Elderly Social Care Funding And Its Interaction With Saving For Retirement

Nick Ridpath

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Abstract

This paper examines how the expected cost of social care later in life affects households' decisions on savings and retirement. I use data from the English Longitudinal Study of Ageing on social care use, health, and assets, to estimate individuals' social care risk, and their attitudes towards how to retire. I find that current UK social care funding provides significant insurance against social care risk, and that further expansions of social care funding would not induce significant changes in precautionary saving for retirement, or age of retirement. This is because the current system insures households against the major risk, that of very low consumption in old age, and other saving motives, such as bequests, mean that further precautionary saving is not necessary. I also find that the nature of the social care funding model should have major consequences for the assets households use to save in old age, particularly with regards to the choice between housing and other assets.

1 Introduction

The question of how households choose to retire, both in terms of how they save for and during retirement, and in terms of when they choose to retire, is a function of what they will need savings for. This can include pensions for spending in retirement, bequests, or medical expenses. I use a UK context to examine the role of elderly social care, separated from medical expenses, in driving saving and retirement decisions. I look at the broad role of care in saving choices, and I think about how different frameworks for funding and providing social care for the elderly can change how individuals optimise their retirement strategies.

I build a detailed model of individuals' health and social care risk, and incorporate it into a life-cycle model of households' retirement and saving decisions. This allows me to understand two different questions about elderly social care provision: how highly is it valued, and how does the prospect of high social care costs in old age affect individuals decisions on how to retire? The use of a structural model allows me to estimate the utility individuals receive from social care, enabling me to understand the welfare implications of increased state provision of social care. I incorporate a dynamic element to this model to examine the consequences of social care risk in the long run as well as the short run.

A range of key parameters are necessary to answer these questions. I estimate the processes that govern individuals' need for social care, and incorporate them into the UK social care funding system. I use this to estimate individuals preferences for social care use, as well as their preferences for retirement, housing, and bequests. The latter parameters govern how households choose to retire, in terms of when they retire, how much they choose to save for retirement, and the type of asset they choose to save in.

I use this to estimate how large of an effect social care risk has on households' retirement decisions. This is done across several dimensions, considering both the generosity of the social care funding system, and how the social care asset test judges housing wealth, to think about a range of retirement choices. These included the amount households save for and during retirement, what assets they use to save, and when they choose to retire. I use the tests of generosity to estimate how well the current social care funding system insures households against risk, and use different considerations of housing as wealth to estimate the extent to which portfolio allocation is driven by social care funding.

I use survey data from the English Longitudinal Study of Ageing (ELSA) to estimate the model. I use data on subjective and objective health measures, assets, and social care use to estimate individuals' risk of needing elderly social care in

England, and combine the institutional setting of the British social care funding system to estimate individuals' financial risk from social care need. I use ELSA data on assets, housing, and labour supply to estimate the unobserved parameters that govern how individuals make retirement decisions, using Simulated Method of Moments. Using these parameters, I simulate the same model but with different counterfactual scenarios.

The results show that the current social care funding model almost fully insures households against social care risk. Removing almost all social care support would increase assets at age 70 by approximately 30%, while expanding social care funding to be universal would only lead to a 3% reduction in how much households save, indicating that the current social care funding system prevents the need for most of the precautionary saving brought on by social care. This difference can be seen in two different channels: a difference in savings rate, and a difference in retirement age.

I also find that housing choices are heavily dependent on the cost of social care. The question of when housing is considered to be an element of wealth that is included in the threshold for receiving help with social care is very important for determining the proportion of household wealth that is held in housing. In particular, I find approximately 5 percentage point increases and decreases in home ownership rates depending on whether the measurement of housing as wealth is more lenient or less lenient than the current policy.

This paper draws on and contributes to several different strands of the literature around saving for retirement and social care. I contribute to the life-cycle literature around saving for retirement, and choices of when to retire. There is a long literature studying saving for old age and the retirement decision (**??**). There are various different elements of saving for retirement that the literature engages with, including housing portfolio choice (**?**), asset testing for government support (**??**), and medical need (**??**). By studying the UK social care system, this paper considers the intersection of all three of these phenomena: receipt of social care support is a function both of level of assets, and of asset portfolio. I test the role of policy contingent on care need, wealth, and housing on how households save for retirement.

The rest of the paper is as follows. Section 2 outlines the institutional setting of social care in the UK. Section 3 outlines the model, and details how it captures the shocks individuals face, and the decisions they make. Section 4 outlines the data used, while Section 5 outlines the estimation process, of both the parameters captured directly from ELSA data and by Simulated Method of Moments. Section 6 demonstrates the results of the counterfactual analysis, while Section 7 concludes.

2 Institutional Setting

In the United Kingdom, a distinction is drawn between healthcare and social care. Healthcare constitutes medical care, and is provided free at the point of use for all individuals, funded by taxation. Social care consists of assistance with everyday tasks, which can range from food shopping to help washing and eating, depending on an individual's need. Unlike healthcare, social care is not free at the point of use. Instead, whether social care can be received free of charge is determined by an individual's assets. In England, those with savings of over £23,250 are expected to pay for their own care. This asset figure does not include the value of someone's home, unless there would be no-one living there if they were to go into care. Effectively, this means that housing is only included in the asset test if every member of the household needs full-time residential care.

If your assets are below £23,250, your care is organised by the local council. They undertakes a 'needs assessment' that adjudicates not just your ability to pay, but also the amount and type of social care you need. If the council pays for the social care, then this may be by the council assigning you a personal budget to be spent on social care, or by the council organising care for you themselves.

3 Life-Cycle Model

I model the saving, retirement, and social care use decisions of households from age 50 until death. These households can comprise of couples, single men, or single women. Households make decisions on how much to spend, both on consumption and on social care, as well as whether or not to retire if they are still working, in response to their previous decisions, and to health and social care shocks they experience. The saving decision also accounts for the possibility of saving money in housing, or saving in non-housing assets. This structure allows me to consider how different methods of social care funding would affect households retirement planning across multiple axes: when to retire, how much to save, and whether to save it in housing or in other assets.

Households are modelled from age 50 until death. Each period t in the model represents households' consumption and retirement decisions at age t. Various cutoffs are put in place in the model for simplicity: households must have retired by age 75, and death is a certainty at age 100. Death occurs stochastically, with its probability determined by age and health. Households with two members are assumed to consist of a man and a woman, with the man two years older than the women.[1] The possibility of divorce is not accounted for.

