Australian National University

Long Term Care Risk For Couples and Singles

by

Elena Capatina,

Gary Hansen,

and

Minchung Hsu

ANU Working Papers in Economics and Econometrics
697

February 2024

JEL Codes: D91, E21, H31, I10, I38, J14

ISBN: 0 86831 697 0

Long Term Care Risk For Couples and Singles*

Elena Capatina[a], Gary Hansen[b], and Minchung Hsu[c]

[a]*Australian National University, 25a Kingsley St, Acton ACT 2600, Australia, elena.capatina@anu.edu.au*
[b]*UCLA, Department of Economics, 8283 Bunche Hall, Los Angeles, CA 90095, U.S., ghansen@econ.ucla.edu*
[c]*National Graduate Institute for Policy Studies, 7-22-1 Roppongi, Minato-ku Tokyo 106-8677, Japan, minchunghsu@grips.ac.jp*

Abstract

This paper compares the impact of long term care (LTC) risk on single and married households and studies the roles played by informal care (IC), consumption sharing within households, and Medicaid in insuring this risk. We develop a life-cycle model where individuals face survival and health risk, including the possibility of becoming highly disabled and needing LTC. Households are heterogeneous in various important dimensions including education, productivity, and the age difference between spouses. Health evolves stochastically. Agents make consumption-savings decisions in a framework featuring an LTC state-dependent utility function. We find that household expenditures increase significantly when LTC becomes necessary, but married individuals are well insured against LTC risk due to IC. However, they still hold considerable assets due to the concern for the spouse who might become a widow/widower and can expect much higher LTC costs. IC significantly reduces precautionary savings for middle and high income groups, but interestingly, it encourages asset accumulation among low income groups because it reduces the probability of means-tested Medicaid LTC.

Keywords: Long Term Care, Household Risk, Precautionary Savings, Medicaid, Informal Care
JEL classification: E21, H31, I10, I38, J14

*We are grateful for very useful comments and suggestions from Mariacristina De Nardi, Eric French, Christos Makridis, and participants at the SED Meeting 2017, SAET Meeting 2017, Arizona State University seminar 2017, UNSW Macroeconomics Workshop 2017, Prescott Fellowship Conference 2018, ANU Macroeconomics Workshop 2018, WAMS 2018 Conference, the GRIPS Workshop on Macroeconomics and Policy 2018, the University of Queensland seminar 2022 and the University of Sydney seminar 2022. This research has been supported by the Australian Research Council Centre of Excellence in Population Ageing Research (project number CE110001029), GRIPS Policy Research Center, JSPS Grants-in-Aid for Scientific Research (Kakenhi, project number 26780173 and 16KK0052), and the John Mitchell Poverty Lab. Declarations of interest: none.

1 Introduction

In the United States, long term care (LTC) risk is not covered by Medicare or other forms of universal health insurance and private LTC insurance is not widely held.[1] Medicaid covers the LTC expenditures of individuals who cannot afford the costs, but the quality of care under Medicaid is very low implying strong public care aversion (e.g., Ameriks et al. (2011), Brown and Finkelstein (2008)). As a result, the risk of out-of-pocket LTC related expenses is an important precautionary savings motive (e.g., De Nardi et al. (2010), Kopecky and Koreshkova (2014)). The savings accumulated in anticipation of these out-of-pocket expenses account for a high share of aggregate wealth and are driven especially by wealthier individuals (De Nardi et al. (2010), Kopecky and Koreshkova (2014)).

The impact of LTC risk on the savings and spending behavior of singles has been studied extensively (e.g. De Nardi et al. (2010), Kopecky and Koreshkova (2014), De Nardi et al. (2016a) and Ameriks et al. (2020)).[2] However, the demographic structure has changed in the last few decades so that married households increasingly dominate over singles until later ages. In particular, married individuals constituted a majority in each age group only up to age 77 in 1990, but this extended to age 85 in 2019. In 1990, 35% of individuals 65+ were widowed compared to only 23% in 2019.[3] In light of this demographic shift, our aim is to study and compare the implications of LTC risk for single and married households, focusing on consumption, savings, and social insurance recipiency rates. The saving behavior of married households is especially important since they own the great majority of wealth. Using HRS data, we find that in 2014, 75% of the total wealth of households 65+ belonged to married households, vs only 12% to singles and 12% to widows and widowers.

LTC expenditure risk varies greatly with family structure due to the availability of informal care from family members which decreases average expenditures on formal LTC (Lakdawalla and Philipson (2002)). Estimates of the implicit value of informal care range from about 60 percent of market spending (formal care) to over 100 percent (Brown and Finkelstein (2011)). Most of this care is provided by spouses (Barczyk and Kredler (2018)). When informal care is available, individuals most often continue to live in their homes and also benefit from consumption sharing. However, a household with two individuals is more likely to face LTC expenses than a single household, and there is a risk that the first spouse to need LTC depletes household assets and leaves the other spouse impoverished when widowed. An interesting aspect of our study is to determine the extent to which couples accumulate precautionary savings against LTC risk for when the couple is intact versus for when one spouse becomes a widow or widower. We also highlight how the Medicaid program for LTC impacts singles and couples' savings differently. These findings are relevant for policy design aimed at singles vs. couples.

[1] Brown and Finkelstein (2007), Brown and Finkelstein (2008), and Ameriks et al. (2018) provide evidence that long term care insurance is not widely held. This could be explained by strong luxury bequest motives (Lockwood (2018)), Medicaid crowd out (Brown and Finkelstein (2008)), adverse selection that arises partly due to the availability of informal care (Ko (2022)), private information (Hendren (2013)), flaws in existing insurance products (Ameriks et al. (2018)), administrative costs and/or rejections of the frail by insurance companies Braun et al. (2019).

[2] Kopecky and Koreshkova (2014) model households at working ages but only individuals after retirement.

[3] Statistics constructed using the CPS, using sampling weights.

We build a life-cycle model with both singles and married couples where individuals face uncertainty about longevity and health status (including the possibility of becoming highly disabled and needing LTC) over the course of their lives, as well as uncertainty about the availability of informal care in case it is needed. For individuals in health states other than high disability, medical expenditures are exogenous and given by a deterministic function of health and demographic variables. On the other hand, the effect of high disability is modeled as a shock to preferences: individuals needing LTC value consumption differently as in Ameriks et al. (2020), and LTC expenditures are endogenous. Households in the model make consumption-savings decisions in every period, and when a member is highly disabled (needing LTC), the household also makes endogenous LTC expenditure decisions. Couples where only one spouse requires LTC need to decide how much to allocate to each member and how much to save, taking into account their different preferences. In addition to precautionary motives for LTC and longevity risk, households also have bequest motives that provide an incentive to save. Since LTC risk in old age affects savings decisions at working ages significantly (Kopecky and Koreshkova (2014)), we model both working and retirement ages.[4]

Households enter the economy as either singles or married couples at age 35, and there is no marriage or divorce. Married households do transform into single households upon the death of a spouse. At age 35, households are assigned a gender (when single), education status (corresponding to that of the male in couples), relative age of wife to that of the husband (if married), initial wealth and permanent productivity type. Income each period is a deterministic function of household characteristics, so income risk arises only from health shocks and the death of a spouse. Health, survival and informal care probabilities are allowed to vary with the demographic characteristics of the household.

A key feature of our model is the possibility of informal care (IC) for individuals needing LTC. We assume that informal care is a perfect substitute for formal paid care, and when available, IC is provided for free, and at no cost to the provider. Therefore households with IC start out with a base level of consumption for the member in the LTC state. This informal care can be provided by non-spouses or spouses, and we estimate the probability of receiving informal care based on detailed household characteristics using data from the Health and Retirement Study (HRS). We find that, at ages 70-75, 83% of highly disabled married individuals have access to IC vs. only 60% of singles. We also show that the presence of a healthy and/or younger spouse is strongly associated with a higher probability of receiving informal care.

We also model the Medicaid system and include social insurance in the form of a consumption floor. We show using HRS data that informal care is strongly associated with lower Medicaid recipiency rates. Given this, an important consideration for couples is the possibility of becoming a widow/widower in which case IC will be received with a lower probability, increasing expected formal LTC expenditures and the possibility of ending up on Medicaid.

We calibrate the model to the U.S. economy using data from the Health and Retirement Study (HRS) and the Medical Expenditures Panel Survey (MEPS). Our model fits very well patterns observed in the data in terms of assets and Medicaid recipiency rates across specific demographic

[4] Kopecky and Koreshkova (2014) find that over half of the wealth generated by out-of-pocket health expenses is accumulated before retirement.

groups. To highlight the importance of LTC shocks and IC, we run counterfactual experiments where we give all agents an LTC shock at age 73, where no agent has such a shock, and where all have the shock in the presence (absence) of IC. We show that for single men, a shock at age 73 raises the probability of qualifying for Medicaid in the future by 14pp on average (11pp if IC is present and 19pp if IC is absent), and the probability of dying without leaving a bequest increases by 11pp (7pp with IC and 19pp without IC). However, for married men, an LTC shock raises the probability of Medicaid by only 5pp (5pp with IC and 12pp without IC), and the probability of leaving zero bequests by only 3pp (1pp with IC and 18pp without IC). Household spending rises dramatically with the shock, especially when IC is absent.

