Housing Equity Extraction from Older Adults via Reduction in Home Improvement

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Abstract

Housing equity accounts for a substantial share of retirees' total wealth, yet many do not use their housing equity to increase consumption in retirement as the Life-Cycle Hypothesis predicts they should. We show that retirees spend a decreasing share of their house value on home improvement as they age, cumulatively summing to 8.4 percent of mean house value for married households. This reduction in home improvement could explain why house values for older adults have lower appreciation rates and why the quality of houses of older adults has decline. Reduction in home improvement can serve as a method of equity extraction for households that are unable to acquire traditional or reverse mortgage instruments.

JEL Classification: J14, J26, J32, D13, D14, R20
KEYWORDS: household production, retirement, housing equity, home improvement

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1 Introduction

Nearly 80 percent of Americans over the age of 65 own a home (US Census Bureau, 2021) and housing equity is the largest component of wealth for many retirees (Begley and Chan, 2018; Eggleston et al., 2020). Despite the presence of active resale and refinancing markets that would allow the extraction of housing equity to increase consumption during retirement, older Americans tend to eschew both. Among retirees, annual housing transition rates are 1.7 to 9.1 percent (Engelhardt and Eriksen, 2022; Munnell, Soto and Aubry, 2007; Venti and Wise, 2001, 2004) and when retirees do change residence, they are just as likely to upsize as downsize (Calvo, Haverstick and Zhivan, 2009; Clark, Deurloo and Dieleman, 2003; Venti and Wise, 1989). The majority of housing transitions associated with a decrease in housing stock follow idiosyncratic negative shocks, such as the death of a spouse or divorce, rather than as part of a long-term retirement asset management plan (Ai et al., 1990; Borsch-Supan, Hajivassiliou and Kotlikoff, 1992; Calvo, Haverstick and Zhivan, 2009; Fisher et al., 2007; Poterba, Venti and Wise, 2011; Venti and Wise, 1989, 1990, 2001, 2004). Around 50 percent of Americans die while still owning a home (Engelhardt and Eriksen, 2021), very often the same home they owned at the start of retirement (American Association of Retired Persons, 1996; Binette and Vasold, 2018; Munnell, Soto and Aubry, 2007). Further, the take-up rate for reverse mortgages is exceptionally low (Davidoff, Gerhard and Post, 2017; Moulton and Haurin, 2019).

The widespread failure to use housing equity to increase consumption during retirement in contradiction to the predictions of the Life-Cycle Hypothesis (Modigliani and Brumberg, 1954) has earned its own name – *the housing-equity puzzle* (HEP). A variety of possible explanations for the HEP have been offered, including market failures, frictions in housing and refinance markets, bequest motives (Begley, 2017; Engelhardt and Eriksen, 2021; Lockwood, 2018; Suari-Andreu, Alessie and Angelini, 2019); housing equity as a form of precautionary savings (Costa-Font, Frank and Swartz, 2019; Murray, 2020; Nakajima and Telyukova, 2017; Poterba, Venti and Wise, 2011); and non-pecuniary utility flows from staying or disutility flows from moving (Carstensen, 2006; Fisher et al., 2007). Each of these hypotheses seek to explain why households forego consumption while maintaining their housing equity position. In this article, we investigate the importance of an alternative mechanism that is fully consistent with the Life Cycle Hypothesis – the extraction of housing equity through reduced home maintenance (Davidoff, 2006; Feinstein and McFadden, 1989; Murray and Dunn, 2022).

To do so, we develop a model of intertemporal utility maximization with home investment that relates household allocations on home improvement to consumption and house values. Applying the empirical specification from Murray and Dunn (2022) to data from the Health and Retirement Study (HRS), we then calculate the cumulative change in spending on home improvement between ages 65 and 85. We compare this amount with reported home values to estimate the potential share of home equity that is extracted through decreased investment into the home. We find that married households home investment by $18,243 between ages 65 and 85, approximately 8.4 percent of mean house value. This finding is consistent with previously reported stylized facts in the housing literature, namely that housing quality is negatively correlated with age (Mayer and Lee, 1981; Reschovsky and Newman, 1991) and homes owned by older households appreciate 1.0-3.6 percent slower relative to working-age households (Davidoff, 2006; Murray and Dunn, 2022; Rodda and Patrabansh, 2007). Recognizing that it is difficult for households to downsize their housing to zero, extraction of home equity by reducing the allocation of household resources to home maintenance accounts for a small, but still economically meaning share of the HEP.

