Marital Transitions, Housing, and Long-Term Care in Old Age*

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Abstract

Retired couples dissave housing wealth at a much slower rate than singles, conditional on income. To understand why, we develop and estimate a life-cycle savings model where marital transitions affect housing, long-term care, bequest motives, and eligibility for means-tested Medicaid. For the low-income group, Medicaid's favorable treatment of housing for couples is the dominant driver behind the large gap in homeownership between couples and singles. Among high-income retirees, the greater value that couples place on bequeathing the house is crucial. For the middle-income group, Medicaid, bequest motives, together with the option of spousal care are significant in understanding couples' higher value for homeownership. Our counterfactual policy experiments show that exempting housing assets in Medicaid's means test only for married households is more desirable than alternative policies, such as extending the homestead exemption to singles or providing the exemption to singles only.

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1 Introduction

Substantial progress has been made to understand why retirees dissave wealth at a much slower rate than predicted by a standard life-cycle savings model. Existing explanations for the retirement saving puzzle include large medical expenditure risk at old ages and bequest motives.[1] Most studies in the literature only consider single retirees' savings decisions and more importantly treat all assets as liquid.

However, housing accounts for the majority of retirement wealth for most households in the U.S. Furthermore, there is a stark difference in housing decisions between couples and singles in retirement. Most retirees maintain homeownership while they are married. Once their spouse dies, individuals across the entire income distribution are likely to sell their house. The homeownership gap between couples and singles is substantial conditional on age and income. The pattern suggests that the presence of a spouse has a significant impact on dissaving of housing wealth in retirement. Yet we lack understanding of why. The gap in the literature is critical in evaluating the effect of welfare programs for the elderly. For example, means-tested social insurance for long-term care, Medicaid, treats housing assets differently depending on one's marital status. In this paper, we fill the gap by uncovering mechanisms through which marital transitions affect housing decisions in retirement. By doing so, we study the welfare impact of Medicaid's treatment of housing assets in its means test for couples and singles.

One key aspect that differs between married and single individuals is the availability of spousal care, which reduces the risk of using formal long-term care services such as nursing home care. The presence of a healthy spouse increases married individuals' chance of receiving long-term care in their own home. The availability of spousal care could therefore increase couples' value for homeownership relative to singles, who are more likely to resort to facility care. At the same time, the presence of a healthy spouse makes it easier to qualify for means-tested public insurance. For example, Medicaid does not deem a recipient's house as an asset available to pay for nursing home costs as long as there is a spouse living in the property. Such protections for the community spouse might also increase couples' homeownership, especially if they have limited assets and want to protect them from a Medicaid "spend down". To quantify the importance of different mechanisms that might explain heterogeneous housing decisions of couples and singles, this paper develops and estimates a life-cycle savings model that incorporates rich interactions among marital transitions, long-term care, and housing decisions.

[1] A review of the literature is presented later in the section. See also De Nardi, French, and Jones (2016) for a survey of the literature.

Using data from the Health and Retirement Study (HRS), we start by providing descriptive evidence for potential mechanisms through which one's marital status affects homeownership in retirement. First, we present evidence that spousal care is the dominant mode of long-term care delivery for disabled couples. We provide empirical evidence that the prospect of spousal caregiving increases couples' incentive to own a home. Second, we demonstrate that Medicaid's estate recovery programs induce couples to maintain homeownership relative to singles. Medicaid is a means-tested public insurance program that covers formal long-term care expenses for eligible individuals. For singles who are deemed to stay in a Medicaid-financed nursing home for a long period of time, Medicaid recovers its expenses from the recipients' housing wealth. In contrast, it disregards the value of the house for married individuals who have a community spouse. Using state variations in Medicaid estate recovery programs, we provide evidence that Medicaid's favorable treatment of the house for couples induces them to maintain homeownership. Third, we show that singles are likely to sell their home in response to an increase in mortality risk, while couples are not. The data pattern suggests that housing as bequests might be more valuable when there is a surviving spouse. The greater value that couples place on bequeathing the house might partially explain their higher homeownership rate especially among wealthy retirees.

To assess the quantitative importance of different mechanisms that could affect housing decisions in retirement, we develop a life-cycle savings model that incorporates interactions among housing assets, long-term care, bequests, and Medicaid. All individuals start as a married couple. They face health and mortality risk, and become a single if they outlive their spouse. In each period, agents make consumption-savings, housing, and long-term care arrangement decisions. Potential long-term care arrangements include formal care, spousal care, and care provided by adult children. While alive, individuals have preference over consumption, housing, and long-term care. When dead, they derive bequest utility which depends on the existence of a surviving spouse and the type of assets they bequeath. In particular, we allow for the possibility that couples place a higher value on bequeathing the house relative to singles. The model incorporates Medicaid as a lower bound on consumption. For individuals who end up in a nursing home, the value of their house is disregarded in Medicaid's means test only if they are married. We use a collective household model, rather than a unitary model to describe couples' decision making process. This is to capture different precautionary savings motives between husbands and wives: as women have longer life expectancy and face higher formal long-term care risk, they have stronger precautionary savings motives.

The model is estimated by a two-step procedure. In the first step, we fix or estimate parameters outside the model, including risk aversion, discount factor, health transition probabilities, and formal long-term care prices. In the second step, we estimate the rest

of the parameters using a limited information Bayesian method that matches the model-generated moments to their empirical counterparts. The estimated parameters inform us about preferences for bequests, housing, long-term care, and the relative Pareto weights on husbands' and wives' utility. The estimated model is able to replicate key patterns of the data, such as long-term care arrangements, savings of housing and non-housing assets, and Medicaid recipiency rates.

Using the estimated model, we first conduct a set of counterfactuals to understand the substantial gap in homeownership between couples and singles. We implement three changes to the baseline model that are aimed at making couples' value for homeownership similar to that of singles: (i) we shut down Medicaid's favorable treatment of the house for couples, (ii) we eliminate the option of spousal care, and (iii) we change bequest preferences such that couples no longer place a higher value on bequeathing the house compared to singles. As a result of making the three changes to the model, the wide homeownership gap between couples and singles in the baseline becomes narrow. The result suggests that Medicaid's treatment of the house in its means test, the option of spousal care, and housing bequest utility are crucial in understanding different housing decisions between couples and singles in retirement.

To analyze the importance of each mechanism, we then implement one change at a time, followed by two changes at a time. The decomposition analysis reveals that for the low-income group, the protected status of the house in Medicaid's means test is the dominant reason for couples' higher homeownership relative to singles, followed by spousal care. For high-income retirees, the greater value that couples place on bequeathing the house relative to singles is crucial. Among the middle-income group, Medicaid's treatment of the house, the option of spousal care, and housing bequest utility are all important in explaining couples' higher homeownership rate than singles.

Finally, we evaluate the welfare effect of alternative Medicaid where we change the recipient of the homestead exemption granted to retirees in a nursing home. We find that the current structure of Medicaid which provides the exemption only to married households generates larger welfare gains than alternative rules, such as extending the exemption to singles or providing it to singles only. When the homestead exemption is offered to couples, retirees maintain homeownership for a longer period of time, which results in slower decumulation of retirement wealth over the life cycle. As a result, fewer households end up in impoverishment. In contrast, when the exemption is offered to singles only, married households with limited resources are likely to liquidate their home early in retirement to spend down to Medicaid eligibility. Early home liquidation results in faster dissaving of retirement wealth and increased impoverishment risk.

We make a contribution to the large literature on the role of bequest motives in elderly savings (Hurd, 1989; De Nardi, 2004; De Nardi, French, and Jones, 2010; Lockwood, 2018). Closely related to our paper is a recent work by De Nardi, French, Jones, and McGee (2021) which studies why couples dissave wealth more slowly than singles after retirement. They find that couples have stronger bequest motives than singles which helps explain the larger savings of couples. Our analysis differs from theirs in two major ways. First, while De Nardi, French, Jones, and McGee (2021) aggregate all assets and treat them as liquid, we show that one's marital status affects retirement wealth primarily through its impact on housing decisions. Second, we allow bequest utility to depend on not just marital status, but also the type of assets that are left behind (housing vs. liquid). We provide descriptive evidence that couples place a higher value on bequeathing the house relative to singles, which we incorporate into our structural model.

Our paper is also related to a growing literature on home equity in retirement. Venti and Wise (2004) find that retirees typically do not liquidate home equity to support general nonhousing consumption unless they experience the death of a spouse or enter into a nursing home. Using an estimated life-cycle savings model, Nakajima and Telyukova (2020) find that homeowners dissave more slowly than renters because they have a preference for staying in their own home as long as possible and cannot easily borrow against it. A recent work by McGee (2019) uses UK data to estimate a retirement savings model that incorporates house price shocks. Closely related to our analysis of Medicaid is the paper by Achou (2021) which studies the value of Medicaid's homestead exemption for single retirees. We complement his analysis by analyzing Medicaid's asymmetric treatment of the home for couples and singles. To the best of our knowledge, we are the first to assess the welfare impact of Medicaid's homestead exemption that depends on marital status.

Our work complements the set of papers that study the role of uncertain medical expenses in elderly savings. While Hubbard, Skinner, and Zeldes (1995) and Palumbo (1999) find relatively small effects, De Nardi, French, and Jones (2010) show that medical expenses that rise with age and income are a key driver in old age savings. Kopecky and Koreshkova (2014) separate nursing home expenses from other health expenses and highlight the significance of nursing home risk on savings in retirement. Medical expenses in our model are also uncertain due to a stochastic health process. However, unlike most papers that treat medical expenses as exogenous, they are endogenously determined in our model as an outcome of the household decision on different types of long-term care, including family care.

Related to our analysis of family care is the literature on old-age caregiving. Papers by Barczyk and Kredler (2018), Ko (2022) and Mommaerts (2016) use an intergenerational life-cycle savings model to study long-term care arrangements between elderly parents and

adult children. A recent work by Barczyk, Kredler, and Fahle (2022) studies how housing assets can be used by parents as a commitment device to leave larger bequests and to elicit caregiving behaviors from their children. Our model also incorporates the availability of care provided by adult children, but it is modeled as exogenous based on individuals' surveyed beliefs about receiving informal care from children. Instead, we endogenize spousal caregiving decisions, which are important in uncovering the relationship between one's marital status and housing wealth.

The rest of this paper proceeds as follows. Section 2 presents descriptive evidence. Section 3 presents the model. Section 4 presents our data and estimation results. Section 5 presents the main results. Section 6 concludes.

2 Data and descriptive patterns

The main dataset for this paper comes from the Health and Retirement Study (HRS) which has surveyed a representative sample of Americans over the age of 50 every two years since 1992. We use biennial interview waves from 1998 to 2014. We only consider individuals who were retired in 1998 and did not miss any interviews while alive.

We measure housing assets as the value of the primary residence less mortgages.[2] We define homeowners as having strictly positive housing assets. We measure non-housing assets as the sum of vehicles, businesses, IRA and Keogh accounts, stocks, mutual funds, investment trusts, checking, savings, money market accounts, CDs, bonds and T-bills.

For each individual, we compute his or her permanent retirement income as the average income observed over the sample period. This measure of income includes Social Security retirement income, pension, annuity, capital income, Social Security disability (SDI), and other income.

The HRS asks respondents about their use of formal long-term care services including nursing homes and paid home care. It also asks about the receipt of informal long-term care, defined as unpaid help associated with managing daily tasks. We observe the identity of informal caregivers, most of whom are either spouses or adult children. Due to inconsistencies in questions in the 1998 wave, we only use data from 2000 to measure spousal caregiving.

[2]Most retirees in our data have zero outstanding mortgages: the mean ratio of mortgage to housing value is 5%.

2.1 Empirical puzzle

Figure 1 shows a substantial difference in homeownership between married and single households in retirement, conditional on age and permanent income quartiles. Our definition of singles includes individuals who are widows or widowers, divorced, and those who have never been married.[3]

Panel A in Figure 1 reveals that among married households, the mean homeownership rate does not decrease much in age, and about 75% are still homeowners at the age of 90. In contrast, singles show fast dissaving of housing assets, and by the age of 90, less than 50% are reported as homeowners. Panel B in Figure 1 shows that the median housing asset share, which is the ratio of housing assets to total assets, is maintained at over 50% among couples, except for the highest income group. In contrast, the median housing asset share among singles reaches zero for most income quartiles by the age of 90.

The stark difference in the housing asset share over time implies that the faster dissaving pattern among singles is restricted to housing assets only. Figure A.1 in Appendix A shows that the evolution of non-housing assets over age looks quite similar between couple and single households.

Figure 2 is drawn using households that transition from couples to singles due to spousal death over the sample period. The figure reveals that there is a substantial reduction in the homeownership rate around the time of spousal death.