Because individuals receiving IC can continue to live in their homes, consumption sharing benefits are also present for couples. Both spouses enjoy higher consumption when IC is available than when it is not, but the healthy spouse still sacrifices some consumption due to the additional spending on LTC relative to when the other spouse is healthy. The ability of spouses to transfer resources to the LTC member of the household is an important source of insurance. However, when IC is not available, disabled individuals have to incur much higher formal care expenditures (likely in nursing homes) and unsurprisingly, household expenditures rise dramatically with the onset of an LTC shock.

To identify the impact LTC risk has on savings, we conduct a counterfactual experiment where we eliminate the possibility of the LTC state. Compared to the benchmark, average assets at age 65 are \$43K (18%) lower, and they decline more rapidly after age 65. This confirms the insight from the existing literature that LTC risk is an important reason why both single and married households continue to save after retirement.

We then focus on the importance of IC for asset accumulation by conducting a counterfactual where we remove IC for all households. At age 65, average assets increase by \$25K (10%) in the absence of IC. However, there are interesting differences by sub-groups: while for highly educated/high income groups the absence of IC leads to higher precautionary saving, the opposite is the case for low income groups. A key finding is that the presence of IC encourages asset accumulation among the poor because it protects them against the possibility of having to rely on the means-tested Medicaid LTC program when hit by a severe disability shock.[5] IC is an important factor that protects the savings of the poor because it helps them stay off Medicaid LTC. Overall, the Medicaid recipiency rate would increase from 31% to 42% in the absence of IC, and expenditures on the Medicaid LTC program would increase by 145%.

Finally, given that married couples have more access to informal care and can share consumption, we consider how asset accumulation would change if LTC risk was eliminated for married couples only *while they are married*. We find that, while mean assets do decline in the counterfactual, the decline is very modest. The savings by married households in response to LTC risk are due primarily to the risk of becoming a widow or widower with LTC needs, and not due to the risk while the couple is intact.

The remainder of the paper proceeds as follows. Section 2 discusses previous literature and defines our contribution. Section 3 describes our model and section 4 provides details on how

[5] Means-tested programs tax away savings in the advent of a bad shock and thus discourage asset accumulation among low income households (e.g., Hubbard et al. (1995)).

the model is calibrated. Results concerning the impact of LTC needs on consumption and expenditures are discussed in section 5.2 and the impact of LTC risk on savings is described in the section 5.4. Section 6 concludes.

2 Previous literature

Our paper is related to a large literature exploring why the elderly save, aiming to disentangle the various saving motives: precautionary savings against medical expense and LTC expense risk, longevity risk, altruism for surviving spouses, and bequest motives. De Nardi et al. (2010) study the extent to which longevity risk and medical expense risk drive savings for elderly singles and how Medicaid affects asset holdings for different income groups. Bequests have been studied extensively as a saving motive (e.g., Kotlikoff and Summers (1981), Hurd (1989), Dynan et al. (2002), De Nardi et al. (2016b)), but have been difficult to disentangle from medical expense risk. Lockwood (2018) emphasizes the importance of bequests as luxury goods which reduce the opportunity cost of precautionary savings. De Nardi et al. (2021) find that richer households and couples, who hold most of the wealth, save more for bequests than medical expenses. Ameriks et al. (2020) show that in a model with flexible health-state utility functional form, spending when in need of LTC is highly valued on the margin and contributes substantially to savings, and that LTC related and bequest motives are roughly co-equal in determining late-in-life saving.[6]

While much of the literature in this area has focused on singles, several papers have studied both single and married households. An important aspect highlighted in several papers is the change in assets with the death of a spouse and the implications for savings given altruism for surviving spouse (e.g., Lillard and Weiss (1997), Poterba et al. (2011), Braun et al. (2017), De Nardi et al. (2021)). Lillard and Weiss (1997) study retired couples and find that there are large transfers from healthy to sick partners and a strong incentive to save for surviving spouses. Braun et al. (2017) study the costs and benefits of means-tested social insurance programs in a model where households (singles and couples) face survival and medical expense risk. Jones et al. (2020) document new patterns in the savings of singles and couples around the time of death showing that for couples, OOP medical spending as well as bequests from the dying spouse to non-spousal heirs are needed to explain the drop in savings when one spouse dies. De Nardi et al. (2021) study the saving behavior of retired couples and singles and disentangle the relative importance of medical expenditures, transfers to non-spousal heirs (side bequests), and terminal bequests for assets dynamics. De Nardi et al. (2016b) provide an in-depth analysis of the modeling choices and channels required to capture singles' and couples' savings behavior in old age.

Our model is built closely on these previous frameworks, but we combine key features that enable us to study the intra-household allocation of resources when hit by an LTC shock, and better capture and disentangle the insurance benefits of having a spouse as well as the risks, and the implications for saving behavior. We differentiate our paper by focusing on the determinants of LTC spending in a model featuring endogenous LTC expenditures and the possibility of infor-

[6]Health state dependent preferences have been emphasized and utilized in many other papers including Arrow (1974), Lillard and Weiss (1997), Finkelstein et al. (2009), De Nardi et al. (2010), Brown et al. (2016), and Ameriks et al. (2018).

mal care. We use a health state dependent utility function which allows us to study how married couples allocate consumption to each individuals, as in Lillard and Weiss (1997). But in our framework, preferences depend specifically on the need for LTC, as in Ameriks et al. (2020), so we can study the demand for formal long term care.[7] Informal care is a key feature and we build our model to capture key determinants of IC such as education, each spouse's health, and the age differences between spouses. We study how the greater availability of informal care among married couples relative to singles, as well as consumption sharing and re-allocation of consumption from one spouse to the other, potentially help insure LTC shocks and allow these households to rely less on precautionary savings or other forms of insurance such as Medicaid.

Our paper is thus closely related to the literature on informal care and old age expenditure risk. Barczyk and Kredler (2018) document that almost two-thirds of all hours of care are provided informally, particularly by retired spouses and working-age children. They develop a model where informal care is determined through intra-family bargaining and use it to study the implications of various policies such as subsidies to informal and formal care and changes to Medicaid. Gruber and McGarry (2023) find that the cost of IC is 27-40 percent of the total cost of care in the US. Mommaerts (2022) study the impact of IC provided by adult children on the demand for LTC insurance. Ko (2022) focus on IC provided by adult children and the implications of accounting for this in pricing long-term care insurance. In contrast to this literature, our goal is not to explain patterns of informal care or how policy might alter these patterns. Instead, we model informal care as exogenous because we focus on insurance within couples where care is provided automatically. This is based on the finding that IC provided by spouses is relatively more important than that provided by children: among disabled HRS respondents, those who are married receive 65% of their total hours of care from an old person, usually their spouse and only 15% from a young person, usually children (Barczyk and Kredler (2018)). In addition, we find that for married couples, the availability of informal care does not depend on income or wealth. Also IC provided by spouses comes at little opportunity cost since most spouse carers are retired.

Lakdawalla and Philipson (2002) argue that population aging may decrease the per capita demand for formal LTC if the supply of informal care given by spouses increases enough. Our model sheds light on the demand for formal care since we endogenize (formal) LTC expenditures. One advantage of our model is that we model LTC generally rather than as a nursing home state as in other models. Our model takes into account that a large share of LTC expenditures comes from non-institutionalized care, and that for individuals, the availability of informal care can be a crucial factor when deciding between living at home or in a nursing home.

Closely related to the demand for formal care is the role and importance of Medicaid. Many papers have focused on understanding who receives Medicaid and who benefits the most. De Nardi et al. (2012) describe the Medicaid rules and highlight the difference between recipients who are categorically needy and medically needy. Borella et al. (2018) study the factors that affect Medicaid recipiency and show that both singles and couples with high income can end up on Medicaid at very advance ages. De Nardi et al. (2016a) and Braun et al. (2017) explore whether the size of the Medicaid program or means-tested social insurance (which includes Medicaid) is optimal.

[7] Ameriks et al. (2020) study individuals only, not married couples, so they cannot look at transfers from one spouse to the other when one needs LTC.

In our paper, we study the importance of Medicaid for singles and couples taking into account endogenous LTC expenditures and informal care.

3 Model

3.1 Demographics Summary

The economy is populated by overlapping generations of households that live for a maximum of J periods where a model period is two years. Households consist of either a single individual of a particular gender ($g \in \{male, female\}$) or a married couple of mixed genders. We assume there is no marriage or divorce. However, households of all ages can transition from married (m) to single (s) as a result of the death of a spouse. We denote marital status by $ms \in \{s, m\}$. Parameters and variables have subscripts s or m when they depend on marital status. We assume the head of married households is the male.

The first period of life for a household is age 35, which is denoted by $j = 1$. Individuals within households face mortality risk each period and live for a maximum of 109 years ($J = 38$).

Single households are described by a state vector $\Phi_s = \{j, g, e, \eta, h, x^I, a\}$, which consists of age, gender, education status, permanent income type, health status, informal long term care and assets. The state x^I, which indicates access to informal care, is only relevant if an individual is highly disabled. The fraction of households that enters the model at $j = 1$ as singles is equal to ψ.

