expectations of future labor income, I confine the analysis to individuals who were retired and either single or whose spouse was not working in 1998.

I count individuals in the same household as separate observations, because there are many households in which spouses report different coverage levels. This may reflect measurement error (note the high frequency of dropping LTCI). I do not cluster standard errors at the household level because it is appropriate to cluster at the metropolitan area level, and

Table 1: Summary Statistics

Variable (symbol)	Obs	Mean	Std. Dev.	Min	Max
Home value	2,823	.95	.84	0	7
Own home ( $H$ )	2,823	.86	.34	0	1
Metropolitan appreciation 1998-2004 ( $g_m$ )	2,823	1.45	.22	1.14	2.27
$g_s$	2,823	1.49	.22	1.21	1.95
$\Delta$ LTCI	2,823	.024	.33	-1	1
Add LTCI	2,493	.08	.27	0	1
Drop LTCI	330	.37	.48	0	1
Total assets	2,823	3.15	4.51	-1.73	43.92
Household Income	2,823	.40	.59	0	13.68
Age	2,823	71.40	6.18	62	92
Married?	2,823	.65	.48	0	1
No. Children	2,753	3.29	2.10	0	13
Yrs. Education	2,816	12.05	3.20	0	17
Female	2,823	.59	.49	0	1
Depression measure	2,693	1.22	1.63	0	8
Categorical self-assessment of health	2,823	2.66	1.013	1	5
Drinks per day	2,823	1.24	2.26	0	7
Smoke?	2,823	.10	.31	0	1

Data is from the RAND HRS panel, with raw HRS contributions for medical factors. Home price appreciation estimates are OFHEO estimates of a price index for first quarter 2004 divided by the estimate for first quarter 1998. These estimates are matched to individuals by a merge of confidential HRS geographic data with the OFHEO estimates by metropolitan area and state.

the household is subsumed within a metropolitan area. Similar results obtain when only one member of each household is counted. Standard errors are clustered at the metropolitan level throughout, because  $g_m$  takes on only one value per metropolitan area, and the interaction  $Hg_m$  takes on only two.

### 3.3 Results

Table 2 presents ordered probit estimates of equations (6) and (7). The first column presents an estimate of equation (6), with only three right hand side variables. We find that home ownership and growth of housing prices are significantly associated with increased LTCI coverage. However, homeownership is significantly more negatively associated with demand

for increases in LTCI where home prices are increasing ( $g_m$  is large), just as the theory suggests. The interpretation of the coefficient is that an additional 100% appreciation of prices between 1998 and 2004 is associated with a reduction in the difference between renters' and homeowners' underlying demand for LTCI coverage changes by -1.22 units. Some understanding of the units of this latent demand can be obtained from the "cut points" below which and above which consumers with zero idiosyncratic deviation from predicted values are estimated to wish to drop and add coverage. These points are at -.11 (below which coverage is predicted to be dropped) and 3.11 (above which coverage is predicted to be added).

The second column of Table (7) adds the level of state price appreciation and its interaction with the homeownership indicator. We find that there is a more negative relative effect of home price appreciation on the underlying latent demand for change in LTCI coverage for owners in this specification, although we cannot reject an identical effect as without the additional control. There is no significant effect of either statewide appreciation or its interaction with homeownership.

Adding a full set of controls  $x$  in column (3), we find again no significant difference in the coefficient of interest  $\beta_3$  (and the distance between cut points is approximately constant). Remarkably, almost none of the estimated coefficients on the controls or their interactions are significantly different from zero. The sole exceptions are drinks per day (negative) and its interaction with home price appreciation (positive).

Specifications (4) and (5) confine the analysis to groups of retirees that may be considered unlikely to take on Medicaid: the wealthy and the unmarried. Because these are small samples, for these groups I drop the controls and their interactions with local growth to keep standard errors reasonable. Specification (4) repeats the analysis of specification (1), but confines the analysis to households with incomes and total wealth (housing plus non-housing) greater than the sample medians. We find that there is, indeed, a more negative effect of homeownership on LTCI changes in markets with more rapidly appreciating prices among the wealthy and high income. Because Medicaid take-up is highly concentrated at the



bottom of the income and wealth distributions, this result suggests that Medicaid's friendly treatment of home equity is not the major reason for the home price appreciation results of interest. The coefficient on the interaction of the ownership indicator and appreciation is larger than in the prior specifications with a similar spread between cutoff points, but the difference is not statistically significant.