3.1 Problem of the Individual

At age t, households make decisions on how much to spend on general goods, $c_{i,t}$, how much to spend on social care, $CARE_{i,t}$, whether or not to retire, and what house to live in, $Move \in \{0, \frac{2}{3}, 1\}$. $Move$ is a tertiary variable, where the three options are to stay in the same home, downsize to a home worth two thirds of the value of their current home, or to sell their home and begin to rent instead. The model only captures the possibility of downsizing or selling your home completely, rather than any increase in housing, because of the model's focus on social care; in the context of social care, the key housing questions are how it affects your ability to keep your home.

Similarly, the decision to retire is an optimal stopping problem, so that after retirement, it is not possible to work again. In order to capture the joint retirement decision made by many households, married couples make their retirement decision together, and stop working at the same time. [2]

[1] When age is discussed in the paper, in the case of married women it is two years older than their actual age.

[2] Where households do not retire jointly in the data, the retirement of the first member of the couple is treated as a decline in wages.

Additional state variables non-housing assets ($A_{i,t}$) and housing wealth ($h_{i,t}$) are a function of the decisions made in the model. Non-housing wealth includes all forms of positive and negative wealth, including cash, private pensions, and mortgage debt. Private pensions are included directly in assets, despite the requirement that they not be spent before the age of 65, because this amounts to a small section of the model. In the case of couples, it is assumed all assets, both housing and non-housing, are jointly held by the couple, rather than by an individual member of the household. $R_{i,t}$ is treated as a state variable, representing whether the household has retired. The first element of the budget constraint for a household j, with number of members n, at age t is therefore as follows:

$$\frac{A_{j,t+1}}{1+r} = A_{j,t} - c_{j,t} - CARE_{j,t} + w_{j,n,t}(1 - R_{j,t,}) + B_{n,t} + (1 - Move_{j,t})h_{j,t} \quad (1)$$

That is, households spend money on general consumption and social care, and receive income in the form of non-housing assets from working, from receiving the state pension $B_{n,t}$, which is a function of age and number of people in the household, and proceeds from any house sale they have made. r represents the risk free return on non-housing assets.

The second element of the budget constraint is the borrowing constraint. The model does not allow for any borrowing besides mortgage debt. This gives the following borrowing constraint for household j at age t:

$$A_{j,t} > -lev(t)h_{j,t} \quad (2)$$

$lev(t)$ is the leverage ratio: the proportion of the value of their house individuals are able to mortgage as a function of their age. Since it is only possible to borrow through mortgage debt, the lowest possible level of non-housing assets (including mortgage debt) is the amount they are able to mortgage. In reality, since private pensions are included in non-housing wealth, it is rare for homeowners to come close to this budget constraint.

The final element of the budget constraint is the progression of housing wealth. This is modelled as having a different risk-free return to non-housing wealth, r_h.

The progression of housing wealth is given by the following equation:

$$h_{j,t+1} = (1 + r_h)Move_{j,t}h_{j,t} \tag{3}$$

3.2 Health Process and Death

The health variable of individual i $H_{i,t}$ is a categorical variable, with four levels: 'very good health', 'good health', 'bad health', and 'very bad health'. It plays a key role in determining need for social care, and on the probability of individuals dying. It is governed by a Markov process, where:

$$P(H_{i,t+1} = x) = f(H_{i,t}, M) \tag{4}$$

This indicated that future health outcomes are a function of current health and of an individual's gender.

It is possible for individuals to die in this model. If an individual dies, and there is still an individual left in the household, then the remaining individual retains all of the household assets. If there are no other individuals left in the household, their assets are left as a bequest.

An individual's probability of death is given by the following process:

$$P(Death) = f(H_{i,t}, t) \tag{5}$$

This means that the probability of death is a function of an individual's health, and of their age - specifically, the ten-year age bracket they fall into.

3.3 Social Care

I estimate the probability that an individual needs social care, and their level of need for social care. 'Need' for social care is determined as the level that is determined by local government when assigning social care to those who are unable to pay for themselves. In the model, this is treated as the minimum level of social care that an individual would ever choose to receive. This is measured in pounds per year, and in the case of local government organisation, is estimated as the number of hours of care someone is assigned, multiplied by the average wage of a care worker.

The probability of needing some social care and the level of need for social care is driven not just by health, but also by age, gender, and past need for social care. The probability of needing some social care ($CARE_{i,t}^{NEED} > 0$) is estimated from the following logit model:

$$y_{i,t}^1 = \alpha_1 + \beta_1 H_{i,t} + \beta_2 t + \beta_3 t^2 + \beta_4 t^3 + \beta_5 M_i + \beta_6 \mathbb{1}[CARE_{i,t-1}^{NEED} > 0] \quad (6)$$

Given that an individual needs social care, there are two different equations that determine how much social care they need. The first of these is the possibility that they might need to be in full-time residential care. Within this, no distinction is made between different levels of care, as the total number of hours of care they need is constant at 168 hours per week. The probability that an individual needs full-time care ($CARE_{i,t}^{NEED} > 30000$) is estimated conditional on them having positive care need. This is given by the following logit model:

$$y_{i,t}^2 = \alpha_2 + \gamma_1 H_{i,t} + \gamma_2 t + \gamma_3 M_i + \gamma_4 \mathbb{1}[CARE_{i,t-1}^{NEED} > 30000] \quad (7)$$

If the individual does not need full-time residential care, then log weekly hours of care need (z) is estimated using the following OLS regression:

$$log(z_{i,t}) = \alpha_3 + \delta_1 H_{i,t} + \delta_2 t + \delta_3 t^2 + \delta_3 t^3 + \delta_4 M_i \quad (8)$$

Care need in pounds per hour is then equal to z multiplied by 52.5, multiplied by the average care worker's hourly salary.

In the model, social care need acts as a lower bound to social care usage. It is possible for individuals to spend more on social care per year than local government would assign to them given their needs. This is true both if they would receive some free care from the government, and if they would not. The model does not discriminate between spending more on more hours of care, or spending more on higher quality care. In the case of those resident in care homes, the margin of further expenditure will be quality, as the number of hours spent in care is fixed. For in-home care, however, it is possible that the main margin of further expenditure will be hours.

It is also possible that individuals spend no money on social care, because they have others who will help them with it. This can be their spouse, or it can be other friends, neighbours, or family members, such as children or siblings, who live nearby. There is therefore a state variable fam_j that represents whether there is someone who is willing to help your household with care. It is assumed that those who have a friend or family member who provide them with care use this for all their care, as it is very uncommon for individuals who receive at least some care from people they know to pay for any care. Furthermore, this variable is constant over time, so those with someone able to care for them continue to have someone throughout old age, while those who do not, continue not to have someone to care for them. Similarly, it is assumed that if you are married, and your spouse does not need any care for themselves, they provide care for you. [3] Note that this only applies to at-home care, and not to those who need to move into a residential care home - where this is the case, presence of family members makes no difference to social care costs.