2.2 Potential mechanisms

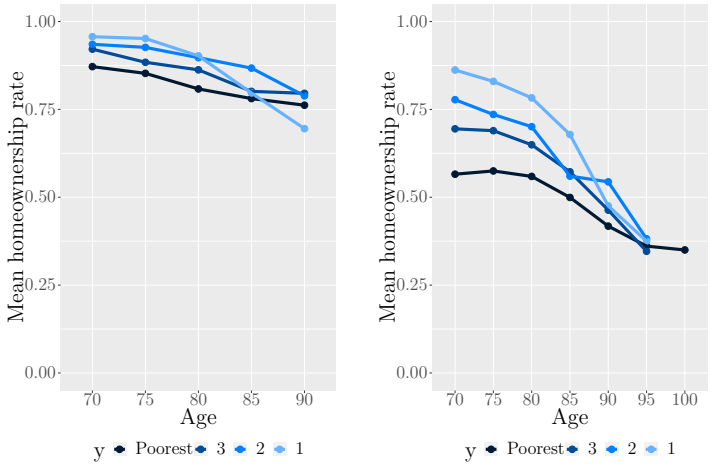
We now use plausibly exogenous variations to identify potential explanations for the stark difference in homeownership between couples and singles in retirement. The variations we use are the timing of spousal death, sudden health deterioration, and Medicaid estate recovery policies across states.

2.2.1 Long-term care and housing

Elderly individuals face substantial risk of having functional limitations and hence requiring long-term care. In the U.S., about three fourths of 60-year-olds will have chronic conditions resulting in daily activity limitations, while the other one fourth will have no such conditions until death (Ko, 2022). Individuals with long-term care needs receive assistance from either family members or formal care services.

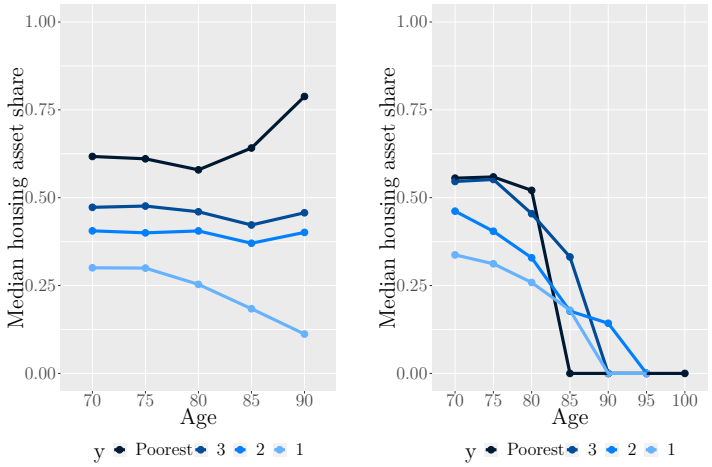
[3] When we restrict our definition of singles to widows and widowers only, the pattern in Figure 1 remains almost unchanged.

Figure 1: Housing assets by marital status



Couples Singles

Panel A: Homeownership rate

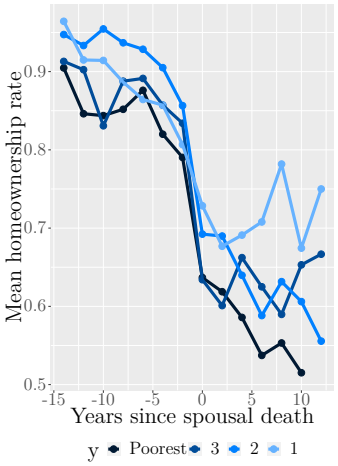


Couples Singles

Panel B: Housing asset share

Notes: Data = HRS 1998-2014. Panels A and B present the homeownership rate and median housing asset share by marital status, age, and income quartiles (y), respectively. In each graph, the darker the color, the lower the household income. Housing asset share is defined as the ratio of housing assets to total assets.

Figure 2: Homeownership rate before and after spousal death



Notes: Data = HRS 1998-2014. Sample consists of initial couples who experience spousal death and never remarry. The figure presents the mean homeownership rate before and after spousal death conditional on household income quartiles (y). The darker the color, the lower the household income.

To compare long-term care arrangements between couples and singles, we define our care sample as a set of disabled individuals who receive either formal or informal care. We consider an individual as disabled if the individual reports having two or more limitations in carrying out activities of daily living (ADLs).[4] Table 1 shows long-term care arrangements by marital status in our care sample. First, informal care by family members plays a critical role in delivering long-term care. For married individuals, spousal caregiving is dominant with over 80%. For singles, care by adult children is prevalent at 55%, while it is only 30% for married individuals. Second, singles are more likely to enter a nursing home. While over 50% of disabled singles use nursing home care services, only about 30% of disabled couples rely on nursing home care. As residing in a nursing home prevents one from deriving a consumption flow from the house, singles' higher nursing home risk might reduce their homeownership relative to couples.

To better explore the relationship between spousal caregiving and homeownership, we implement a regression analysis. We conjecture that the prospect of spousal caregiving strengthens homeownership among couples. If the hypothesis is true, then widows/widowers who provided careigving to their deceased spouse will be more likely to sell home than their counterparts who did not provide care. To test the hypothesis, we construct a sample that consists of individuals who are initially a couple, experience a spousal death over the sample

[4]The HRS asks about difficulty in carrying out five ADLs, which are bathing, dressing, eating, getting in/out of bed and walking across a room.

Table 1: Long-term care arrangements by marital status

	Married	Single
Caregiving by spouse	0.82	0.00
Caregiving by children	0.30	0.55
Nursing home care	0.30	0.53
Homeowner	0.76	0.35
Observations	2429	4220

Notes: Care sample is used which consists of disabled retirees who receive either informal or formal long-term care.

period, and own a home at the spousal death. The dependent variable is whether the new widow or widower sells home within 4 years since the spousal death.[5] The key control is provision of informal care to the deceased spouse. Table 2 reports the results. It shows that provision of spousal care is associated with a 13.8 percentage point increase in the probability of liquidating home upon the spousal death. The result suggests that the prospect of spousal caregiving increases homeownership, which could be one of the explanations for the higher homeownership rate among retired couples than singles.

2.2.2 Medicaid's treatment of the home

One third of people turning 65 will require nursing home care at some point before death.[6] Formal long-term care services in the U.S. are expensive with the median annual cost for nursing homes exceeding $90,000 in 2017.[7] The primary payer for nursing homes is Medicaid, which is a means-tested program jointly funded by the federal and state governments. According to a report by the Kaiser Family Foundation, Medicaid covered 6 out of 10 nursing home residents in 2015. Nursing homes are the most expensive item among Medicaid's outlays on senior long-term care, accounting for 70%.

The home is an excluded resource in determining Medicaid eligibility, regardless of its value (Department of Health and Human Services, 2005). However, a house loses its protected status when it is no longer a "home." Specifically, a recipient's house becomes an asset available to pay long-term care when there is no living spouse or the recipient moves into a nursing home without the intent to return.[8] Therefore, when an unmarried retiree permanently enters a nursing home, the house is treated as a resource that should be used to pay for long-term care before Medicaid provides transfers. In contrast, when the recipient

[5] We have verified that the results are robust to using different time horizons.

[6] https://files.kff.org/attachment/Infographic-Medicaids-Role-in-Nursing-Home-Care.

[7] Genworth, https://www.genworth.com/aging-and-you/finances/cost-of-care.html.

[8] Medicaid also counts the value of the home if it is transfered within a specified period (3-5 years) prior to applying for Medicaid long-term care.

Table 2: Caregiving and home sales upon spousal death

	Sell home
Spousal care before death	0.138**
	(0.059)
Age	0.019***
	(0.004)
Have LTC needs	0.167***
	(0.040)
Female	0.034
	(0.031)
Have children	0.080
	(0.062)
Income (in 100K)	0.006
	(0.015)
Non-housing assets (in 100K)	-0.001
	(0.001)
Mean of dependent variable	0.332
Observations	1102

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses. HRS 2000-2014 used. See Table A.1 for summary statistics of the variables used in the regression. Linear probability model is used. Year fixed effects and birth cohort fixed effects are included. Sample is at the respondent level and consists of individuals who had strictly positive housing wealth at the spousal death. The dependent variable is whether the surviving spouse sells the home in the next 4 years. Time-varying variables are measured at spousal death.

has a spouse living in the home, the house maintains its protected status and is disregarded by Medicaid. Homeownership thus helps couples qualify for Medicaid without depleting all of their retirement wealth, while such channel is absent for singles.

In principle, there are two ways Medicaid can make recipients pay for nursing home expenses from their housing wealth when the house is no longer a home. The first is to deny coverage by counting the housing value against Medicaid eligibility. However, as individuals can easily be granted an exemption by stating the intent to return from a nursing home, in practice this rarely happens (Department of Health and Human Services, 2005). The second is to put liens on the home and recover Medicaid-paid long-term care costs from the recipient's estates upon death. Using exogenous policy variations in the estate recovery program across states, Greenhalgh-Stanley (2012) finds that estate recovery indeed reduces singles' homeownership.

To provide further empirical evidence on the impact of the estate recovery program on retirees' housing decisions, we use exogenous policy variations as in Greenhalgh-Stanley (2012), but with more policy changes over a longer sample period. While most states had adopted the estate recovery program by 1998 which is the beginning of our HRS sample period, states had a significant control over how they run the program. According to Greenhalgh-Stanley (2012), the most popular component of the program is known as a TEFRA (Tax Equity and Fiscal Responsibility Act) lien. TEFRA liens are placed on the home of a permanently institutionalized beneficiary and act to keep the states' interest in the estate. The liens therefore serve to signal states' strong intention of recovering from the estate once beneficiaries die. Consistent with Medicaid's treatment of housing assets for couples, TEFRA liens cannot be placed when there is a surviving spouse living in the home (Greenhalgh-Stanley, 2012). During our HRS sample period of 1998-2014, the number of states with TEFRA liens increased from 18 to 25.[9]

The regression we estimate is

$$Y_{ist} = \beta D_{ist}^{TEFRA \times Single} + \delta D_{st}^{TEFRA} + \eta D_{ist}^{Single} + \rho X_{ist} + \gamma_s + \phi_t + u_{ist} \tag{1}$$

The outcome variable is the homeownership status of individual i living in state s in year t. D_{st}^{TEFRA} is an indicator variable for whether a TEFRA lien is in place in state s in year t. D_{ist}^{Single} is an indicator variable for whether the individual i is single in state s in year t. $D_{ist}^{TEFRA \times Single}$ is the variable of interest. It is an indicator variable for whether the individual is single *and* a TEFRA lien is in place. The coefficient β therefore represents how TEFRA liens affect homeownership incentives of singles relative to couples. We control for state

[9] Greenhalgh-Stanley (2012) provides TEFRA adoption years by state. We complement the data to incorporate states' more recent adoption of the policy.

and year fixed effects and include individual demographics contained in X_{ist}. We estimate equation (1) using restricted HRS data that contain geographic information.

Table 3 reports the results. We find that TEFRA liens discourage homeownership among singles relative to couples. Specifically, a state's implementation of TEFRA liens reduce singles' homeownership rate by 8.9 percentage points. The results are consistent with Greenhalgh-Stanley (2012) who also find that Medicaid estate recovery programs reduce singles' homeownership relative to couples.

Table 3: TEFRA liens and homeownership

	Own home
TEFRA x Single	-0.089**
	(0.036)
TEFRA	0.036
	(0.054)
Single	-0.175***
	(0.025)
Age	-0.004*
	(0.002)
Female	0.005
	(0.020)
Have children	0.027
	(0.043)
Income (in $100K)	0.048**
	(0.018)
Non-housing assets (in $100K)	0.002**
	(0.001)
Mean of dependent variable	0.68
Observations	1947

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the household-state level. Restricted HRS data from years 1998-2014 used. See Table A.2 for the summary statistics of the variables used in the regression. Linear probability model is used. Year, state, and birth cohort fixed effects are included. The sample consists of respondents living in states that adopted TEFRA liens before and during the sample period. We further impose the following restrictions. (1) We exclude respondents on Medicaid or in a nursing home as they might have limited freedom in housing decisions. (2) We exclude young and healthy respondents as they might deem the use of Medicaid "too far", and the estimated impact of Medicaid policies might be contaminated due to a high discount factor. The results are robust to removing the second restriction.

We perform two additional regression analyses. First, we use variations in estates recovered. We define the estate recovery rate as the ratio of estates recovered to total Medicaid nursing home expenses in a given state-year combination.[10] This is not our preferred empirical strategy as the estates recovered are endogenous to recipients' saving behavior. Nevertheless, we examine the correlation between the amount of estates recovered and homeownership. Table A.3 reports the results. While the estimates are less accurate, we find that a higher estate recovery rate is associated with a lower homeownership rate among singles, consistent with Table 3.

Second, we use the timing of spousal death to study whether the Medicaid program induces couples to maintain homeownership. Suppose the conjecture is true. Then once their spouse passes away, widows/widowers will be more likely to sell home if their deceased spouse were a Medicaid beneficiary. Table A.5 reports the results. Consistent with the hypothesis, there is a positive correlation between the use of Medicaid while the spouse is alive and home sales upon spousal death.