2 Model of Housing and Consumption

Consider a single infinitely lived consumer who maximizes their utility over the consumption of housing and non-housing goods. Housing evolves according to $p_{t+1}h_{t+1} = (1-\delta+I_t)\,p_t h_t$ where h_t denotes quantity of housing at time t, p_t is the price per unit of housing, $\delta \in (0,1)$ is the depreciation rate, and I_t is the investment rate into home improvement and maintenance at time t. If $\delta = I_t$, then the consumer is investing into their home at the same rate that housing depreciates. When $\delta < I_t$, the consumer is investing more into their home to increase the value (e.g., adding an addition, upgrades, etc.). When $\delta > I_t$, the consumer is allowing the home to depreciate. The consumers lifetime utility function is defined by

$$\max_{\{c_t, h_{t+1}, a_{t+1}\}_{t=0}^{\infty}} \quad \sum_{t=0}^{\infty} \beta^t u(c_t, h_t) \tag{1}$$

where $\beta \in (0,1)$ is the subjective discount factor and c_t denotes non-housing consumption at time t. The consumers choices are subject to the following sequential budget constraint

$$c_t + p_{t+1} h_{t+1} + a_{t+1} = y_t + (1 - \delta + I_t) p_t h_t + (1 + r_t) a_t \tag{2}$$

$$c_t \geq 0, h_t \geq 0$$

where y_t is income at time t and a_t is non-housing asset holdings at time t that earns rate of return $r_t > 0$. The consumers utility maximization problem is solved by

$$\mathscr{L} = \sum_{t=0}^{\infty} \beta^t \left[u(c_t, h_t) + \lambda_t \left(y_t + (1 - \delta + I_t) p_t h_t + (1 + r_t) a_t - c_t - p_{t+1} h_{t+1} - a_{t+1} \right) \right] \tag{3}$$

which yields the following first order conditions:

$$\frac{\partial \mathscr{L}}{\partial c_t} = \beta^t \left[u_c(c_t, h_t) - \lambda_t \right] = 0 \tag{4}$$

$$\frac{\partial \mathscr{L}}{\partial a_{t+1}} = \beta^t (-\lambda_t) + \beta^{t+1} \lambda_{t+1} (1 + r_t) = 0 \tag{5}$$

$$\frac{\partial \mathscr{L}}{\partial h_{t+1}} = \beta^t (-\lambda_t) p_{t+1} + \beta^{t+1} \left[u_h(c_{t+1}, h_{t+1}) + \lambda_{t+1} (1 - \delta + I_{t+1}) p_{t+1} \right] = 0 \tag{6}$$

By substituting (4) into (5) we get

$$u_c(c_t, h_t) = \beta (1 + r_t) u_c(c_{t+1}, h_{t+1}) \tag{7}$$

and substituting (4) into (6) we get

$$u_c(c_t,h_t)\,p_{t+1} = \beta\left[u_h(c_{t+1},h_{t+1}) + u_c(c_{t+1},h_{t+1})\,p_{t+1}(1-\delta+I_{t+1})\right] \tag{8}$$

Then substituting (7) into (8) we get

$$(1+r_t)\,u_c(c_{t+1},h_{t+1})\,p_{t+1} = u_h(c_{t+1},h_{t+1}) + u_c(c_{t+1},h_{t+1})\,p_{t+1}(1-\delta+I_{t+1}) \tag{9}$$

$$u_h(c_{t+1},h_{t+1}) = u_c(c_{t+1},h_{t+1})\,p_{t+1}\left[r_t+\delta-I_{t+1}\right] \tag{10}$$

For simplicity, if we assume Cobb-Douglas utility so that $u(c_t,h_t) = c_t^{\alpha} h_t^{1-\alpha}$, then we can rearrange (10) to show

$$\frac{c_{t+1}}{p_{t+1}h_{t+1}} = \frac{\alpha}{1-\alpha}\left(r_t+\delta-I_{t+1}\right) \tag{11}$$

Equation (11) implies that there is an inverse relationship between the investment rate into the home, I_{t+1}, and the value of consumption relative to the value of housing. This has two implications. First, any household can reduce the rate at which they reinvest into their home to increase consumption expenditure. Second, because housing evolves according to $p_{t+1}h_{t+1} = (1-\delta+I_t)\,p_t h_t$, the decreased investment into the home has a direct impact on house value. If households decrease I_t and $\delta < I_t$, then the house will still appreciate, but at a lower rate. If households decrease I_t and $\delta > I_t$, then the house value will depreciate. If rate of investment into the home, I_{t+1}, declines in retirement, then households are forgoing future housing wealth that could be recognized at a future date, either through selling the home or a reverse mortgage.

