Maintenance and the Home Equity of the Elderly

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Abstract

Economists have puzzled over the apparent failure of older homeowners to cash out home equity. Casual observation suggests that the elderly may remove home equity by spending less on home maintenance than younger homeowners. American Housing Survey data show that homeowners over 75 spend roughly .8 percent of home value less per year on routine maintenance than younger owners of similar homes. The homes of younger owners appreciate at a rate at least 2 percentage points greater than the rate for similar homes of older owners. Older homeowners do, thus, take money out of their homes. The large magnitude of depreciation relative to expenditure differences suggests that undermaintaining homes is an inefficient way to spend down housing wealth. The results heighten the puzzle of the small reverse mortgage market.

JEL Classification Numbers: J14, R21, R31

1 Introduction

A canonically modeled household, with no bequest motive, no direct utility over wealth, and no tax or liquidity reasons for holding wealth in the form of home equity, should consume most home equity before death. Artle and Varaiya (1978) estimate the utility costs from lumpy consumption resulting when these complications are not present, yet home equity is not spent until close to death. Findings that the elderly rarely move out of their homes or take on mortgage debt (conventional or reverse),[1] suggest that one or more of these complicating factors may be important. The failure of older consumers to spend home equity is surprising considering the dominant share of home equity in their portfolios.

In this paper, I show that the elderly consume a considerable quantity of home equity through reduced expenditures on home maintenance and improvement (sometimes collectively referred to below as "maintenance"). The reduction in expenditures is documented in Figures 1 and 2. That the elderly spend less on maintenance than other homeowners is not surprising based on casual observation, and has been documented elsewhere, e.g. Reschovsky (1992). The novelty of this paper lies in linking reduced maintenance to reduced appreciation of home values. Appreciation rates for similar homes are shown to be considerably smaller when the household head is over 75 years old.

The finding that the elderly consume home equity through reduced maintenance is neither necessary nor sufficient to show that the housing behavior of the elderly is consistent with standard life cycle optimization. Preservation of home equity up to death could be optimal, given a desire to remain at home, a strong bequest motive, willingness to substitute between housing and other consumption, and historically favorable treatment of home equity by social insurance programs. Further, the optimal level and timing of home maintenance and improvement for a particular household is simply not knowable given the current state of

[1] See, for example, Feinstein and McFadden (1989) and Venti and Wise (2000) regarding mobility and Rodda et al. (2000) regarding reverse mortgage debt. Based on HUD loan origination data and US Census counts, to date, take-up of the dominant reverse mortgage program (HECM) is less than one-half of one percent of eligible homeowners.

Figure 1: Mean unconditional home maintenance spending by age

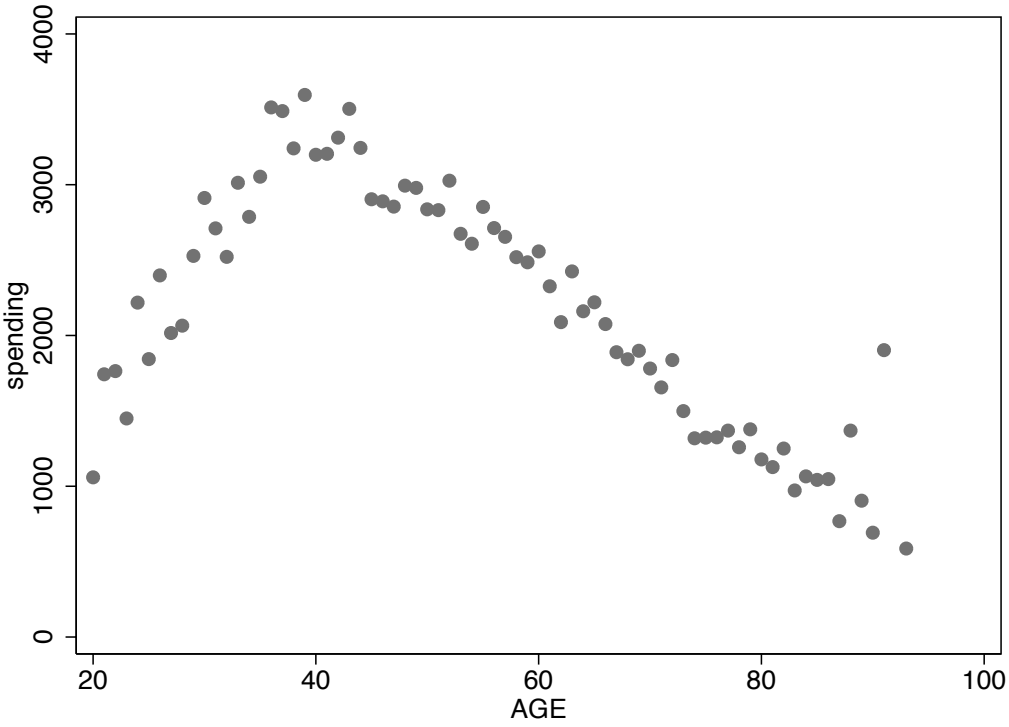
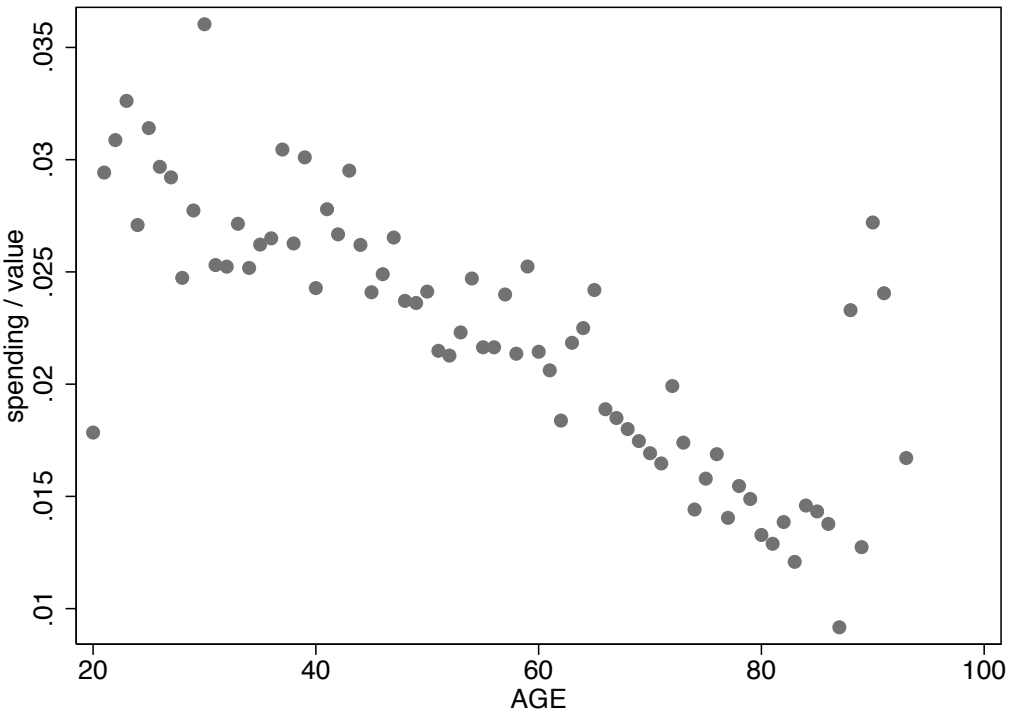