In short, the results presented in this subsection provide descriptive evidence that Medicaid's different treatment of home by marital status might be an important explanation for the higher homeownership rate among retired couples than singles.

2.2.3 Bequest motives and housing

Couples and singles might have different bequest motives as couples care about not just their heirs, but also their surviving spouse. Furthermore, bequest utility from leaving housing assets relative to liquid assets might differ depending on whether the recipient is a child or a surviving spouse. To examine possibly heterogeneous bequest motives by marital status, we examine changes in housing decisions in response to an increase in mortality risk.

We construct a sample that consists of individuals who were reported as a homeowner in the previous interview wave. We measure unanticipated increases in mortality risk based on self-reported changes in health.[11] We treat a single individual as having a substantial health deterioration if the individual reports somewhat or much worse health relative to the previous interview. For a couple, the indicator for substantial health deterioration is one if the respondent or the respondent's spouse reports somewhat or much worse health.

[10] We use Warshawsky and Marchand (2017) for information about the estates recovered. We obtain Medicaid nursing home expenses from Medicaid.gov. The estate recovery rate is computed for 2002-2010.

[11] For the HRS interviews conducted in 1998-2004, allowed responses were much better, somewhat better, same, somewhat worse, and much worse. For the interviews conducted in 2006-2014, they were somewhat better, same, and somewhat worse.

The dependent variable is whether an individual sells home in the current wave. The key control is an indicator for substantial health deterioration interacted with one's marital status. As individuals might sell their home to prepare for large medical expenditures, we control for income and liquid assets as well as coverage by government health insurance and private long-term care insurance. We also control for the presence of children as they might affect individuals' house selling decisions.

Table 4 reports the results. An increase in mortality risk significantly increases singles' likelihood of selling their home relative to couples, conditional on other observables. Specifically, the probability increases by 4.8 percentage points which is substantial given the mean selling rate of 6.2%. In contrast, an increase in mortality risk does not make couples more likely to liquidate their housing assets. The result suggests that singles might have a weaker preference for leaving housing bequests than couples.

2.2.4 Other explanations

There might be other reasons why retirees sell their home as they become a single. First, they might decide to move into one of their children's home. In our HRS sample, we find that about 18% of retirees who liquidate their home upon spousal death start living with one of their children. Second, singles might find it more costly to take care of the home or enjoy a lower homeownership premium relative to couples. Our model presented in the next section will incorporate not just the three main channels introduced above, but also these other mechanisms that might reduce singles' homeownership relative to couples.

3 Model

The model presented in this section describes retirees' housing, long-term care arrangement, and consumption-savings decisions in the face of health and mortality shocks. Time, t, is discrete and finite and represents the household head's age. As the HRS interviews are carried out biannually, each period lasts two years: $t = 65, 67, ..., 99$. All individuals are married in the initial period but might become a single in subsequent periods if they outlive their spouse. We use a collective household model to describe couples' decision making process. The model incorporates welfare programs including Medicaid as a lower bound on consumption. Table B.1 summarizes model variables.

Table 4: Increases in mortality risk and homeownership

	(1) Sell home
Mortality risk increased x Single	0.048***
	(0.007)
Mortality risk increased	-0.004
	(0.003)
Single	0.037***
	(0.011)
Have children x Single	0.024***
	(0.008)
Have children x Married	0.015*
	(0.008)
Age	0.004***
	(0.000)
Have LTC needs	0.069***
	(0.005)
Income (in 100K)	0.002
	(0.002)
Non-housing assets (in 100K)	-0.000***
	(0.000)
Covered by either Medicare or Medicaid	-0.019***
	(0.007)
Covered by private LTC insurance	-0.006*
	(0.003)
Mean of dependent variable	0.062
Observations	36976

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are clustered at the household level and are in parentheses. HRS 1998-2014 used. See Table A.6 for summary statistics of the variables used in the regression. Linear probability model is used. Year fixed effects and birth cohort fixed effects are included. Sample is at the respondent-wave level and consists of individuals who were homeowners in the previous wave. The dependent variable is whether the individual sold home since the last wave. Non-housing assets are measured using the previous wave when the individual was a homeowner.

3.1 Timing

All individuals are married in the initial period. At the beginning of each period, mortality shocks are realized. In the event of death, if there is a surviving spouse, he/she keeps the household assets. If there is no surviving spouse, the household assets are bequeathed to children. In the event of survival, health risk is first realized. If there is a sick member in the household, long-term care arrangements are determined which could be either spousal care, nursing home care, or informal care provided by adult children. Homeowners then decide whether to sell home, and renters choose housing services. The government makes transfers to guarantee a minimum consumption floor. Finally, the household chooses consumption.

3.2 Preferences

Single retirees' flow utility is given as

$$u(c_t, h_t) = \frac{{c_t}^{1-\gamma} - 1}{1-\gamma} + \sigma \frac{{h_t}^{1-\gamma} - 1}{1-\gamma} \tag{2}$$

They have additively separable preferences for consumption c_t and housing services h_t similar to Fisher and Gervais (2011), which follow a constant relative risk aversion utility function.

Married individuals are endowed with their own separate utility:

$$\text{Husbands:} \quad u(c_t^H, h_t^H) \tag{3}$$

$$\text{Wives:} \quad u(c_t^W, h_t^W) - \psi_{\tilde{h}_t, y} P_t^W \tag{4}$$

We use superscript H for husbands and W for wives. We index each spouse's consumption and housing services separately because as we will describe shortly, the two spouses might enjoy different levels of consumption and housing services depending on their nursing home residency. P_t^W is an indicator for providing spousal care to a disabled husband. As most spousal caregiving hours are provided by wives, we assume only wives are able to provide spousal care. $\psi_{\tilde{h}_t, y}$ represents wives' caregiving disutility. It could potentially depend on housing assets $\tilde{h}_t$. This is to capture possible complementarity between homeownership and spousal caregiving.[12] The caregiving disutility is also allowed to vary by household income y.

When there is no surviving spouse, utility from bequests depends only on total assets that the individual leaves behind, b_t. Specifically, if the individual's non-housing wealth at the

[12] Home modifications or improvements facilitate long-term care, and they can be done more conveniently in owned houses than in rented properties.

time of death is a_t and housing wealth is $\tilde{h}_{t-1}$, then

$$b_t = a_t + (1-\tau)\tilde{h}_{t-1} \tag{5}$$

where τ represents the transaction cost from selling home. Utility from bequests when there is no surviving spouse is

$$v^S(b_t) = \delta_1 \frac{(a_{b1} + b_t)^{1-\gamma} - 1}{1-\gamma} \tag{6}$$

The parameter $a_{b1} \geq 0$ represents the threshold of consumption level below which the individual does not leave any bequests under conditions of perfect certainty. This is a commonly used functional form to model single retirees' bequest utility in the literature (e.g., De Nardi (2004), De Nardi, French, and Jones (2010), and Lockwood (2018)).

If a deceased individual is survived by a spouse, utility from bequests is

$$v^M(a_t, \tilde{h}_{t-1}) = \delta_2 \left(\frac{(a_{b2} + a_t)^{1-\gamma} - 1}{1-\gamma} + \sigma \frac{(h_b + \tilde{h}_{t-1})^{1-\gamma} - 1}{1-\gamma} \right) \tag{7}$$

There are two things to note about the utility specification above. First, we take a "warm-glow" approach where the bequest utility is determined by the assets that the deceased individual leaves behind.[13] Alternatively, one could make it a function of the surviving spouse's value function. However, this would not be coherent with the collective approach that we take where we endow each individual with their own separate utility. Second, in contrast to (6), non-housing (a) and housing assets ($\tilde{h}$) do not enter the bequest utility function as perfect substitutes. This is to incorporate the possibility that the value married individuals derive from bequeathing home to their surviving spouse might be higher than the value singles derive from bequeathing home to their children. For example, Table 4 in Section 2 shows that an increase in mortality risk induces singles to liquidate their home relative to couples, conditional on other observables.[14]

[13] The bequest utility when there is no surviving spouse, specified in equation (6), also takes a warm-glow utility approach.

[14] We have estimated the model using alternative functional forms for bequest utility. For example, we have used the functional form in (6) for couples' bequest utility, allowing the values of (δ_1, a_{b1}) to be different by marital status. We have also used the functional form in (7) for singles' bequest utility, allowing the values of (δ_2, a_{b2}, h_b) to be different by marital status. We found that in both cases, the predicted homeownership rate from the high-income group was very far from the empirical counterpart.

3.3 Consumption

Individual consumption of non-housing goods depends on nursing home (NH) residency:

$$c_t = \begin{cases} \hat{c}_t & \text{if not in NH} \\ c_{nh} & \text{if in NH} \end{cases} \tag{8}$$

When the individual is not in a nursing home, the individual gets to choose his consumption denoted by $\hat{c}_t$. If the individual is in a nursing home, then his consumption is fixed to the basic consumption level c_{nh} provided by nursing home care.

The household consumption expenditure is given as

$$x_t = \begin{cases} [(\hat{c}_t^H)^\rho + (\hat{c}_t^W)^\rho]^{\frac{1}{\rho}} & \text{for couples} \\ \hat{c}_t & \text{for singles} \end{cases} \tag{9}$$

$\rho \geq 1$ means there are economies of scale for couples' consumption. When none of the spouses is in a nursing home, then each spouse gets an equal share of the household consumption expenditure, i.e., $\hat{c}_t^j = \frac{x_t}{2^{\frac{1}{\rho}}}$ for $j \in \{H, W\}$.[15] If only one spouse is in a nursing home, then that spouse's consumption expenditure is zero as described in equation (8), and the other spouse gets the entire household consumption expenditure. If both spouses are in a nursing home, then the household will optimally choose $x_t = 0$.

3.4 Housing

Each family enters period t with initial housing assets denoted by $\tilde{h}_{t-1} \geq 0$.[16] $\tilde{h}_{t-1} > 0$ means the household is a homeowner, and $\tilde{h}_{t-1} = 0$ means the household is a renter. Switching from a renter to a homeowner is rare in retirement, so we assume renting is an absorbing state.[17] Homeowners decide whether they sell home ($D_t = 1$) or keep it ($D_t = 0$). As in Nakajima and Telyukova (2020) and Achou (2021), we do not allow homeowners to switch houses unless they become a renter based on the fact that retired homeowners rarely downsize.

[15] With ideal data, one could make the relative Pareto weights affect each spouse's share of the household consumption expenditure. As we lack individual-level consumption data, we impose the equal division rule when both spouses are living in community.

[16] We assume zero outstanding mortgages as the mean mortgage to housing value ratio is about 5% in the data.

[17] In the HRS data, less than 10% of retirees purchase a new home.

After homeonwers' liquidation decision, housing assets are updated as the following:[18]

$$\tilde{h}_t = \begin{cases} \tilde{h}_{t-1} & \text{if } \tilde{h}_{t-1} = 0 \text{ or } (\tilde{h}_{t-1} > 0 \text{ and } D_t = 0) \\ 0 & \text{if } \tilde{h}_{t-1} > 0 \text{ and } D_t = 1 \end{cases} \tag{10}$$

Households with $\tilde{h}_t = 0$ decide on renting services, denoted by R_t.

Individual consumption of housing services depends on homeownership, marital status, and nursing home residency:

$$h_t = \begin{cases} \omega_{couple}\tilde{h}_t & \text{if not in NH, homeowner, and couple} \\ \omega_{single}\tilde{h}_t & \text{if not in NH, homeowner, and single} \\ R_t & \text{if not in NH and renter} \\ h_{nh} & \text{if in NH} \end{cases} \tag{11}$$

If an individual is a homeowner ($\tilde{h}_t > 0$), then the individual's housing consumption is equal to the value of the home ($\tilde{h}_t$) multiplied by the homeownership premium which depends on the marital status. The homeownership premium is lower for singles, i.e., $\omega_{couple} > \omega_{single}$. This is to reflect the fact that singles are more likely to move into their child's home, which represents a higher opportunity cost of owning a home.[19] The lower premium for singles also reflects the idea that they might enjoy homeownership less than couples due to higher maintenance costs (de Ruijter, Treas, and Cohen, 2005). If the individual is a renter, then the individual derives utility from the rented housing service R_t. If the individual is in a nursing home, then his housing consumption is equal to the basic housing value from nursing home care h_{nh}.

Housing expenditure in each period is

$$e(\tilde{h}_t, R_t) = \begin{cases} \delta\tilde{h}_t & \text{if } \tilde{h}_t > 0 \\ (r+\delta)R_t & \text{if } \tilde{h}_t = 0 \end{cases} \tag{12}$$

where δ is the depreciation rate, and r is the real interest rate. Liquidating housing assets worth of $\tilde{h}$ incurs transaction costs $\tau\tilde{h}$.