3 Data

In this paper, we use data from 2004 to 2014 waves of the restricted geocoded version of the Health and Retirement Study (HRS) and the 2005 to 2015 Consumption and Activities Mail Survey (CAMS). The HRS is a longitudinal survey administered to 20,000 older adults every other year and thus is a large, nationally representative sample of older households. In off years, a subsample of the HRS participants participate in CAMS, where respondents answer detailed questions about time and expenditure on a variety of goods and services.

We use data on age, marital status, education, health, income, house value, and wealth from the HRS. We define age as the age of the husband in married households and age of the individual in single households. To reduce the potential confounding effect of shocks to household structure, we restrict the sample to continuously married or single households that have no other residents living in the household (e.g., children, grandchildren, etc.). Thus, we drop households that change structure through divorce, death, or death of a spouse and households that move at any point in the sample because those households may adjust spending on home improvement in preparation for or in response to these events. Our sample is also restricted to married adults and single women aged 56-85 due to too few observations at each age outside of this range and for single men throughout the age profile.

Murray and Dunn (2022) demonstrate that the total value of home improvement must account for three separate sources of investment: expenditure on professional services, expenditure on materials, and the time that homeowners allocate to home repair and maintenance activities. We therefore follow their approach and calculate the total investment in home improvement as the value of household production plus expenditure on professional services. We estimate the value of household production as a function of time spent on home repair and maintenance and expenditure on do-it-yourself materials using the method outlined in Murray and Dunn (2022)[1]. The percent of house value spent on home improvement is defined as the total investment in home improvement divided by house value. Nominal monetary values reported in the HRS and CAMS are converted to 2009 real dollars using the PCE chain-type price index (Bureau of Economic Analysis, 2017).

Descriptive statistics for these variables can be found in Table 1.

[1] Murray and Dunn (2022) predict the value of household production from estimates generated from a regression analysis, however, they also show that this result is robust to alternative methods of calculating the value of household production

4 Empirical Strategy

Figure 1 shows the unconditional means and three-period moving average of home improvement as a fraction of house value over the age profile. Both married households and single women see an increase in home improvement as a fraction of house value between the ages of 65 and 70. This is followed by a clear downward trend for both married households and single women. The trend is more pronounced for married households as the mean before age 65 is around 3 percent compared to around 1 percent for single women. Because these are unconditional means, there may be household characteristics that may influence the home improvement decisions such as income, wealth, education, health, and location.

To control for these characteristics, we follow the empirical strategy of Murray and Dunn (2022) and estimate nonparametric kernel local-linear regressions using the Epanechnikov kernel with the bandwidth selected using cross-validation per Li and Racine (2004). The benefit of using nonparametric regression is we avoid making assumptions about the shape of the age-profile. We estimate the following regression separately for married households and single women:

$$Improvement_{it} = g(Age_{it}, X_{it}, \phi_i, \lambda_t) + \varepsilon_{it} \tag{12}$$

Where $Improvement_{it}$ is the dollar value of home improvement as a fraction of house value for household i in period t; X_{it} denotes household characteristics that includes household income, non-housing wealth, education, urban location, and mobility; ϕ_i denotes a state fixed-effect; and λ_t denotes a year fixed-effect.