Figure 2: Mean unconditional home maintenance spending by age, as fraction of home value



economic research and the considerable heterogeneity that exists across households. Given uncertainty and endogeneity of the length of stay at home for an elderly homeowner, volatility of future home prices, the irreversibility of improvement projects, likely mismatch of tastes with subsequent owners, and the difficulty of estimating disutility of direct homeowner labor for maintenance, estimation of a price or rate of return schedule for maintenance projects would require extremely strong assumptions.[2]

The purpose of this investigation is not to characterize optimal maintenance or housing decumulation of the elderly. More modestly, I explore the extent to which old age is associated with reduced expenditures on home maintenance, reduced quantity of maintenance, and accelerated depreciation of home value. This exploration is motivated by the casual observation that reduced maintenance may be an important means of reducing home equity that has not been considered in the economic literature on aging. An effort is made to separate the effects of aging from the possibly correlated effects of living in the types of homes owned by older homeowners. No effort is made to identify a role of aging *per se* from individual characteristics, such as lifetime wealth or family structure, that are correlated with aging. We can thus learn *if* the elderly undermaintain their homes, but not *why*, if so. Because modeling optimal maintenance presents so many difficulties, I leave questions of motivation for the behavior of the elderly to future research.

The empirical analysis yields an interesting result: the reduction in home maintenance spending with old age is less than the difference in appreciation rates. An implication is that older homeowners fail to perform projects that are on a steep portion of an investment-return graph, and choose not to undertake projects with positive net present value, exclusive of any benefits from improved living conditions. Far from resolving the puzzle of why the elderly hold on to home equity, this result poses a new puzzle: why, given the availability of forward and reverse mortgages, would older owners not take on a project that costs $1,000 but would increase the value of their home by $2,000?

[2]Bogdon (1996), for example, characterizes first order conditions in a static setting.

A challenge to interpretation of the results relates to substitution between performing maintenance one's self and hiring others to do maintenance. To the extent that the two types of maintenance are complements, the elderly may enjoy increased leisure as a result of reduced maintenance, so that there may be no loss of utility from undermaintenance. Even if the two forms of maintenance are substitutes, project management and the disruption of home improvement projects may be sufficient that there remain no positive present value projects available to most elderly homeowners. These issues are highlighted by Bogdon (1996), who finds that at least among couples, older homeowners are more likely to perform improvement projects on their own. This issue relates to findings of Aguiar and Hurst (2005) that reduced expenditures on food are not the same thing as reduced consumption of food, and that the elderly substitute towards preparation from home, away from meals away. This issue does not appear to drive the main results. To the contrary, I find that older homeowners' reduced expenditures on maintenance are matched by a significantly reduced probability of performing maintenance projects on one's own, conditional on a project being undertaken.

This paper proceeds as follows. In section 2, I discuss the data used and the equations estimated to determine the relationship between old age and maintenance and depreciation outcomes. Section 3 details the empirical results. Section 4 concludes.

2 Data and Equations to be Estimated

We wish to know if old age is associated with reduced expenditures on home maintenance and on reduced appreciation. Ideally, these questions would be asked in the form of a first and second stage of an instrumental variables regression, with age serving as an instrument for maintenance. For such an approach to be valid, we would need to have some confidence that old age does not proxy for characteristics of homes that are associated with low appreciation rates, independent of age. Gaining confidence that maintenance has a causal role

through appreciation requires a data set with information both on appreciation rates and maintenance of homes, but also characteristics of homes that could plausibly be associated with appreciation through age other than through maintenance.