Married couples consist of a husband and wife and are described by a state vector $\Phi_m = \{j, j^*, e, \eta, h, h^*, x^I, a\}$, where j and h are the husband's age and health status and j^* and h^* are the wife's age and health. We assume that married households share the same education, permanent income type and asset level, as well as informal care if both members are highly disabled. Given a husband's age j, a wife can be of age $j^* \in \{j-5, j-2, j+1\}$.[8] This enables us to capture heterogeneity in age differences between husband and wife across married couples which is important for informal care and household longevity risk.

Households start the first period with initial assets given by the functions $A_{s,j=1}(g, e, \eta)$ and $A_{m,j=1}(j^*, e, \eta)$ for singles and married, respectively. Initial assets depend on gender, education and permanent income type for singles, and on the relative age of the wife, education and permanent income type for those who are married.

[8] We discretize the possible age differences between spouses into these three groups based on our analysis of the age difference distribution observed in the HRS among married couples. We divide the distribution into 3 groups: the first group contains wives who are 8 or more years younger than the husbands; the second groups contains wives who are between 1 and 7 years younger; and the third group contains wives who are the same age or older than their husbands. The first and the third groups each contains approximately 20% of couples, while the second group contains approximately 60% of couples at the time when the husband is 65. On average, the wive's ages relative to the husbands' in these three groups are approximately: (1) 10 years younger; (2) 4 years younger; and (3) 2 years older. Details on this analysis are provided in the Appendix.

3.2 Education and Permanent Income

Households are heterogeneous in education (e) and permanent income type (η), which remain fixed for life. Education, $e \in \{e_l, e_h\}$, can be low (less than 16 years of education) or high (16+ years of education). In addition, each household belongs to one of ten possible permanent income types denoted by η. Individuals retain this type for life even when the household changes from being married to single.

3.3 Health

The health of each individual (either single or married) is one of four possible states: good, bad, low disability and high disability $h \in \{h_g, h_b, h_{LD}, h_{HD}\}$.[9] We assume that disability states become possible only from the age of 65. Good and bad health states, h_g and h_b, are free of disability. Low disability h_{LD} corresponds to states where the individual needs some help with at least one activity of daily living (ADL) or instrumental activity of daily living (IADL). High disability h_{HD} is a state where the individual needs intensive long term care, which we define more precisely when we discuss the data in section 4.2.

Health status evolves according to a Markov process that depends on marital status, sex, health, age, and education. The health transition probability matrices are given by $H_s(h', h, j, g, e)$ for singles, $H_m(h', h, j, e)$ for husbands, and $H_m^*(h^{*'}, h^*, j^*, e)$ for wives.

3.4 Survival

Survival probabilities depend on marital status, age, sex, education, and health. They are given by $\rho_s(j, g, e, h)$ for single individuals, $\rho_m(j, e, h)$ for married males, and $\rho_m^*(j^*, e, h^*)$ for married females. If a married woman survives until her spouse reaches J, an extremely unlikely event, we assume that both members of the household die together.

3.5 Income

Income is measured at the household level and is modeled as a deterministic function of household characteristics. In particular, for singles, income depends on age, gender, education level, permanent income type, and health status. For married households, the age and health status of the spouse is added to this list in place of gender. We define income as after tax income from all sources (e.g., earnings, Social Security, pension income, unemployment insurance, workers' compensation) with the exception of government transfers and returns to assets which we model separately. Income is given by:

$$y = \begin{cases} y_s(\eta, j, g, e, h) & \text{if } ms = s \\ y_m(\eta, j, j^*, e, h, h^*) & \text{if } ms = m \end{cases} \tag{1}$$

[9] The health of the wife in a married couple is denoted by $h^* \in \{h_g, h_b, h_{LD}, h_{HD}\}$.

We abstract from labor supply decisions, including retirement. The exogenous income profiles implicitly capture the labor market decisions of each type of household. All income risk comes from changes in health and from the death of a spouse.

3.6 Medical Expenditures

We treat medical expenditures differently depending on whether the individual is highly disabled or not. If $h \in \{h_g, h_b, h_{LD}\}$, we model out of pocket (OOP) medical expenditures as exogenous income shocks. Each individual's OOP medical expenditures are given by $ME(j,g,e,h)$, where these are set to zero when $h = h_{HD}$. They depend on the individual's age, sex, and health and on the household's education. A married couple's medical expenditures are the sum of the two individual's expenditures. Household medical expenditures when neither member is highly disabled are given by:

$$ME = \begin{cases} ME(j,g,e,h) & \text{if } ms = s \\ ME(j,g = male,e,h) + ME(j^*,g = female,e,h^*) & \text{if } ms = m \end{cases} \tag{2}$$

3.7 Long Term Care Expenditures and Informal Care

When individuals are highly disabled, their consumption is given by $x = x^F + x^I$, where x^F denotes formal care that requires a monetary cost and x^I denotes the value of informal care that is assumed to be provided at zero cost. Formal care, x^F, includes paid formal care, medical goods and services, and regular consumption such as food and housing. We are implicitly assuming that x^F and x^I are perfect substitutes.[10] We abstract from modeling the cost of IC since most care is in fact provided by spouses who are retired and have little opportunity cost. Of course, IC may also be provided by children or other relatives at a cost, such as an expected bequest (Barczyk and Kredler (2018)). Our results will be discussed keeping in mind this limitation of our model. Informal care $x^I \in \{0, \hat{x}\}$ is either absent (equal to 0) or present (equal to a fixed amount $\hat{x}$). The value of x^I is drawn from a probability distribution at the beginning of the period, and x^F is then chosen by households to maximize expected lifetime utility. Note that we do not separate consumption x into a medical and non-medical component. For highly disabled individuals that often live in nursing homes, this distinction is impossible to make. We assume that there is a common technology producing both types of consumption, c and x, so their relative price is one.

Individuals who just enter a high disability state draw an initial x^I from the probability distribution $\Omega_s(x^I|j,g,e)$ if single, and $\Omega_m(x^I|j,g,e,j^*,h^*)$ if married. For singles, this distribution depends on age, sex and education, while for married individuals, it also depends on the relative age of the spouse and the spouse's health. For singles who stay highly disabled in consecutive periods, informal care evolves according to a Markov process that depends on gender, given by

[10] Bonsang (2009) find that informal care is a substitute for formal home care at relatively low levels of disability, but that this substitution effect disappears at higher levels of disability. They also find that informal care is a weak complement to nursing care independently of the level of disability. For simplicity, we abstract from modeling the degree of severity within the LTC state, and we assume that informal care and all other consumption are additive.

$\Delta_s(x^{I'}, x^I, g)$. Married individuals make a new draw of informal care x^I from the probability distribution $\Omega_m(x^I | j, g, e, j^*, h^*)$ in each subsequent period in which they are highly disabled.[11] In the case where both spouses are highly disabled, we assume they both receive the informal care drawn by the husband, $\Omega_{mr}(x^I | j, g = m, e, j^*, h^*)$.[12] Finally, when a spouse dies, the newly single widow or widower draws $x^I$from the singles' distribution Ω_s.

We assume there is a minimum level of total consumption in the high disability state that is guaranteed by social insurance, denoted by x_{med}. In particular, if the household cannot afford the cost of $x^F = x_{med} - x^I$, social insurance is provided. Social insurance is described in detail in Section 3.9.

3.8 Preferences

Preferences for consumption in a given period are age and health-dependent. When not highly disabled, individuals derive utility from regular consumption goods c. When highly disabled, individuals derive utility from long term care consumption $x = x^F + x^I$, where x^F is chosen by the household and x^I is drawn from the relevant distributions outlined in the previous section. Long term care consumption is valued differently than c.

Preferences for singles are given by:

$$U_s(c,x) = \begin{cases} \frac{c^{1-\sigma}}{1-\sigma} & \text{if } h \neq h_{HD} \\ \theta_x \frac{(x+\kappa_x)^{1-\sigma}}{1-\sigma} & \text{if } h = h_{HD} \end{cases} \tag{3}$$

As noted in Ameriks et al. (2020), the two key parameters are θ_x and κ_x. A higher θ_x increases the marginal utility of a unit of consumption when highly disabled, while a higher κ_x indicates that LTC consumption is valued as more of a luxury good. A negative κ implies that a certain level of LTC consumption is a necessity.

A married couple's utility is obtained by adding up the utilities of the two members as follows:

$$U_m(c,x) = \begin{cases} 2\frac{c^{1-\sigma}}{1-\sigma} & \text{if } h \neq h_{HD} \text{ and } h^* \neq h_{HD} \\ \frac{c^{1-\sigma}}{1-\sigma} + \theta_x \frac{(x+\kappa_x)^{1-\sigma}}{1-\sigma} & \text{if } h = h_{HD} \text{ and } h^* \neq h_{HD} \\ & \text{ or } h \neq h_{HD} \text{ and } h^* = h_{HD} \\ 2\theta_x \frac{(x+\kappa_x)^{1-\sigma}}{1-\sigma} & \text{if } h = h_{HD} \text{ and } h^* = h_{HD}. \end{cases} \tag{4}$$

When both members are not highly disabled, each member consumes c, and when they are both highly disabled, they each consume x. When only one member is highly disabled, the household optimally chooses c and x as to maximize the sum of the members' utilities.