5 Results

Figure 2 shows the estimated mean of home improvement as a fraction of house value from the nonparametric local-linear regressions for married households (in Panel A) and single women (in Panel B). The results show that when controlling for household income, non-housing wealth, education, urban location, mobility, location, and year, married households spend around 2.5 percent of their house value on home improvement between ages 55-65. There is a small spike to 3 percent at age 70, followed by a decline to less than 1 percent by age 85. For single women, there is an increase in the percent of house value spent on home improvement from 1 at age 55 to 3 percent at age 65, which is followed by a decline a sharp decline to around 1.5 percent at age 75 and a gradual decline throughout the rest of the age profile. While in any one given period, this may be interpreted as a reduction in investment, the model presented in Section 2 shows that a decrease in investment in home improvement as a fraction of house value can lead to a lower appreciation rate of a home or a depreciation of value, depending on how the fraction of home improvement compares to the depreciation rate. While it is difficult to draw concrete causal relationships between investment in home improvement and housing depreciation, there is empirical evidence suggesting this might be the case as houses of older homeowners appreciate 1-3 percent less than houses of younger homeowners (Davidoff, 2006; Murray and Dunn, 2022; Rodda and Patrabansh, 2007).

The implications of the fall in housing investment are evident as shown in Figure 3, which plots the three-period moving average of actual spending on home improvement relative to mean spending between ages 56-64. For both married households and single women, there is an increase in investment in home improvement relative to the age 56-64 average between ages 65 and 70. For married households, there is a decline in investment starting at age 70. The cumulative decline in spending from age 65-85 (the shaded region on Figure 3) is $18,244. This means that between ages 65 and 85, married households invested $18,244 less on home improvement than they would have had they maintained the average level of investment from ages 56-64. Since the mean house value for married couples in the sample is $217,839, the aggregate decline of investment in home improvement is approximately 8.4 percent of total home value.

Repeating the counterfactual for single women yields a very different result. There is almost no net difference in the total value of home improvement under the counterfactual, because increases in time and money allocations between ages 65 and 74 almost exactly offset declines between ages 75 and 84.

One explanation for these differing outcomes is that married households tend to have higher incomes and wealth than single households. It also likely captures the ability of married individuals to allocate DIY activities across household members. These additional resources thereby allow married households to engage in home improvement more heavily in the years on either side of retirement and thus reduce investment more aggressively afterwards.

6 Conclusions

At the outset of this study, we noted that the HEP might be partially explained by a failure to adequately account for housing disinvestment through forgoing home improvement (Davidoff, 2006; Feinstein and McFadden, 1989). Although we are unable to definitively establish that households are forward-looking and purposeful in their home improvement allocations as part of an asset management strategy, there is still benefit in quantifying the magnitude of this potential mechanism. Using the value of home improvement between ages 56 and 64 as a benchmark, we demonstrated that married households "under-improve" by $18,244 from ages 65-84, approximately 8.4 percent of the mean property value (and even higher if ignoring the value of land). This is not large enough to explain the entirety of the HEP, but, given reasonable limits on how much downsizing a married couple is willing to accept, this is also not inconsequential.

First, it mitigates some of the reliance on preferences alone to explain why older Americans tend not move as they age. Butrica and Mudrazija (2016) show that older households could increase their median income by as much as 40 percent by selling their home and annuitizing the money from the sale. But it is clear that households are not simply trading off nostalgia for disposable income. That reductive reasoning ignores that older Americans may be willing to accept a steady decline in housing quality as the consumption flows from any physical structure are lowest to maintain utility associated with their home and their community.

Second, it changes the relative benefit of extracting home equity through financial instruments, e.g., reverse mortgage, home equity line of credit (HELOC), second mortgage, or cash-out refinancing. A reverse mortgage allows homeowners to extract equity from their home without the burden of repaying the loan back until the homeowner leaves the house, which usually does not occur until death. The most popular reverse mortgage in the United States is a Home Equity Conversion Loan (HECM), where the average loan amount is $165,751 (Mayer and Moulton, 2020). However, few households take our reverse mortgages (Davidoff, Gerhard and Post, 2017; Nakajima and Telyukova, 2017) and the amount of equity that can be extracted had declined due to recent policy reforms (Lambie-Hanson and Moulton, 2020). Many older households do not take out reverse mortgages due to high costs (Moulton et al., 2016; Redfoot, Scholen and Brown, 2007) and general lack of awareness of them (Davidoff, Gerhard and Post, 2017; Kaul and Goodman, 2017). If deferring home maintenance is viewed as a low-cost, low-stress, easy to understand way of increasing disposable income to maintain a (subjectively) comfortable lifestyle, then the relatively low uptake of reverse mortgages may be easier to rationalize.