Such data is provided by the American Housing Survey (AHS), a biennial panel survey of American homes performed by the US Census Department in conjunction with the Department of Housing and Urban Development. The unit of observation in the AHS is a home, rather than a household. Hence a home stays in the panel after its initial occupant moves out. Up to ten observations per home are available, although approximately 14 percent of homes enter the panel before 1985, and approximately 13 percent exit before 2003. As it turns out, an instrumental variables approach has large standard errors, estimating an elasticity of annualized appreciation with respect to annualized maintenance of .4 that is indistinguishable from zero. However, the data allow us to control for some critical characteristics of the home, and features of the empirical results provide comfort that age has a causal role to play in appreciation, through maintenance.

I confine the sample to houses always owner occupied when present in the AHS. To allow estimation of an effect of owners' elderly status, I delete homes headed by individuals who either do not identify their age or claim an age below 20 years. I also delete condominiums and cooperative apartments; in such units, maintenance expenditures by the occupant are difficult to separate from work performed by management. The relatively small number of owner occupied seasonal housing units are retained, but the results presented are robust to their exclusion The results presented here should thus be interpreted as relating to the changes in maintenance with age and the consequences among owners of detached homes. This subset represents the large majority (93 percent above age 75 and 97 percent below age 75) of homeowners in the AHS. Table 1 provides summary statistics on the variables discussed below.

Before discussing the effect of old age on expenditures and changes in home value, it is necessary to define old age. Absent a natural definition of an older homeowner, I define older

homeowners as households in which the survey respondent is over age 75. Age 75 is chosen somewhat arbitrarily, but with the justification that 75 and above is the oldest age bin in the Consumer Expenditure Survey. In that survey, the oldest respondents report reduced expenditure shares on "maintenance, repairs, insurance, other expenses." This characteristic is measured in some cases by reported age in a given year (AGE>=75), in other cases by the mean age of a household head through the household's duration in the sample, and in still other cases as the number of years through some interval during which the household head was over 75 years old (YEARS>=75). A final measurement of old age is the change in old age status between a seller and a purchaser of a given home in the survey. The variable ΔAGE>=75 is -1 if the seller is over 75 and the purchaser is not, 0 if both buyer and seller have the same AGE>=75 status, and 1 if the purchaser is over 75 and the seller is not. In an earlier version of this paper, qualitatively similar results arose when the discrete indicator for old age was replaced with a continuous measure of age.[3]

The first set of regressions estimate the effect of being over 75 on different measures of home improvement expenditures. In these regressions, individuals i in different years t are sometimes treated as different observations. The regressions have the form:

$$IMPROVEMENT_{it} = \alpha + H_{it}\beta_1 + X_{it}\beta_2 + \gamma A75_{it} + \epsilon_{it}. \quad (1)$$

Here $IMPROVEMENT$ measures expenditures on home maintenance, repairs and additions or counts the number of improvements. H_{it} represents characteristics of the home. In particular, most specifications control for fixed effects for the metropolitan area in which the home is located interacted with an indicator for the year t. Hence homes in the Pittsburgh area in 1987 share a common treatment. Additional controls include polynomials in home age, in square feet of structure in the home, and in some cases the owner-reported value of the home. In some cases, additional neighborhood characteristics are included: the owner

[3]The continuous measure is the US population probability of death by age. Like AGE>=75, this variable is fairly flat before growing sharply late in life.

assessment of neighborhood quality, and interviewer assessment of the age and abandonment status of nearby buildings.[4]

X_{it} represents household characteristics in equation (1). The only such characteristic sometimes included is a polynomial in the length of tenure in the home up to date t. This characteristic is arguably a characteristic of the home, because optimal maintenance will depend on the match between the home and the owner, and this match depends on the length of stay. Other owner characteristics, such as gender of the head, income, and wealth, are ignored because they are not characteristics of the home. Inclusion of other owner characteristics in unreported specifications does not change the sign of the coefficient of interest on AGE>=75.

I consider four broad measures of $IMPROVEMENT$: (i) routine maintenance costs (CSTMNT), (ii) major alterations and repairs, (iii) the sum of (i) and (ii) (SPEND), and (iv) indicators for four particular types of repairs or replacements identified in the first six waves of the panel: ROOF, KITCHEN, additions to the home (ADDITION), and major equipment (MEQ).[5] A finding of consistently negative effect of old age on both the performance of all types of maintenance and expenditures on each suggests that undermaintenance exists not only with respect to taste-driven projects, but also with respect to more generically "necessary" repairs.

Home maintenance expenditures do not map trivially to changes to the quality of a home because quality has both vertical and horizontal components. For example, painting a room one's favorite color may add nothing to the resale value of one's home, but fixing a leaky pipe almost certainly enhances resale value.[6] Also, the marginal benefit of maintenance and

[4]The variable EAGE from AHS is transformed into an indicator for whether surrounding buildings are older than the building in question. EABAN is transformed into an indicator for observed presence of nearby abandoned buildings.

[5]Following Gyourko and Tracy (2003), I halve RAC, which is a two-year sum so that figures are annual. CSTMNT is defined in the early years as spending on routine maintenance last year and in later years as spending in a typical year - the latter definition elicits many fewer zeroes. These variables are in CPI-adjusted 2001 dollars.

[6]To the extent that a house, or the affected walls near a leak are certainly going to be torn down by the next purchaser, even vital repairs may add zero to resale value.

repair expenditures is likely decreasing because lot size is typically fixed and housing quality is presumably concave in land and capital. Further, houses that require less maintenance are more desirable than those which require more, all else equal. Hence directly regressing housing quality measures on home maintenance spending would not give a good idea of the consequences of home maintenance for housing quality. Instead, I ask whether homes headed by older individuals appear to depreciate relative to homes of younger households. The presence of controls for home characteristics points to a causal link between neglect and depreciation among the elderly.[7]

Some of the regressions of the form (1) are run at the group mean level, where a group is defined as all the observations of a given home under a given owner.[8] In other specifications, differences between owners of the same home are considered. These specifications overcome problems of missing variables in some but not all observations within groups and also ameliorate obvious serial correlation in maintenance that arises particularly within an owner-home group. Across owners, standard errors are clustered at the home level.

