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ABSTRACT

Home equity is the primary self-funding mechanism for long term services and supports (LTSS). Using data from the relevant waves of the Health and Retirement Study (1996-2010), we exploit the exogenous variation in the form of wealth shocks resulting from the value of housing assets, to examine the effect of wealth on use of home health, unpaid help and nursing home care by older adults. We find a significant increase in the use of paid home health care and unpaid informal care but no effect on nursing home care access. We conduct a placebo test on individuals who do not own property; their use of LTSS was not affected by the housing wealth changes. The findings suggest that a wealth shock exerts a positive and significant effect on the uptake of home health and some effect on unpaid care but no significant effect on nursing home care.

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1. Introduction

One key social policy question facing most western societies is how best to fund long term services and supports (LTSS) in aging populations. About half of adults that reach the age of 65 can expect to use some long-term services and supports before they die (Favreault and Dey, 2015). Among those who will use LTSS, the expected present discounted value of the services they would use is estimated at $133,700 in 2015 dollars. Roughly 5% of men and 12% of women age 65 and over will incur costs for LTSS of more than $250,000 in present discounted 2015 dollars before they die (Favreault and Dey, 2015). Private insurance is limited, and in the United States it pays for only about 10% of LTSS. Public insurance, and more specifically Medicaid, accounts for about 35% of LTSS spending. As a result, about 50% of all spending for LTSS is paid for out-of-pocket by service users and their families. Housing assets play an important role in such "self-insurance" mechanisms. However, to date evidence of the effect of wealth shocks on LTSS use is limited.

Housing assets have historically been the main source of non-pensionable wealth of Americans (Venti and Wise, 1991). This is especially the case for older adults: 72% of older Americans are homeowners, and continue to be homeowners at older ages (ASPE, 2016). The median per capita net value (after accounting for debt) of housing assets of older adults is about $80,000 in 2015 dollars. That amounts to 67% of the median per capita net worth of adults over the age of 65. Because housing wealth is the largest source of savings that can be used to pay for unexpected health shocks that involve LTSS, we seek to understand how a wealth shock affects

individual long-term care decisions.

Given the central role housing plays as a form of precautionary savings one would expect changes in household wealth to influence the capacity to self-fund for LTSS. Establishing the causal links of wealth to LTSS is complicated by the fact that unobservable factors that drive wealth accumulation may also affect the demand for LTSS later in life (Garber, 1989). Indeed, most individuals save 'generically' for old age, which includes LTSS and other sources of expenditure.

Our identification strategy relies on observing changes in patterns of use of LTSS in response to housing wealth shocks created by the great recession (2006-2010). Since home equity is such a large component of wealth for most households, large unexpected changes in housing prices are likely to have an important influence on consumer's decisions, especially at old age when individuals tend to rely heavily on their housing assets. That is, an exogenous reduction in wealth at the time it is needed to pay for LTSS can reduce its use.

In this paper, we focus on wealth shocks created by the great recession's induced movements in housing prices in the United States and the impact of LTSS use. The variation in housing values begins with the start of the real estate boom that dates to the first quarter of 1998, through to the beginning of the housing bubble burst in quarter one of 2006, the bust (or post-boom) period runs through 2012 (Cohen *et al*, 2012). That is, housing prices peaked in early 2006 after a decade of price increases, and at the end of that year there was a sudden, unexpected and historic drop in prices of 18.9%. Home prices continued to fall significantly into 2009, after

which prices exhibited more moderate reductions until 2012, when prices began to climb again[1]. Changes were heterogeneous across the country: housing prices tended to rise much faster in metropolitan areas on the East and West coasts compared to the middle of the nation (Cohen et al, 2012)[2,3]. Thus, there is considerable variation in the magnitude of housing price changes across both geography and time. However, although local housing price changes are exogenous to individual households, they are in part driven by local economic conditions that may affect individual health in ways other than through home equity effects. We account for this by incorporating locality and time fixed effects into our econometric model. As a robustness check, we estimate the impact of local housing price changes on the use of LTSS by *renters* who experience the same housing market conditions as owners but without experiencing the direct wealth gains or losses.

We confirm in our data the effect of a significant wealth expansion from 1994 to 2006. After that we find a wealth reduction (in the form of wealth shocks) that is on average a 20-25% drop in net value until 2010. The large and for the most part unexpected changes in housing prices are posited to have an influence on consumers' decisions regarding the use of LTSS. The analysis shows little response to housing wealth changes in nursing home use while formal home health and the intensity of informal care use are positively related to housing wealth.

[1] See Figure A1 in the Appendix
[2] For example, prices in Boston during the boom increased by 121% and during the bust dropped by 15%, whilst in LA they increased by 231% during the boom and dropped by 40% during the burst. In contrast in Detroit, the price changes were more balanced: prices increased during the boom by 46% and then declined by 44% during the bust.
[3] The two main indexes that are regarded as reliable are the Standard & Poor's (S&P)/Case-Shiller house price index and the Federal Housing Finance Agency (FHFA) Purchase-Only. However, although variation is larger in the former, the two indexes are remarkably similar in the timing of the changes. Overall, metropolitan areas with the larger booms tended to have larger busts.

The structure of the paper is as follows. The next section contains the background, followed by a section describing the data and our empirical strategy; section four reports results and a final section contains some concluding observations.

2. Background

Housing wealth is a a major source of savings that is frequently used to finance LTSS for older adults. Recent research estimates that the median adult has sufficient housing wealth to purchase a little more than one-half year of nursing home care, 208 days (ASPE, 2016). In assessing how changes in housing wealth may affect patterns of using LTSS, it is important to understand how and when housing wealth is used by older adults, the role of housing wealth in the total net worth of older adults, and the demand for LTSS. We briefly review what is known about older adults' wealth and use of LTSS.

Housing at old ages. One of the most striking trends in US housing markets has been the sustained increase in the homeownership rate for those 65 years and older that is attributed to a rise in Social Security benefits (Engelhardt, 2008). There is a strong desire among older adults to age in place (Venti and Wise,1990), and in turn a correlation between income and homeownership for this group. Housing wealth is used to smooth consumption, although evidence indicates that this happens primarily at very old age. Walker (2004) shows that housing sales by older people in single-person households are mostly driven by poor health rather than age. Surging policy attention and research interests have focused on the relationship between housing price fluctuations as a proxy for wealth shocks.

Housing wealth effects. Housing equity has a very important influence on the income of older European (Doling and Elsinga, 2012), and has been found to reduce the amount people save (Doling & Horsewood, 2008).Venti and Wise (1991) reported that approximately 80 per cent of the wealth of older households in the USA was held in the form of housing equity. Recent data from the US Census Bureau (2015) displayed in Figure A2 show that still today, the average American over 65 holds about 77-86% of its net worth in the form of housing equity.

Thus, older adults are often described as being 'income-poor and housing-rich' (Hancock, 1998). Property is generally the last resource liquidated, and the liquidation timing has been shown to depend on people's health.

Changes in wealth have an impact on welfare and consumption at old age (Case et al., 2005 and Campbell and Cocco, 2007) although there are some differences between short and long run effects. More specifically, Case et al. (2005) find that changes in aggregate housing values expand consumption with an elasticity that can be as high as 0.1. However, when long run effects are accounted for, the housing wealth elasticity drops to 0.04 but still remains significant (Carrol et al., 2006). Some studies find differences between financial and non-financial wealth (Bostic et al. ,2009) and other studies distinguish between positive and negative wealth shocks (Disney et al., 2020). Finally, one ought to distinguish perfectly anticipated housing price changes from unanticipated ones. The effects of the latter are the focus of this paper.