3.4 Maximisation Problem

The state space for a household j at time t is:

$$\Omega_{j,t} = \{t, A_{j,t}, h_{j,t}, R_{j,t}, H^m_{j,t}, H^f_{j,t}, CARE^{NEED,m}_{j,t}, CARE^{NEED,f}_{j,t}, fam_j\} \tag{9}$$

Here, $H^m_{j,t}$ and $H^f_{j,t}$ represent the health of the man and the woman in the household respectively. If one of them is deceased, or if the individual was always single, then the value of $H_{i,t}$ for that individual is 'dead'. Similarly, in this case, the value of their need for care is 0.

The value function of a household j at age t is therefore given by:

$$V_t(\Omega_{j,t}) = max_{q_{j,t}}\{u_1(c_{j,t}, CARE_{j,t}, R_{j,t}, h_{j,t}) + \tag{10}$$

$$\beta((1-\Psi)E_t(V_{t+1}(\Omega_{j,t+1}))\} + \Psi u_2(A_{j,t}, h_{j,t}))\} \tag{11}$$

[3] Over 80% of those who receive care from their partner or a family member do not receive any other care. Less than 5% of individuals who receive some care from their partner or a family member receive more than half of their care through paid care.

where $q_{j,t} = \{c_{j,t}, CARE_{j,t}, Retire_{j,t}, Move_{j,t}\}$ represents the choices a household makes each period. There are two possible outcomes in the next period, each discounted by discount rate β: with probability Ψ, all individuals in the household will be dead, and utility will derive from bequests. With probability $1-\Psi$, there will still be at least one individual left in the household. Their expectation is across all possible health, social care and death shocks that the household could encounter.

Within period utility is dependent on consumption, care expenditure, retirement, and housing. The relationship to utility is dependent on age (in the case of retirement) and on number of people in the household (in the case of housing). The utility function is as follows:

$$u_1(c, CARE, R, h) = \frac{\frac{c}{k(N)o(h)}^{1-\sigma}}{1-\sigma} - \eta_t(1-R) + \alpha_N \mathbb{1}[h > 0] + f(CARE) \tag{12}$$

Utility in this model is almost completely separable, with utility from consumption independent of labour supply and care spend. Utility from consumption depends on the equivalence scale $k(N)$, which is set as 1 if there is one individual in the household, and as 1.6 if the household consists of a couple. Utility from consumption also depends on home ownership, with $o(h)$ varying depending on whether the individual owns their house or is renting, to reflect the fact that renters will have to spend some of their consumption on rental costs, which owners would not have to. Utility from consumption has constant relative risk aversion, with risk aversion coefficient σ. Utility from retirement is given by the $\eta_t(1-R)$ term, which reflects that the utility cost of work changes linearly over time, adjusting for the model starting at age 50:

$$\eta_t = \eta_1 + \eta_2(t - 50) \tag{13}$$

Thus the utility cost of work at the start of the model is η_1, and it changes by η_2 every year after that.

There is also a non-separable term representing utility from housing, $\alpha_N \mathbb{1}[h > 0]$. This represents only utility from owning a home, not any utility that might be obtained from owning a more expensive home. It may be that individuals choose to move to a smaller home when they are older out of preferences, and so we do not apply any change in utility to moving from a larger home to a smaller home. It is worth noting also that the utility from home ownership is dependent on whether a household is a couple or not. Home ownership rates amongst the elderly vary dramatically by marital status: one would expect utility from ownership for couples to be positive, but in the case of single people, particularly widowers, it is possible they may have a preference for selling their home.

The final term of the utility function represents utility from care. This term is given by the following function:

$$f(CARE_{j,t}) = \begin{cases} \epsilon(max_N)^{1-\sigma}(1-\sigma)^{-1} & \text{if } CT_{j,t} = 0 \\ \epsilon(CARE_{j,t}\frac{max_N}{CT_{j,t}})^{1-\sigma}(1-\sigma)^{-1} & \text{if } CT_{j,t} > 0 \end{cases} \tag{14}$$

Here, $CT_{j,t} = CARE_{j,t}^{NEED,m} + CARE_{j,t}^{NEED,f}$, represents the total amount of care needed by the household. max_N represents the maximum amount of care that might be needed by a household with number of members N. For a married couple, this represents the cost of two people in residential care. If there is no need for care, households receive a fixed amount of utility from care, and so do not choose to obtain any care.

If there is need for care, individuals get utility from additional care. The term $\frac{max_N}{CT_{j,t}}$ indicates that individuals get more utility from an additional pound of care if they have less serious care needs, as less is needed to be spent in order to meet their care needs. It also means that individuals with different levels of care needs all have exactly the same utility from care when they are receiving that amount of care. Utility from care has the same coefficient of risk aversion as from consumption, σ, but is adjusted by ϵ based on households' relative preferences for spending on care relative to spending on consumption of other goods.

Utility from bequests is received upon death of the last member of household j between age t and age $t+1$, and is given by the following equation:

$$u_2(A_{j,t}, h_{j,t}) = \zeta\frac{(A_{j,t} + h_{j,t} + 1)^{1-\sigma}}{1-\sigma} \tag{15}$$

Effectively, utility from bequests is equivalent to spending all remaining assets, both non-housing and housing, adjusted by some parameter ζ.[4] The same risk aversion coefficient σ applies. No distinction is made between leaving housing and non-housing assets as a bequest.

3.5 Wages

This model uses a very simplified model of the labour market. Households containing a married couple have a combined labour income, while single individuals have their own labour income. Labour income progresses deterministically over time, meaning that there are no wage shocks in the economy, though initial wages are heterogeneous. The progression of household incomes over time is given by the following equation:

$$w_{j,t} = w_j^{Initial} + w_1(t-50) + w_2(t-50)^2 \tag{16}$$

Thus each household knows its expected wages up until retirement, and there are no income shocks to provide uncertainty. This is done for computational simplicity, as the purpose of this model is examine saving and retirement responses to health and social care risk, rather than to income risk.

3.6 Solution

The solution of the model consists of policy functions for consumption, care use, retirement, and housing choice conditional on the state space. There are no analytical expressions for these policy functions. Therefore, I solve the model numerically, beginning with consumption, care and housing decisions made at age 100, and then iterating backwards, solving for decisions in each period. A detailed description of the solution method can be found in the Appendix.

[4]Note the +1 term in Equation (15) exists only to avoid infinitely negative utility for those who die with no assets at all.