[11] In principle, we could also have a Markov process for informal care for married individuals who stay highly disabled. However, this process would have to depend on many states, including the spouse's relative ages and the spouse's past and present health. Unfortunately the data does not allow us to estimate such a detailed process as relatively few individuals are observed staying highly disabled over multiple periods. For this reason, we assume that they draw a new x^I from a stationary distribution that is conditional on all the relevant states.

[12] This assumption is based on the fact that in the HRS, among couples where both members are highly disabled, 91% of them either have both members receiving IC or both members not receiving IC.

Households also value leaving bequests which is captured by a warm glow utility function as in De Nardi (2004):

$$v(b) = \theta_b \frac{(b+\kappa_b)^{1-\sigma}}{1-\sigma}. \quad (5)$$

3.9 Social Insurance

The government runs a social assistance program which guarantees a minimum level of consumption $\underline{c}$ to every individual who is not highly disabled. For singles, when disposable income (net of required medical expenditures) falls below $\underline{c}$, a government transfer Tr is given to compensate for the difference. Similarly, married couples where neither member is in a high disability state receive a transfer Tr that allows both individuals to consume $\underline{c}$.

In addition, the Medicaid LTC program guarantees a minimum level of LTC consumption x_{med} to highly disabled individuals such that $x^F + x^I \geq x_{med}$. In the case of single individuals and married households where both members are highly disabled, if the household's financial resources do not allow it to afford x^F such that $x^F \geq x_{med} - x^I$, the government provides a transfer Tr to ensure x_{med} is attainable.

The transfer received by a married couple where only one household member is highly disabled is more complicated due to special "spousal impoverishment rules" that allow the disabled spouse to qualify for Medicaid LTC if institutionalized, while the non-disabled spouse is allowed to keep joint income and assets up to a certain threshold that we denote by the parameter ϑ.[13] These rules are designed to keep the spouse living in the community from becoming impoverished when the other spouse enters a nursing home. In particular, the community spouse is allowed to keep one-half of the couple's combined assets, up to a maximum of \$115,920 in 2013. The institutionalized spouse's income is also protected for the community spouse up to \$2,898 per month in 2013.

Couples are not eligible for these rules if the highly disabled spouse lives at home.[14] Therefore, in our model, we allow only households where the disabled spouse has no informal care ($x^I = 0$) to qualify for the special rules captured by the threshold ϑ since in the absence of informal care, it is very likely a disabled spouse is institutionalized.

We describe formally the function determining Tr in all of these situations when we describe a household's dynamic programming problem in the next sections.

3.10 Single Individual's Dynamic Problem

At the beginning of each period, the state of a single individual is given by $\Phi_s = \{j, g, e, \eta, h, x^I, a\}$. Given Φ_s, each individual maximizes the expected discounted lifetime utility by making a consumption/saving decision. Households discount the future at the rate $\beta(e)$ which is allowed to depend on education. When not highly disabled, the individual chooses expenditures on regular

[13] An overview is available at https://longtermcare.acl.gov/medicare-medicaid-more/medicaid/medicaid-eligibility/considerations-for-married-people.html.

[14] The asset limit in most states is only approximately \$3,000 for a couple when both spouses are living together.

consumption c and when the individual is highly disabled, he/she chooses expenditures on formal care x^F. Borrowing and negative bequests are not allowed.

A single individual solves:

$$
\begin{aligned}
V_s(\Phi_s) = \max_{c,x} \{ & U_s(c,x) + \rho_s(j,g,e,h)\beta(e)EV_s(\Phi_s') \\
& + (1-\rho_s(j,g,e,h))\beta(e)v(b)\}
\end{aligned} \tag{6}
$$

subject to

$$
Tr = \begin{cases} \max\{0, \underline{c} - y - [1+r(1-\tau_a)]a + ME\} & \text{if } h \neq h_{HD} \\ \max\{0, x_{med} - x^I - y - [1+r(1-\tau_a)]a\} & \text{if } h = h_{HD} \end{cases} \tag{7}
$$

$$
y + [1+r(1-\tau_a)]a + Tr = \begin{cases} c + ME + a' & \text{if } h \neq h_{HD} \\ x^F + a' & \text{if } h = h_{HD} \end{cases} \tag{8}
$$

$$
b = [1+r(1-\tau_a)]a \tag{9}
$$

$$
x = x^F + x^I,\ x \geq x_{med} \tag{10}
$$

$$
a' \geq 0 \tag{11}
$$

In the first period, individuals start with asset levels drawn from an initial distribution of assets $A_{s,j=1}(g,e,\eta)$. Available financial resources equal the sum of after tax income and asset returns, assets, government transfers when applicable, minus required medical expenditures. These are allocated optimally between period consumption and savings for the next period. Starting with age 65, high disability states become possible. In these states, the individual draws a level of informal care x^I and optimizes between x and next period assets. If the individual's available financial resources do not allow x_{med} to be attainable, the individual qualifies for Medicaid LTC and receives a government transfer Tr equal to what is needed to just afford $x = x_{med} - x^I$. At all ages, when the individual is not highly disabled and cannot afford the consumption floor, the government provides a transfer Tr that allows for this minimum consumption.

3.11 Consumption Sharing Within a Married Household

In a married household, either both members do not require LTC, both members require LTC, or one member needs LTC and one member does not. In the first case, both members consume the same c, but some of this is shared consumption (furniture, appliances, etc). Hence, the cost that a married household bares in order for both members to consume c is $(1+\lambda)c$, where $\lambda < 1$. We also allow for consumption sharing when both spouses are highly disabled: each member consumes the same $x = x^F + x^I$, but the total cost for this consumption is $(1+\lambda^{:LTC})x^F$, where $\lambda^{LTC} < 1$. We allow for joint consumption regardless of informal care availability because disabled spouses can benefit from shared goods and services whether they live at home or in a shared room in assisted living or nursing home.

Finally, if one member is disabled and one is not, the healthy member will consume c and the disabled member will consume $x = x^F + x^I$. In addition to being a substitute for formal care, informal care enables consumption sharing to continue within a married household when one member has LTC needs and other does not. That is, a married couple where one partner is receiving informal care is assumed to live together and share furniture, utilities, housing services and other types of consumption. If informal care is not available it is assumed that the disabled spouse is living in a facility, such as a nursing home, where formal LTC is provided. Consumption sharing is not possible in this case.

Thus, if $x^I > 0$, the consumption of the healthy spouse is partly shared with the disabled spouse. However, the disabled spouse requires additional consumption specific to that member's LTC needs.[15] Hence, the consumption expenditure of this household is $(1+\lambda)c + (x^F - c) = \lambda c + x^F$. That is, the consumption c that is enjoyed by both spouses is included in the consumption of the disabled spouse, so the additional expenditure needed to provide the disabled spouse with x^F units of LTC consumption will only cost the household $(x^F - c)$ beyond what has already been spent on joint consumption, $(1+\lambda)c$. If $x^I = 0$ and only one spouse requires LTC, consumption is not shared, and the consumption expenditures of the household is equal to $c + x^F$.[16]

These consumption sharing assumptions are incorporated into the budget constraints of a married household's dynamic program, which we describe next.

3.12 Married Household's Dynamic Problem

A married couple's state is given by $\Phi_m = \{j, j^*, e, \eta, h, h^*, x^I, a\}$. Initial assets are drawn from the distribution $A_{m,j=1}(j^*, e, \eta)$. The continuation value is calculated over the probabilities that both spouses survive, one spouse dies, or both die.

We assume that spouses are altruistic towards each other, and in case one spouse dies, they value the widow/widower's single continuation value by an additional factor that captures this altruism. The degree of altruism towards the living spouse is captured by the preference parameter $\phi > 1$ which multiplies the household's continuation value when they transition from a married couple to a single individual. In addition, given the findings in (Jones et al., 2020) regarding asset dynamics around the time of death, we assume that when only one spouse dies, there are death related costs and side bequests to non-spousal heirs equal to a fraction ω of the wealth. The surviving spouse receives only $1-\omega$ of the wealth. When both members of a couple die in the same period, any remaining wealth is left as a terminal bequest with total value $2v(b)$.

A married household solves:

[15] Note that this implicitly assumes that $x^F \geq c$. As we will see later, the model parameters are chosen to ensure this always holds.