Sets of regressions similar to equation (1) replace improvements with measures of levels and changes in housing quality on the left hand side. Such measures include interviewer and interviewee assessments of home quality as well as market and owner-estimated prices. These regressions, representing the reduced form of the second stage of the instrumental variable regression alluded to above, are of the form:

$$\Delta QUALITY_{it,t-s} = a + \Delta\tilde{H}_{it,t-s}b_1 + \Delta\tilde{X}_{it}b_2 + A75_{it-s} + u_{it,t-s} \tag{2}$$

in a panel setting taking s-year differences. The tildes above H and X indicate that most of the home and owner characteristics are fixed across time; the exception is the owners'

[7]Using age as an instrument home maintenance spending in a two stage least squares setting generates a reasonable estimate that a dollar of maintenance is uninformative due to the weak explanatory power in the first stage regression. Determining the appropriate functional form for such an estimation strategy would be challenging given the likely nonlinear relationship between maintenance expenditures and appreciation.

[8]Changes in ownership are defined by the AHS variable SAMEHH, which appears to be a better measure of change of ownership than changes in family structure, in the sense that it is more highly correlated with a change in reported purchase price.

and surveyors' judgement of neighborhood quality and in some cases we consider changes in perceived quality when there is a new owner.

Two sets of dependent variables suggest themselves in assessing the effect of home maintenance (through age) on housing quality: the dollar value of the home and the perceived quality of the home. Home values are provided both by the respondents' estimate of the market value ($VALUE$) of the home and by the purchase price for homes when they are sold ($PRICE$), or at the time of a respondents' initial purchase. Housing quality is measured both by the respondent's answer to the question "On a scale of 1 to 10, how would you rate your unit as a place to live?" ($HOWH$) and by the interviewer's estimation of whether the home is in adequate repair, inadequate repair or severely inadequate repair. I denote a change from adequate repair to inadequate or severely inadequate repair between periods t and $t-k$ by $FALL_k$. Only approximately four percent of the houses in the sample are deemed to be in disrepair.

All dollar values are deflated by the US Consumer Price Index for non-shelter goods and measured in 2003 dollars.

3 Results

3.1 Elderly Homeowners Spend Less on Maintenance

Figures 1 and 2 illustrate the cross sectional relationship between age and home maintenance spending, plotting unconditional mean spending on maintenance against age in the case of Figure 1 and dividing total spending by home value in Figure 2. These graphs pool the ten waves of AHS, so that the same household's head forms part of mean expenditures for several increasing ages until the end of the sample or the end of the household's tenure in a given home.

Home maintenance spending visibly falls with age, and households headed by an individual aged 75 or over spend approximately $1,300 less than other households on total home

improvement expenditures at $1,122 as opposed to the mean spending among younger homeowners of 2,433. There is a hump-shape to total spending. This hump is not seen in the more consistently downward sloping graph of the fraction of home value spent on maintenance.[9] The mean fraction of value spent on maintenance and improvement by older homeowners is 1.6%, as opposed to the younger owners' average of 2.3%.

An obvious concern in interpreting Figures 1 and 2 is that older homeowners might live in different regions, have stayed longer in their homes or have different types of homes such that there is no independent role for age to play. Table 2 displays OLS estimates of equations of the form (1) with total expenditures on the left hand side. These estimates allow for conditioning the difference in expenditures on home characteristics. In columns (1), (2), (3), and (6), all variables are averages over the owner's biennial reports throughout their stay in the home over the course of the AHS survey.[10] In column (1), we find an unconditional difference in mean expenditures of over $1,200 between households whose head is never over 75 and one whose head is over 75 throughout the household's stay in a surveyed home. We find that adding controls for the metropolitan area (SMSA), years of surveys, building, and neighborhood characteristics (column (2)) reduce the estimated effect of age on maintenance dramatically. We also find that controlling for the length of the owner's tenure in the home (column (3)) also reduces the estimated effect of aging. It is difficult to interpret the result of adding the control for length of tenure, since this variable may be as good a measure of aging as the constructed AGE>= 75 indicator.

An alternative approach to estimating the effect of aging on maintenance expenditures is to take differences across consecutive owners of the same home. Differences in mean spending are straightforward to calculate. The right hand side variable Δ AGE>= 75 is set to the difference in the variable AGE>=75 across two owners of the same home. If the buying

[9] I thank a referee for pointing this out to me.

[10] For example, consider a household that had a household head aged 74 in the 1985 (first) wave, with that age increasing by one every year, with the household exiting the home between the 1999 (eighth) and 2001 (ninth) waves. The household would is observed to have a value for AGE>=75 of $\frac{7}{8}$. The value for maintenance would be the mean of the reported maintenance and improvement expenditures over the eight responses.

head is old throughout the household's tenure in the AHS and the seller's head was never old, this variable has a value of 1, for example. If the reverse transaction took place, the variable would take on a value of -1. Conditioning on building characteristics, we find that the average absolute effect of moving either from an older to a younger homeowner or from a younger to an older homeowner is approximately $600 in spending per year (column (5)), or roughly .8% of home value (column (7)). Given the relatively small differences in estimates for the difference approach when covariates are added, these estimates appear more reliable than the estimates under the control approach described above.