4 Data

I use data from nine waves of the English Longitudinal Study of Ageing (ELSA), spanning from 2002 to 2019. ELSA is a nationally representative sample of UK adults over 50 with data on a wide range of demographic, saving, and labour-market information. Respondents are interviewed every two years. I use the whole sample, removing only those with a partner who does not live with them. All nine waves of the survey contain data on marital status, health conditions, self-reported health, job status, labour income, house value, non-housing assets, mortgage debt. From wave 6 to wave 9, there is also detailed data on care receipt. This includes data on number of hours of care per week, amount paid for care, and who provided the care, broken down by individual. Therefore, data on care is taken only from waves 6 to 9, covering 2012 to 2019, while data on labour market outcomes, saving choices, and health is used from throughout ELSA.

Private pensions data is not collected from wave 5 onwards. Data from waves 1 to 4 is therefore used to impute private pension holdings of individuals from wave 5 onwards, using information on retirement, income, savings, and housing, as well as past private pension holdings where possible.

Data on care is much better for those receiving at-home care than for those who move into a residential home. Where ELSA has data on those receiving residential care, it often does not have data on assets, and so data from the previous wave is used. Those in residential care are also under-sampled, and so the data is re-weighted using estimates of the care home population of the UK. Finally, unlike with at-home care, ELSA does not have data on the amount spent on residential care, so this data is not used to inform how much people spend on care in the model. Data on deaths is taken from the ELSA End of Life Survey, which took place in waves 2, 4, and 6 of the study.

4.1 Initial Conditions

The model is estimated on a population taken from ELSA. To ensure a large enough sample, data is taken from those households where the representative adult is between 50 and 54. Those with obvious anomalies are removed, and some single

Variable	Mean	Standard Deviation
Log Household Income	10.14	1.766
Log House Value	12.41	0.632
Log Total Assets	13.34	1.16
% Retired	2.3%	
% Homeowners	86.1%	
% Married Households	73.8%	

women are removed at random to ensure an even gender balance in the initial group. This gives a sample of 1995 households in their early fifties. In each case, we have data on the number of members of the household, the health of each individual, the retirement status of the household, their labour income, whether they own a house and its value, their mortgage, and their total non-housing assets. Summary statistics for this group are shown below:

5 Estimation

The parameters of this model are estimated in three different ways. Some are set using standard values from the literature or from legislation, some are directly estimated from ELSA data, and the rest are estimated using Simulated Method of Moments (SMM).

5.1 Externally Set Parameters

Some parameters are taken directly from the literature. The coefficient of relative risk aversion σ is set to 1.5, following much of the literature, including **?** and **?**. I follow **?** in setting the discount rate β to 0.98.

The thresholds and rules for social care receipt are taken from legislation. This includes the asset threshold above which individuals have to fund their own care, set at £23,250, as well as the rules regarding home ownership, and when it counts towards the threshold. The state pension level and eligibility are also taken from legislation - the state pension in the model is set to £8528 per year per person, and the cutoff age is set to 65, as it was in 2019. Care home costs and details on the care home population, used for weighting the data, are taken from the Office for National Statistics (ONS). Meanwhile, data on average pay for care workers is taken from The King's Fund.

5.2 Directly Estimated Parameters

5.2.1 Health and Health Process

In order to estimate the health process, it is first necessary to create a good measure of health. ELSA contains two different health metrics: self-reporting of health, and indicator variables for a wide range of health conditions. Using either of these independently can face pitfalls: self-reporting of health is subjective and can be subject to justification bias (**?**), while it is difficult to transform individual health measures into a single health index. Since **?**, this problem has been circumvented by using objective health measures as an instrument for self-reported health. I follow the specific method used by **?**, who carry this out on ELSA data. In the first stage of this process, I run a regression of different health conditions on self-reported health:

$$SubjHealth_{i,t} = a + bX_{i,t} \tag{17}$$

Where $SubjHealth_{i,t}$ is an individual's self-reported health, a base 5 categorical variable ranging from 'poor'' to 'excellent', and $X_{i,t}$ is a vector of indicator variables, representing different health conditions. Full results of this regression, and the list of health variables considered, are presented in the Appendix. I use this regression to predict each individual's self-reported health from their health, and use this prediction as the basis of a health index. I then discretise it into 4 categories, matching the self-reported health variable, and use this as the health variable $H_{i,t}$ used in the model.

In order to estimate the probabilities of the Markov process underlying health, I use the longitudinal element of ELSA. I estimate the proportion of individuals of a given level of health, for each possible previous level of health in the last wave, for each gender. This faces the issue that the waves are two years apart, while the model I apply it to is annual. To resolve this, I take the square root of the probability of remaining the same level of health, and use this as the probability of staying the same level of health in one year. I then adjust the other probabilities proportionately. Thus, in order for an individual to remain the same level of health over two years, they probability of not changing would have to be multiplied by itself, to give the figure from the data. This rules out the possibility of individuals experiencing two shocks, the latter reversing the former, in two years, but because health is persistent, this is unlikely to be common, and so this method provides a good estimate of the underlying probability of health transitions.

5.2.2 Social Care Process

As discussed in Section 3.3, there are three equations which govern social care use and need in the model. These are the equation governing the probability that an individual will need some social care, the equation governing the probability that an individual will need residential care, and the equation governing the amount of at-home care an individual needs if they do not need residential care.

In order to estimate the equation governing social care need, I run a logistic regression with a similar specification to Equation (6), differing only for the inclusion of measurement error:

$$[CARE_{i,t}^{NEED} > 0] = \alpha_1 + \beta_1 H_{i,t} + \beta_2 t + \beta_3 t^2 + \beta_4 t^3 + \beta_5 M_i + \beta_6 \mathbb{1}[CARE_{i,t-1}^{NEED} > 0] + \upsilon_{i,t} \tag{18}$$

The probability of needing social care is therefore estimated from an individual's health, age - allowing for curvature by including higher order polynomials, gender and whether they needed social care in the previous period. I use the point estimates of these regressions to inform the logit regression in the model; this informs both the probability that an individual will need care, and individuals' expectations that they will need care. The results of this regression are as follows:

As these results show, the largest determinant of social care need is previous social care need; it is unlikely that those who currently need social care will not need it in future. Following this, shifting health by one category is more important for affecting social care need than gender, although gender is significant, with men less likely to need care than women. Due to the use of higher order polynomials for age, the effect of age is difficult to interpret, although probability of social care

Table 1: Probability of Needing Any Care

	Probability of Any Care	
Independent Variable	Regression Estimate	Standard Error
Health	0.706	0.025
Age	0.053	0.003
Male	-0.268	0.051
Past Care Need	3.453	0.064
Constant	-8.211	0.212
N	67,490	

need does increase monotonically with age.