[16] Using HRS data, we find that approximately 80% of disabled married individuals without informal care and with non-disabled spouses live in nursing homes.

$$
\begin{aligned}
V_m(\Phi_m) \quad = \quad & \max_{c,x}\{U_m(c,x) \\
& +\rho_m\rho_m^*\beta(e)EV_m(\Phi_m') \\
& +(1-\rho_m)\rho_m^*\phi\beta(e)EV_s(j^*+1,g=female,e,\eta,h^{*'},x^{I'},(1-\omega)a') \qquad (12) \\
& +\rho_m(1-\rho_m^*)\phi\beta(e)EV_s(j+1,g=male,e,\eta,h',x^{I'},(1-\omega)a') \qquad (13) \\
& +(1-\rho_m)(1-\rho_m^*)\beta(e)\,2v(b)\} \qquad (14)
\end{aligned}
$$

subject to

$$
y^d = y + [1+r(1-\tau_a)]a \tag{15}
$$

$$
y^d + Tr = \begin{cases}
(1+\lambda)c + ME + a' & \text{if } h \neq h_{HD} \text{ and } h^* \neq h_{HD} \\
c + x^F + ME + a' & \text{if } h = h_{HD},\, h^* \neq h_{HD} \text{ and } x^I = 0 \\
 & \quad \text{or } h \neq h_{HD},\, h^* = h_{HD} \text{ and } x^I = 0 \\
\lambda c + x^F + ME + a' & \text{if } h = h_{HD},\, h^* \neq h_{HD} \text{ and } x^I = \hat{x} \\
 & \quad \text{or } h \neq h_{HD},\, h^* = h_{HD} \text{ and } x^I = \hat{x} \\
(1+\lambda^{LTC})x^F + a' & \text{if } h = h_{HD} \text{ and } h^* = h_{HD}
\end{cases} \tag{16}
$$

$$
Tr \quad = \begin{cases}
\max\{0, \underline{c}(1+\lambda) - y^d + ME\} & \text{if } h \neq h_{HD} \text{ and } h^* \neq h_{HD} \\
\max\{T1, T2\} & \text{if } h = h_{HD},\, h^* \neq h_{HD} \text{ and } x^I = 0 \\
 & \text{or } h \neq h_{HD},\, h^* = h_{HD} \text{ and } x^I = 0 \\
\max\{0, \lambda\underline{c} + x_{med} - x^I - y^d + ME\} & \text{if } h = h_{HD},\, h^* \neq h_{HD} \text{ and } x^I = \hat{x} \\
 & \text{or } h \neq h_{HD},\, h^* = h_{HD} \text{ and } x^I = \hat{x} \\
\max\{0, (1+\lambda^{LTC})(x_{med} - x^I) - y^d\} & \text{if } h = h_{HD} \text{ and } h^* = h_{HD}
\end{cases} \tag{17}
$$

where

$$
\begin{aligned}
T1 = \max\{0, \underline{c} + x_{med} - y^d + ME\} && (18) \\
T2 = \max\{0, x_{med} I_{y^d < \vartheta}\} && (19) \\
x = x_{med} \text{ if } Tr = T2 && (20) \\
b = [1+r(1-\tau_a)]a && (21) \\
x = x^F + x^I,\, x \geq x_{med} && (22) \\
a' \geq 0 && (23)
\end{aligned}
$$

For convenience, we denote the after tax disposable income by y^d (see equation 15). Households receive social insurance benefits as outlined in section 3.9 and share consumption as described in section 3.11. When only one spouse is highly disabled, the household receives a transfer equal to $T1$ if it cannot afford to consume the minimum consumption $\underline{c}$ plus the minimum LTC level x_{med} (equation 18). However, when no IC is available and disposable income is below the threshold ϑ associated with the Medicaid spousal impoverishment provisions (the indicator $I_{y^d<\vartheta}$ equals 1), the household is eligible for the transfer $T2$ which covers x_{med} (equation 19). This type of household receives the maximum of $(T1, T2)$ as specified in equation 17.[17] The non-disabled spouse cannot transfer additional resources to the highly disabled spouse who consumes exactly x_{med} as in a Medicaid LTC facility (eqn 20).

3.13 Effects of LTC Risk

Several studies discuss the implications of LTC risk for different types of households (e.g., Braun et al. (2017), De Nardi et al. (2016a), Ameriks et al. (2020)). LTC risk and the presence of means-tested Medicaid discourage savings for low income individuals: savings would quickly run out in the advent of LTC needs, forcing them to rely on the Medicaid LTC program and leave no bequest. High income individuals have an incentive to self-insure against LTC risk due to Medicaid aversion and the desire to leave a bequest. These two reasons amplify each other resulting in the accumulation of significant wealth among high income households, especially those who are married (De Nardi et al. (2021)). In our results, we emphasize how the availability of informal care (which depends on family structure) in an important factor in the savings decisions of households.

4 Parameterization, Estimation and Calibration

We employ a two-step parameterization strategy. In the first step we estimate the parameters which can be cleanly identified outside the model using CEX, CPS, HRS and MEPS data. These include the distribution of initial assets, the income process, health transition probabilities, survival probabilities, medical expenditures, and probabilities of receiving informal care. In addition, some parameters are set to values consistent with previous literature or empirical evidence. In the second step, we calibrate the remaining parameters: preference parameters, the value of informal care $\hat{x}$, the asset cost of a spouse dying ω, and the social insurance parameters $\underline{c}$, x_{med}, and ϑ (see Table 2). The calibration minimizes the distance between model predicted and data

[17] Clearly, these rules could induce strategic behavior where couples refuse IC and institutionalize the highly disabled spouse to qualify for the special rules. The extent of this likely depends greatly on the couple's preferences and extent of disability, and it is beyond the scope of our paper. In a simulation exercise where we allow couples to strategically switch from an "IC" to a "no IC" state to qualify for the spousal rules, we find that the fraction of married individuals with IC who receive Medicaid becomes close to zero. This is inconsistent with the data where 23% and 10% of non-college and college married couples with IC in fact get Medicaid after becoming impoverished. In reality, highly disabled individuals likely have a high preference for living at home, so the "IC" state is not affected much by strategic behavior to qualify for the Medicaid spousal impoverishment rules.

moments on household spending, Medicaid, other government transfers, and wealth. All dollar values are CPI adjusted to year 2010.

4.1 Data

The main data set used in our analysis is the Health and Retirement Study (HRS). The HRS is a nationally representative panel survey of older individuals and their spouses that started in 1992 and is ongoing. The survey is conducted every two years, and currently thirteen waves of data are available. It contains information on more than 37,000 individuals over age 50 in 23,000 households. Detailed information is collected on demographics, income, assets, health insurance, health, ADLs, health care expenditures, and formal and informal long term care. In married households, both spouses receive all individual-level questions, making the HRS an ideal data set for studying health, LTC needs, and medical expenditures in households over time. In our analysis, we use data from waves 5 to 12, covering years 2000 to 2014. All statistics are calculated using the combined respondent weight and nursing resident weight variable.

For ages younger than 65, we estimate health status transition probabilities and medical expenditures using data from the Medical Expenditure Panel Survey (MEPS). The initial assets distribution at the age of 35 is estimated using the Consumer Expenditure Surveys (CEX), and income profiles are estimated using the Current Population Survey (CPS).

4.2 First-Step Estimation and Parameterization

Health status and health transitions

In the HRS, we construct health status using a combination of self-reported health, help received with 6 activities of daily living (ADLs) and 5 instrumental activities of daily living (IADLs), and information on informal and professional care received. The self-reported health measure is the standard variable where respondents rate their health as excellent, very good, good, fair or poor. The 6 ADL variables used in the HRS ask whether the respondent gets help with: (1) walking across a room, (2) dressing, (3) bathing, (4) eating, (5) getting in and out of bed, and (6) using the toilet. The 5 IADL variables ask whether the respondent has difficulty (1) using the phone, (2) managing money, (3) taking medication, (4) shopping for groceries, and (5) preparing hot meals. The HRS also has information on total hours of care received from a spouse/children/others and on nursing home status.

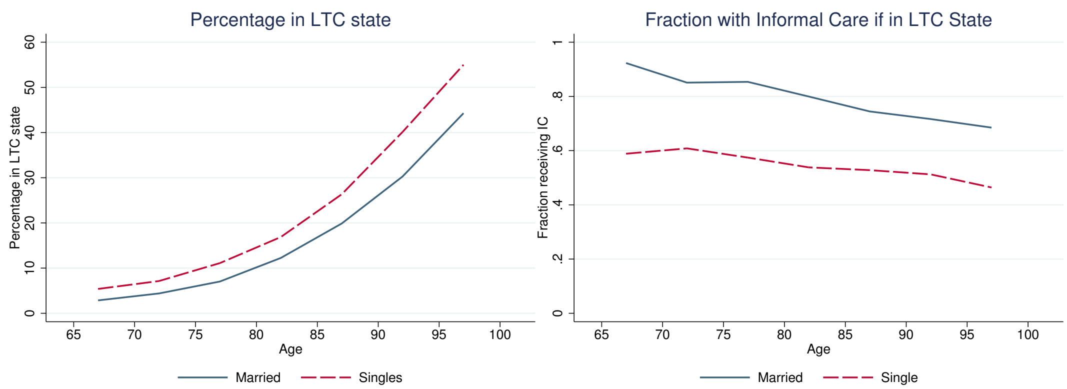
We classify health as good when the respondent reports excellent/very good/good health, and as bad when he/she reports fair/poor health. However, if respondents get help with at least one ADL or IADL, we re-classify them as having low disability. We further re-classify individuals as highly disabled (LTC state) if they additionally receive at least 90 hours of care per month or have professional care (PC) or live in a nursing homes (NH) at the time of interview.[18] The left panel of Figure 1 shows the fraction of individuals who are highly disabled at ages 65 and over, separately by marital status. We see that singles are more likely to be highly disabled, consistent

[18] Barczyk and Kredler (2018) also use the 90 hours/month threshold to classify individuals in the HRS as disabled.

with previous findings that singles are less healthy than married individuals (e.g., Guner et al. (2018)).

Health transitions are estimated using logit models that include a cubic in age, marital status, sex, and education. For transitions from disability states, the regressions exclude education and marital status due to the small number of observations. Sample transition probabilities for women are presented in Figure 2. We see that high disability becomes increasingly persistent with age. The Appendix provides the figures for men and additional details.