We focus on housing price shocks that are plausibly orthogonal to individual decision making. This is in part because home ownership has consumption effects, and individuals do not

necessarily perceive its investment nature at every point in time. However, in the event of a combined health and wealth shock, then the investment effects might become more salient. Other instances when investment effects kick-in include downsizing effects later in life (Campbell and Cocco, 2007).

A body of research has used variation in economic circumstances to study choices about long-term care and the health of older adults (Davidoff, 2010). Using evidence form the Social Security notch that would differentially affect the income of retirees, Goda et al. (2011) find that a positive permanent income shock reduces the demand for nursing homes and increases demand for paid home care services. Poterba et al. (2011) find that net worth rises with age for healthier households (those in the top three quintiles of initial health status), but is flat or more slowly increasing for less healthy households. The latter finding explains why a preference for sale and home reversion later in life to pay for care is mainly determined by health and personal care needs (Costa-Font et al., 2010). Finally, one study found that the requirement for people in the UK with capital resources to contribute to their care is a significant disincentive to institutional admission, whereas institutional use is more common among renters (McCann et al., 2012).

Family Proximity and Informal care. Aging often entails a higher dependence on personal support including care from informal caregivers, such as children and their families. Children who expect to provide care to their family members might incorporate such a caregiving responsibility into their residential choices. Proximity to family members determines availability of informal caregiving, and arguably the economic downturn of 2006-2010 might have improved the welfare gain from living close to family members. However, the effects of distance on

contact is less obvious and might depend on an individual's socioeconomic circumstances (Greenwell and Bengtson, 1997)[4].

Insofar as an economic downturn might exert an influence on resources, one might expect it to impact the decision to live close to an older family member, and to increase the probability of informal caregiving. Aquilino (1990) finds that marital status influences adult co-residence with parents, and other studies find that the presence of a female sibling in the family explains distance to family and adult co-residence (Michelin and Mulder, 2008). Education and number of children appear to be the strongest correlates of parent-child proximity (Lin and Rogerson, 1995). Hence, we need to control for such covariates in modeling long term care use decisions.

Effects on Health and Disability. A wealth shock also can influence long term care decisions by changing the need for long term care. Previous research finds a weak wealth and health nexus effect (Meer et al., 2003). However, such an effect is due in part to the fact that individuals can adapt their housing to their physical and mental health needs (Heywood, 2004). Observing a home owner's health over the business cycle, and more specifically the recent great recession, McInerney et al. (2013) find evidence of a change in health. But the change in health is driven mainly by a change in non-housing wealth, which increases the chances of depressive symptoms and the use of anti-depressants.

[4] Among the potential reasons is the fact that potential caregivers are in the middle of their careers, and most likely caregiving duties to parents might coexist with that of children. Bengtson and Roberts (1991) argue that geographic distance is typically adjusted over time on the basis of the both changes in needs and resources of both generations.

3. Empirical Implementation

We use the variation in housing prices between 1992 and 2010 as an instrument for evaluating the effect of wealth shocks on the use of long term services and supports. In particular, we focus on the wealth shock effects at the extensive margin (those using LTSS that previously were not) and at the intensive margin (specifically, whether it influences the intensity in use of nursing home care). We also document the effect that exogenous changes in housing assets exerted on the probability that an individual uses various forms of LTSS. We rely on the Health and Retirement Study (HRS) 3-10 waves, and we use time and state specific housing price changes to identify the effect of housing assets change on use of LTSS. Examining changes in wealth during the period 1992 to 2010 is of particular importance given the considerable heterogeneity on the effects of the housing bubble across the United States. Housing price data were obtained from the Federal Housing Finance Agency (FHFA); we could match the data to individuals who own a property for a total of 173,480 observations. Thus, the exogenous variation in metropolitan and regional housing prices allows us to exploit exogenous variation in home equity wealth based on an individual's residence. We have estimated reduced forms and tested for the robustness of the instruments. The result indicate that wealth is endogenous and housing price variation performs well as an instrument for changes in wealth. We have controlled for individual factors that are likely to impact individuals' caregiving and housing alternatives at older ages. Time specific effects also are an important source of variation we control for by including time dummies in our regression estimates. At the

same time, we examine the effects of changes in housing prices on renters, who would not experience a direct wealth effect.[5]

Data and Sample. The Health and Retirement Study (HRS) is a publicly available longitudinal data set that has been sponsored by the National Institute on Aging. The HRS surveys (waves) have been conducted biannually since 1992, and follow respondents who were born between 1931-1941 and their spouses. A separate sample, AHEAD,[6] was added in 1993; it consists of community-dwelling people born before 1924. Subsequent samples have periodically been added to maintain a basic sample of people 51 years of age and older.[7] Given that long term care can potentially affect all those cohorts, we merge the samples. The latest available cohort comprises the tenth wave; responses to the survey were taken in 2010. Given the evidence that the expansion of housing prices occurred after the second wave of the HRS, we concentrated our analyses on waves 3 to 10. This choice is based on the quality of data and is consistent with previous studies (Goda, 2011, Finklestein and McGarry, 2006). However, unlike previous studies, we do not limit our analysis to a specific age group because we are interested in the effect of a wealth shock on use of LTSS. Overall, the survey is rich in socio-economic variables that describe individuals and their households. They include demographics, health status, wealth (housing related and other), income and insurance converge.

We were able to obtain restricted access to examine changes in housing wealth at the state and metropolitan level. The results show the same effects as when using the unrestricted

[5] They might experience an indirect income effect if owners transferred part of the wealth effect by changing the individuals' rent but we cannot observe that.
[6] AHEAD is an acronym for Assets and Health Dynamics among the Oldest Old.
[7] For more information about the HRS sample, see: http://hrsonline.isr.umich.edu/sitedocs/sampleresponse.pdf.

census region data on residence, largely because the housing bubble disintegrated most in specific census regions and the relative declines in housing prices were largely consistent within regions. Thus, focusing on regions provides sufficient variability to obtain a local average treatment effect (LATE). Further, while housing prices were a relevant and statistically significant instrument for wealth among home owners, it is the disintegration of the housing bubble that allows us to identify unanticipated wealth changes. Crucially for our study, some earlier work argues that wealth shocks have different effects on LTSS utilization depending on the number of residents in the household (Bell and Rutherford, 2012).

The analysis sample includes 172,572 observations and the dependent variables mostly refer to the external margin of long term care utilization. That is, a set of binary indicators that measure the use of nursing home, home health care, and informal care. For some variables, we examine the internal margin too when available (informal care). Table A1 in the Appendix displays names of the variables and the descriptive statistics and sample size. The table shows that 1.8% of the sample lives in a nursing home and 6.2% received home health care in the past 12 months. Using additional information from the HRS we could measure informal care support by identifying individuals who received help with activities of daily living (ADL). About 10% of the sample receives informal care, and we could identify the number of monthly hours of informal care an individual received, estimated at 14.26 (0.45) which is consistent with Norton and Von Houtven (2004). The table summarizes the average net worth (net total assets), and net total housing assets. In addition, we report the descriptive statistics of the housing price index (HPI) employed for the period. This is a broad measure of the movement of single-family house prices. It serves as a timely, accurate indicator of house price trends at various geographic

levels. It also provides an analytical tool that is useful for estimating changes in the rates of mortgage defaults, prepayments and housing affordability in specific geographic areas. The HPI is a measure designed to capture changes in the value of single-family houses in the U.S. as a whole, in smaller areas. The HPI is published by the Federal Housing Finance Agency (FHFA) using data provided by Fannie Mae and Freddie Mac. Table A1 contains information on demographic and health controls for the respondent as well as that of the spouse. Finally, means tests on the equality of characteristics between renters and home owners suggest no statistical significance differences on marital status and family composition, but some differences in age composition were observed (renters are more likely to be over 75 and owners are more likely to fall in the 65-75 age groups).