Specification (5) of Table 2 restricts the sample to individuals who were not married as of the 1998 survey. In this subsample, there is a much weaker differential effect of home price appreciation for homeowners, and the coefficient on the interaction between ownership and price appreciation is indistinguishable from zero. In that being married may make Medicaid's treatment of home equity relatively friendly, this finding leaves open the possibility of a dominant role for Medicaid in explaining the results found in specifications (1) through (3). This, of course, stands in contrast to the results from the sample restriction to the wealthy.

Specifications (6) and (7) of Table 2 restrict the analysis to renters and homeowners, respectively. In this case, there is no need to interact control variables with state or local home price appreciation or to include homeownership as a right hand side variable. In column (6), we find that renters' demand for increasing (and not decreasing) coverage is significantly positively associated with increasing home prices. In column (7) we find a significant negative effect among owners.

That renters are significantly more likely to add and not drop coverage in metropolitan areas with rapidly increasing home prices does not follow trivially from the discussion in Section 2. However, as noted above, many confounding factors could give rise to such a result, which makes the "triple difference" setup of columns (1) through (5) appealing. One plausible explanation for renters' demand increasing with price appreciation is that the cost of care rises dramatically with home prices. Genworth Financial (2007) finds a high correlation between urbanization and health care costs; and recent home price appreciation is highly correlated with urbanization. Average annual costs in the New York City area are \$136,000, while in non-urban parts of New York State, annual costs are \$87,000. The

analysis for homeowners is fundamentally unchanged if price is a separate argument in utility under LTCI.

Table 3 presents linear probability estimates of the one-directional interactive effects of homeownership and price appreciation on adding LTCI coverage (odd columns) and dropping LTCI coverage (even columns). Because the coefficient of interest  $\beta_3$  is unaffected by the presence of controls in Table 2, they are dropped in Table 3. The first two columns report results from the full sample. We find that the homeownership-price interaction has the predicted effects in both directions, with both effects significantly different from zero. Interpreting the coefficient of interest in column (1), we find that increasing home prices by 100% in a metropolitan area would lead renters to be 17 percentage points likelier to add coverage than homeowners, relative to owners' and renters mean propensities. However, interpreting the direct effects  $g_m$  and the Own indicator, with average appreciation, owners are 29% likelier to add coverage, and increasing home prices by 100% is associated with a 12% increase in coverage for the full sample. The magnitudes of all these effects work in the same way (with opposite sign) on the choice of dropping coverage in specification (2) of Table 3.

In column (3) of Table 3, we find that all of the effects found in column (1) are exaggerated among the wealthy and high income. That is, the effect of home price increases on adding LTCI is more relatively negative for wealthy and high income homeowners compared to wealthy and high income renters than for all homeowners relative to all renters. However, in the small (181 consumer) sample of wealthy consumers who had coverage in 1998, we find in column (4) that home price appreciation was associated with a smaller and insignificant relative increase in the propensity to drop coverage among homeowners.

Not surprisingly in light of the results in Table 2, we find small and insignificant relative differences in the propensity to add and drop coverage with home price appreciation when the sample is restricted to unmarried individuals in specifications (5) and (6) of Table 3. The number of single retirees who held coverage in 1998 is only 86.

Table 2: Ordered probit estimation of the effect of exposure to home price changes on changes in LTCI takeup, 1998 to 2004

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$g_m$ (metropolitan growth)	0.984 (0.256)**	1.399 (0.442)**	-0.022 (2.489)	1.861 (0.915)*	0.501 (0.383)	1.324 (0.627)*	-0.540 (0.249)*
Own	1.978 (0.553)**	1.776 (0.557)**	1.265 (0.708)	3.565 (1.416)*	0.554 (0.879)		
Own $\times g_m$	-1.220 (0.369)**	-1.887 (0.580)**	-1.584 (0.704)*	-2.181 (0.958)*	-0.263 (0.579)		
$g_s$		-0.488 (0.429)	-0.407 (0.538)			-0.596 (0.607)	0.348 (0.231)
Own $\times g_s$		0.784 (0.538)	0.758 (0.631)				
Observations	2,823	2,823	2,622	1,060	984	355	2,267
Controls	No	No	Yes	No	No	Yes	Yes
Controls $\times g_m$	No	No	Yes	No	No	No	No
Lower cut pt.	-1.11 (.38)	-2.24 (.39)	-3.37 (-1.10)	1.28 (1.33)	-.88 (.57)	.30 (1.18)	-3.38 (.62)
Upper cut pt.	3.11 (.39)	2.99 (.40)	-1.1 (3.69)	4.35 (1.34)	2.53 (2.54)	3.93 (1.19)	-.15 (.61)
Subset	Full	Full	Full	“Rich”	Single	Rent	Own