Analogously to the estimation of social care need, I run a logistic regression similar to Equation (19) in order to estimate the probability that an individual needs residential care, once again allowing for measurement error. Higher order polynomials in age are not included here, as they are not significant:

$$\mathbb{1}[CARE^{NEED}_{i,t} > 30000] = \alpha_2 + \gamma_1 H_{i,t} + \gamma_2 t + \gamma_3 M_i + \gamma_4 \mathbb{1}[CARE^{NEED}_{i,t-1} > 30000] + \upsilon_{i,t} \tag{19}$$

Once again, the point estimates of these regressions are used to inform the logit regression in the model, generating the probability that an individual will need care in a care home, and their expectations of needing that care. This regression is run only on those individuals who use some care, and so is used to generate the probability of needing residential care conditional on needing some care. The results of this regression are as follows:

As with care need in general, residential care need is strongly positively related to previous residential care need, indicating that those in residential care are likely to stay there. Health plays a smaller role in determining residential care need than general care need, while it appears that age plays a larger role: ageing by five years has a larger effect on the probability of needing residential care than shifting from very good to very bad health.

Estimating social care need for those individuals who do not need residential care is more difficult, as some may choose to spend more of their savings on care.

Table 2: Probability of Needing Residential Care

	Probability of Residential Care	
Independent Variable	Regression Estimate	Standard Error
Health	0.325	0.094
Age	0.081	0.012
Past Residential Care	3.389	0.360
Constant	-8.824	1.037
N	5221	

I attempt to capture only those who cannot afford to pay for other types of care. I do this by estimating an analogous OLS regression to the process in Equation (8). However, it is estimated only on those with non-housing assets below £5000 - I use this as a threshold below which it is unlikely individuals will spend their own money on care. The sample is also restricted only to those who need some non-residential care. This gives the following regression:

$$log(CARE_{i,t}^{HOURS}) = \alpha_3 + \delta_1 H_{i,t} + \delta_2 t + \delta_3 t^2 + \delta_3 t^3 + \delta_4 M_i + \upsilon_{i,t} \qquad (20)$$

This estimates how much care individuals who cannot afford to pay for their own care receive, giving an estimate of care need, as this paper defines it. The results are as follows:

Table 3: Number of Hours of Care Needed

	$log(CARE_{i,t}^{HOURS})$	
Independent Variable	Regression Estimate	Standard Error
Health	0.260	0.126
Age	0.029	0.008
Man	0.508	0.254
Constant	-1.173	0.845
N	151	

Health plays a significant role in determining care need, while age plays less of a role - variation in care need, amongst those who do need care, is fairly minor across age.

5.2.3 Informal Care Access

The proportion of individuals who have access to help with care from family, friends and neighbours is taken from ELSA data. Different proportions are used for married households and unmarried households. The assumption that where family members are able to help, they always do, is used. This is justified by the fact that it is very rare for individuals to receive both informal care and professional care.[5] Therefore, the proportion of households with access to informal care is taken to be the proportion of households who need care, and receive it informally, rather than by paying for it - in the case of married couples, this is only relevant when both individuals need care. To estimate the probability that someone will have access to care, I use the proportion of single individual's who receive help with care, as estimates for couples are harder, due to them helping each other. This tells us that quite a large proportion have access to help with at-home care: approximately 71%.

5.2.4 Mortality Rates

The probability of a death in the model is estimated in a similar manner to health transitions. For a subset of individuals who have died, ELSA has data on their health and age before dying. I use ONS data on the mortality rates of different age groups, and re-weight the ELSA data to match these mortality rates. Thus, the effect of age on probability of death comes from ONS data, rather than from ELSA. For each ten-year age bracket, I then estimate the relative probability of dying for each different level of health. This gives death probabilities conditional on age and health.

5.2.5 Other Parameters

Other parameters are also estimated directly from ELSA and other sources. One of these is the real interest rate r, which is taken from the mean savings rate return

[5] See the Appendix for more information on informal care use.

over the period considered, subtracting mean inflation. This gives a real return on savings of 1.14%. Another parameter estimated directly, this time from ELSA, is r_h, which is estimated using the mean change, as a percentage, in housing value for those who do not move house. Since the model does not include housing risk, I follow **?** by subtracting the variance of returns. Due to the difference in length between the periods in the model and the waves in the data, the square root of this value is taken, to get the average percentage change in housing value in one year. This gives a real return on housing of 0.3% over the time period considered from 2002 to 2019. This low real return is likely a reflection of the housing crash in the UK during the Great Recession.

5.3 Estimation by Simulated Method of Moments

The remaining parameters are estimated using SMM. I minimise:

$$\min_{\Pi}(\hat{\phi}_{data} - \phi_{sim}(\Pi))'\mathcal{F}(\hat{\phi}_{data} - \phi_{sim}(\Pi)) \tag{21}$$

The vector Π contains the rest of the unknown parameters. This includes the parameters determining the base level and change over time of the utility cost of work, η_1 and η_2. It also includes the parameters governing preferences for housing for single individuals and for married couples, α_1 and α_2, as well as the parameters governing the progression of the income process, w_1 and w_2. Finally, it includes the two parameters that govern relative preferences towards bequests and care, ζ and ϵ respectively.

The empirical moments $\hat{\phi}_{data}$ are calculated using data from ELSA. Moments relating to home ownership rates, asset holdings, wages, retirement rates, and the relationship between care use and asset holdings are used. Simulated moments ϕ_{sim} are calculated by running the full model, and obtaining equivalent statistics from the simulated data. The weighting matrix $\mathcal{F}$ is a diagonal matrix, containing the inverse of the standard error of each moment.

Moments can be linked fairly clearly with the category of moments they belong with. These can be divided into income moments, retirement moments, housing moments, a bequest moment, and a social care moment.

5.3.1 Income Moments

Income follows a deterministic path in this model, with heterogeneity taken from the initial population in the ELSA data. Therefore, the only parameters that need to be estimated are those governing the progression of income over time. It is necessary to estimate it using simulated method of moments due to the selection effect of households' retirement decisions, which have an effect on which individuals' wages can be observed.

Income for married couples is considered jointly in this model. To generate equivalence between single individuals and couples, I double the income of single individuals, in both the data and the model, for use in the income moment conditions.

I use the following moments, in each case representing only the results for those who are not retired:

Table 4: Income Moments

Moment	Value	Standard Error
Mean Log Annual Income, Age 57	10.23	0.02
Mean Log Annual Income, Age 62	9.98	0.02
Mean Log Annual Income, Age 67	9.45	0.04

These moments represent household income, and so can be thought of as representing the total amount earned by a married couple in a year. The years 57, 62 and 67 are chosen for five-year intervals, and so as to avoid possible sharp changes around the state pension age of 65. These identify the moments governing the progression of household wages over time.