3.2 Expenditure Typology

Figures 1 and 2, along with Table 2, strongly suggest that the elderly invest less in home improvement than other homeowners under similar conditions. Table 3 explores whether this undermaintenance applies across types of home improvement projects. Routine maintenance (MAINT) spending is lower for older homeowners than younger homeowners by roughly $200 per year, with a lower estimate under OLS with the control variables discussed above and a larger estimate taking a differences approach. The probability of a household undertaking an improvement project related to a kitchen, a new addition, a roof repair, or major equipment such as a furnace, is significantly lower for the elderly than for younger owners, as shown in columns (3) through (6) of Table 3.

Column (7) of Table 3 shows that older homeowners are considerably less likely than younger homeowners (16%) to do the majority of work on a project themselves (RAH) rather than having a contractor do the work. This fact, combined with the fact that the elderly are less likely to do projects at all, eliminates the concern related to Aguiar and Hurst (2005) that labor substitutes for expenditures among the elderly.

3.3 Consequences: Changes in Housing Quality

3.3.1 Changes in Subjective Perceived Quality Measures

Given that older households spend less on home maintenance, we might expect that their homes suffer a loss in observable quality or value relative to younger homeowners. Table 4 asks whether homeowners or the AHS interviewers perceive such a difference. The first two columns measure changes in interviewer assessed home repair over a two year period among homes owned in consecutive years by the same owner. In the absence of covariates, we find no significant difference in the probability that a home falls into disrepair between consecutive waves of the AHS (FALL). In column (2), we find that conditional on building and neighborhood characteristics as well as metropolitan area - year interactions, that older homeowners are .4% more likely to preside over such a reduction in quality. This is relative to a 3.6% overall rate of moves into disrepair. Columns (3) and (4) of Table 4 show a very similar pattern with respect to owner's estimated change in their homes value. Column (4), which includes metropolitan area and year dummy variables is the more plausible specification. There, we find that the elderly perceive their homes to increase in value at a rate 1.1% smaller than the rate for younger owners of comparable homes. Columns (5) and (6) reveal no significant difference in the owners' assessment of the quality of the home depending on age, either in a cross section or examining different views when a younger owner sells to an older owner or vice-versa. These last (non-) results are invariant to the presence or absence of controls.

3.3.2 Changes in Market values of homes

A natural way to measure the extent to which older homeowners are subject to greater rates of depreciation is to compare annual rates of appreciation among older and younger homeowners. Table 5 estimates regressions of the log change in a homes value from a base of the owner's estimated value when a home is first surveyed in the AHS to the reported

purchase price when a new household occupies the home. Under varying sample restrictions and control schemes, we find that an additional year of ownership by a household headed by someone 75 or over between the two years (YEARS>=75) is associated with diminished appreciation of roughly 2% per year. The results are not significantly different when controls are included or excluded, or when non-metropolitan observations are treated as missing or as belonging to a single composite metropolitan area. The critical control is a dummy variable that interacts the year of first observation, the year of resale, and the metropolitan area. For example, a common treatment is thus assigned to all homes in Boston first observed in 1985 and first sold in 2000. We note that 2% is substantially larger than the .8% difference in total home maintenance and improvement spending found between older and younger homeowners.

Table 6 is similar to Table 5, but takes as a base price the reported original purchase price of the first occupant in the year they originally purchased the home. In this way, any concern that the elderly overstate value to a greater extent than younger owners is eliminated. The correlation between recollected purchase price in two consecutive waves is .94. For homeowners less than 75, the correlation between consecutive recollections is .9386, for those over 75, the correlation is .9463. There is thus no systematic difference in the quality of price recollection between older an younger homeowners and the quality of recollections appears to be quite high.

The critical dummy variable in this case interacts the year of original purchase (typically before 1985) with the year of first AHS recorded resale and the metropolitan area. The variable YEARS>=75 is transformed to include all years between the original purchase year and the year of resale. The sample is somewhat smaller because of missing purchase year information and small cell sizes, but there remain 379 degrees of freedom (as opposed to over 2,200 in the specification presented in Table 5. The presence of control variables and exclusion of non-metropolitan observations increases the magnitude of the estimated effect of a year of being over age 75 from 1.5% to an almost incredible 4.2%. Either of these bounds

is significantly greater than the estimated .8% difference in maintenance.

Ideally, we would compare appreciation rates for homes that are identical but for the age of the owner. The AHS allows comparison of homes of similar size and age within the same metropolitan area, but little neighborhood information is available and included as a control. For the exclusion of neighborhood effects to matter for the results, it would have to be the case that older homeowners live in neighborhoods that see less appreciation than those in which younger homeowners live for reasons having to with something other than building characteristics or the level of upkeep. Building age and square footage may proxy for neighborhood traits, so the fact that controls generally add to, rather than subtract from, the effect of aging is helpful. It is also noteworthy that exclusion of non-metropolitan areas increases the estimated effect of aging. This suggests that the relative depreciation seen by the elderly is not associated with rural location. Finally, the assumption of a constant within-MSA appreciation rate, however unrealistic, is implicit in the construction of house price indices such as OFHEO's.

4 Concluding Remarks

American Housing Survey data show that older homeowners spend significantly less money on both routine home maintenance and on alterations and repairs than younger households. Homeowners over 75 invest between one-half and one percent of home value less per year on maintenance. Older homeowners also do fewer repairs by themselves. For given levels of housing wealth, savings and income, older households appear to enjoy a greater level of non-housing consumption, when non-housing consumption is considered net of investments in home maintenance and improvement.