Robust standard errors clustered at the metropolitan area level in parentheses, \* significant at 5%; \*\* significant at 1%. Controls are those summarized in Table 1 as well as unreported indicators for race and Hispanic status. The dependent variable is set equal to -1 if LTCI coverage is present in 1998 but not in 2004, 1 if there is no coverage in 1998 but yes coverage in 2004, and 0 if coverage is the same in 2004 as in 1998. The lower cut point is the estimated value of the sum of characteristics times coefficients at which an individual with zero idiosyncratic error would be indifferent between dropping or retaining coverage. The upper cut point is the value at which such an individual would be indifferent between continuing with no coverage or adding coverage. The “Full” sample includes only healthy retirees (see text). Column (4) is confined to households with both income and wealth above the full sample median. Column (5) is confined to unmarried individuals. Column (6) is confined to renters and column (7) to owners.

Table 3: Linear probability OLS regressions of the effect of home price changes on adding or dropping LTCI coverage between 1998 and 2004

	(1)	(2)	(3)	(4)	(5)	(6)
	Add	Drop	Add	Drop	Add	Drop
$g_m$	0.118 (0.059)*	-0.618 (0.278)*	0.844 (0.282)**	-0.362 (0.380)	0.009 (0.058)	-0.460 (0.508)
Own	0.291 (0.103)**	-1.253 (0.453)**	1.379 (0.379)**	-0.769 (0.690)	0.081 (0.099)	0.254 (0.748)
Own $\times g_m$	-0.171 (0.071)*	0.720 (0.313)*	-0.956 (0.285)**	0.371 (0.402)	-0.033 (0.066)	-0.236 (0.533)
Constant	-0.130 (0.084)	1.455 (0.402)**	-1.089 (0.370)**	0.954 (0.653)	0.014 (0.085)	1.214 (0.712)
Observations	2,493	330	873	187	898	86
R-squared	0.01	0.03	0.02	0.02	0.01	0.10
Controls	No	No	No	No	No	No
Subset	Full	Full	Rich	Rich	Single	Single

See notes to Table 2. Odd columns are linear probability estimates of the effect of OFHEO-estimated metropolitan area appreciation rate and its interaction with homeownership on an indicator for adding LTCI coverage between 1998 and 2004. Even columns have dropping coverage as the dependent variable. Samples are larger in the Add columns because a minority of HRS retirees have LTCI coverage.

## 4 Conclusion

The widespread absence of insurance against long-term care expenses, arguably the most important financial risk facing the elderly, has attracted considerable attention from economists. This paper links weak demand for LTCI to another puzzlingly thin market: that for home equity borrowing among the elderly. Given the dominant role of home equity in the portfolios of older Americans, and the well-documented correlation between home equity extraction and poor health, home equity as self-insurance presents a plausibly rational explanation for low LTCI demand.

HRS data lend credence to the view that home equity crowds out long-term care insurance. Metropolitan area home price appreciation between 1998 and 2004 was associated with homeowners being less likely to add LTCI and more likely to drop coverage. Just the opposite pattern arose among renters. This phenomenon can not be explained by any correlation between state level changes in policy or other supply or demand factors and changes in state

level prices. Moreover, including controls for the interaction between local home price appreciation and characteristics correlated with rental status does not significantly reduce the estimated differential effect of home price appreciation on changes in LTCI coverage between homeowners and renters. Almost none of these characteristics themselves are significantly associated with change in LTCI status.