Empirical Strategy. With these data from the HRS, we estimate an instrumental variable model to estimate the impact of variation in an individual's wealth stemming from changes in housing prices on use of LTSS. Given that changes in housing prices did not affect individuals who were not home owners, we examine the estimated effects for those who were renting a property before and after 2007-8 (interpreted as one control group not affected by a decline on property prices) and compare those estimates to changes for individuals that owned property (OWN). This is a form of "placebo test". In addition, we compare the changes in wealth of those who were already receiving LTSS to those who obtained such services after the downturn (POST). Since we control for fixed effects for each region and each year, the effect of the economic change is identified. Additional robustness checks include analyses of specific subgroups of the population such as single people. We address the problem of the existence of within geographic-year correlation across observations, as well as serial correlation within provinces across time.

[Insert Figure 1 about here]

A number of key features in the economic environment play a crucial role in our identification strategy. First, the panel (a) in Figure 1 plots the trends in the population share without housing assets over time by age group. Overall the trends are suggestive of no overall change in the proportion of non-homeowners, with a slight increase towards 2008-10 for younger people. Thus, there appear to be parallel trends on homeownership. The second panel (b) in Figures 1 contains the evolution of housing prices as reported by FHFA and, as expected we find a comparable trend. However, such differences vary by age groups. Indeed, Figure 2 reports differences in trends for total assets by age group of those without housing assets, and Figures 3 and 4 display the trends in total and housing assets by age group. Once again, trends in Figure 3 indicate that there is a slight difference in the trends for the younger groups. However, individuals over the age of 65 show comparable trends irrespective of the age group, which is suggestive of an expansion in housing assets through 2006 that then exhibits a sharp decline in 2008 and beyond. Similar and more homogeneous trends are observed form housing assets in Figure 4. Hence, we can conclude that changes in housing prices are indeed correlated with changes in individual's assets.

[Insert Figure 2 and 3 and 4 about here]

Drawing on the variation in housing prices that is orthogonal to an individual's choices, we define in what follows an instrumental variable strategy capturing the effect of house prices

as a source of variation in assets to examine the impact of housing wealth on decisions regarding LTSS. Our basic estimating equation is an instrumentals variables equation of the following form:

$$\boldsymbol{P}(Y_{itg}) = \boldsymbol{\gamma_t} + \boldsymbol{\mu_g} + \boldsymbol{X_{itg}} \cdot \boldsymbol{\delta} + \boldsymbol{\varphi}\widehat{\boldsymbol{ASSETS}}_{\boldsymbol{it}} + \boldsymbol{\varepsilon_{itg}} \quad \textbf{(1)}$$

$$ASSETS_{it} = \boldsymbol{a_t} + \boldsymbol{b_g} + \boldsymbol{Z_{itg}} \cdot \boldsymbol{\varphi} + \boldsymbol{c}\left(House\ \ Price_{\ gt}\right) + \boldsymbol{u_{itg}}$$

Where Y_{itg} denotes LTSS (home health care, nursing home) use by an individual i in a group g and year t; γ_t denotes a set of time dummies (survey waves), $X_{itg}$is a vector of covariates that act as controls (age, gender, married, health status) which are exogenous (especially time variant ones). Z is a vector of covariates that act as controls (age, gender, married, health and disability) and all-time constant variables between different locations are controlled for. We condition our estimates for individuals who own a home, where OWN_{itg} is a dummy variable for whether the individual is an owner of a property and thus affected by the housing bubble burst. Standard errors are clustered at either the census region or state level to account for potential correlation errors within regions and states[8]. We estimated different specifications using different dependent variables, namely use of home health care, use of informal care, and nursing home care at the external margin. We also consider a number of placebo tests and reduced forms of house prices to confirm that the first stage regressions are indeed suggestive of an experiment as described in the results section.

[8] We can estimate the main effects using linear probability models, but estimates using nonlinear models such as 2SRI (Terza *et al* 2008) deliver comparable estimates.

***Preliminary evidence on use of* LTSS**: Figure 5 plots trends over time of use of home health care and nursing home care. Overall, we find hardly any change in rates of nursing home utilization. However, a sharp increase in the rate of home health care use is observable after 2006. When the trends are stratified by age group in Figure 6, and we find that after 2006 there is a sharp increase in the utilization of home health care by individuals ages 75 and over (those most at risk for needing LTSS). This effect occurs alongside a reduction in the use of nursing home care for the same age group as shown in Figure 5. Figure 7 displays trends of nursing home care utilization across income groups that suggests that utilization has been higher among peoples 75 and over, but overall the trends are stable during the period examined. Finally, Figure 8 displays trends in informal care for a shorter period where we can gather reliable data. Trends suggest a relative rise in the use of informal care that becomes stable in the middle of the decade of 2000's at around 40-45%. However, all of our analyses focus on the extensive margins.

[Insert Figure 5 and 6, 7 and 8 about here]

4. Results

Reduced forms. As a way to test for the validity of our instruments, we begin by reporting reduced form estimates including a time trend as a covariate and housing price indexes (Table 1). The estimates indicate that housing prices do indeed exert a positive effect on informal care, and a negative effect on the likelihood of using both home health and nursing home care. The effect of housing prices in turn suggests that the instrument is associated with the dependent variables. However, whether the effect survives the inclusion of controls is an empirical question resolved below.

[Insert Table 1 about here]

Validity of the instruments. Next, we examine the validity of instruments in predicting total housing assets. We find that an expected a change in the index would change total wealth irrespectively of whether it refers to total assets or just housing wealth (Table 2). However, we also find that when we examine the period 1998-2010 for housing assets, the coefficient is three time larger. The F-tests of these regressions are always significantly larger than 10, and this is the case irrespective of the inclusion of controls. Table 3 shows placebo tests of the effects of house prices on wealth of non-home owners; the tests consistently find no effect on any of the different sub periods and the total sample.

[Insert Table 2 and 3 about here]

Use of LTSS. Next we examine the effect of wealth changes on the use of home health. We find evidence of a positive wealth effect on the likelihood of using home health that is robust to the inclusion of individual fixed effects (see Table 4). This is the case for both total assets and housing assets, and the coefficient indicates that one standard deviation change in wealth (total assets) increases the probability of home health care use by 0.25 percentage points. The effect on home health care use of one standard deviation change in assets is of 0.2 percentage points; this effect compares in percentage points to the effect of one standard deviation increase in the number of a person's ADLs (which results in a 0.027 percentage point increase).

[Insert Table about here]

Our results indicate that wealth exerts a positive effect on the use of informal care both at the intensive and extensive margins (Table 5). The intensive margin of informal care is measured by the monthly hours of help used by those who receive help with ADLs. The results are positive and significant for both measures of wealth: the coefficient estimates suggest that a one standard deviation change in total net assets and housing assets leads to increases of 3.2% and 4.3%, respectively, in the probability of informal care use. The effect on the intensive margin of a one standard deviation change in total (housing) assets increase informal care use by 8.36 (27.3) hours a month.