Mayer and Moulton (2020) show that many older households are extracting some housing equity through traditional mortgage instruments, like a HELOC, where the average loan value is $108,918. The downside to these types of loans is borrowers must pay them back, which can be a burden for retired households on a lower income and not all households will qualify for a HELOC. More than half of all HELOC's denied to older homeowners were because they could not afford a monthly payment. For liquidity constrained — or "cash poor, housing rich" — households that are unable to acquire funds through a traditional or reverse mortgage instruments, forgoing investment in home improvement is another avenue these household can pursue to extract housing equity.

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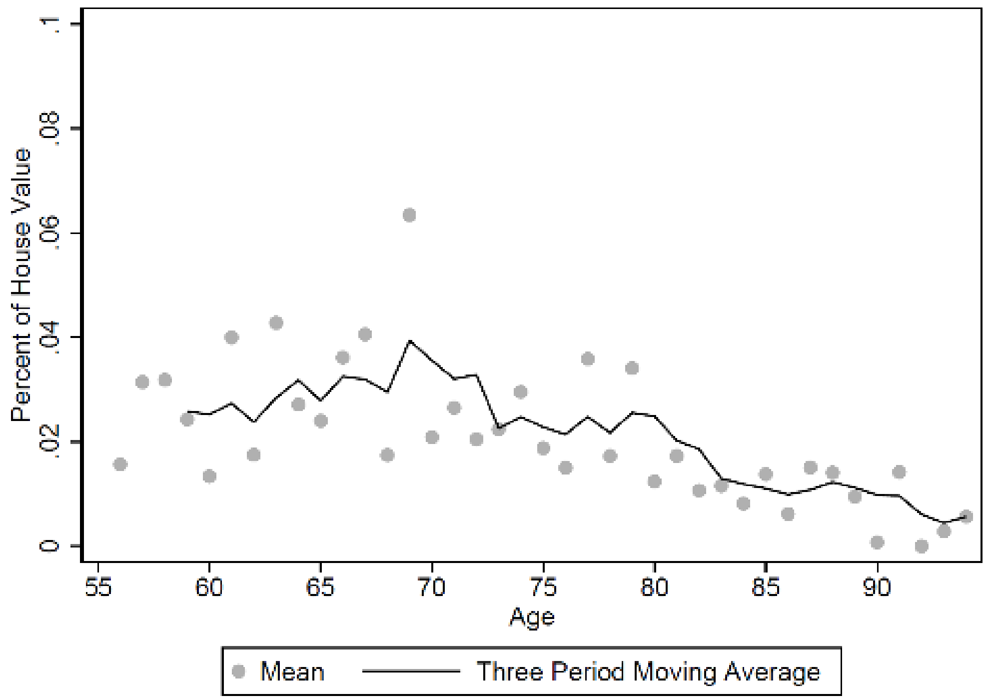
Table 1: Descriptive Statistics