The empirical results and their robustness to natural checks suggest that home equity does, in fact, crowd out LTCI. An insidious identification problem is that Medicaid treats home equity in a friendlier way than other assets. Theoretically, home equity, holding other characteristics constant may make private LTCI more or less attractive than Medicaid, but no effect would be knife-edge case. We find that there are mixed results when the HRS retiree sample is confined to groups that are relatively unlikely to find Medicaid's treatment of home equity appealing. Homeowners and renters who are wealthy and high income exhibit the same comparative patterns as less wealthy households, but to greater extent. However, singles, who have somewhat less opportunity to pass on their home to loved ones under Medicaid, do not exhibit the same pattern.

In the narrow context of the LTCI industry, the results suggest that expanding demand for LTCI may require simultaneously expanding demand for home equity extraction among the elderly, an idea that has been put forward by Ahlstrom et al. (2004) and others. Eliminating Medicaid coverage of long-term care might well fail to spur demand for private LTCI, as lower wealth households have particularly large home equity shares of wealth. While an expansion of home equity borrowing among the elderly should expand the appeal of LTCI, the marketing of a bundled product (or one combined also with standard annuities) would be complicated by multi-dimensional selection and moral hazard problems.

More broadly, we find new evidence that the elderly do not treat home equity and more liquid assets as perfect substitutes in financial decisions. Moreover, the results illustrate how the illiquidity of housing can affect attitudes towards risk in general. The results in this paper can be seen as part of a nascent literature (along with Chetty and Szeidl (2007)

and Shore and Sinai (2005)) that shows how kinks in indirect utility around the point at which homes are sold can reduce aversion to important risks. Finally, the surprising fact that renters tend to add coverage in areas with rapidly appreciating prices suggests that the correlation between long term care costs and home prices may play a role in the portfolio choices of the elderly.

## References

- Alexis Ahlstrom, Anne Tumlinson, and Jeanne Lambrew. Linking reverse mortgages and long-term care insurance. Technical report, The Brookings Institution and George Washington University, 2004.
- John Ameriks, Andrew Caplin, Steven Laufer, and Stijn Van Nieuwerburgh. Annuity valuation, long-term care, and bequest motives. Working Paper 2007-20, Pension Research Council, Wharton, 2007.
- Jeffrey R. Brown and Amy Finkelstein. Why is the market for long-term care insurance so small? *Journal of Public Economics*, forthcoming, 2007.
- Raj Chetty and Adam Szeidl. Consumption commitments and risk preferences. *Quarterly Journal of Economics*, 122(2):831–877, 2007.
- Norma Coe. Financing nursing home care: New evidence on spend-down behavior. Working Paper, Tilburg University, 2007.
- Thomas Davidoff. Housing, health, and annuities. Working paper, Haas School of Business, UC Berkeley, 2007.
- Thomas Davidoff and Gerd Welke. Selection and moral hazard in the reverse mortgage market. working paper, UC Berkeley, 2006.
- Mariacristina De Nardi, Eric French, and John Bailey Jones. Differential mortality, uncertain medical expenses, and the saving of elderly singles. Working Paper 12554, National Bureau of Economic Research, October 2006.
- Amy Finkelstein and Kathleen McGarry. Private information and its effect on market equilibrium: New evidence from the long term care industry. working paper 9957, NBER, 2003.

Genworth Financial. 2007 cost of care survey. Wellesley, MA, 2007.

Charles Himmelberg, Christopher Mayer, and Todd Sinai. Assessing high house prices: Bubbles, fundamentals and misperceptions. *Journal of Economic Perspectives*, 19(4):67–92, Fall 2005.

Mark V. Pauly. The rational nonpurchase of long-term-care insurance. *The Journal of Political Economy*, 98(1):153–168, 1990.

Stephen H. Shore and Todd Sinai. Commitment, risk, and consumption: Do birds of a feather have bigger nests? NBER Working Papers 11588, National Bureau of Economic Research, Inc, August 2005.

Thompson/Medstat. Medicaid treatment of the home: Determining eligibility and repayment for long-term care. policy brief, U.S. Department of Health and Human Services, 2005.

Cassio M. Turra and Olivia S. Mitchell. The impact of health status and out-of-pocket medical expenditures on annuity valuation. Working paper, Pension Research Council, 2004. WP 2004-2.

Steven Venti and David Wise. Aging and housing equity. NBER Working Paper 7882, 2000.