Finally, we find no significant effect of total wealth and housing assets on the probability of using nursing home care (Table 6). We posit that the informal care response is due to the possibility that nursing home use is reduced as wealth increases, thereby inducing more informal help. We recognize that our estimation results on nursing home use are mixed but there is some evidence of reduced use as wealth grows. We are cautious in our views of the nursing home impact because of potential power issues in the IV estimation and our limited definition of institutional care.

[Insert Tables 5 and 6 about here]

Mechanisms. As a final analysis, we tested for the effect of a wealth shock on health and disability at old age. Overall, we find no evidence of any effect. Hence, the main mechanism

appears to be a direct effect of a change in the value of housing assets on the demand for LTSS, and specifically on a higher reliance on community care services, consistent with a stronger probability of ageing in place.

5. Conclusion

This article exploits the quasi-experimental variation in both the timing and strength of the housing price change (which we expect constitute unanticipated wealth shocks to families) on the use of LTSS in the United States. The latter is used in the context of an instrumental variable strategy drawing on both the effects on total and housing assets. Consistent with the study expectations, we find evidence that a wealth shock after the change in housing prices does change long term care choices for homeowners but not for renters. More specifically, changes in housing wealth affect use of home health and informal care both at the intensive and extensive margins. However, our causal LATE estimates indicate that such an exogenous change in wealth does not significantly influence nursing home care utilization. A more complete analysis would incorporate measurement of the use of assisted living arrangements that are likely to be more sensitive to wealth than is nursing home use. Unfortunately, information about assisted living arrangements were not available to us.

Overall, we find that the increased use of home health care due to a positive wealth shock compares in size to the effect of a one standard deviation change in disability (ADLs). Further, we find a 3-4% increase in the probability of informal care use after an asset shock, which is consistent with the literature and suggestive of a preference for individuals to age in place (Costa-Font et al., 2009). We find causal evidence of effects of wealth changes for home owners

and no effect for renters, thereby strengthening our causal inference about the impact of wealth on LTSS demand.

References

Aquilino, W. S. (1990). The likelihood of parent-adult child co-residence: Effects of family structure and parental characteristics. *Journal of Marriage and the Family*, 405-419.

Assistant Secretary for Planning and Evaluation (ASPE) (2016), *How Much Nursing Home Care Can Home Equity Buy*, ASPE Research Brief, March

Bell, D., & Rutherford, A. (2012). Long-Term Care and the Housing Market. *Scottish Journal of Political Economy*, *59*(5), 543-563.

Bengtson, V.L. and R.E.L. Roberts (1991). "Intergenerational Solidarity in Aging Families: An Example of Formal Theory Construction." *Journal of Marriage and the Family* 53:856-870

Bostic, R., Gabriel, S., & Painter, G. (2009). Housing wealth, financial wealth, and consumption: New evidence from micro data. *Regional Science and Urban Economics*, *39*(1), 79-89.

Campbell, J.Y., Cocco, J.F., 2007. How do House prices affect consumption? Evidence from micro data*, Journal of Monetary Economics* 54, 591-621.

Carroll, J Otsuka, M and Slacalek, J (2006). *How large is the housing wealth effects? A new approach.* NBER Working Paper 12746.

Case, KE, Quingley, JM and Shiller, RJ (2005). Comparing wealth effects: the stock market versus the housing market. *Advances in Macroeconomics*, 1(5): 1-34.

Cohen, JP C C. Coughlin, and D.A. Lopez (2012). *The Boom and Bust of U.S. Housing Prices from Various Geographic Perspectives*. Federal Reserve Bank of St. Louis *REVIEW* September/October 2012 341.

Costa-Font, J and Mascarilla-Miró, O. and Elvira, D. (2009) Ageing in place? An examination of elderly people housing preferences in Spain *Urban Studies*, 46 (2). 295-316.

Davidoff, T. (2010). Home equity commitment and long-term care insurance demand. *Journal of Public Economics*, *94*(1), 44-49.

Disney, R., Gathergood, J., & Henley, A. (2010). House price shocks, negative equity, and household consumption in the united kingdom4. *Journal of the European Economic Association*, *8*(6), 1179-1207

Doling, J., & Elsinga, M. (2012). Housing as income in old age. *International Journal of Housing Policy*, *12*(1), 13-26.

Doling, J. & Horsewood, N. (2010) Home ownership and pensions: causality and the really big trade-off, Housing, Theory and Society, 28(2), pp. 166–182.

Engelhardt, G. V. (2008). Social security and elderly homeownership. *Journal of Urban Economics*,*63*(1), 280-305.

Favreault, M, J Dey. 2015. *Long-Term Services and Supports for Older Americans: Risks and Financing Research Brief*. Washington, DC: Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health and Human Services. https://aspe.hhs.gov/basic-report/long-term-services-and-supports-older-americans-risks-and-financing-research-brief.

Feinstein, JD. McFadden, The dynamics of housing demand by the elderly: Wealth, cash flow, and demographic effects, in: D. Wise (Ed.), The Economics of Aging, University of Chicago Press, Chicago, 1989, pp. 55–92.

Fichera, E., Gathergood, J. (2013). House prices, home equity and health. *Health Econometrics and Data Group. (January 3, 2013)*.

Frank, R. G. (2012). Long-term care financing in the United States: sources and institutions.*Applied economic perspectives and policy*, *34*(2), 333-345.

Garber, A. M. (1989). Long-term care, wealth, and health of the disabled elderly living in the community. In *The economics of aging*(pp. 255-278). University of Chicago Press.

Grabowski, D. C., & Gruber, J. (2007). Moral hazard in nursing home use. *Journal of Health Economics*,*26*(3), 560-577.

Greenwell, L., & Bengtson, V. L. (1997). Geographic distance and contact between middle-aged children and their parents: The effects of social class over 20 years. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *52*(1), S13-S26.

Goda, G. S., Golberstein, E., & Grabowski, D. C. (2011). Income and the utilization of long-term care services: Evidence from the Social Security benefit notch. *Journal of health economics*, *30*(4), 719-729

Heywood, F. (2004). The health outcomes of housing adaptations. Disability & Society, 19, pp. 129–43

Hoerger, T. J., Picone, G. A., & Sloan, F. A. (1996). Public subsidies, private provision of care and living arrangements of the elderly. *The review of Economics and Statistics*, 428-440

Hotz, V. J., McGarry, K., & Wiemers, E. (2010). Living arrangements of mothers and their adult children over the life course. *Unpublished manuscript*.

Kemper, P., Komisar, H. L., & Alecxih, L. (2005). Long-term care over an uncertain future: what can current retirees expect?. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, *42*(4), 335-350.

Lin, G., & Rogerson, P. A. (1995). Elderly parents and the geographic availability of their adult children. *Research on Aging*, *17*(3), 303-331.

McCann M, Grundy E and O'Reilly D (2012) Why is housing tenure associated with a lower risk of admission to a nursing or residential home? Wealth, health and the incentive to keep 'my home', *Journal of Epidemiology and Community Health* 66 (2) : 166-169

McInerney, M., Mellor, J. M., & Nicholas, L. H. (2013). Recession depression: mental health effects of the 2008 stock market crash. *Journal of health economics*, *32*(6), 1090-1104.

Meer, J Miller, D and Rosen, D (2003). Exploring the health-wealth nexus. *Journal of Health Economics*, 22: 713-730.