[18] Housing assets are risk-free in our model. Admittedly, this is a simplifying assumption. However, our primary goal is to understand different homeownership incentives between couples and singles. As house price shocks are aggregate shocks that should have similar effects on housing decisions of couples and singles, we abstract from them.

[19] In the HRS data, 18% of singles who sell their house upon spousal death move into their children's home.

3.5 Household income

In the initial period, all individuals are married and receive household retirement income y. They keep receiving y in each period as long as they remain a couple. When an individual becomes a single followed by spousal death, the individual's per-period income becomes $0.5y$ for the remaining life cycle.

3.6 Health and mortality risk

We consider three health statuses: $s_t \in \{\text{healthy, require long-term care, dead}\}$. Health transition probabilities follow a Markov chain and depend on the individual's current health, age, gender, and initial household income:

$$\pi(s_{t+1}|s_t, age_t, sex, y). \tag{13}$$

The health transition process is treated as exogenous and does not depend on the receipt of care. This is based on previous studies which find that the evolution of elderly health is largely unaffected by the receipt of care (Finkelstein and McKnight, 2008; Card, Dobkin, and Maestas, 2008); the primary role of long-term care lies in reducing discomfort experienced by the elderly with everyday task limitations.

3.7 Long-term care arrangements

We model different long-term care options based on marital status and gender. To reduce the computational burden, we assume disabled individuals receive one type of care at a time. Table 1 shows that for singles, children are the major source of long-term care. As previous studies find that individuals prefer family care over formal care (Barczyk and Kredler, 2018; Mommaerts, 2016; Ko, 2022), we assume disabled singles rely on care provided by children if it is "available", and resort to formal care only when it is not.[20] In the empirical implementation of our model, we proxy for the availability of informal care ($ic_{child} \in \{0, 1\}$) based on individuals' surveyed beliefs about receiving long-term care from their children.[21] We

[20] While papers like Barczyk and Kredler (2018), Ko (2022), and Mommaerts (2016) have children as active agents taking a part in long-term care arrangement decisions, we do not pursue that route as our focus is not on intergenerational interactions.

[21] The HRS asks "Suppose in the future, you needed help with basic personal care activities like eating or dressing. Will your daughter/son be willing and able to help you over a long period of time?" If the answer is positive for any of the respondent's children, we assume informal care from children is available ($ic_{child} = 1$). Otherwise, we assume it is not ($ic_{child} = 0$) and the single individual uses nursing home care whenever the individual becomes sick. We have verified that the reported beliefs are reasonable by comparing them to the actual receipt of informal care from children.

abstract from the possibility that children help their parents pay for formal care services as such transfers are negligible in the data.[22]

A disabled husband can either use formal care or receive spousal care from his healthy wife. We abstract from the possibility that the disabled husband receives informal care from his children. This is based on the empirical fact that care from children is rarely used as a single source of care for disabled husbands.[23] Whether the husband receives formal care or spousal care will be determined by the household's collective decision making process.

Women usually develop long-term care needs after their husband has passed away.[24] In the unlikely scenario that a female individual requires long-term care while still married, she uses formal care.[25]

We abstract from paid home care and have nursing home care as the only type of formal long-term care. While this is a simplifying assumption, we believe it is justifiable on the following rounds. First, nursing homes are the largest financial long-term care risk faced by the elderly: Kemper, Komisar, and Alecxih (2005/2006) find that a person turning 65 in 2005 can expect to spend about $47,000 on formal long-term care before death, most of which is on facility care at about $39,000. Second, the lion's share of Medicaid spending on long-term care is attributed to nursing homes, accounting for 70%. Third, Medicaid's asset test rules regarding housing change dramatically by nursing home residency, but not by paid home care use.

3.8 Medicaid and government transfers

Government guarantees a minimum consumption floor through means-tested welfare programs such as Medicaid and SSI. To simplify notations, we define the household's cash-at-hand before government transfers as

$$\tilde{a}_t = a_t + I[n_t = 2]y + I[n_t = 1]0.5y + \underbrace{I[D_t = 1](1-\tau)\tilde{h}_{t-1} - e(\tilde{h}_t, R_t)}_{\text{net proceeds from housing decisions}} - \underbrace{m_t}_{\text{cost of NH}} \tag{14}$$

[22] Among disabled parents who use formal long-term care, the mean financial transfer received from their children is merely $300 annually (Ko, 2022).

[23] Among disabled husbands that receive informal care from their children, 80% also receive care from their wife. In contrast, spousal care and nursing home care are often used as the only source of care.

[24] In the HRS data, among male individuals that develop long-term care needs, about 70% have their onset while they are married. Among female individuals that develop long-term care needs, only about 20% have their onset while married.

[25] We abstract from the possibility that husbands provide care as most spousal caregiving hours are provided by wives. We could alternatively have the disabled wife receive informal care from her children if it is available. However, in the HRS data, the formal long-term care usage rate is higher than the informal care rate from children among married women.

n_t represents the number of members in the household where $n_t = 2$ means a couple and $n_t = 1$ means a single. $D_t = 1$ means the household sells home. $e(\cdot, \cdot)$ is the housing expenditure. m_t represents the cost of nursing home care and is strictly positive only for nursing home users.[26]

The amount of government transfers that singles receive is

$$tr_t = \begin{cases} \max\{0, \bar{a}_{nh=0} - \tilde{a}_t\} & \text{if single and not in NH} \\ \max\{0, \bar{a}_{nh=1} - (\tilde{a}_t + (1-\tau)\tilde{h}_{t-1})\} & \text{if single and in NH} \end{cases} \tag{15}$$

For non-institutionalized singles, the government offers the homestead exemption by excluding housing assets from the eligibility test. Only the liquid assets at hand $\tilde{a}_t$ are considered, and the government makes transfers to ensure the consumption floor for non-institutionalized singles denoted by $\bar{a}_{nh=0}$.

For singles in a nursing home, their post-sales housing assets are counted. Eligible single homeowners must first liquidate their home to pay for nursing home care, and then the government makes transfers to ensure the consumption floor for institutionalized singles $\bar{a}_{nh=1}$.[27] This is how the model incorporates the fact that for institutionalized single retirees, Medicaid treats the house as an asset available to pay for long-term care. Alternatively, we can have Medicaid pay first and then have it recover from beneficiaries' house upon death, which is closer to the reality as described in Section 2.2. As recovering from housing estates is almost identical to making the beneficiary pay with their housing wealth before Medicaid benefits, we model the latter to avoid keeping track of Medicaid-paid costs as an additional state variable.[28]

The amount of government transfers that couples receive is

$$tr_t = \begin{cases} \max\{0, 1.5\bar{a}_{nh=0} - \tilde{a}_t\} & \text{if couple and none in NH} \\ \max\{0, \bar{a}_{nh=0} + \bar{a}_{nh=1} - \tilde{a}_t\} & \text{if couple and one in NH} \\ \max\{0, \bar{a}_{nh=1} - \tilde{a}_t\} & \text{if couple and both in NH} \end{cases} \tag{16}$$

[26] We abstract from private long-term care insurance which pays for formal long-term care costs before Medicaid. In the data, the private insurance ownership rate is less than 10%. In contrast to a common misconception, Medicare does not pay for prolonged nursing home stays.

[27] As nursing home residents already receive basic food and housing from the facility, we have $\bar{a}_{nh=0} > \bar{a}_{nh=1}$. We calibrate $\bar{a}_{nh=1}$ to be zero as in Lockwood (2018).

[28] The alternative specification will yield a similar equilibrium outcome where most singles liquidate their home before becoming a Medicaid nursing home resident. This is because nursing home events happen towards the end of life and the probability of moving back home is very small. As one cannot derive consumption utility from homeownership while living in a nursing home, the estate recovery will induce singles to sell their home.

The consumption floor for non-institutionalized couples is assumed to be 1.5 times the consumption floor for non-institutionalized singles, $\bar{a}_{nh=0}$, as in De Nardi, French, Jones, and McGee (2021).[29] The key difference from equation (15) is that housing assets are disregarded by Medicaid when a married individual ends up in a nursing home. This is consistent with the Medicaid rules which provide the homestead exemption to married households in a nursing home, as explained in Section 2.[30] The favorable treatment of the house for couples could induce them to maintain homeownership for a longer period of time relative to singles.

3.9 Asset accumulation law

Non-housing assets tomorrow become

$$a_{t+1} = (1 + r)(\tilde{a}_t + tr_t - x_t) \tag{17}$$

x_t is the household consumption expenditure described in equation (9). We assume there is no borrowing. Furthermore, we abstract from reverse mortgages which enable households to borrow against their home equity. The choice is based on the empirical fact that almost no retirees use such loans: according to Nakajima and Telyukova (2017), only 1.9% of eligible homeowners were reported to use reverse mortgages in 2013.[31]

3.10 Recursive formulation

We provide a recursive formulation for a couple's problem. In each period, a married household's state vector is given as

$$z_t = (a_t, \tilde{h}_{t-1}, s_t^H, s_t^W; y, ic_{child}) \tag{18}$$

where a_t is the non-housing wealth, $\tilde{h}_{t-1}$ is the housing wealth at the beginning of the period, and s_t^j is the health status of each spouse, $j \in \{H, W\}$. Time-invariant state variables are household income y and the availability of informal care from children ic_{child}.

[29] Later, we calibrate $\bar{a}_{nh=1}$ to be zero as in Lockwood (2018). Hence, the consumption floor for institutionalized couples would be zero regardless of the constant in front of $\bar{a}_{nh=1}$.

[30] In the unlikely scenario that both spouses end up in a nursing home, we could alternatively have Medicaid count the value of the house in its means test. However, as the probability of both the husband and the wife becoming disabled is small, the alternative specification has little impact on model outcomes.

[31] Nakajima and Telyukova (2017) find that bequest motives, uncertain medical expenses, and loan costs account for low demand of reverse mortgage loans.

The household's choice vector is

$$q_t = (D_t, R_t, P_t^W, x_t) \tag{19}$$

where $D_t \in \{0,1\}$ represents the house selling choice, $R_t \geq 0$ is the rent choice, $P_t^W \in \{0,1\}$ is the spousal caregiving choice, and $x_t \geq 0$ is the household consumption expenditure.

Denote the survival probability by χ which depends on current health, age, gender, and income, as stated in equation (13). A recursive formulation for a couple's problem is:

$$\begin{aligned} V_t^M(z_t) \quad &= \max_{q_t} \quad \kappa u(c_t^H, h_t^H) + (1-\kappa)\left[u(c_t^W, h_t^W) - \psi_{\tilde{h},y} P_t^W\right] \\ &+\beta \chi_t^H \chi_t^W E[V_{t+1}^M(z_{t+1})|z_t, q_t] \\ &+\beta(1-\chi_t^H)\chi_t^W E\left[\kappa v^M(a_{t+1}, \tilde{h}_t) + (1-\kappa)V_{t+1}^{S,W}(z_{t+1})|z_t, q_t\right] \\ &+\beta \chi_t^H (1-\chi_t^W) E\left[\kappa V_{t+1}^{S,H}(z_{t+1}) + (1-\kappa)v^M(a_{t+1}, \tilde{h}_t)|z_t, q_t\right] \\ &+\beta(1-\chi_t^H)(1-\chi_t^W) E\left[v^S(b_{t+1})|z_t, q_t\right] \end{aligned} \tag{20}$$

subject to budget constraints. V^M represents a married household's value function. β is the discount factor. The expectation operator is taken with respect to health statuses of the next period. $V^{S,j}$ represents a single retiree's value function when the retiree's gender is $j \in \{H, W\}$, which we derive in the Appendix. κ is the relative Pareto weight on the husband.[32] Among other things, it acts to resolve the tension that arises from different precautionary savings motives between husbands and wives. As women have longer life expectancy and face higher formal care risk, they have stronger precautionary savings motives than men. In particular, the value of κ will have a non-trivial effect on the homeownership rate among couples. For example, as the value of κ decreases, couples' homeownership rate might increase as wives want to lock assets in illiquid housing to transfer more assets into her widowhood.

3.11 Model discussions

Children and housing While our model does not have children as active agents making decisions, they affect retirees' choices in the following manner. First, children act to lower singles' homeownership premium relative to couples. As discussed in Section 2.2.4, moving into one of the children's home is a viable option for singles. We capture singles' higher opportunity cost of owning a home by assuming that the homeownership premium is lower

[32] As individuals are retired and their incomes remain fixed over the remaining life cycle, we assume κ is time invariant.

for singles as shown in equation (11). Second, children act to decrease the chance of moving into a nursing home for single retirees. Singles in our model resort to nursing home care only when informal care from children is not available.[33] Informal care from children reduces the need to liquidate housing and "spend down" to the Medicaid eligibility. This is consistent with the empirical pattern that among singles, beliefs about receiving care from children are positively correlated with homeownership.[34]

Bequests to children at spousal death De Nardi, French, Jones, and McGee (2021) find that household assets decline non-trivially when the first spouse dies, most of which is explained by transfers to children. Given this empirical pattern, one might think that the surviving spouse faces a hard constraint and sells the house to execute financial transfers specified in the deceased spouse's will. However, we do not observe whether the surviving spouse was obligated to make such transfers in the data. It could be that the surviving spouse sold the house for other reasons and chose to share some of the proceeds with her children. Given the lack of appropriate data, our model allows bequests to children only when there is no surviving spouse left.