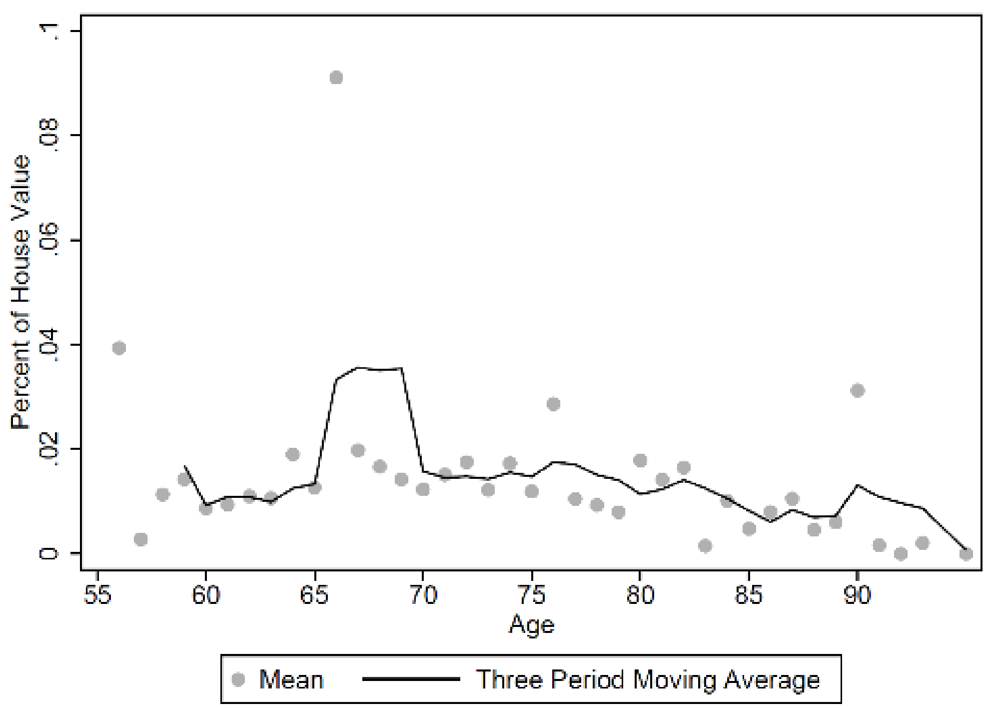
	All	**Married**	**Single Women**
Age	71.64	71.41	72.72
	(7.19)	(7.11)	(7.42)
Men	0.426	0.492	0.00
	(0.49)	(0.50)	(0.00)
Women	0.574	0.508	1.00
	(0.49)	(0.50)	(0.00)
Married	0.764	1.00	0.00
	(0.42)	(0.00)	(0.00)
Urban	0.775	0.784	0.734
	(0.42)	(0.41)	(0.44)
Good Mobility	0.895	0.910	0.832
	(0.31)	(0.29)	(0.37)
Education	12.93	13.03	12.54
	(2.78)	(2.80)	(2.79)
House Value	$206,863.8	$217,838.5	$159,351.4
	(178677.42)	(180644.75)	(143618.94)
Income	$65,633.5	$75,019.1	$32,209.5
	(78324.64)	(84210.77)	(36612.32)
Non-Housing Wealth	$345,855.7	$390,211.6	$174,704.0
	(710926.74)	(783856.76)	(309574.77)
Home Improvement Spending	$3,360.9	$3,849.0	$1,739.0
	(8219.41)	(8272.72)	(8655.72)
Fraction of House Value	0.0244	0.0266	0.0173
Spent on Home Improvement	(0.12)	(0.12)	(0.10)
Observations	4,944	3,777	918