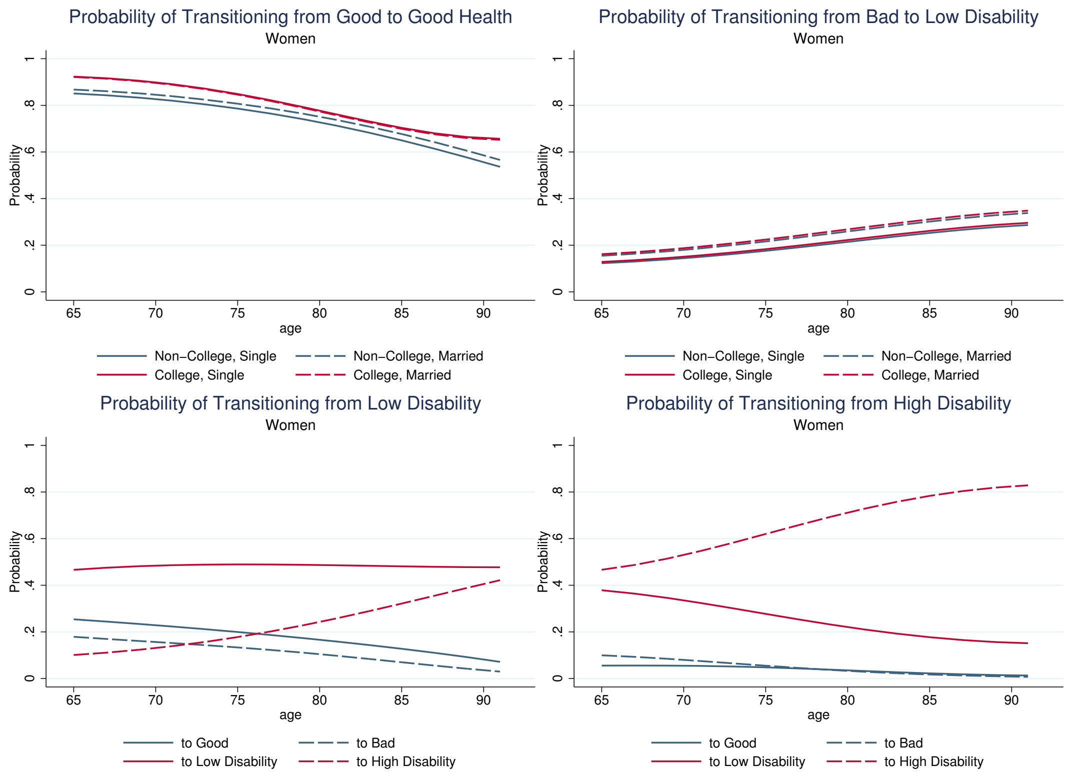
Figure 1: Fractions with high disability and informal care, by marital status, HRS



Notes: We calculate the fractions combining ages into 5-year groups to smooth the profiles. The first point corresponds to age group 65-69.

We use the MEPS to estimate health status transitions at ages 35-63 when only good or bad health states are allowed in the model. These are constructed using the self-reported health measure as in the HRS: excellent, very good and good responses are categorized as good, and fair and poor responses are categorized as bad. To estimate biennial health status transition probabilities, we use data from Rounds 1 and 5 of the MEPS which are approximately just under 2 years apart. A logit regression model is used that includes age, age squared, and marital status, estimated separately for each sex-education group.

Figure 2: Sample Biennial Health Transitions, HRS



Notes: The figures present the predicted probabilities from logit models of health transitions on education, marital status and age estimated using HRS data from 2000-2014.

Informal Care Probabilities

We use information on care-giving found in the Harmonized HRS data files which supplement the RAND HRS. The key variables are: (1) whether the respondent's spouse helps with ADL or IADL care needs, (2) the number of children or grandchildren who help, (3) the number of other non-professional people who help (unpaid), (4) whether the respondent receives any professional help, and (5) the number of paid carers and the OOP costs associated with these carers. For variables (1)-(3), we also observe the number of days per week and the number of hours per day they help.

We classify highly disabled individuals as receiving informal care if they report receiving at least 90 hours of care per month from the spouse, children and grandchildren, or other unpaid non-professional people. If information on hours of care from any of these sources is missing, and if the total hours of care from other sources are less than 90/month, we set informal care to missing. Figure 1, right panel, shows the fractions of highly disabled single and married individuals who have IC, by age. On average, married individuals are significantly more likely to have IC than singles (83% vs. 60% at ages 70-75).

We estimate the probabilities of having informal care conditional on age, marital status, education, sex, the age of the wife relative to the husband, and the spouse's disability status. Sample probabilities are presented in Figure 3.[19] When we disaggregate by these characteristics, we find that at age 75, 86% of highly disabled married men and 77% of women have IC vs 44% of single men and 70% of single women. Among singles, the probabilities of IC are considerably higher for the less educated and for women. Only 38% of college single men have IC. Among those who are married, we find that the probability of having IC is much lower when the spouse is also disabled (having low or high disability). For men, the IC probabilities do not depend significantly on the relative age of the wife once we control for her disability status. However, women with relatively young husbands have significantly higher probabilities of receiving IC. IC probabilities decline steadily with age for all groups.

Figure 3: Probability of Having Informal Care (IC) if Highly Disabled, HRS

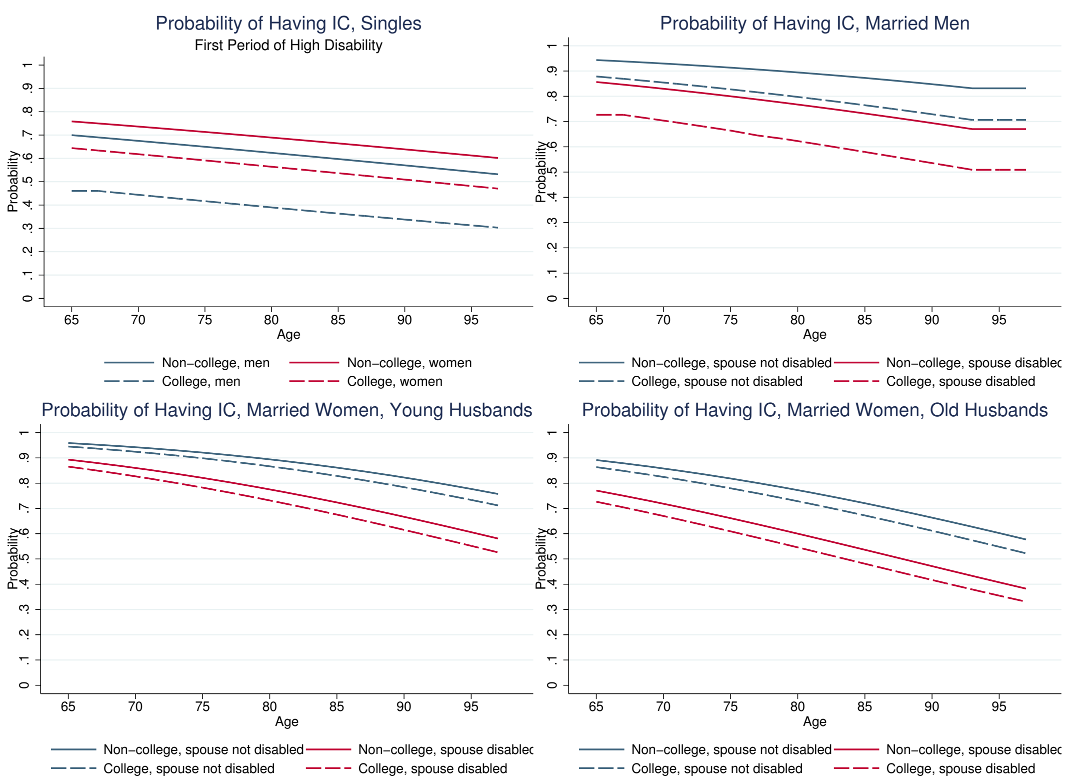


Table 1: Informal Care Transition Probabilities for Singles

Probability of having IC at $t+1$		
	Male	**Female**
Has IC at t	0.73	0.75
No IC at t	0.17	0.16

[19] For singles, the probabilities are estimated using data on individuals who experience high disability for the first time. We use all highly disabled individuals for the married group due to small sample sizes. Married men's IC probabilities do not depend significantly on the relative age of the wife, so we estimate these combining all couples.

We also estimate informal care transition probabilities for singles who are highly disabled in consecutive periods (Table 1). We observe that IC is fairly persistent: the probability of not having IC next period conditional on not having it today is 83% for men (84% for women) while the probability of having it next period conditional on having it today is 73% for men (75% for women).

A potential concern is that IC could depend on income and wealth, with wealthier individuals consuming more formal professional care and less informal care. A detailed analysis of IC is presented in the Appendix. We show that generally, IC does not depend on income or total wealth.

Survival probabilities

The HRS contains information on the exact date of death for each respondent who dies during the survey period. We estimate biennial survival probabilities for ages 55 to 109 using logit regressions. We then use linear interpolation to obtain survival for ages 35 to 53, assuming that the survival probability is 1 at the age of 35.