4 Estimation

To estimate our model, we employ a two-step estimation procedure as frequently done in the literature (e.g., De Nardi, French, and Jones (2010)). In the first step, we fix or estimate parameters outside the model. In the second step, we use a limited information Bayesian method to recover structural parameters within the model.

4.1 Sample selection procedure

For estimation, we use nine interview waves which happened biannually from 1998 to 2014. All monetary values presented henceforth are in 2013 dollars, unless otherwise noted. From 11,721 respondents who were aged 60 and over in 1998 and do not miss any interviews, we restrict to respondents whose wealth and housing value do not exceed 98th percentiles, resulting in the sample size of 11,325.

[33] This is consistent with previous studies which find that parents prefer care from their children over paid care services (Barczyk and Kredler, 2018; Mommaerts, 2016; Ko, 2022).

[34] We find that the homeownership rate is about 50% among singles who do not believe children will provide care, while the rate is higher at around 70% among singles who believe children will provide help in the future.

Table 5: Summary statistics of initial conditions in the estimation sample

	Married		Single	
	Mean	Median	Mean	Median
Age	70.02		75.43	
Homeowner	0.88		0.58	
Housing assets ($)	127,957	109,200	66,899	31,200
Non-housing assets ($)	299,356	123,240	124,009	15,600
Require long-term care	0.10		0.22	
Income ($)	34,255	25,934	29,743	19,845
Availability of informal care	0.53		0.49	
Female			0.76	
Observations	6,800		4,525	

Notes: The table presents the summary statistics of initial conditions in the estimation sample, constructed from the HRS 1998.

An individual is considered a homeowner if the value of housing assets is greater than zero. We consider an individual's health status as "require long-term care" if the individual reports having two or more limitations in carrying out activities of daily living (ADLs). The availability of informal care provided by children is a dummy variable which is equal to one if a respondent says the number of children he/she believes will provide care when necessary exceeds zero. The helper file in the HRS contains information about help received regarding one's long-term care needs. We treat a married household as using spousal care if the helper is identified as the wife.

Table 5 presents the summary statistics of initial conditions in the estimation sample, constructed using the 1998 wave. The mean age of married couples is 70 and that of single households is 75. Compared to single households, married couples are more likely to be homeowners, own more liquid and illiquid assets, and have higher average income over the sample period. Since wives tend to outlive their husbands, the fraction of female observations is 0.76 among singles. The fraction of singles who require long-term care is much higher than that of couples, reflecting that singles are older on average.

4.2 First-stage parameters

This section describes parameters of the model that are fixed or estimated outside the model. The model assumes health transition probabilities follow an exogenously given Markov process where the next period's health is determined by one's current health, age, gender, and permanent income. We estimate the health transition probabilities by maximum likelihood estimation using a flexible logit. The estimates show that life expectancy is longer for women

and higher-income people, and the probability of developing long-term care needs over the life-cycle is higher for women and lower-income individuals.

The OECD modified equivalence scale assigns a value of 1 to the household head and 0.5 to the spouse. Based on this, we set the parameter on economies of scale in consumption for couples at 1.5.

We assume a coefficient of relative risk aversion of 3 for both consumption and housing. Following Brown and Finkelstein (2008), we use 3% time preference rate per year and 3% annual real interest rate. We consider three values of permanent income which correspond to the 20th, 55th and 80th percentiles of the income distribution in the sample.

We set the depreciation rate for housing assets at 1% per year. This value compares to the calibrated value of 1.7% in Nakajima and Telyukova (2020). We set the homeownership premium for married couples so that the same magnitude of economies of scale applies to consumption and housing services. Given this condition, we set married couples' homeownership premium at 2.725 and that of singles at 2.162 so that the average homeownership premium is 2.5 as in Nakajima and Telyukova (2020). We set the transaction cost of selling house at 7% of the value of the house, following Gruber and Martin (2003).

For formal care prices, we use the average rates in 2008 which was $230 per day for nursing home care (MetLife, 2008). We set the per-capita consumption floor for nursing home residents to zero (Lockwood, 2018). We set the consumption and housing value of nursing home services to be 40% of the consumption floor of non-nursing home residents, $\bar{a}_{nh=0}$, which we estimate internally.

4.3 Structural estimation

4.3.1 Identification strategy

We now provide identification arguments for the parameters that we estimate within the model. We identify the wife's disutilty from providing care ($\psi_{\tilde{h},y}$) using the frequency of spousal care provision conditional on permanent income group and homeownership status.

The housing consumption utility scale (σ) is identified from variation in housing asset shares. This is because the fraction of total assets that is invested in housing should inform us about individuals' consumption value for housing relative to general consumption.

To identify the parameters governing bequest utility, we use various moments related to dissaving of assets over the life cycle. We divide the households into two age groups based on their household head's age. If the head's age is between 60 and 70, we categorize the household as young; otherwise, we categorize the household as old. As the bequest

utility parameters differ by marital status, we use the median non-housing assets not just conditional on age group, but also on marital status. To identify married individuals' utility from bequeathing housing assets, we use the mean homeownership rate of couples across age groups.

The consumption floor for non-nursing home residents is identified by the Medicaid recipiency rate of low-income households, conditional on age group. Within the model, a larger consumption floor leads to a higher welfare recipiency rate, especially among low-income households.

To identify the Pareto weight of couples separately from bequest motives, we use savings decisions of low-income households. As low-income households do not have much asset to leave behind, bequest motives do not play a significant role in their savings decision. Their savings decisions are primarily driven by the tension between husbands' wish to consume and wives' wish to transfer assets to their widowhood. The tension arises because men have weaker precautionary saving motives than women: they have shorter life expectancy and expect smaller medical expenditures due to reliance on spousal care. As this tension is resolved through the relative bargaining power of husbands and wives, savings decisions of married households with limited assets are informative about the Pareto weight. In particular, we use the change in the homeownership rate at the time of a spousal death. For example, if the Pareto weight of wives were relatively large, then married households' homeownership would be high as wives wish to lock assets in illiquid housing. In this case, there would be a greater reduction in the homeownership rate after husbands' death.

4.3.2 Estimation strategy

We adopt a limited information Bayesian method as in Fernandez-Villaverde, Rubio-Ramirez, and Schorfheide (2016) and quantify the uncertainty on parameters by the posterior distribution implied by the data. Based on the identification arguments provided in the previous section, Table 6 shows moments used in estimation and the parameters associated with them. Conditional on permanent income y, we assume the wife's caregiving disutility when she is a homeowner ($\psi_{\tilde{h}>0,y}$) is proportional to her caregiving disutility when she is a renter ($\psi_{\tilde{h}=0,y}$). We denote the ratio by $\zeta \equiv \psi_{\tilde{h}>0,y}/\psi_{\tilde{h}=0,y}$. For the wife's caregiving disutility, we estimate $\psi_{\tilde{h}=0,y}$ for each value of y and the ratio ζ.

Let $\widehat{\psi}$ denote the empirical moments to match. The goal is to choose a parameter vector $\theta \equiv (\psi_{\tilde{h}=0,y=1}, \psi_{\tilde{h}=0,y=2}, \psi_{\tilde{h}=0,y=3}, \zeta, \sigma, \kappa, \bar{a}_{nh=0}, \delta_1, a_{b1}, h_b, \delta_2, a_{b2})$ to make the model-simulated

Table 6: Internally estimated parameters and associated moments

Parameter	Identifying moment
Wife's caregiving disutility	
$(\psi_{\tilde{h}=0,y=1}, \psi_{\tilde{h}=0,y=2}, \psi_{\tilde{h}=0,y=3})$	Spousal care provision rate by permanent income groups
ζ	Spousal care provision rate by homeownership status
Weight on housing consumption	
σ	Mean housing asset share of singles
	Mean housing asset share of couples
Husband's relative Pareto weight	
κ	Homeownership rate before/after spousal death in low income group
Medicaid consumption floor	
$\bar{a}_{nh=0}$	Medicaid recipiency rate of low-income group
Bequest utility	
$(\delta_1, a_{b1}, h_b, \delta_2, a_{b2})$	Median non-housing asset of young singles
	Median non-housing asset of old singles
	Median non-housing asset of young couples
	Median non-housing asset of old couples
	Homeownership rate of young couples
	Homeownership rate of old couples

Notes: The table reports internally estimated parameters and their identifying moments.

moments $\psi(\theta)$ as close as possible to $\widehat{\psi}$. The approximate likelihood of $\widehat{\psi}$ is written as

$$f(\widehat{\psi}|\theta) = \left(\frac{1}{2\pi}\right)^{\frac{M}{2}} |\bar{V}|^{-\frac{1}{2}} \exp\left[-\frac{1}{2}\Big(\widehat{\psi} - \psi(\theta)\Big)' \bar{V}^{-1}\Big(\widehat{\psi} - \psi(\theta)\Big)\right],$$

where M is the number of moments in $\widehat{\psi}$. $\bar{V}$ is obtained by a bootstrap approach with N_B bootstrap samples as

$$\bar{V} = \frac{1}{N_B}\sum_{b=1}^{N_B}(\psi_b - \bar{\psi})(\psi_b - \bar{\psi})',$$

where ψ_b stands for the moments from the b-th bootstrap sample, and $\bar{\psi}$ is the mean of ψ_b for $b = 1, \ldots, N_B$. The Bayesian posterior of θ conditional on $\widehat{\psi}$ is derived as

$$f(\theta|\widehat{\psi}) = \frac{f(\widehat{\psi}|\theta)p(\theta)}{f(\widehat{\psi})},$$

where $p(\theta)$ denotes the priors on θ, $f(\widehat{\psi})$ denotes the marginal density of $\widehat{\psi}$, and $f(\widehat{\psi}) = \int f(\widehat{\psi}|\theta)p(\theta)d\theta$. Then we characterize the posterior density using the Random-Walk Metropolis Hastings sampler with the objective function $\log f(\widehat{\psi}|\theta) + \log p(\theta)$.

This limited information Bayesian method is closely related to the simulated method of moments in that the objective function is larger when the simulated moments are closer to the empirical moments constructed from the data. Since we adopt the Bayesian approach,

Table 7: Parameter estimates

Parameter	Prior median [5th, 95th percentile]	Posterior median [5th, 95th percentile]
Wife's caregiving disutility		
$\psi_{\tilde{h}=0,y=\text{high}}$	0.14e-6	0.1447e-6
	[0.131e-6, 0.149e-6]	[0.1443e-6, 0.1454e-6]
$\psi_{\tilde{h}=0,y=\text{middle}}$	0.14e-6	0.1404e-6
	[0.131e-6, 0.149e-6]	[0.1401e-6, 0.1409e-6]
$\psi_{\tilde{h}=0,y=\text{low}}$	0.14e-6	0.1392e-6
	[0.131e-6, 0.149e-6]	[0.1383e-6, 0.1393e-6]
ζ	0.5	0.9575
	[0.05, 0.95]	[0.9566, 0.9581]
Weight on housing consumption		
σ	1.5	0.9313
	[0.15, 2.85]	[0.9312, 0.9326]
Husband's relative Pareto weight		
κ	0.75	0.6920
	[0.525, 0.975]	[0.6917, 0.6926]
Medicaid consumption floor		
$\bar{a}_{nh=0}$	15,600	10,080
	[3,720, 27,480]	[10,080 10,082]
Bequest utility		
δ_1	2.5	0.7541
	[0.25, 4.75]	[0.7523, 0.7545]
a_{b1}	15,000	10,151
	[1,500, 28,500]	[10,144, 10,156]
δ_2	2.5	1.4982
	[0.25, 4.75]	[1.4977, 1.5006]
a_{b2}	15,000	5,534
	[1,500, 28,500]	[5,532 5,540]
h_b	15,000	6,531
	[1,500, 28,500]	[6,517, 6,535]

Notes: The table reports the parameter estimates.

one could incorporate prior beliefs. If one uses uniform prior distributions for all of the parameters, the estimation results could be interpreted as the estimates from the simulated method of moments using $\bar{V}^{-1}$ as the weighting matrix. We adopt uniform priors for all of the parameters.