Figure 1: Home Improvement as a Fraction of House Value

(a) Married Households



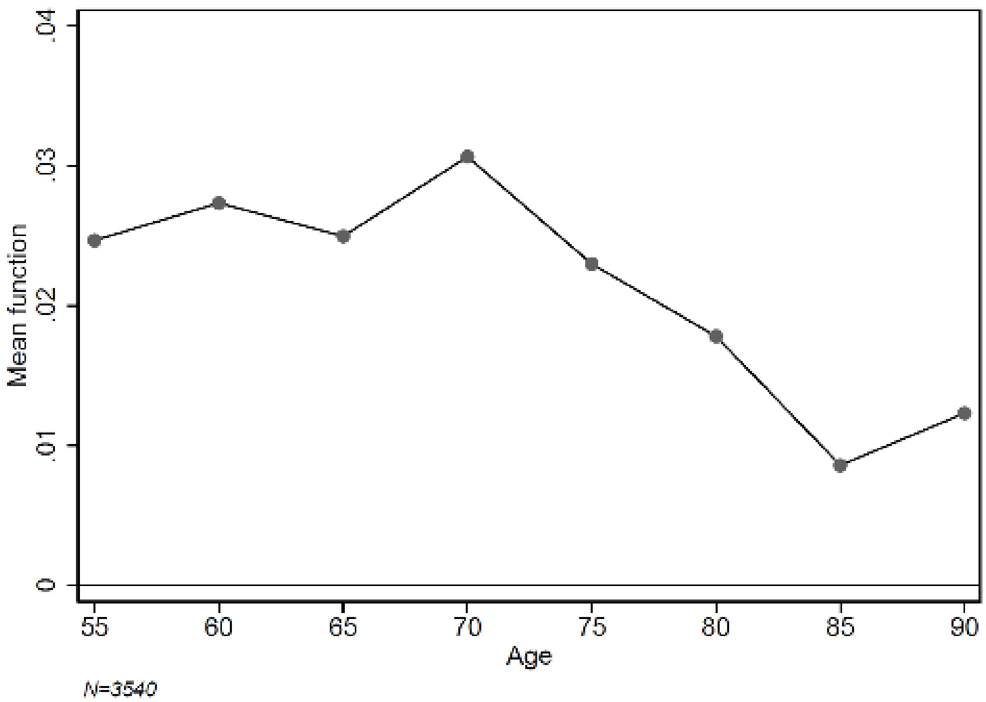
(b) Single Women



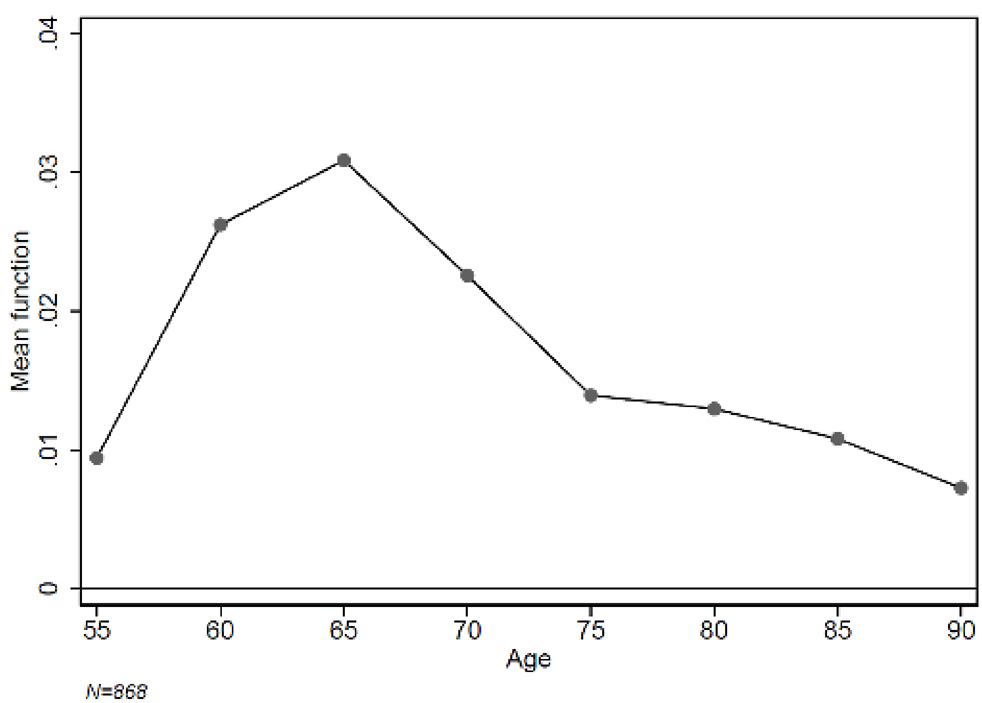
Notes: These graphs show the unconditional mean for the fraction of house value that is spent on home improvement over the age-profile along with a three period moving average. The fraction of house value that is spent on home improvement is calculated by $\frac{\text{Value of Home Improvement}}{\text{House Value}}$