Table 5: Income Parameters

Parameter		Estimate
Linear Log Wage Change With Age	w_1	-0.0168
Quadratic Log Wage Change With Age	w_2	-0.0029

This shows that incomes decrease over time, and that the rate of decrease of wages increases over time. At age 50, households lose about 1.6% of their income each year, a value that gets higher as time goes on. This follows from the moments, which show increasing drops in levels of income, despite the fact that those retiring are likely to have lower incomes.

These results may reflect not just productivity declining with age, but also that those who retire choose to work fewer hours, or more enjoyable but less well paid jobs. Since the model does not account for change along those margins, this is captured in decreasing wages for older workers.

5.4 Retirement Moments

In order to estimate the utility cost of working in this model, I use similar moments to those used for income. As in the model, I define retirement in the data as when the entire household is retired. In the ELSA data, that means that every member of the household report themselves as 'Retired', 'Permanently Sick or Disabled', or 'Looking After Home Or Family', though in the last case, only if there is not evidence of them working after that point. This generates the following moments:

Table 6: Retirement Moments

Moment	Value	Standard Error
Proportion Retired, Age 57	0.142	0.008
Proportion Retired, Age 62	0.315	0.009
Proportion Retired, Age 67	0.680	0.009

These moments identify the two parameters, which govern the original utility cost of work at age 50, and how that utility cost of work changes over time:

Table 7: Retirement Parameters

Parameter		Estimate
Utility Cost of Work, Age 50	η_1	0.00370
Change in Cost of Work Each Year	η_2	-0.00005

The utility cost of work parameter is difficult to interpret. In terms of consumption, 0.00330 represents approximately the change in utility of a single person increasing their non-housing consumption from £10,000 to £14,000. It is also noteworthy that the utility cost of work decreases as time goes on, perhaps counterintuitively. This can likely be explained by the fact that those who continue to work later in life, particularly above state pension age, are more likely to be doing jobs they prefer. These parameters therefore capture this shift, though it may just apply to those who are on the margins of working or not working at a later age.

A key element here is that utility cost of work in the model is not heterogeneous. This does mean that it misses the increasing utility cost of work for many individuals, but those individuals are ones who choose to retire fairly early anyway. For the purposes of considering social care counterfactuals, the utility cost of work of those making the marginal decision whether or not to work is most relevant, so for that purpose, this utility cost of work measure is reasonable.

5.5 Housing Moments

In order to estimate preferences for housing, home ownership moments are used. Because preferences for housing are based on the binary indicator of home ownership, rather than on utility from the value of a home, rates of home ownership are preferred to mean house values. The moments are as follows:

Table 8: Housing Moments

Moment	Value	Standard Error
Home Ownership Rate, Single, Age 67	0.667	0.016
Home Ownership Rate, Single, Age 77	0.637	0.017
Home Ownership Rate, Single, Age 87	0.624	0.023
Home Ownership Rate, Married, Age 67	0.898	0.007
Home Ownership Rate, Married, Age 77	0.876	0.008
Home Ownership Rate, Married, Age 87	0.886	0.018

This shows that there is a large gap in home ownership rates between married couples and single people, lasting deep into old age. This gap exists at age 50, and is reflected in the initial conditions of the model. However, it persists even though there are likely to be frequent transitions from married households to single households, as a result of the death of one member of the household. Meanwhile, home ownership rates amongst married couples remain consistently high. These moments generate the following values for the parameters that govern preferences for housing, for both single individuals and married couples:

Table 9: Housing Parameters

Parameter		Estimate
Utility from Home Ownership, Single	η_1	-0.00027
Utility from Home Ownership, Married	η_2	0.00005

These results show that the utility from home ownership is positive for married couples, and negative for single individuals. As is the case for the retirement moments, this likely reflects the fact that utility from home ownership is homogenous across all individuals. It is likely to in part capture a particular negative preference for home ownership amongst the recently widowed, causing home ownership rates among single individuals to drop, despite a large majority of individuals who become single by becoming widowed being homeowners.

5.6 Bequest and Care Moments

The moments used to estimate the final two parameters, those that estimate the relative strength of preferences for bequests and care relative to preferences for consumption. In order to estimate the strength of individuals' bequest motives, I use the average level of total assets at age 85, as an indicator of how much individuals might plan to leave when they die. Meanwhile, the method for generating a moment to identify households' preferences for care is to estimate the average amount spent on care by those who receive some care. This is only done for those who receive at-care, as ELSA does not include data on nursing home expenditures.

Table 10: Other Moments

Moment	Value	Standard Error
Mean Log Total Assets, Age 85	11.80	0.07
Mean Log Care Spend	8.061	0.060

These moments give the following parameter values:

Table 11: Other Parameters

Parameter		Estimate
Preference for Bequests	ζ	3.17
Preference for Care	ϵ	0.21

This shows that bequests are valued over three times more than a year of consumption, indicating that there is a strong bequest motive for individuals. Meanwhile, preferences for care are weaker than those for consumption. It is worth noting that this applies on the margin, given that in the model, individuals always choose to spend on what they would need. Thus their preferences for care *beyond this point* are weaker than their preferences for consumption.

6 Counterfactuals

I use these parameter estimates, estimated both directly from the data and using SMM, to construct different counterfactuals. The dynamic element of the model can be used to examine how saving and retirement decisions in the run-up to needing care change with changes to how social care is funded. In particular, by considering households' decisions in the run-up to needing social care, I examine how well the current funding structure insures households against the cost of social care.

To do this, I first consider two different counterfactuals, which are the extremes of possible government funding for social care. In the most generous case, the government funds social care costs according to their needs assessment of the household, no matter the size or makeup of the wealth of a household. I define the least generous case to still include funding for social care for those who have no other option at all, so households still receive social care if they have no money at all; effectively, if a household has any assets at all at the end of a period, it is always taken to fund any social care needs that a household may have.

Doing this allows us to see the extent to which precautionary saving for social care risk currently drives saving, and the extent to which current social care funding reduces the need for precautionary saving relative to a much more limited form of government support.

I then consider another mechanism by which social care funding might impact saving for retirement, which is saving portfolio choice. I do this by considering the counterfactual where housing is not treated differently to other forms of assets in the test for social care. This allows me to examine the extent to which social care risk can drive not just the amount households save for retirement, but also through what medium households save.

6.1 Comparison of Social Care Funding by Generosity

In order to tell how well households are insured against social care risk by the current social care funding structure, I examine two extremes of generosity. The current system involves receiving help with social care if your assets are below £23,250, in which case the government provides you with a baseline level of social care. The £23,250 figure only includes housing wealth if your care would mean you moving out of your home, and it would mean no one else was living there.

For the maximum generosity case, I assume that there is no longer a threshold which households need to fall below, and so everyone receives their baseline needed level of social care. It is still possible for households to spend money on higher quality or more social care if they choose to, but their baseline need is covered.