4.3.3 Estimation results

Table 7 reports the estimates of the parameters. The posterior median estimates on the wife's disutility from providing spousal care increase with permanent income. The ratio of the wife's caregiving disutility when she is a homeowner to her disutility when she is a renter has the posterior median value of 0.9575, which is less than 1. The result suggests that

there is complementarity between homeownership and spousal care. The posterior median value for the weight on housing consumption is 0.9313. This is comparable to 1, which is a commonly used value in the literature as in Fisher and Gervais (2011). The posterior median estimate of the Pareto weight on husbands is 0.6920 which is very similar to 0.7, the calibrated value for husbands' relative weight in Fernandez and Wong (2014). The median estimate of the consumption floor for non-nursing home residents is $5,040 per year, which is consistent with $4,108 in De Nardi, French, Jones, and McGee (2021).

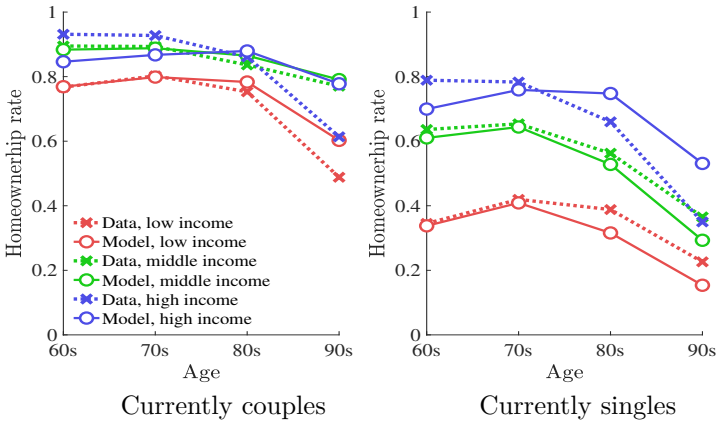
Bequest utility scale parameters δ_1 for singles and δ_2 for couples are estimated to have posterior median values of 0.7541 and 1.4982, respectively. The parameters a_{b1} and (a_{b2}, h_b) which determine the curvature of the bequest utility function for singles and couples have the posterior median estimates of 10,151 and (5,534, 6,531), respectively. To interpret the estimates, we follow the practice in the literature and compute the asset threshold below which individuals do not leave any bequests in a two-period model with perfect certainty about mortality risk. The threshold below which a single household does not leave any bequest is $\underline{a}_S = a_{b1}/\varphi_S$ where $\varphi_S = (\beta\delta_1(1+r))^{\frac{1}{\gamma}}$. Based on our estimates, $\underline{a}_S = \$11,152$, which is smaller than the threshold of $29,600 found in De Nardi, French, Jones, and McGee (2021). In other words, our estimation finds stronger bequest motives for singles. This might be due to the fact that in our model, singles face smaller long-term care expenditure risk as they can rely on informal care from children when it is available. To rationalize the same savings patterns with smaller medical expenditure risk, our estimation finds stronger bequest motives for singles. For a married household with a surviving spouse, the non-housing asset threshold is $\underline{a}_M = a_{b2}/\varphi_M$ where $\varphi_M = (\beta\delta_2(1+r))^{\frac{1}{\gamma}}$. Based on our estimates, $\underline{a}_M = \$4,836$. The housing asset threshold is $\underline{h}_M = h_b/(\sigma^{\frac{1}{\gamma}}\varphi_M) = \$5,845$. To the best of our knowledge, we are the first to estimate a bequest utility function of this form. Comparing couples' asset threshold $(\underline{a}_M, \underline{h}_M) = (\$4,836, \$5,845)$ to that of singles $\underline{a}_S = \$11,152$, we conclude that couples have stronger bequest motives, which is consistent with De Nardi, French, Jones, and McGee (2021).

We now discuss the fit of the model. Panel A in Figure 3 shows that the model is able to generate the life-cycle profiles of the homeownership rate of couples and singles across permanent income groups. Panel B shows that the model fits life-cycle profiles of non-housing assets closely for the low and high income groups, whereas it overestimates savings for the middle-income group.

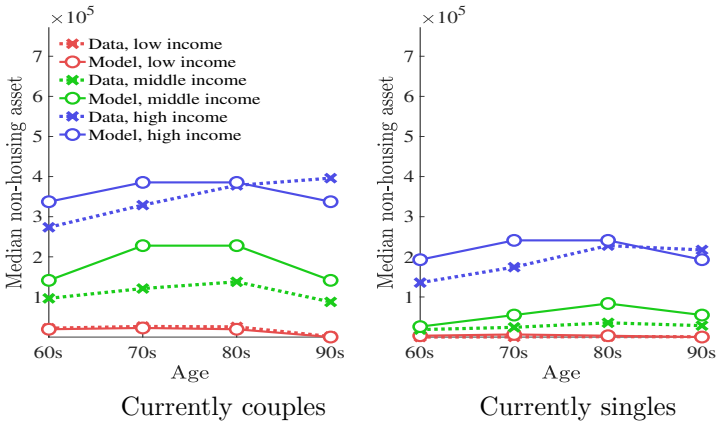
Figure 4 shows that although the estimation targeted the change in the homeownership rate at spousal death from the low income group only, the estimated model is able to replicate the change across all income groups.

Figure 5 reports the model fit of spousal care provision. The estimated model is able to

Figure 3: Model fit of housing and non-housing savings



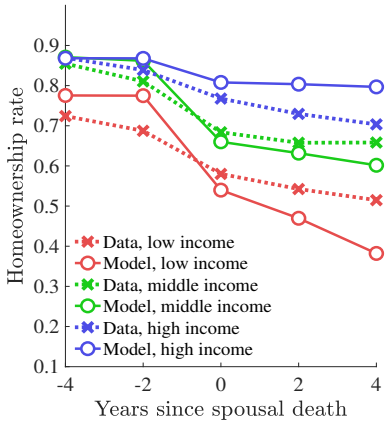
Panel A



Panel B

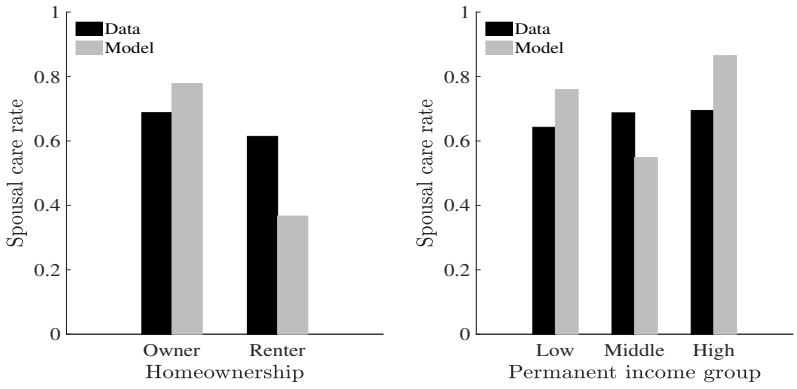
Notes: The figure shows the model fit for the life-cycle homeownership rate (Panel A) and non-housing assets (Panel B) by permanent income and marital status. In each graph, dashed lines with cross markers represent empirical moments, and solid lines with circle markers represent model-simulated moments.

Figure 4: Model fit of homeownership around spousal death



Notes: The figure shows the model fit for the homeownership rate before and after spousal death. Dashed lines with cross markers represent empirical moments, and solid lines with circle markers represent model-simulated moments.

Figure 5: Model fit of spousal care provision



Notes: The figure reports the model fit of the spousal care rate by homeownership (left) and by permanent income (right). In each graph, black bars represent empirical moments, and gray bars represent model-simulated moments.

Table 8: Model fit of untargeted moments

	Data	Model
Medicaid recipiency by marital status		
Couples	0.08	0.08
Singles	0.18	0.11
LTC arrangement among disabled couples		
Medicaid nursing home	0.07	0.02
Private nursing home	0.21	0.27
LTC arrangement among disabled singles		
Medicaid nursing home	0.24	0.31
Private nursing home	0.31	0.22

Notes: The table reports empirical moments and model-simulated moments that are not targeted in our estimation.

generate the positive correlation between homeownership and spousal caregiving observed in the data. It also does a decent job of matching the spousal care rates across income groups.

Table 8 reports the model fit of untargeted moments on the Medicaid recipiency and nursing home usage rates by marital status. Our model matches well the Medicaid recipiency rate for couples. The model is able to generate the empirical pattern that singles' Medicaid recipiency rate is higher than married couples, although it underpredicts singles' rate compared to the data. In addition, the model does a reasonable job in matching Medicaid and private nursing home usage rates conditional on marital status.

5 Main results

In this section, we first use counterfactual experiments to quantify the effect of Medicaid's treatment of housing, spousal caregiving, and bequest utility on explaining the difference in homeownership between retired couples and singles. Then, we consider alternative treatments of housing assets by Medicaid and assess their effects on welfare and government spending.

We build the simulation sample used in our counterfactuals in the following manner. According to our model, everybody is married and the husband's age is 62 in the first period. To ensure a sufficiently large number of observations, we select married households where the husband's age was between 60 and 65 in years 1998 and 2000. Table C.1 in the Appendix shows the summary statistics of our simulation sample. For each individual in the sample,

we make 400 duplicates. We draw the history of idiosyncratic health and mortality shocks using each individual's current health, age, gender, and permanent income.[35]

5.1 Homeownership gap between couples and singles

To understand the substantial gap in homeownership between couples and singles, we first conduct a counterfactual where we shut down the three channels that strengthen married individuals' incentive to own a home compared to singles. Specifically, we make the following changes to our baseline model.

C1 Medicaid no longer provides the homestead exemption to couples in a nursing home.

C2 There is no spousal caregiving.

C3 Couples no longer place a higher value on bequeathing the house compared to singles.

To implement the first change (C1), we modify the government transfer in equation (16) such that the liquidated value of the couple's housing assets is counted when the couple ends up in a nursing home.[36] For the second change (C2), we force disabled husbands to always use formal care. For the third change (C3), we modify the bequest preference in equation (7) such that the second additive term which represents the housing bequest utility is zero. Just like singles, liquid and housing assets are perfect substitutes and only the liquidated value of the total assets (b) matters.

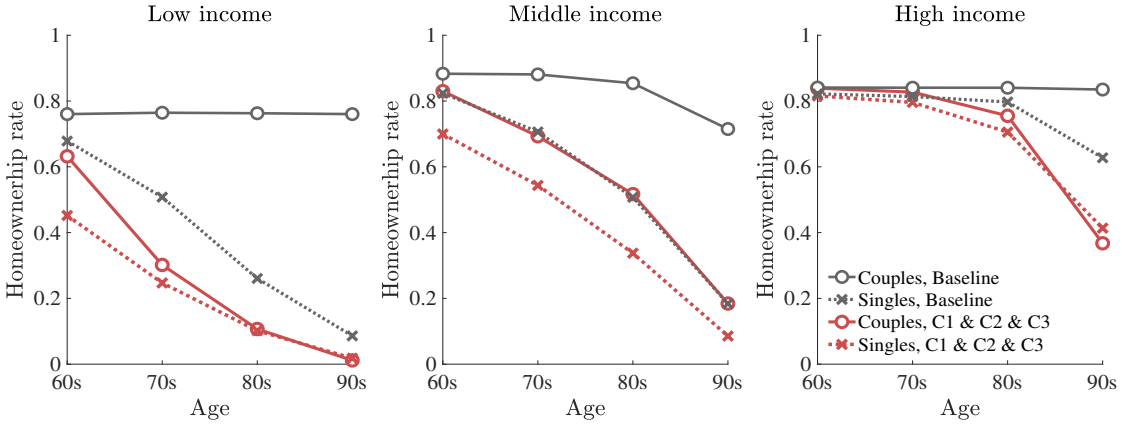
Figure 6 reports the counterfactual homeownership gap conditional on age and income when we implement the three changes above. Compared to the baseline, couples' homeownership rate is lower over the life cycle. The homeownership gap between couples and singles is substantially smaller across all income groups. The results imply that the three channels incorporated into our model are crucial in explaining different housing decisions by marital status in retirement.

To understand which mechanism is important for which income group, we implement one change at time (Figure C.1) followed by two changes at a time (Figure C.2), which we report in the Appendix. The decomposition exercise reveals that the impact of each mechanism

[35] The same history of shocks is used for all counterfactual experiments.