Translating these difference in home improvement into a relative reduction in housing wealth is not a trivial exercise; heterogeneity among homeowners, depreciation, inflation and likely decreasing returns to capital investment in homes imply that a dollar spent on

home improvement will not in general add exactly one dollar to the resale value of the home. However, to the extent that differences in maintenance expenditures across age groups are related neither to home characteristics nor to differences in regional price changes, comparing realized appreciation among older and younger homeowners should provide an estimate of the consequences of the relative underinvestment of the elderly. One clear result of this undermaintenance is that older homeowners are significantly more likely to have their home fall into disrepair.

In the years leading up to resale, older homeowners see significantly less appreciation, or more depreciation, than younger than younger homeowners in homes of similar size and age in the same metropolitan areas. Older homeowners who do not sell their homes perceive appreciation one percent less per year than other homeowners. This difference in appreciation rates is approximately two percent per year based on market resale prices when the base price is deemed to be estimated value as of the first year in the AHS panel. A much larger difference, over four percent per year, is seen when the base price is taken to be the owner's recollection of the original purchase price.

Three features of the empirical results on relative appreciation rates provide comfort that unobserved home characteristics correlated with aging are driving the results. First, the difference in annual appreciation rates can not be attributed to differences in bargaining approaches between older and younger sellers, because the annualized difference arises even when a control is present for the age of the seller. Second, adding home characteristics to regressions consistently fails to reduce the estimated difference in appreciation rates. Third, excluding non-metropolitan homeowners from the analysis increases the estimated differences. A shortcoming of the results is that standard errors are too large to find a significant effect of maintenance on appreciation rates through two stage least squares estimation.

The magnitude of realized relative depreciation appears to be greater than the difference anticipated by older sellers. This suggests that surveys showing no relative decrease in home equity among the elderly may suffer from a bias due to failure to fully recognize depreciation

of homes. If the differences in expenditures and appreciation are roughly constant across wealth levels, then at a median home value among older homeowners in AHS of $100,000, there is an annual gap of $2,000 between the lesser home improvement expenditures relative to younger homeowners and the difference in annual appreciation for comparable homes. While equivalent expenditures by older and younger homeowners might not yield identical rates of depreciation, discussions with contractors suggest that on average, annual expenditures of less than $1,000 should equalize the opportunity sets of seniors completely unable to do work on their own and younger homeowners highly proficient at repairs.

While some of the difference in expenditures appears attributable to diminished customization, through expansion or kitchen remodeling, older homeowners spend significantly less on routine maintenance than younger homeowners and there is a significant difference in the propensity to replace major equipment or repair a roof. Further, a refusal to exercise any option to undertake a project, regardless of type, that generates more capital gains than costs violates utility maximization as long as the project itself does not reduce utility. In fact, anecdotal evidence suggests that disruption and fear associated with contracting out home improvement may be important factors in the relative underprovision of maintenance among the elderly. Given that older homeowners perceive their homes to have inflation rates only slightly and insignificantly smaller than younger homeowners, it also seems possible that older homeowners are not aware of the availability of profitable home improvement expenditures.

Venti and Wise (2000) cite an AARP report stating that most elderly homeowners strongly wish to remain in their home. This appears to be a costly preference, in that older homeowners enjoy smaller capital gains on housing than younger households at the time of sale. The smaller rate of appreciation may be due not to a greater rate of depreciation among the elderly, but rather to a greater rate of upgrade to existing homes among younger households. It is difficult to distinguish between repairs required to keep a home in constant condition from alterations and repairs which enhance quality. In either event, these results

can be viewed as older households failing to make high return investments in home maintenance, and seeing large depreciation as a result, so the puzzle of elderly homeownership has been extended.

One might argue that a wish to stay in place, precautionary savings motives, the structure of Medicaid benefits, and absence of a bequest motive could rationalize the observed undermaintenance. However, a homeowner wishing to remain in place for a long time and with no bequest motive should find reverse mortgages, loans of cash to be repaid when the homeowner moves out or dies, appealing. However, to date, there has been very little demand for reverse mortgages.[11] In any event, the results modify the conventional view that older households are overinvested in housing.

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[11]It could be argued that the absence of a market for reverse mortgages is a result of a lack of supply, or of high interest rates and fees (which only matter if there is a bequest motive or intent to move) which could arise from recognition of the deteriorating quality of older households' homes. Neither appears to be the case, as discussed in Rodda et al. (2000). Rather there appears to be widespread lack of appreciation for the benefits of reverse mortgages, in particular, cashing out home equity. If some of the proceeds from a reverse mortgage could be used for projects which generate lifetime wealth and a part less than the net change in lifetime wealth for consumption, then it is very difficult to explain an absence of demand.

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Table 1: Summary Statistics: Data From the American Housing Survey