Figure 2: Kernel Regression of Home Improvement as a Fraction of House Value

(a) Married Households



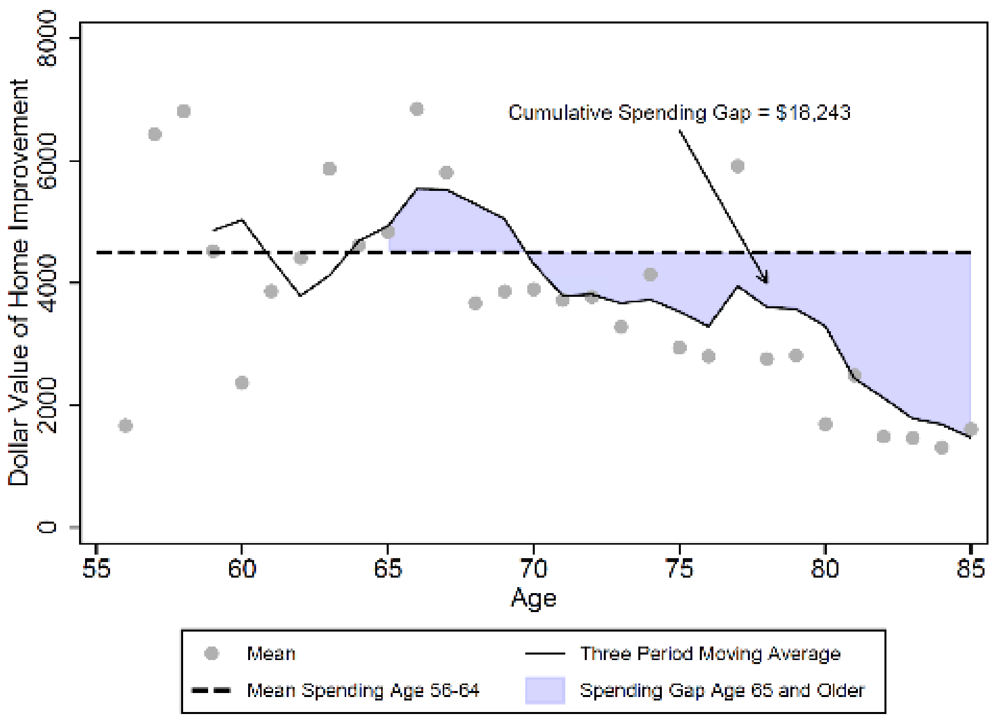
(b) Single Women



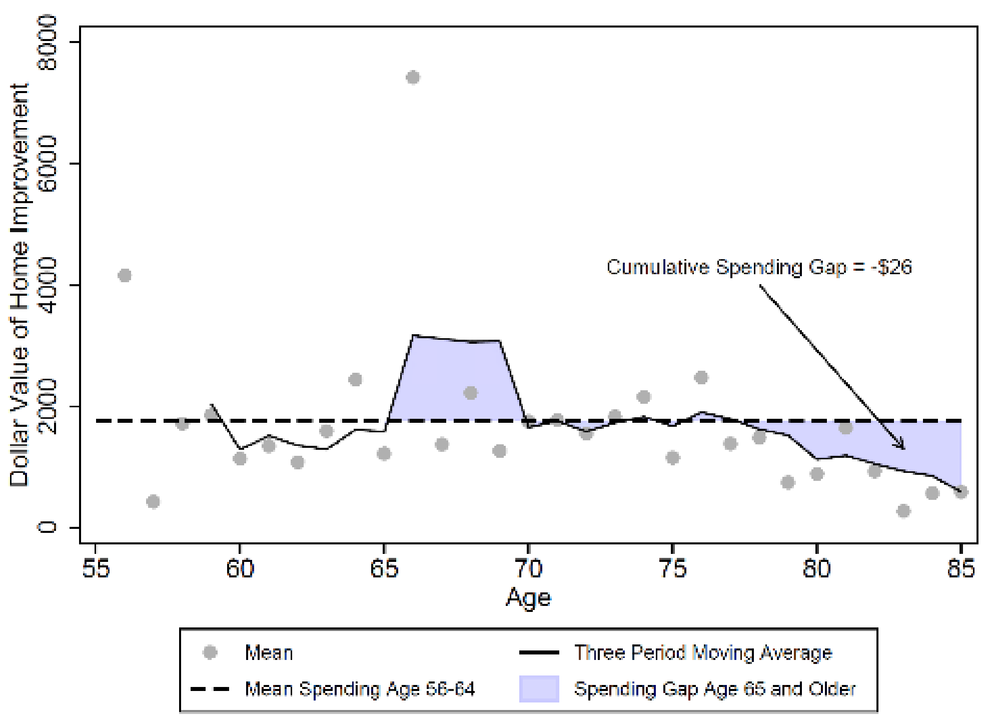
Notes: These graphs show the observed mean of the non-parametric local-linear regression on the value of home improvement as a fraction of house value over the age-profile while controlling for household income, non-housing wealth, education, mobility, urban status, a state-fixed effect, and a year fixed-effect.

Figure 3: Value of Home Improvement compared to Average Value before Age 65

(a) Married Households



(b) Single Women



Notes: The dashed line is the mean value of home improvement between ages 56-64 and the dashed line is a three period moving average of home improvement. The shaded region is the difference between the mean from ages 56-64 and the three period moving average from age 65 and over. The sum of the shaded region represents the cumulative difference in household investment into home improvement compared to what they would have spent if they maintained the same level of spending before age 65.