Poterba J M, Venti S F and Wise D A (2011) The Composition and Draw-down of Wealth in Retirement [NBER Working Paper No. 17536],

Spillman, B and P Kemper (1995), "Lifetime Patterns of Payment for Nursing Home Care," *Medical Care* 33, no. 3 (1995): 280-96

Norton, EC (1995) "Elderly Assets, Medicaid Policy, and Spend-Down in Nursing Homes," *Review of Income and Wealth* 41, no. 3 (1995): 309-329.

Sloan, F. A., & Shayne, M. W. (1993). Long-term care, Medicaid, and impoverishment of the elderly.*The Milbank Quarterly*, 575-599.

Terza, J. V., Basu, A., & Rathouz, P. J. (2008). Two-stage residual inclusion estimation: addressing endogeneity in health econometric modeling. *Journal of health economics*,*27*(3), 531-543.

Venti,S D. Wise, But they don't want to reduce housing equity, in: D. Wise (Ed.), Issues in the Economics of Aging, University of Chicago Press, Chicago, IL, 1990, pp. 13–29.

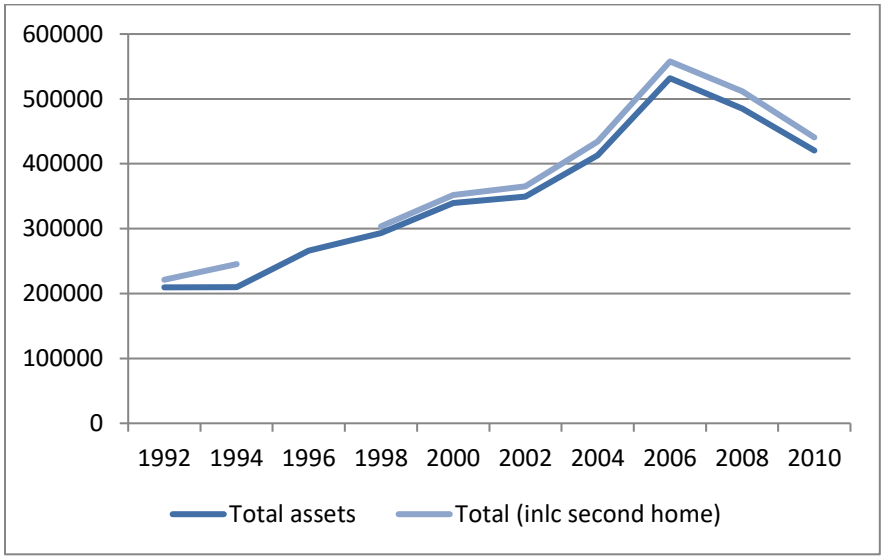
Webb, A (2001). *The Impact of the Cost of Long-Term Care on the Saving of the Elderly*, (New York: International Longevity Center, 2001).

Walker, L (2004). Elderly Households and Housing Wealth: Do they Use It or Lose it? Michigan Retirement Research Centre.

Tables and Figures

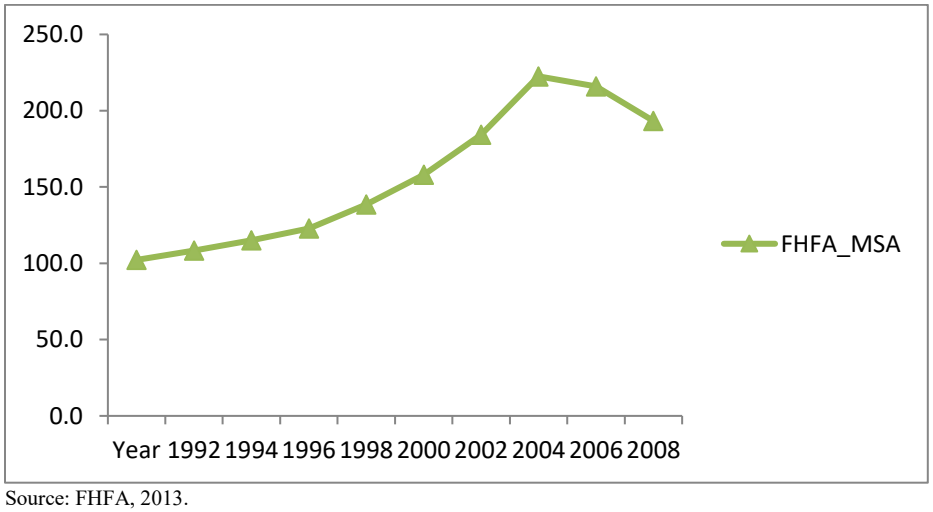
Figure 1. Total Assets of Elderly American Households and the Evolution of different house prices (FHFA Index)

a) **Wealth of Elderly Americans**



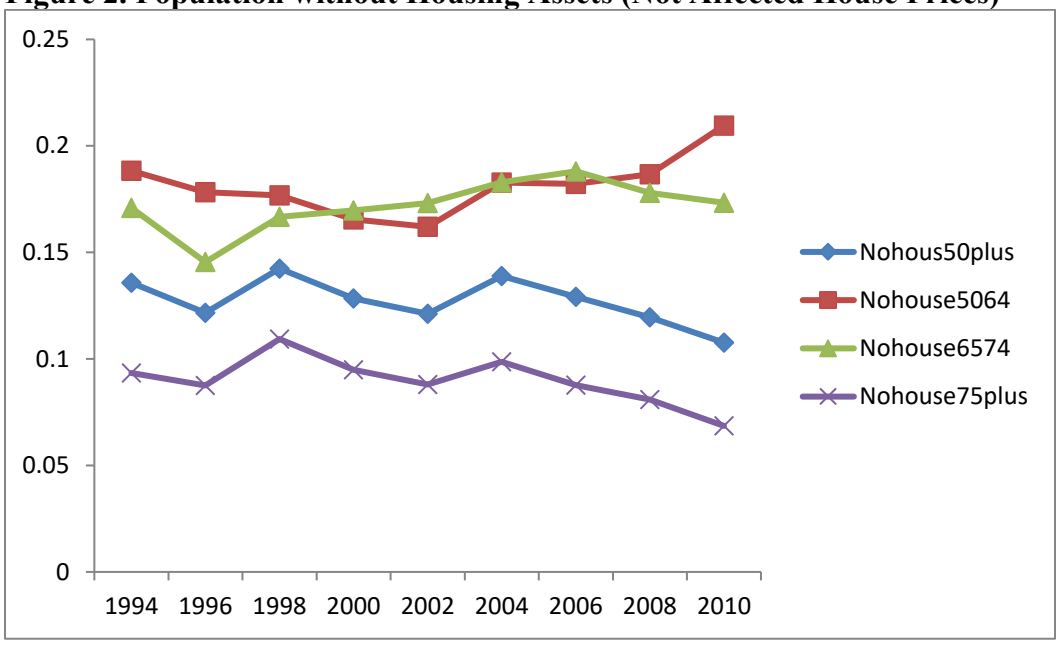
Source: Health and Retirement Study, waves 1 -10.