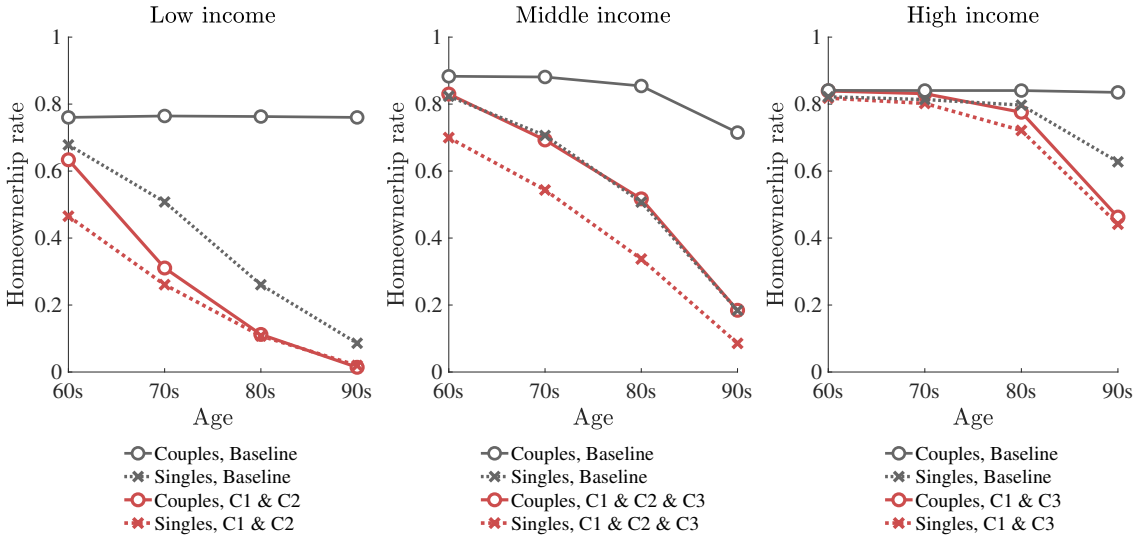
[36] We maintain the assumption that the value of the house is disregarded by Medicaid when the beneficiary is living in community, regardless of marital status.

Figure 6: Counterfactual homeownership (all three changes)



Notes: The figure reports the baseline (black) and counterfactual (red) homeownership rate conditional on age, marital status (solid for couples and dashed for singles), and income (from left to right: low, middle, and high). For the counterfactual, we implement three changes to the model (C1, C2 and C3). C1 changes the model such that Medicaid no longer provides the homestead exemption to couples in a nursing home. C2 removes spousal caregiving. C3 eliminates the higher value that couples place on bequeathing the house relative to singles. See the main text for details.

Figure 7: Counterfactual homeownership (key changes for each income group)



Notes: The figure reports the counterfactual homeownership rate when we implement for each income group, the changes that are the most important in explaining the homeownership gap between couples and singles. See the main text for the description of the changes.

depends on how strong the other mechanisms are.[37] We summarize the main findings for each group, emphasizing the interactions among different mechanisms.

First, when the house loses its protected status in Medicaid's means test for couples (C1), low-income couples sell their house early in retirement to better qualify for Medicaid benefits (Panel A in Figure C.1). The homeownership rate of low-income couples becomes almost identical to that of singles. When we also remove spousal care, i.e., we simultaneously implement changes C1 and C2, low-income couples' homeownership rate is even further reduced (Panel A in Figure C.2). Note that removing the spousal care option alone has almost no impact on low-income retirees' housing decisions as long as Medicaid remains unchanged (Panel B in Figure C.1). The results imply that Medicaid's favorable treatment of the house is the dominant reason for low-income couples' higher homeownership followed by spousal care. As low-income retirees have little assets to leave behind, changing bequest preferences of couples (C3) has almost no impact.

Second, when we eliminate the special value that couples place on bequeathing the house (C3), we see a meaningful reduction in high-income couples' homeownership (Panel C in Figure C.1). When we additionally remove the favorable treatment of the house by Medicaid, i.e., we implement changes C1 and C3, high-income couples' homeownership rate is further reduced at the end of life to the point that it becomes almost identical to that of singles (see Panel B in Figure C.2). Note that as a stand-alone mechanism, changing Medicaid has almost no impact on high-income retirees' housing decisions (Panel A in Figure C.1). The results imply that how Medicaid treats the house in the means test becomes relevant only when high-income couples do not place a special value on bequeathing the house to their surviving spouse.

As Medicaid is means-tested, one might find it unintuitive that it has any impact on high-income retirees' savings decisions. However, the substantial cost of nursing homes towards the end of life makes the public insurance option relevant even for high-income retirees. Brown and Finkelstein (2008) obtain a similar result in the context of private long-term care insurance purchase decisions: they find a large crowd-out effect of Medicaid on demand for private insurance even among high-wealth retirees.

Third, for middle-income households, all of the three channels are important in explaining why couples are more likely to maintain homeownership than singles. Panel A in Figure C.1 shows that eliminating the homestead exemption granted to couples in a nursing home (C1) has a large impact on reducing middle-income couples' homeownership. However, the

[37]For example, shutting down the spousal care option (C2) has almost no effect on retirees' housing decisions across all income groups as long as we leave Medicaid and bequest motives unchanged from the baseline (Panel B in Figure C.1). However, when we implement C2 along with C1 or C3, then removing the spousal care option has a meaningful impact on some retirees.

resulting homeownership rate is still much greater than the rate reported in Figure 6, which is when we implement all three changes at the same time. Implementing any two changes at a time does not close the gap in homeownership between middle-income couples and singles to the degree reported in Figure 6 (see Figure C.2). The results imply that for middle-income couples, Medicaid, spousal care, and bequest motives all play an important role in strengthening their incentive to own a home compared to their single counterparts.

Figure 7 summarizes the dominant channels for each income group. Among low-income retirees, the protected status of the house in Medicaid's means test together with the spousal care option strengthen couples' homeownership relative to singles. For the middle-income group, Medicaid, spousal care, and bequest motives together play the major role. For high-income couples, the desire to bequeath the house to the surviving spouse together with Medicaid's favorable treatment of the house are important.

5.2 Counterfactual Medicaid policies

In our baseline model, Medicaid disregards the value of the house for nursing home residents only when they are married. We consider alternative Medicaid rules where the recipient of the homestead exemption changes.[38] For each counterfactual policy, we compute the initial wealth transfer needed to make a household under the baseline regime indifferent to the counterfactual regime. To measure the effect on the government budget, we compute the change in the present-discounted value of government expenses over the life cycle of retirees.

First, we study the welfare impact when Medicaid no longer provides the homestead exemption to couples in a nursing home (Medicaid 1 in Table 9). This is the model change described earlier as C1. The stricter Medicaid rules have an impact of reducing an average retiree's initial wealth by $18,976 which is substantial. The negative impact is significant among low- and middle-income households for whom Medicaid is the most relevant. The Medicaid spending decreases by a modest amount of $4,252 per household.

Next, we go to the other extreme and consider what happens when Medicaid provides the homestead exemption not just to couples but also singles in a nursing home (Medicaid 2 in Table 9). The more lenient version of Medicaid has a positive impact on households across all income groups. On average, it is equivalent to increasing baseline retirees' initial wealth by $6,314. However, as more people qualify for Medicaid, the government spending increases substantially by an amount of $6,441.

[38] We maintain the assumption that the value of the house is ignored in Medicaid's means test for individuals living in community, regardless of marital status.

Table 9: Counterfactual Medicaid policies

	(1) Homestead exemption	(2) Low income	(3) Middle income	(4) High income	(5) All income	(6) Δ Medicaid
Baseline	Couples	0	0	0	0	0
Medicaid 1	Nobody	-34725	-33301	-2088	-18976	-4252
Medicaid 2	Everybody	9630	10190	2196	6314	6441
Medicaid 3	Singles	-33070	-28652	-38	-16216	515

Notes: The table reports the household welfare effect (columns 2-5) and the change in Medicaid spending (column 6) for alternative recipients of the homestead exemption in Medicaid's means test. All values are in 2013 dollars. We compute the welfare effect by computing the average initial wealth transfer needed to make a married household in the baseline regime indifferent to the counterfactual regime. The change in the Medicaid spending is represented in the mean present-discounted value per household.

Finally, we reform Medicaid such that the homestead exemption is given to singles in a nursing home but not to couples (Medicaid 3 in Table 9). The households are much worse off compared to the baseline: it has an impact of reducing an average retiree's initial wealth by $16,216. As expected, low- and middle-income households are much worse off compared to high-income households. The negative welfare effect implies that retirees prefer to enjoy the homestead exemption while they are married than they are single. This is because by the time they are single, they are less likely to be homeowners such that the value of the homestead exemption is lower. As the recipient of the homestead exemption changes from couples to singles, the Medicaid spending increases slightly by $515 per household.

To summarize, Table 9 rationalizes the current Medicaid rule which treats housing assets more favorably for couples than singles in a nursing home. By offering the homestead exemption when retirees are relatively young, the current Medicaid program decreases the incentive to liquidate home and spend down to Medicaid eligibility early in retirement, which leads to reduced impoverishment risk over retirement.

6 Conclusion

This paper uncovers mechanisms through which marital transitions affect housing decisions of retirees. We develop and estimate a life-cycle savings model where marital transitions affect housing, long-term care arrangements, bequest motives, and eligibility for means-tested welfare programs. We find that the key driver behind the homeownership gap between couples and singles varies substantially by income. For the low-income group, Medicaid's

favorable treatment of housing for couples is the dominant force, followed by spousal care. Among the high-income group, the greater value that couples place on bequeathing the house is crucial. For the middle-income group, Medicaid, bequest motives, together with the option of spousal care are substantial in understanding couples' higher value for homeownership. Our counterfactual policy experiments show that exempting housing assets in Medicaid's means test only for married households is more desirable than alternative policies, such as extending the homestead exemption to singles or providing the exemption to singles only.

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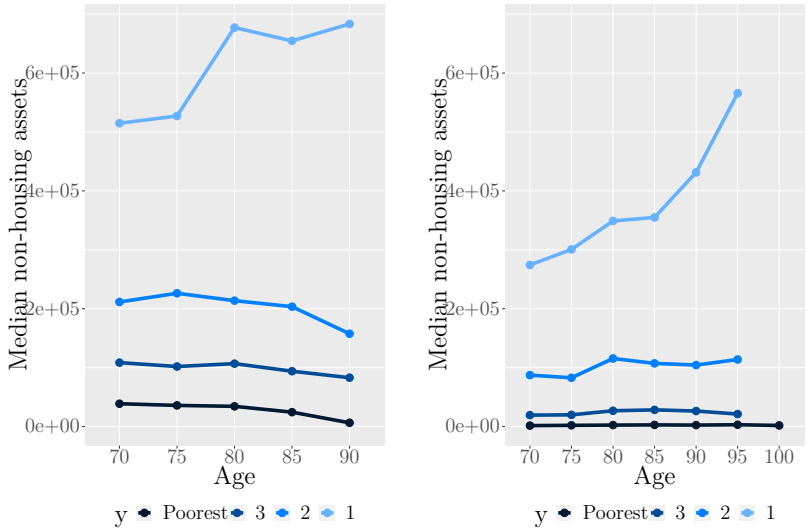
Appendix

A Data appendix

Figure A.1: Median non-housing assets



Currently couples Currently singles

Notes: Data = HRS 1998-2014. The figure shows the median non-housing assets by marital status, income (y), and age group.

Table A.1: Caregiving and home sales upon spousal death: summary statistics

	Mean	Median	S.d.
Sell home	0.33	0.00	0.47
Spousal care before death	0.06	0.00	0.24
Age	80.43	80.00	6.26
Have LTC needs	0.15	0.00	0.36
Female	0.69	1.00	0.46
Have children	0.95	1.00	0.22
Income	45943.32	25696.44	93410.15
Non-housing assets	411793.07	116585.00	974977.49
Observations	1102		

Notes: The table reports summary statistics of the data used in the regression reported in Table 2.

Table A.2: TEFRA liens and homeownership: summary statistics

	Mean	Median	S.d.
Own home	0.68	1.00	0.47
TEFRA x Single	0.46	0.00	0.50
TEFRA	0.87	1.00	0.34
Single	0.53	1.00	0.50
Age	79.40	80.00	8.57
Female	0.61	1.00	0.49
Have children	0.91	1.00	0.29
Income (in $100K)	0.45	0.30	0.60
Non-housing assets (in $100K)	2.75	0.41	9.58
Interview wave	7.26	7.00	2.55
Observations	1947		

Notes: The table reports summary statistics of the data used in the regression reported in Table 3.

Table A.3: Estate recovery rate and homeownership

	Own home
ERP rate x Single	-0.065
	(0.076)
ERP rate	-0.072
	(0.083)
Single	-0.125
	(0.159)
Age	-0.003
	(0.004)
Female	-0.002
	(0.057)
Have children	0.052
	(0.105)
Income (in $100K)	0.058***
	(0.011)
Non-housing assets (in $100K)	0.003*
	(0.001)
Mean of dependent variable	0.66
Observations	573

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses and are clustered at the household-state level. HRS 2002-2010 used. See Table A.4 for the summary statistics of the variables used in the regression. Linear probability model is used. Year, state, and birth cohort fixed effects are included. The sample consists of respondents living in states that have TEFRA liens in place. We further impose the following restrictions. (1) We exclude respondents on Medicaid or in a nursing home as they might have limited freedom in housing decisions. (2) We exclude young and healthy respondents as they might deem the use of Medicaid "too far", and the estimated impact of Medicaid policies might be contaminated due to a high discount factor.