Variable	Description	Obs	Mean	Std. Dev.	Min	Max
ADD	Addition to Home	97,256	0.05	0.22	0.00	1.00
ADPRICE	$\frac{\text{Resale Price}}{\text{Purchase Price}} / \frac{1}{\text{Yr. Sold - Yr. Bought}}$	68,187	0.04	0.38	-14.24	10.19
ADVALUEPRICE	$\frac{\text{Resale Price}}{\text{Value(Yr.0)}} / \frac{1}{\text{Yr. Sold - Yr.0}}$	86,185	-0.03	0.22	-3.47	2.61
AGE	Household Head's age	206,204	51.89	16.22	20.00	93.00
AGE>=75		206,204	.11	.31	0	1
AGE>=75	Owner-unit group mean	235,576	0.09	0.29	0.00	1.00
Building Age		233,978	38	21	-14	84
MAINT	Cost of Routine Maintenance	182,073	553	1,056	0	17,172
Δ MAINT		239,267	-125.33	970.99	-17,021	16,464
$\Delta \frac{SPEND}{VALUE}$		239,267	-0.002	0.06	-2.65	3.69
ΔHOWH	Change in HOWH	174,984	-0.03	1.66	-9.00	9.00
ΔHOWN	Change in HOWN	174,605	-0.04	2.01	-10.00	10.00
ΔAGE>=75	Change 1st to 2nd owner	239,267	-0.15	0.42	-1.00	1.00
ΔTSPEND		239,267	-89.64	4,833	-313,721	124,456
ΔVALUE	Natural Log 2 year diff.	155,625	0.03	0.57	-5.48	5.85
EAGE (dummy)	Nearby bldg's older than subject?	238270	.0676053	.1532159	0	1
EABAN (dummy)	Nearby abandoned bldg's	237577	.0315408	.1119393	0	1
FALL	Interviewer newly assesses disrepair	192,069	0.04	0.19	0.00	1.00
$\frac{SPEND}{VALUE}$		80,437	0.02	0.08	0.00	7.35
Yr. Bought	1st Surveyed Occupant	239,267	1,986.15	3.31	1985	2003
Yr. Sold	Reported move-in of 2nd " "	117,125	1,993.14	5.38	1987	2003
HOWH	Owner home quality assessment	211,358	8.45	1.59	1.00	10.00
HOWN	Owner neighborhood " "	211,116	8.20	1.92	0.00	10.00
KITCHEN	Kitchen project indicator	97,230	0.09	0.28	0.00	1.00
MEQ	Major equipment project indicator	97,162	0.11	0.31	0.00	1.00
PRICE1	1st occupant purchase price	218,577	94,856	115,642	1.68	5,647,668
PRICE2	2nd Occupant purchase price	104,915	126,588	117,010	2.11	4,269,133
RAC	Major repair spending (2 years)	90,590	3,586	11,795	0	618,954
RAH	Do-it-yourself indicator	239,267	0.08	0.27	0.00	1.00
ROOF	Roof project indicator	97,237	0.17	0.38	0.00	1.00
SPEND	MAINT + RAC/2	80,685	2,490	6,262	0.00	313,721
UNITSF	Building Square Feet	217,684	1,804	844	99	5001
VALUE	Owner's Assessment	202,705	145,275	123,738	1,052	737,595
YEARS>=75	Years home head 75+	105,507	1.60	3.61	0.00	18.00
YEAR	Survey Year	239,267	1994	5	1985	2003

Table 2: Regressions of total home improvement expenditures on age

	(1) SPEND	(2) SPEND	(3) SPEND	(4) Δ SPEND	(5) Δ SPEND	(6) $\frac{SPEND}{VALUE}$	(7) $\Delta\frac{SPEND}{VALUE}$
AGE>=75	-1,227.990**	-854.307**	-643.904**			-0.007**	
	(59.466)	(56.555)	(60.053)			(0.001)	
ΔAGE>=75				-556.867**	-610.396**		-0.008**
				(122.145)	(218.544)		(0.002)
Controls for							
Building characteristics	No	Yes	Yes	No	Yes	Yes	Yes
Neighborhood characteristics	No	Yes	Yes	No	Yes	Yes	Yes
Owner's estimate of value	No	Yes	Yes	No	Yes	Yes	No
Owner's length of tenure	No	No	Yes	No	No	No	No
metro×years surveyed dummies	No	Yes	Yes	No	Yes	Yes	Yes
Owner unit	Mean	Mean	Mean	Change owner	Change owner	Mean	Change owner
Constant	2,357.231**	18.426	-315.350	1,539.015**	149.754	0.054**	0.024**
	(37.332)	(390.922)	(430.854)	(57.414)	(460.755)	(0.006)	(0.007)
Observations	17,236	17,236	17,236	11,031	11,031	17,226	11,031
R-squared	0.01	0.25	0.26	0.00	0.16	0.11	0.11

Notes: Robust standard errors in parentheses, clustered at the home level. * significant at 5%; ** significant at 1%. AGE>= 75 indicates age 75 or over for the household head. The variable SPEND is mean spending over a given household's stay in an AHS home. Δ SPEND is the change between owners. VALUE is the owner's estimate of home value. Controls are third order polynomials except for a seventh order polynomial in owner's length of owner's stay. Building characteristics are the age of the building and the size of the structure in square feet. Neighborhood characteristics are interviewer assessments of the abandonment status and age of nearby buildings.

Table 3: The Effects of Old Age on Different Expenditure Types

	(1) MAINT	(2) Δ MAINT	(3) MEQ	(4) ROOF	(5) KITCHEN	(6) ADDITION	(7) RAH
AGE>=75	-180.308**		-0.032**	-0.017**	-0.068**	-0.040**	-0.164**
	(11.572)		(0.003)	(0.005)	(0.002)	(0.002)	(0.003)
ΔAGE>=75		-201.330**					
		(28.987)					
Controls							
Building characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Neighborhood characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Owner's value estimate	No	Yes	Yes	Yes	Yes	Yes	Yes
Metro*Years dummy?	Yes	Yes	No	No	No	No	No
Metro and year dummies?	No	No	Yes	Yes	Yes	Yes	Yes
Constant	253.546**	77.083					
	(53.493)	(112.392)					
Owner Unit	Mean	2nd-1st means	all obs	all obs	all obs	all obs	all obs
Observations	27,418	11,031	89,804	89,916	89,914	89,706	74,524
R-squared	0.25	0.18					
Functional Form	OLS	OLS	Probit	Probit	Probit	Probit	Probit

Notes: MAINT is expenditures on routine maintenance. There are more observations available for this variable than for TSPEND because MAINT (unlike RAC) is available for all years of the AHS survey. ROOF indicates a roof replacement project. ADDITION indicates a new addition. MEQ indicates replacement of major equipment. KITCHEN indicates a kitchen rehabilitation or addition. RAH indicates that a project was done all or mostly by household members. Column (1) takes mean values over owners spells. Column (2) considers changes from the first to second owners of an AHS home, with Δ AGE>=75 denoting the difference in old status of the second versus first owner. Columns (3) through (7) evaluate each year's observation as a home. * Denotes significance at five percent, ** at 1 percent. Standard errors are clustered at the home level. Probit coefficients reflect marginal effects.