a) **Average House prices**



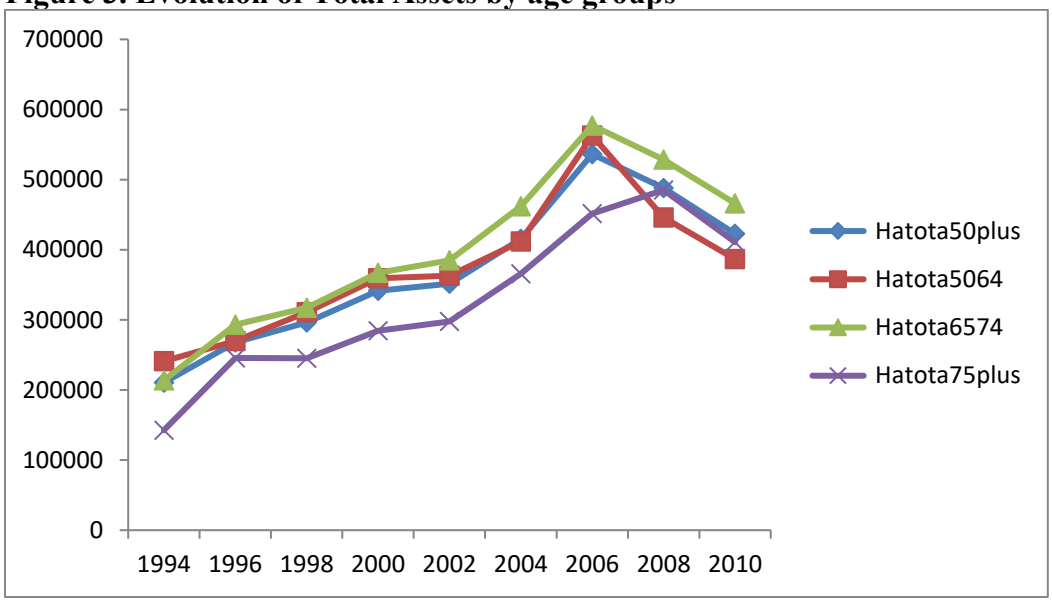
Source: FHFA, 2013.

Figure 2. Population without Housing Assets (Not Affected House Prices)



Source: Health and Retirement Study, waves 2 -10.

Figure 3. Evolution of Total Assets by age groups



Source: Health and Retirement Study, waves 2 -10.

Figure 4. Evolution of Total Housing Assets by age groups

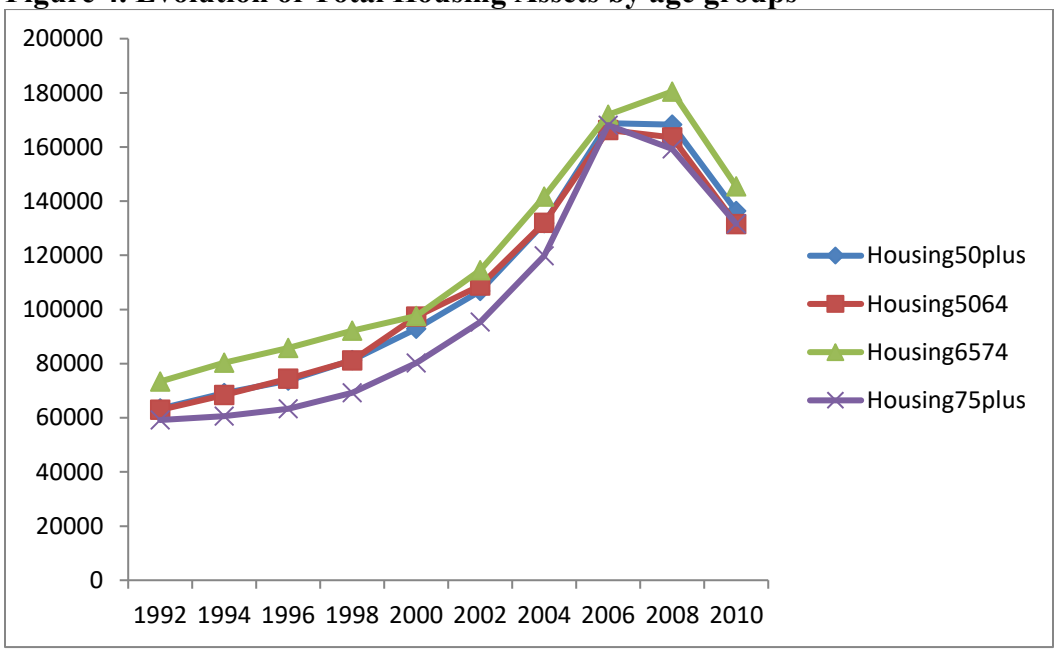
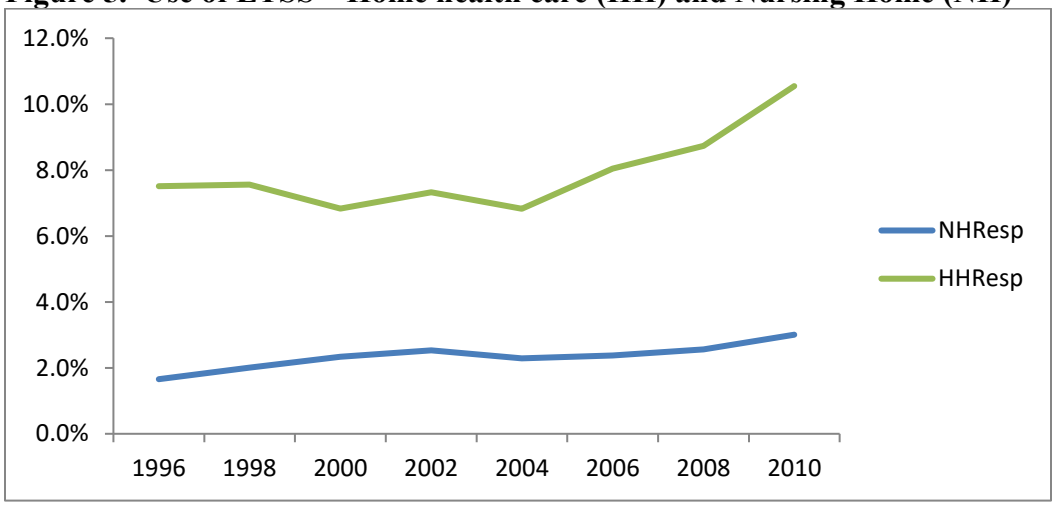
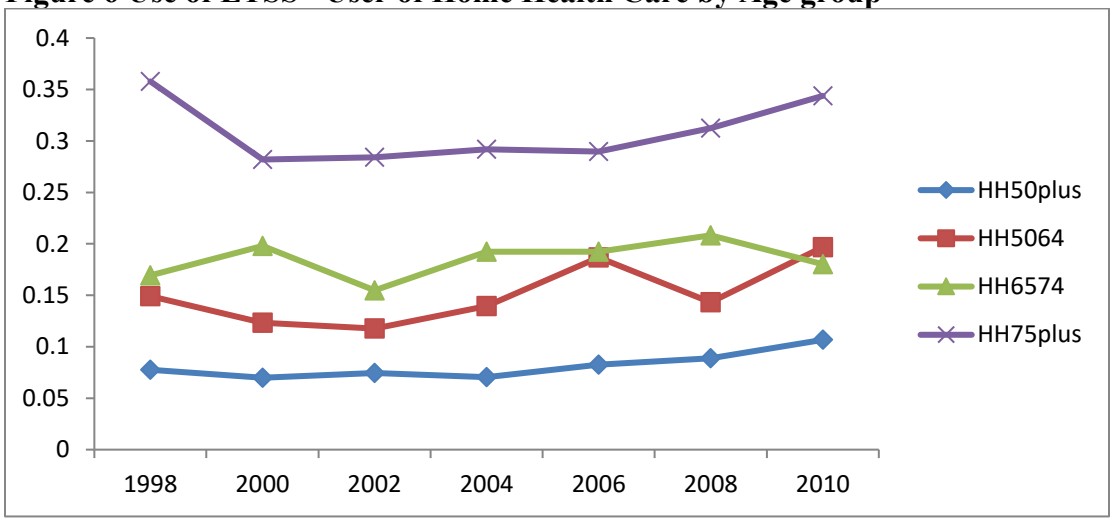