Table A.4: Estate recovery rate and homeownership: summary statistics

	Mean	Median	S.d.
Own home	0.66	1.00	0.47
ERP rate x Single	1.03	1.29	1.03
ERP rate	1.90	1.69	0.52
Single	0.54	1.00	0.50
Age	80.21	80.00	8.13
Female	0.59	1.00	0.49
Have children	0.93	1.00	0.25
Income (in $100K)	0.45	0.31	0.62
Non-housing assets (in $100K)	3.09	0.45	12.12
Interview wave	7.95	8.00	1.42
Observations	573		

Notes: The table reports summary statistics of the data used in Table A.3.

Table A.5: Medicaid use and home sales upon spousal death

	Sell home
Medicaid before spousal death	0.095***
	(0.033)
Age	0.015***
	(0.003)
Have LTC needs	0.130***
	(0.032)
Female	-0.000
	(0.026)
Have children	0.092*
	(0.052)
Income (in 100K)	0.001
	(0.013)
Non-housing assets (in 100K)	-0.001
	(0.001)
Observations	1678
Mean of dependent variable	0.340

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in parentheses. HRS 1998-2014 used. Linear probability model is used. Year fixed effects and birth cohort fixed effects are included. Sample is at the respondent level and consists of individuals who had strictly positive housing wealth at the spousal death. The dependent variable is whether the surviving spouse sells the home in the next 4 years. Time-varying variables are measured at spousal death.

Table A.6: Increases in mortality risk and homeownership: summary statistics

	Mean	Median	S.d.
Sell home	0.06	0.00	0.24
Mortality risk increased	0.42	0.00	0.49
Married	0.60	1.00	0.49
Age	77.12	77.00	7.08
Have LTC needs	0.16	0.00	0.36
Have children	0.93	1.00	0.25
Number of Children	3.26	3.00	2.16
Income	56388.77	37960.32	100633.12
Non-housing assets	447379.82	136680.00	1173447.61
Covered by either Medicare or Medicaid	0.97	1.00	0.17
Covered by private LTC insurance	0.16	0.00	0.36
Observations	36976		

Notes: The table reports summary statistics of the data used in Table 4.

B Model appendix

B.1 Recursive formulation

We provide a recursive formulation for a single household's problem. In each period, a single household's state vector is given as

$$z_t = (a_t, \tilde{h}_{t-1}, s_t; y, ic_{child}) \tag{21}$$

where a_t is the non-housing wealth, $\tilde{h}_{t-1}$ is the housing wealth at the beginning of the period, and s_t is the health status. Time-invariant state variables are household income y and the availability of informal care from children ic_{child}.

The household's choice vector is $q_t = (D_t, R_t, x_t)$ where $D_t \in \{0, 1\}$ represents the house selling choice, $R_t \geq 0$ is the rent choice, and $x_t \geq 0$ is the consumption expenditure.

Denote the survival probability by χ which depends on current health, age, gender and income, as stated in equation (13). A recursive formulation for a single household's problem is

$$V_t^S(z_t) \quad = \max_{q_t} \quad u(c_t, h_t) + \beta\chi_t E[V_{t+1}^S(z_{t+1})|z_t, q_t] + \beta(1-\chi_t)E[v^S(b_{t+1})|z_t, q_t] \tag{22}$$

subject to budget constraints. V^S represents a single household's value function. β is the discount factor. The expectation operator is taken with respect to health statuses of the next period.

Table B.1: Model notation

Symbol	Definition
Choice variables	
$D \in \{0, 1\}$	House selling choice for homeowners: keep (0) or sell (1)
$R \geq 0$	Rented housing service
$P^W \in \{0, 1\}$	Spousal care from the wife: no care (0) or care (1)
$x \geq 0$	Household consumption expenditure
State variables	
t	Household head's age
$a \geq 0$	Non-housing assets
$\tilde{h} \geq 0$	Housing assets. $\tilde{h} > 0$ implies homeowner, $\tilde{h} = 0$ renter.
s	Health status: healthy, require long-term care, or dead
y	Permanent retirement income
ic_{child}	Availability of informal care from children: available (1) or not available (0)
Functions	
u	Utility over general consumption and housing services
v^M	Bequest utility when there is a surviving spouse
v^S	Bequest utility when there is no surviving spouse
Utility parameters	
$\psi^W_{\tilde{h},y}$	Wife's disutility from providing spousal care
σ	Housing consumption utility scale
γ	Consumption and housing CRRA coefficient
δ_1, a_{b1}	Bequest utility parameters of v^S
δ_2, a_{b2}, h_b	Bequest utility parameters of v^M
Others	
$c_{nh},\ h_{nh}$	Basic consumption and housing value from nursing home care
ρ	Economies of scale for married households' consumption
$\omega_{couple}, \omega_{single}$	Homeownership premium for couples and singles
κ	Relative Pareto weight on husbands
δ	Depreciation rate for housing assets
r	Real interest rate
τ	Home transaction cost
m	Formal long-term care cost
$\bar{a}_{nh=0}$	Per-capita consumption floor for non-nursing home residents
$\bar{a}_{nh=1}$	Per-capita consumption floor for nursing home residents

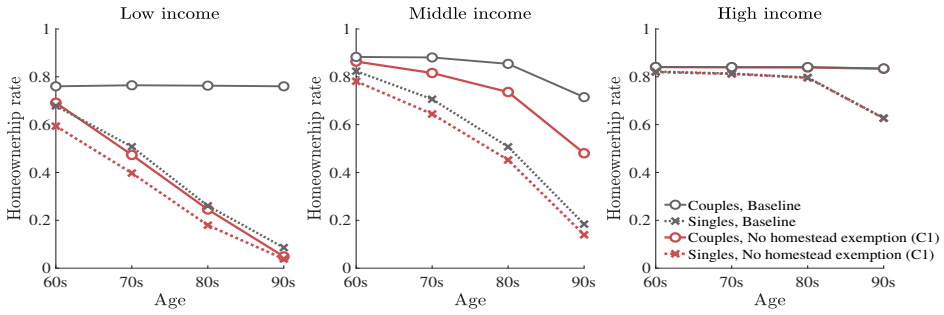
C Counterfactual appendix

Table C.1: Summary statistics of initial conditions

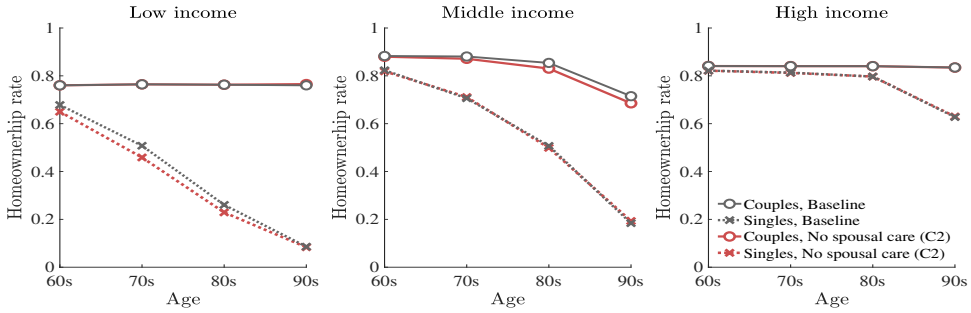
	Mean	Median
Homeowner	0.91	
Housing assets ($)	152,582	115,440
Non-housing assets ($)	474,021	138,705
Require long-term care	0.05	
Income ($)	47,202	33,498
Availability of informal care	0.62	
Observations	3,112	

Notes: The table reports initial conditions used in counterfactual simulations. The sample consists of married households where the husband's age was between 60 and 65 in years 1998 and 2000.

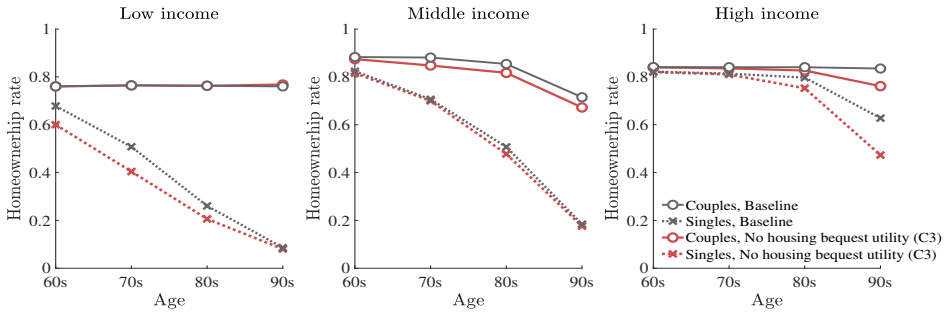
Figure C.1: Counterfactual homeownership (one change at a time)



Panel A



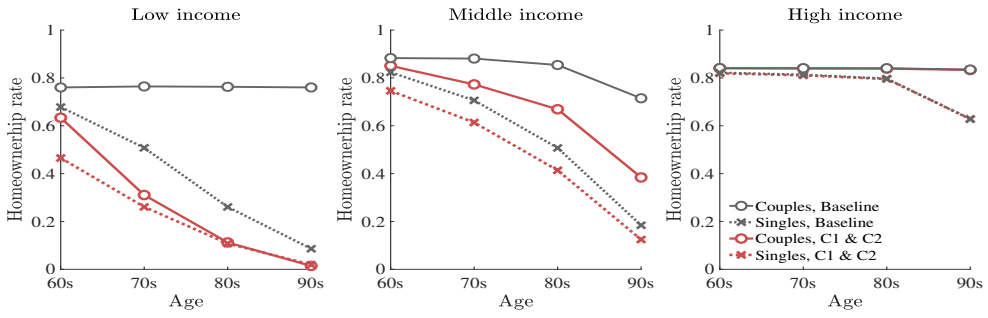
Panel B



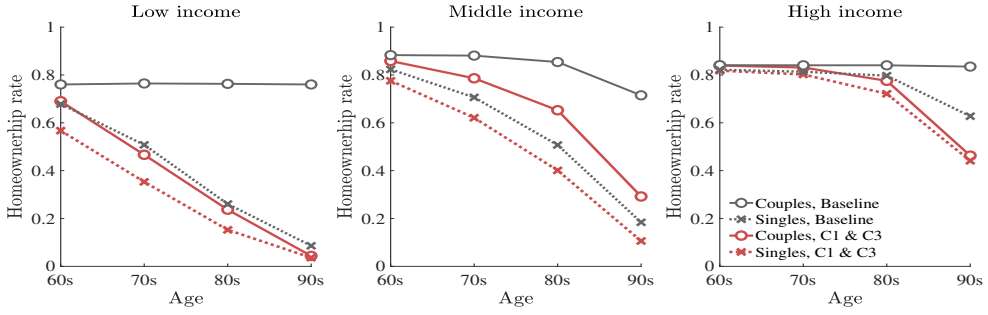
Panel C

Notes: In all graphs, black lines represent the baseline homeownership rate (solid black for couples and dashed black for singles). The red lines in Panel A represent counterfactual homeownership rates when Medicaid no longer provides the homestead exemption to couples in a nursing home (C1). The red lines in Panel B represent counterfactual homeownership rates when there is no spousal care (C2). The red lines in Panel C represent counterfactual homeownership rates when we eliminate the higher value that couples place on bequeathing the house relative to singles (C3).

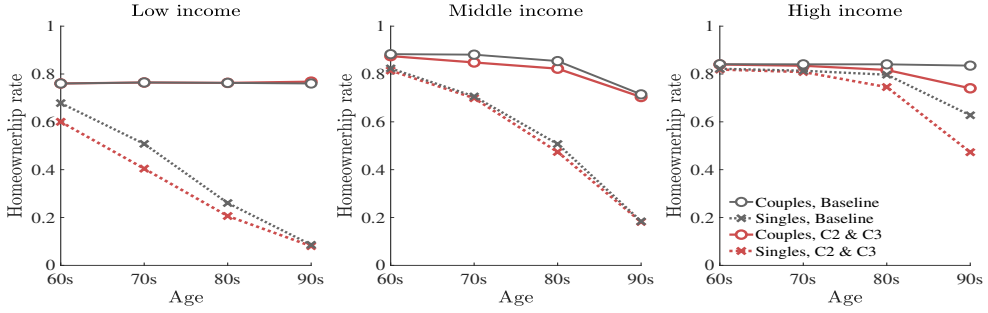
Figure C.2: Counterfactual homeownership (two changes at a time)



Panel A



Panel B



Panel C

Notes: In all graphs, black lines represent the baseline homeownership rate (solid black for couples and dashed black for singles). The red lines in Panel A represent counterfactual homeownership rates when we implement changes C1 and C2. The red lines in Panel B represent counterfactual homeownership rates when we implement changes C1 and C3. The red lines in Panel C represent counterfactual homeownership rates when we implement changes C2 and C3. C1 changes the model such that Medicaid no longer provides the homestead exemption to couples in a nursing home. C2 removes spousal caregiving. C3 eliminates the higher value that couples place on bequeathing the house relative to singles.