Income Profiles

We use CPS data to estimate the deterministic after-tax income profiles $y_s(\eta, j, g, e, h)$ and $y_m(\eta, j, j^* e, h, h^*)$. We use total income minus income from government transfers, interest, dividends and rent. For married couples we add the husband and wife's incomes. We construct cells defined by age, health, education, marital status, sex (if single) and the relative age of the wife to that of the husband and her health (if married). Within each cell, we calculate income decile groups. Each decile corresponds to a permanent income type η in our model. We smooth the income profiles using an OLS regression of log income on all the characteristics defining each cell, a cubic in age, and the decile groups.

Figures M.8 and M.9 in the Appendix present estimated income profiles by sub-groups. As one would expect, married couples with "young" wives have lower incomes early in the life-cycle, but higher incomes later when the younger wives are more likely work than older wives. Single women have consistently the lowest income profiles. Finally, income profiles for households where the head is in good health are significantly higher than for those where the head is in bad health.

Initial Assets

We use the CEX to estimate the initial assets functions $A_{s,j=1}(g, e, \eta)$ and $A_{m,j=1}(j^*, e, \eta)$. We separate single and married households with male heads aged 33-36, and divide these into demographic groups by gender and education (singles) and education and relative age of the wife (married). We then divide each group into wealth deciles and calculate mean total wealth in each decile. We assume that each wealth decile corresponds to the equivalent income decile η in our model.

Medical Expenditures

We estimate out-of-pocket (OOP) medical expenditures using the MEPS for non-retired households, and the HRS for retired households. We use the predicted values from OLS regressions of OOP expenditures (measured over 2 years) on the individual's age, sex, health, and household education.

Parameters Set Directly

We set the risk aversion parameter σ to 2.0, which is in the middle of the estimates in the empirical consumption literature. The parameter λ determines the degree of joint consumption in married couples where at least one of them is not highly disabled, and we set it to 0.67 following Attanasio et al. (2008). When both spouses are highly disabled, the consumption sharing parameter λ^{LTC} is set to 0.764. This value is inferred from the cost of a semi-private nursing home room relative to that of a private room.[20] The tax rate on asset returns, τ^a, is set at 20%, and the annual interest rate is set to 4%.

4.3 Second-Step Calibration

The remaining parameters which are calibrated inside the model are the initial demographic distribution at the age of 35 and the parameters in $\Upsilon = (\beta(e), \kappa_x, \theta_x, \hat{x}, x_{med}, \underline{c}, \vartheta, \theta_b, \kappa_b, \phi, \omega)$ (see Table 2).

Table 2: Model Parameters

Parameter	Description	Value
Preferences		
$\beta(e_l)$	Time Preference (2 years), non-college	0.846
$\beta(e_h)$	Time Preference (2 years), college	0.869
κ_x	LTC preference parameter	-0.57
θ_x	LTC preference parameter	4.3
$\hat{x}$	Value of informal care	\$58,619 (0.556)
θ_b	Bequest parameter	11.0
κ_b	Bequest parameter	1.0
ϕ	Altruism towards living spouse	3.61
ω	Cost of death of a spouse (% of wealth)	0.33
Social Insurance		
$\underline{c}$	Consumption floor (2 years)	\$14,760 (0.14)
x_{med}	Medicaid LTC (2 years)	\$74,855 (0.71)
ϑ	Threshold for Medicaid spousal rules	\$358k (3.4)

Notes: Model units are in parenthesis.

[20] The median national annual costs in 2019 for a semi-private room in a nursing home was \$90,155 compared to \$102,200 for a private room (Genworth Cost of Care Survey). We set λ^{LTC} = (2* 90,155)/102,200-1.

Table 3: Calibration Targeted Moments

	Non-college		College	
Moment	**Model**	**Data**	**Model**	**Data**
median assets (65-69)	128.12	113.13	399.15	377.65
spending if ($h = h_{HD}$ and $x^I > 0$) / $h \neq h_{HD}$ (singles 75-84)	1.21	1.14	1.15	1.17
Medicaid recipiency rate if $x^I = 0$ (singles 65+)	0.60	0.50	0.19	0.19
Medicaid recipiency rate if $x^I > 0$ (singles 65+)	0.32	0.35	0.12	0.10
Medicaid recipiency rate if $x^I = 0$ (married 65+)	0.54	0.54	0.12	0.14
Gov transfer recipiency rate if $h \neq h_{HD}$ (65+)	0.22	0.17	0.09	0.10
% with assets < 10K (period before death, singles 65+)	0.40	0.39	0.14	0.19
spending/assets (period before death, singles 65+)	0.25	0.24	0.19	0.22
median assets (first period of widowhood, 70-85)	143.90	141.69	347.61	355.21
median assets (ages 80 to 85) / (ages 65 to 70) (married)	0.84	1.01	1.06	0.87

Notes: Assets and spending are in thousands of 2010 US dollars.

Demographic population structure at age 35

Since our paper is focused on ages 65 and above, it is important to have the right demographic structure at these ages. Because we abstract from marriage and divorce, it is not trivial to obtain the right demographic distribution at the age of 65. If we imputed the demographic structure observed in the data at the age of 35, we would obtain a very different demographic structure at older ages than in the data. Therefore, our strategy is to calibrate an initial demographic structure at the age of 35 such that, given the estimated health transitions and survival probabilities, we obtain a demographic structure at the age of 65 that matches the data. The details and results are provided in the Appendix.

Remaining Parameters

The 12 parameters in $\Upsilon = (\beta(e), \kappa_x, \theta_x, \hat{x}, x_{med}, \underline{c}, \vartheta, \theta_b, \kappa_b, \phi, \omega)$ are calibrated simultaneously since they all impact the model's ability to match the data with respect to wealth accumulation, spending, and government transfers. The targeted data moments and corresponding model moments are presented in Table 3. We construct all moments separately by education. Out of all parameters in Υ, only β is education specific. All other differences across education groups arise from differences in incomes, health transitions, survival, marriage rates, the age distribution of spouses, and IC probabilities. The education specific moments highlight the extent to which the model is able to match the data with the parameter heterogeneity we allow for.

The discount factor $\beta(e)$ is crucial to match the median assets of young retirees aged 65-69 by education group. Clearly, the parameters $(\kappa_x, \theta_x, \hat{x}, \underline{c}, \vartheta, \theta_b, \kappa_b, \phi, \omega)$ are also important determinants of asset accumulation during working ages, but we pin these down using other moments outlined below. We construct assets in the HRS as outlined in Section K.2 of the Appendix. We focus on financial assets and exclude housing.[21]

[21] We abstract from modeling housing wealth, however, several papers have emphasized the distinctive patterns in

The parameter θ_x determines the marginal utility of a unit of LTC consumption versus regular consumption, so it is key for the households' intertemporal allocation across health states (highly disability vs others) and in the couples' allocation of resources to c versus x when only one spouse is highly disabled. To have this parameter set appropriately, we target the ratio of total spending when highly disabled to total spending when not highly disabled, for singles aged 75-84. We restrict the sample to singles without Medicaid and with wealth between \$100K and \$1,500K which limits the frequency of outliers and implausible values. The sample size of such individuals without IC is very small in the HRS, so we focus only one those receiving IC. We obtain ratios of 1.14 for the non-college and 1.17 for the college educated.[22] We make the same restrictions when constructing the model generated moments.

The parameter κ_x determines the extent to which consumption in the LTC state is a luxury versus a necessity. However, since we impose a minimum level of consumption equal to x_{med} when highly disabled, the value of κ_x only matters in relation to the size of x_{med} which sets the actual lower bound of $x+\kappa_x$ in the denominator of the utility function of highly disabled individuals. We set κ_x to equal the difference between x_{med} and the estimated consumption floor when not highly disabled, $\underline{c}$. This value of κ_x approximates the minimum required expenditures associated with the high disability state.

The parameter x_{med} determines the generosity of the Medicaid LTC program, and for this we target the Medicaid recipiency of highly disabled singles *without* IC. These fractions are very high, at 0.5 for the non-college and 0.19 for the college educated. Together, the parameters x_{med} and θ_x determine the marginal utility of an additional unit of x when close to the Medicaid LTC floor, and hence the degree of "Medicaid aversion."

The value of $\hat{x}$ determines the spending needs of highly disabled households with IC relative to those without IC. Hence, we choose the Medicaid LTC recipiency rate of singles *with* IC as a calibration target (0.35 for non-college and 0.1 for the college educated). These fractions are considerably lower than for those without IC.

The parameter ϑ (capturing the generosity of the special spousal LTC Medicaid eligibility rules) is crucial to deliver the right fraction of married households without IC who receive Medicaid, since only households with institutionalized spouses (approximated in our model by those without IC) can qualify. A higher threshold ϑ implies more married couples without IC receive Medicaid.

The minimum consumption floor $\underline{c}$ is important to match the fraction of households without any highly disabled members who receive government transfers (0.17 for the non-college and 0.1 for the college groups).

The bequest preference parameter κ_b determines the wealth threshold at which the bequest motive becomes operative, and θ_b drives the marginal propensity to bequeath when wealth is above this threshold and death is certain. The bequest motive is difficult to disentangle from the

financial and housing wealth among retirees (e.g., Nakajima et al. (2018), Nakajima and Telyukova (2020), Barczyk et al. (2022)). Nakajima et al. (2018) show that medical expense risk affects primarily financial assets, while its impact on housing is limited. Barczyk et al. (2022) find that home ownership reduces dis-saving while increasing the likelihood and persistence of informal care from children, which in turn protects bequests by preventing nursing home entry.