Figure 5. Use of LTSS – Home health care (HH) and Nursing Home (NH)



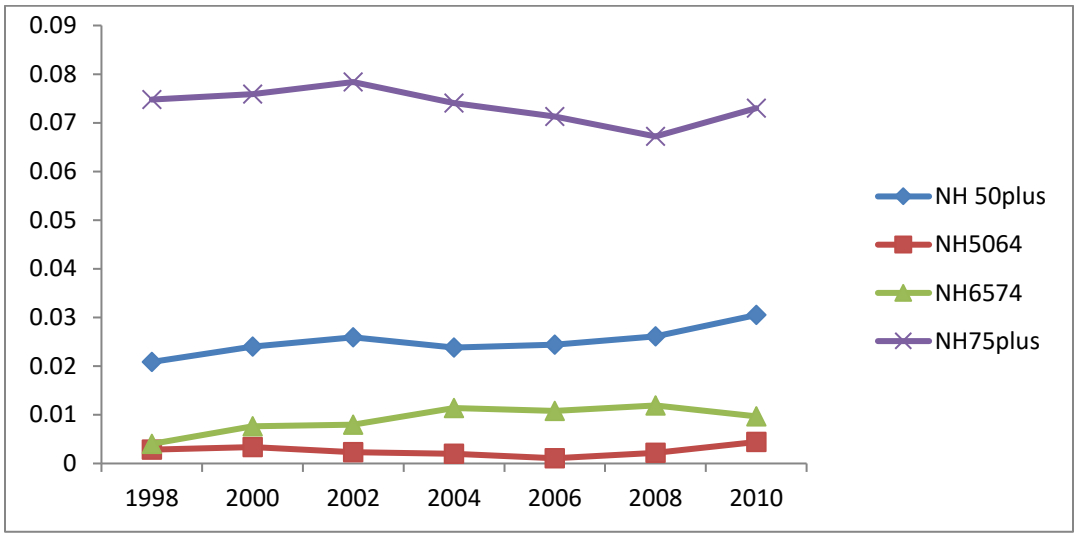
Source: Health and Retirement Study, waves 3 -10.

Figure 6 Use of LTSS - User of Home Health Care by Age group



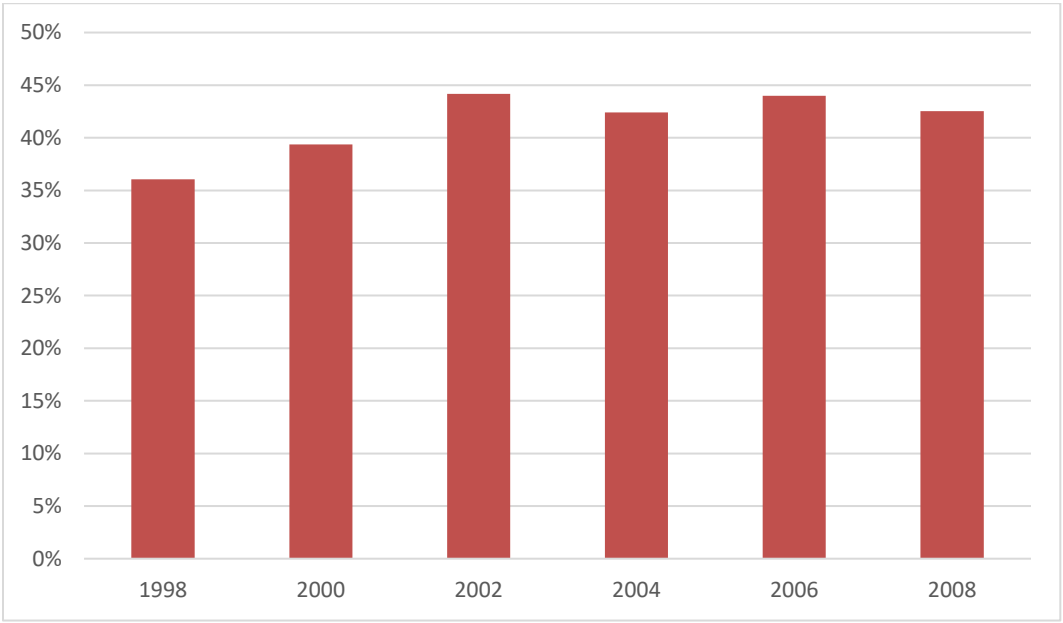
Source: Health and Retirement Study, waves 3 -10.

Figure 7 Use of LTSS - Individuals residing in nursing home by Age group



Source: Health and Retirement Study, waves 3 -10.

Figure 8. Informal Care Trends (HRS)



Source: Health and Retirement Study, waves 3 -9.

Table 1. Reduced forms on informal care, home health care and nursing home

VARIABLES	(1) Informal Care	(2) Home Health Care r	(3) Living Nursing Home
Housing Price	0.000215**	-4.72e-05***	-4.57e-05***
	(0.000105)	(1.53e-05)	(1.01e-05)
Trend	0.0211***	0.00530***	0.00130***
	(0.00214)	(0.000263)	(0.000213)
Constant	0.240***	0.0499***	0.0222***
	(0.0201)	(0.00255)	(0.00195)
Observations	12,468	156,642	128,657
R-squared	0.008	0.003	0.000

Note: Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Table 2. House Price effects on Total and Housing Assets (in logs)

VARIABLES	(1) Total Assets	(2) Total Assets	(3) Housing Assets	(4) Housing Assets
Housing Price	0.0016***	0.0011***	0.0024***	0.0020***
	(0.000)	(0.000)	(0.000)	(0.000)
Controls	No	Yes	No	Yes
Constant	10.9604***	11.7227***	8.5579***	10.7026***
	(0.027)	(0.049)	(0.043)	(0.090)
Observations	153,323	103,387	156,809	104,439
F-Test	78.52	633.96	72.11	639.16
R-squared	0.001	0.018	0.001	0.018

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Controls: age, gender, health and disability, place of birth, marital status, household size, income, education, ethnicity, time effects.

Table 3 Placebo Effects (Effect of House price change on Assets of Non-Property Owners)

VARIABLES	(1) Total Assets (logs)	(2) Housing Assets (logs)	(3) Total Assets (logs)	(4) Housing Assets (logs)
	[1992-10]	[2006-10]	[1992-10]	[2006-10]
Housing Price	-0.000455	-0.00144	-0.00221	-0.00154
	(0.00151)	(0.00170)	(0.00215)	(0.00442)
Constant	7.810***	7.935***	-1.738**	-7.294***
	(0.240)	(0.298)	(0.870)	(2.802)
Location - FE	No	No	Yes	Yes
Observations	13,018	2,487	5,456	853
R-squared	0.001	0.001	0.262	0.297

Note: Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1
Controls: age, gender, health and disability, place of birth, marital status, household size, income, education, ethnicity, time effects.

Table 4. Assets Effects on Home health care use.