Table 4: Regressions of Changes in Owner and Interviewer Assessment of Housing Quality; 2 Year differences

	(1) FALL	(2) FALL	(3) Δ VALUE	(4) Δ VALUE	(5) Δ HOWH Same Owner	(6) Δ HOWH New Owner
AGE>=75	-0.001	-0.004**	-0.002	-0.011**	-0.007	
	(0.001)	(0.001)	(0.004)	(0.004)	(0.008)	
ΔAGE>=75						0.071
						(0.063)
Δ HOWN					0.298**	0.365**
					(0.004)	(0.013)
Controls						
Building Characteristics	No	Yes	No	Yes	Yes	Yes
Neighborhood Characteristics	No	Yes	No	Yes	Yes	Yes
Metro×year dummy?	No	Yes	No	Yes	Yes	Yes
Constant			0.025**	-0.015	-0.049	0.415
			(0.001)	(0.015)	(0.034)	(0.286)
Observations	158,238	158,238	138,642	138,642	155,028	7,204
R-squared			0.00	0.03	0.14	0.29
Functional Form	Probit	Probit	OLS	OLS	OLS	OLS
Owner Year	All obs	All obs	All obs	All obs	All obs	2nd-1st owner

Notes: Robust standard errors in parentheses. Standard errors are clustered at the home level. All differences are two-year differences between panels in the AHS. Control variables are means within owner-home groups (third order polynomials in building age and square feet, seventh order in owners' length of tenure. In columns (1) and (2), the coefficients are changes in probability of a home falling into interviewer assessed disrepair (FALL) over a two year period. The dependent variable in columns (3) and (4) is the log change in owner's estimate of home value (VALUE). Columns (5) and (6) have as a dependent variable changes in the owner's subjective report of quality of the home (HOWH). In columns (1) through (5), the sample is all homeowners. In column (6), the sample is only homeowners in their first year of ownership after a purchase. Δ AGE >= 75 is -1 if the purchaser is under 75 and the buyer over, 1 if vice-versa, and 0 otherwise. HOWN is the owner's subjective estimate of neighborhood quality (as opposed to the interviewer assessments included in the Neighborhood Characteristics).

Table 5: Log ratio of resale price to owner estimated value in first survey year

	(1)	(2)	(3)	(4)
YEARS>=75	-0.021**	-0.018**	-0.019**	-0.025*
	-0.004	-0.006	-0.006	-0.01
			-0.103	-0.208
metro×years dummy	Yes	Yes	Yes	Yes
Building and neighborhood controls?	No	No	Yes	No
Sample Exclusion	None	Non-metro	Non-metro	Non-metro, Seller Age<55
Constant	-0.137**	-0.106**	-0.462**	-0.550**
	-0.006	-0.008	-0.085	-0.186
Observations	8018	3873	3837	1608
R-squared	0.23	0.5	0.51	0.63

Notes: The unit of observation is the first (if any) sales transaction documented in the American Housing Survey for each home in the panel. Resale is the price at which a home transacted in yr. sold. Standard errors in parentheses. * denotes significant at five percent, ** at one percent. YEARS>=75 is the number of years between the first survey year and the year in which the second owner moved in that the first household head was over 75. Fixed effects interact the first survey year, the year sold, and the metropolitan area. When non-metropolitan areas are included, they are bunched as a single "metropolitan area."

Table 6: Log ratio of resale price to original purchase price

	(1)	(2)	(3)	(4)	(5)	(6)
YEARS>=75	-0.013**	-0.014**	-0.022**	-0.015**	-0.021**	-0.042**
	(0.003)	(0.004)	(0.005)	(0.004)	(0.006)	(0.014)
Non-metro excluded?	No	No	No	No	No	Yes
Seller age control	None	None	Continuous	No	No	AGE>=75
Building controls	No	No	No	Yes	Yes	Yes
Neighborhood controls	No	No	No	Yes	Yes	Yes
Dummies: purchase-sale years	Yes	No	No	No	No	No
Dummies: " " interacted with metro?	No	Yes	Yes	Yes	Yes	Yes
Constant	0.305**	0.306**	0.185**	-0.248*	-0.250*	-0.233
	(0.008)	(0.009)	(0.038)	(0.098)	(0.098)	(0.216)
Observations	7,322	7,322	7,322	7,241	7,241	3,553
R-squared	0.22	0.62	0.63	0.64	0.64	0.95

Notes: The unit of observation is the first (if any) sales transaction documented in the American Housing Survey for each home in the panel. Resale is the price at which a home transacted in yr. sold. Purchase is the price at which the reseller originally purchased the home in yr. purchased. YEARS>=75 is the number of years between purchase and resale during which the reported head of the household was 75 or older, based on average reported age of the head for the original AHS household. Fixed effects in the first column interact the year of purchase and sale. In the other columns, the purchase-sale interaction is again interacted with region. In the first 5 columns, all non-metropolitan respondents are included within a single region. These respondents are excluded from the final column's analysis.