The minimum generosity case is a little more complicated. Because the model uses discrete time periods of a year, rather than continuous time, the counterfactual is generated that at the end of the year, those with social care needs and any money must use that money to pay for their social care. Effectively, this means that those with social care needs greater than their remaining assets at the end of the year will end the year with no assets, incentivising households to spend all of their savings and so receive the same level of social care as if they had not.

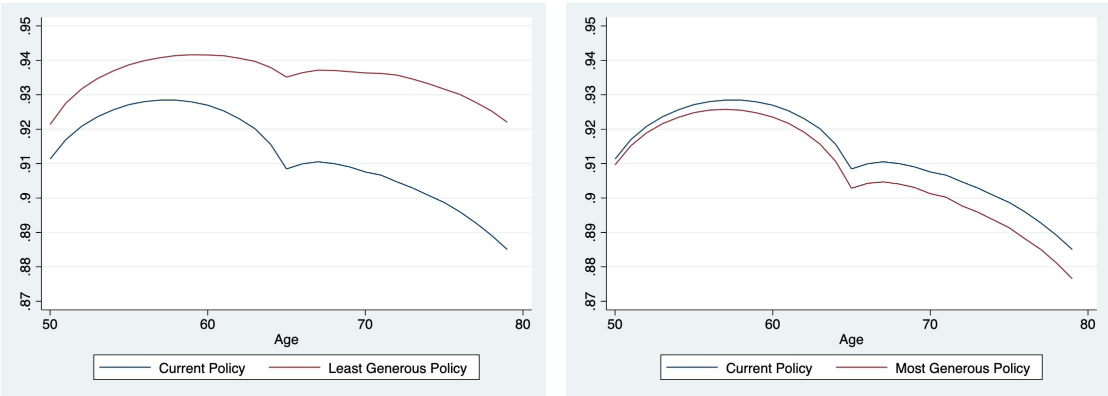
In order to examine how well the policies at the two extremes insure households relative to current policies, I compare how much they save in each case. I do this both by comparing the savings rates in each case, and comparing the consequent level of assets as a result of these savings. I also compare the average retirement age in each of the three cases.

Firstly, the comparison with current policy of the savings rate in each case is shown below.

Figure 1: Savings Rates Over Time

(a) Savings Rate, Low Generosity

(b) Saving Rate, High Generosity



Simulations from the estimated model.

This shows that the current funding structure for social case provokes saving responses much closer to the most generous possible policy than it does to the strictest possible policy. By the state pension age of 65, households spend 2.5% less of their wealth each year than they would if there was almost no social care funding structure. On the other hand, they only spend about 0.5% more of their wealth in the current case than they would if everyone had a baseline level of social care funding guaranteed for them.

Similar results are visible in the other margin of saving for retirement, which is when individuals choose to retire. These results are visible in Table 12. They show that the average age at which the whole household will have retired is much higher when social care funding is less generous. On the other hand, households do not much work longer under the current policy than they would if they were guaranteed to receive some help with social care.

Table 12: Average Retirement Age, by Generosity of Policy

	Current Policy	Least Generous	Most Generous
Mean Retirement Age	63.8	66.6	63.6

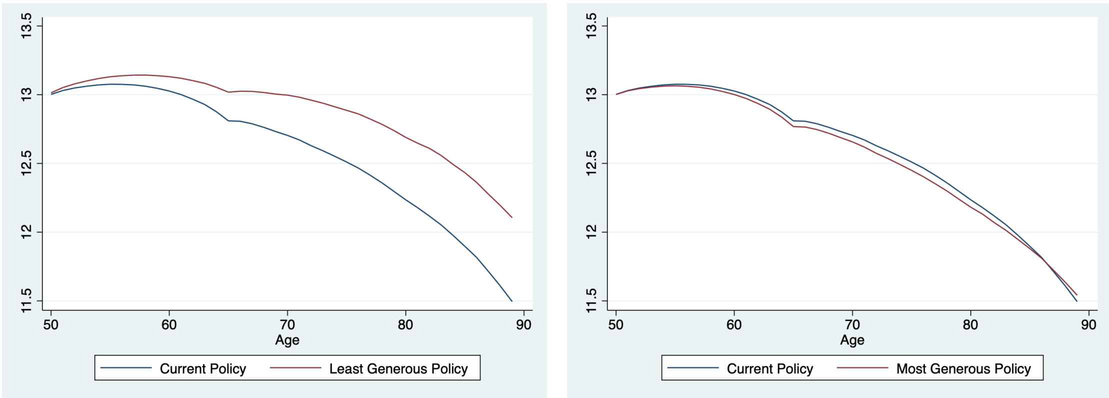
Unsurprisingly, the combination of large gaps in savings rates and retirement choices between the current policy and much less generous policies leads to very large differences in levels of total assets in each case. Figure 2 demonstrates this, highlighting a huge gap in assets between the current policy and the low-generosity case, and a very small gap in assets between the current policy and the high-generosity case. Compared with the low-generosity case, assets currently are approximately 30% lower by age 70, and the gap increases as time goes on.[6] This continues deep into old age, indicating that it would be rare for households to actually reach a state of having zero assets, because of the high cost to consumption of doing so. In contrast, there is only a very small drop in assets in the high-generosity case relative to the current policy, about 3%, which is erased by the increase in assets from savings on social care in old age.

This indicates that the main purpose of saving for social care may be to avoid the worst-case scenario, that of completely spending down savings, and then having to continue to pay for social care costs even at that point. Not only does this result in very low consumption in old age, but also removes any bequest, which I estimate as an important motive for saving. On the other hand, it appears that household saving is much less affected by the expected cost of social care above that which will get paid for currently. This may be explained by the complementarity of saving for social care and for other expenditure: households are already saving for retirement for consumption in old age and bequests anyway, and those costs can also contribute towards the cost of care in the case that it is needed.

[6] It is worth noting that the model treats the decisions individuals make before age 50 as given, so this is an underestimate of the effect, as it is treated as an exogenous change to social care funding that happens when individuals are 50.

Figure 2: Log Assets Over Time

(a) Log Assets, Low Generosity (b) Log Assets, High Generosity



Simulations from the estimated model.