VARIABLES	(1) IV (Total Assets)	(2) IV (Housing Assets)	(3) IV (Total Assets) FE	(4) IV (Housing Assets) FE
Total Assets (logs)	0.0738**		0.0720**	
	(0.0323)		(0.0287)	
Housing Assets (logs)		0.115		0.0867**
		(0.0884)		(0.0395)
Constant	-0.582***	-0.553**	-0.721***	-0.881***
	(0.166)	(0.268)	(0.209)	(0.324)
Trends	Linear	Linear	Linear	Linear
Controls	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Individual FE	No	No	Yes	Yes
Observations	137,859	140,952	137,859	140,952
Number of hhidpn			28,448	28,647

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1
Controls: age, gender, health and disability, place of birth, marital status, household size, income, education, ethnicity, time effects.

Table 5. Effect of Assets on Informal Care

Extensive Margin	(1) OLS	(2) IV	(3) IV-owners	(4) OLS	(5) IV	(6) IV-owners
Total Assets (logs)	0.214***	0.214***	0.282***			
	(0.0637)	(0.0637)	(0.0764)			
Total Housing Assets (logs)				-0.00613***	0.0788***	0.231***
				(0.00109)	(0.0289)	(0.0655)
Constant	-2.270***	-2.270***	-3.004***	0.170***	-0.487**	-2.331***
	(0.713)	(0.713)	(0.855)	(0.0147)	(0.224)	(0.704)
Observations	11,768	11,768	7,973	11,725	11,725	7,930
R-squared	0.163	0.163	0.114	0.164		0.028
Intensive Margin						
lhatota	37.11**	37.11**	36.88**			
	(18.13)	(18.13)	(17.10)			
lhatoth				-0.160	13.97*	29.62**
				(0.316)	(7.462)	(14.02)
Constant	-402.5**	-402.5**	-394.4**	14.10***	-96.19*	-300.3**
	(202.9)	(202.9)	(191.5)	(4.381)	(58.39)	(151.0)
Observations	10,585	10,585	7,317	10,542	10,542	7,274
R-squared	0.045	0.045	0.040	0.045		0.010

Notes: Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Controls: age, gender, health and disability, place of birth, marital status, household size, income, education, ethnicity, time effects.

Table 6. Effect of Assets on Nursing Home Care

VARIABLES	(1) IV (Total Assets)	(2) IV (ADL>0)	(3) IV (Medicare=0)	(4) IV (Housing Assets Medicare=0)	(5) IV-FE	(6) IV-FE (Housing Assets)	(7) IV-FE (Medicare=0)
Total Assets (logs)	-0.00622		-0.00589		-0.00730		-0.00751
	(0.0109)		(0.00383)		(0.00471)		(0.00474)
Housing Assets (logs)		-0.0652		-0.00440		-0.00700	
		(0.172)		(0.00284)		(0.0158)	
Trends	Linear	Linear	Linear	Linear	Linear	Linear	Quadratic
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	No	No	No	No	Yes	Yes	Yes
Constant	0.0138	0.105	0.0362	0.0299	0.0462	-0.193	0.0489
	(0.0571)	(0.614)	(0.0293)	(0.0251)	(0.0612)	(0.279)	(0.0616)
Observations	103,131	13,502	87,545	87,324	91,222	113,644	91,046
R-squared	0.026						

Note: Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1
Controls: age, gender, health and disability, place of birth, marital status, household size, income, education, ethnicity, time effects.

Table 7. Effect of Assets on Disability and Health (2SRI-Probit)

VARIABLES	ADL	Obesity	CESD	ADL	Obesity	CESD
		2006-2010			1998-2010	
Housing Assets (logs)	0.0590	-0.225**	0.275	0.139	-0.287	0.977
	(0.0619)	(0.112)	(0.287)	(0.106)	(0.184)	(0.774)
Controls						
Constant	0.784***	0.424***	4.098***	0.629***	0.329***	2.775***
	(0.0918)	(0.141)	(0.332)	(0.0444)	(0.0705)	(0.255)
Observations	14,506	14,509	13,779	78,061	78,104	73,453
R-squared						

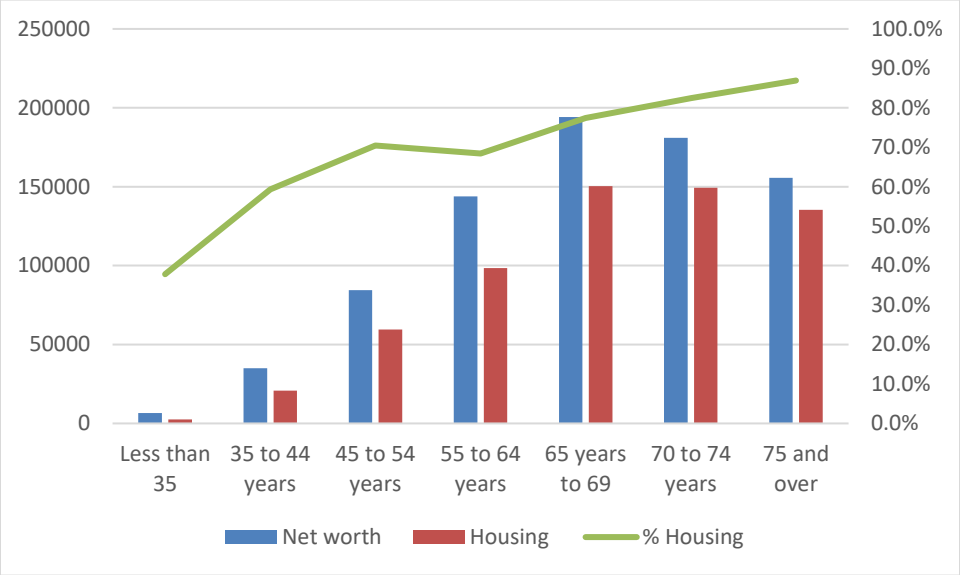
Notes: Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1
Controls: age, gender, health and disability, place of birth, marital status, household size, income, education, ethnicity, time effects.

Appendix

Table A1. Descriptive Statistics

	N	Mean (s.e)	Definition
Dependent Variables			
rnhmliv	126652	0.0180	Respondent lives in Nursing Home
Informal	170075	0.0999	Respondent received informal care – extensive margin
Informalhours	34048	14.260 (0.456)	Respondent monthly hours of informal care – intensive margin
rhomcar	155694	0.0620	Respondent receives home health is last 12 months
Assets and House Prices			
hpriceindex	156997	152.9 (0.1)	FHFA Index- Census Divisions- MSA
hatota	157059	363,156 (3149)	Total household Assets
hatoth	157059	110,601 (969)	Total household housing Assets
Demographic Controls			
married	298550	0.3479	Respondent is married
gender	298541	0.4370	Respondent is Male
hchild	170149	3.1986 (0.005)	Number of ever born children
ragey_b	157057	65.92 (0.028)	Respondents age
sagey_b	109043	63.70 (0.03)	Spouse's age
Respondents and Spouse Health and Disability			
Sadl2more	298550	0.650	Spouse has 2 ADL's or more
adl2more	298550	0.4346	Respondents has 2 ADL's or more
rcesd	145017	1.3254 (0.005)	Respondents Mental Health (CESD score)
scesd	97146	1.0989 (0.005)	Spouse Mental Health (CESD score_
rbmi	154994	27.12 (0.014)	Respondent Body Mass Index (BMI)
sbmi	104482	27.31 (0.016)	Spouse Body Mass Index (BMI)

Figure A2. Housing Assets (amount and %) and Net Worth of Americans



Source: US Census Bureau, 2015.