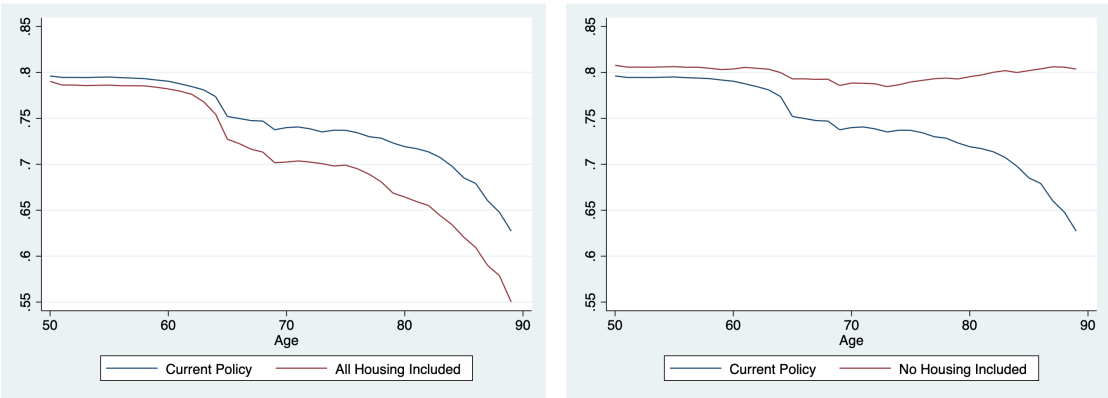
6.2 Comparison by Nature of Housing Test

As a second set of counterfactuals, I estimate the role that social care funding plays in the nature of a household's saving portfolio. In particular, I estimate this by considering a different pair of counterfactuals, representing two extremes of the effect of social care funding on housing choice. At one end, there is the scenario where the asset test never applies to housing, even in cases where being in residential care would mean that the house is left empty. At the other end, there is a case where the asset test treats housing as equivalent to any other wealth. Effectively, given the asset test falls at £23,250, this means that anyone who owns their home would be expected to pay for their own care, no matter their other savings.

I measure the effect of these different care policies on housing with two different measures. The first is the proportion of home-owning households in the two cases, and the second is the proportion of a households total portfolio made up of housing. The first, of these, the effect of the nature of this asset test on home-ownership rates, is shown in Figure 3. This demonstrates that the nature of the social care asset test plays a major role in households' portfolio decisions, both in incentivising and disincentivising home-ownership to different degrees, even before there is a significant risk of losing one's home. In one direction, if housing were always be considered under the asset test, home ownership would decrease by 5 percentage points by age 70, a point at which very little social care has been needed. In the other direction, the effect is of a similar magnitude, where housing being completely unconsidered for the social care asset test leads to a 5 percentage point increase in home ownership at age 70. This gap continues to diverge, but most of that is likely driven by the proportion of households who do have to sell their homes because of needing residential care. Nevertheless, the effect before any risk of social care need has emerged is large.

Figure 3: Home Ownership Over Time

(a) Home Ownership %, All Housing Included (b) Home Ownership %, No Housing Included



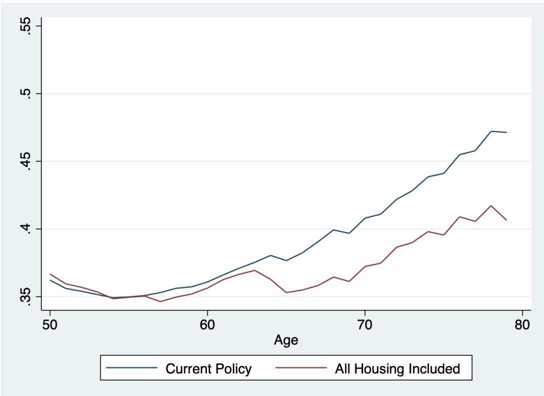
Simulations from the estimated model.

Similar results emerge from an analysis of how the social care housing test affects the makeup of a household's asset portfolio. Figure 4 demonstrates how this process varies over time. This shows that the extent to which households would reduce their housing assets, both by choosing to rent and by choosing to downsize, in the case where their housing would definitely be included in any social care asset test, is about 3% of their total assets portfolio at age 70. In general, there is a trend for households to spend down their non-housing assets before selling their home in old age, due to the lumpiness of housing as an asset, and this policy change would be enough to mitigate a lot of this shift in the portfolio, encouraging households to sell their home around retirement age in larger numbers.

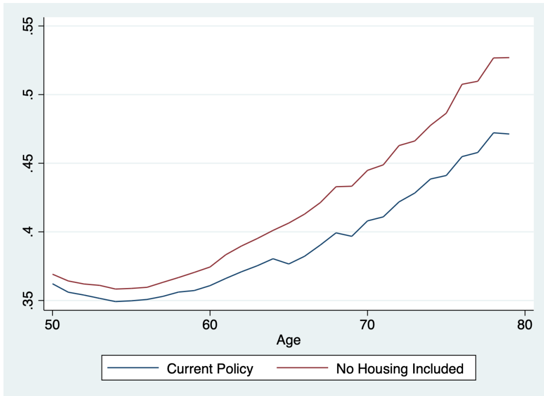
On the other hand, we see an even more pronounced effect on housing as a percentage of a household's asset portfolio in the case where housing is always walled off from the asset test for social care funding. In this case, we see that housing becomes the dominant asset by age 80, constituting more than 50% of all wealth. This is in spite of the fact that the return on housing is lower than the return on cash assets in the time period we study. This indicates that its value as a store of wealth, both as a last resort for spending and for bequests, that could not be touched to pay for social care, is very significant.

Figure 4: Portfolio Allocation Over Time

(a) Housing as % of Total Assets, All Housing Included



(b) Housing as % of Total Assets, No Housing Included



Simulations from the estimated model.

The counterfactuals used in this paper demonstrate that the model of social care funding used has significant consequences for how individuals save for retirement. Both in the generosity of the asset test, and in how different assets are treated, the social care means test affects household decisions leading up to retirement along three different dimensions: how much to save for retirement, in what assets to save it in, and when to retire.

7 Conclusion

In this paper, I have considered the dynamic implications of social care costs, both in their broad influence on saving and in the specifics of the British social care funding context. By estimating the process of need for social care, and by using Simulated Method of Moments to estimate household preferences for different saving drivers and for social care itself, I am able to estimate the interaction between social care risks and saving choices for those of retirement age.

I find that the nature of social care funding plays a major role in how households choose to save for retirement. In particular, the current framework almost completely removes the need for precautionary saving for social care for households before and during retirement. My findings that household retirement planning under the current policy closely resembles what it would be if social care were provided in a universal manner, whilst representing vastly less saving than it would if social care were provide only to those with no wealth of any kind, demonstrate this. Social care funding in its current form drastically reduces the need for precautionary saving, but further generosity would be unlikely to have a similar effect.

I also find that the style of the means test used in social care funding also has a big impact on the nature of saving for retirement. I find a wide variance in the proportion of home-owners, and the role of housing in asset portfolios of the elderly, depending on the extent to which housing wealth is included with other savings in the asset test for social care. I find that the current policy splits the difference in consequences for home ownership in the wide gap between housing always and never being included as part of savings.