[22]Spending is inferred from changes in assets in the HRS in consecutive survey periods.

precautionary savings motive for LTC.[23] To have θ_b and κ_b set appropriately in the model, we select target moments on assets and spending constructed for singles in the last 2-year period before death observed in the data. Of course, the extent to which individuals know they will die in the near future varies in this period, so their consumption/savings decisions are made under some uncertainty (in both the actual and simulated data). If they do not die, they might need LTC. Nevertheless, most of these individuals have high enough probabilities of dying in the next period for their consumption/savings decisions to be informative regarding their preferences for bequests.

Specifically, to calibrate the parameter κ_b, we target the fraction of single individuals with negligible assets (<\$10,000) in the last period of life (0.39 for non-college and 0.19 for college groups). A higher κ_b implies a higher wealth threshold above which individuals leave positive bequests, and therefore a higher fraction of individuals leaving zero or negligible bequests. To identify θ_b, we target the ratio of spending to assets in this last period which approximates the marginal propensity to bequeath (0.24 for non-college and 0.22 for college groups).[24][25] We restrict the sample for this statistic to those with wealth greater than spending since those with lower wealth are unlikely to have an active bequest motive. Any transfers to children in this period (which are observed in the HRS) are added to end of period wealth (approximating bequests) rather than being counted as spending.

The wealth cost ω associated with the death of the spouse is calibrated to match the median assets of widows/widowers in the first period after the death of their spouse. Finally, the degree of altruism towards a living spouse measured by the parameter ϕ is pinned down by the dis-saving rate of intact couples at ages 65+ . Figure 4 shows that the median wealth of married couples remains approximately constant from age 65 to age 90 as long as both spouses are alive. A higher ϕ implies a slower dis-saving rate for couples only.

Overall, our calibration strategy in distinguishing between precautionary saving and bequest motives is based on the approach in De Nardi et al. (2016a): matching Medicaid recipiency rates bounds medical expense risk and the strength of the associated precautionary saving motives, while matching asset holdings ensures the model captures correctly the bequest motives.

Calibrated Parameter Values

We describe the model's ability to match the targeted moments as well as untargeted statistics in Section 4.4. In this section we describe the calibrated parameter values which are presented in Table 2. We obtain a value of the biennial discount factor β of .85 for the non-college and .87

[23] See De Nardi et al. (2016b) for a survey of existing literature that disentangles these motives and the strategies used. For example, Ameriks et al. (2011) use strategic surveys asking individuals hypothetical questions that allow them to infer the trade-offs, De Nardi et al. (2016a) use moments on Medicaid recipiency to isolate the role of precautionary saving motives, and Lockwood (2018) use information on LTC insurance take up.

[24] Note that because death in the next period is not certain at this point, some of the wealth may be used for future consumption needs, so the ratio of spending to assets is likely somewhat lower than if death was certain.

[25] To be precise, let $t_{death} = 0$ denote the last period in which the respondent is observed alive (in both the HRS and simulated data). Let $t_{death} = -1$ be the period prior to it. We use information on total spending in period $t_{death} = -1$ and the total wealth at the beginning of $t_{death} = 0$. We infer spending in period $t_{death} = -1$ from changes in assets.

for the college educated. The annual values are .92 and .93, respectively, which are in the range estimated in much of the related literature.

The estimated bequest parameter θ_b equals 11.0, and κ_b equals 1.0. Together, these parameters imply that for singles in the period before certain death, the bequest motive becomes operative at cash-on-hand levels greater than \$33K, and the marginal propensity to bequeath above this threshold is 0.81 out of each additional dollar.[26] The bequest threshold of 33K is in the ballpark of previous estimates, but the marginal propensity to bequeath is lower (e.g. De Nardi et al. (2010)). Our calibration targets the ratio of spending to savings in the last 2-year period observed before death for singles. This ratio is quite high at .24 for the non-college and .22 for the college, so a fairly low value of θ_b is required to match these statistics.

We estimate a consumption floor (x_{med}) of \$74,855 when highly disabled which is considerably higher than the consumption floor ($\underline{c}$) of \$14,760 when not highly disabled (both biennial). As discussed previously, we set the parameter κ_x as the difference between $\underline{c}$ and x_{med}, which is -\$60k (or -0.57 in model units). This can be interpreted as the value of care and OOP medical expenditures one needs to pay as a minimum when in LTC.[27] The values of x_{med} and $\hat{x}$ need to be considered in relation to κ_x which determines the extent to which consumption is a necessity when highly disabled. Our estimates are consistent with Ameriks et al. (2020) who find that LTC is a necessary good with a spending floor of about \$37K/year, which is exactly equal to our annual value of x_{med}. The value of informal care $\hat{x}$ is estimated at .556 equivalent to \$58,619 for 2 years. Our estimated value of θ_x is equal to 4.3.[28]

The parameter ϑ is equal to 3.4, or \$358K in terms of the cash on hand threshold at which married couples qualify for the special spousal Medicaid LTC rules. This is set to match the rates of Medicaid recipiency among married individuals without IC. While this threshold may appear high, the actual threshold is approximately \$150K, but housing wealth is exempt. Therefore, our threshold seems plausible if it includes housing wealth.

The cost associated with the death of a spouse is calibrated at 33% of total household wealth, which is on average \$120K. De Nardi et al. (2021) who study side bequests report that in the AHEAD data, \$87K is bequeathed on average to non-spousal heirs when one spouse dies, and there are additional end of life medical expenditures of approximately \$22K. Therefore, our estimate of ω seems plausible. The parameter ϕ which determines the altruism towards the living

[26]For an individual with zero probability to survive to the next period and who is not highly disabled, the first order condition together with the budget constraint imply that the bequest $b = \frac{1+r}{1+r+f}(fW - \kappa_b)$ where $f = [(1+r)\beta\theta_b]^{1/\sigma}$ and W is cash on hand (net of taxes and OOP expenditures). The threshold of W for leaving a positive bequest is therefore $\bar{W} = \kappa_b/f$. When $b > 0$, the marginal propensity to bequeath out of an extra dollar today is $\frac{\partial b}{\partial W} = \frac{(1+r)f}{1+r+f}$.

[27]This is approximately equal to the value of care for two years estimated in Barczyk and Kredler (2018) plus the average OOP expenses for highly disabled individuals estimated in the HRS. Ameriks et al. (2020) find a similar negative value of κ_x.

[28]As noted in Ameriks et al. (2020), individuals with $\theta_x > 1$ and $\kappa_x < 0$ view expenditures when in need of LTC as a strong necessity and optimally desire to consume the necessary amount, but not much more. They estimate $\theta_x < 1$ which implies a high value of marginal expenditure in LTC even when above the necessary amount. Our finding that $\theta_x > 1$ implies that LTC expenditures should not increase much with wealth. In the Appendix, we provide suggestive evidence from the HRS that on average, past the wealth threshold of \$110K, the additional spending associated with high disability remains fairly constant with increasing wealth. However, since there are strong data limitations, we do not take a strong stance on this parameter.

spouse is 3.61. This ensures we match the slow dis-saving rates of married couples.

4.4 Model Fit

The benchmark model matches well the moments targeted in the calibration (Table 3) as well as additional features observed in the data that have not been explicitly targeted (Tables 4 and 5). First, we observe that the model performs very well in capturing the important differences across education groups in terms of wealth patterns and Medicaid recipiency, revealing that the heterogeneity we allow for across groups is sufficient in producing patterns consistent with the data.

As stated earlier, it is crucial for our model to match Social Insurance (SI) and Medicaid recipiency rates for singles and couples. Table 4 shows that our model does a very good job matching these rates by education, marital status and IC availability. Married individuals, especially those in the non-college group, are considerably less likely than singles to receive SI when not highly disabled (14% vs 22% among the non-college group), and our model approximates this well.

For highly disabled individuals we see the following key Medicaid recipiency patterns. First, among the non-college group, the Medicaid rate is only 27% for married vs. 42% for single individuals. The Medicaid rates for those lacking IC are similar across marital status groups (approximately 50%). They are much lower for those with IC, especially when married: 23% of married vs 35% of singles receive Medicaid in the presence of IC. Second, among college graduates, Medicaid rates are much lower and vary much less with marital status and IC. Our model does an excellent job replicating the overall patterns.[29]

[29] The model misses out on a couple of statistics: it generates too high a fraction of government transfer recipients among those not highly disabled (.27 vs .22 in the data), and too high a fraction of Medicaid LTC recipients for those without IC (.60 vs .50 in the data). This is likely because the non-college asset profiles for singles are lower in the model than observed in the data. Another possibility is that in reality, single non-college individuals might find it more costly to apply for Medicaid LTC benefits or might not be aware of their eligibility for some benefits (e.g., Lockwood (2018)).

Table 4: Social Insurance and Medicaid Recipiency Rates, Model and Data

A. Fraction of individuals 65+ who are not highly disabled and who receive Social Insurance				
	Non-college		**College**	
	Model	**Data**	**Model**	**Data**
Singles	0.27	0.22	0.11	0.11
Married	0.13	0.14	0.07	0.09
B. Fraction of individuals 65+ who are highly disabled and who receive Medicaid				
	Non-college		**College**	
Singles	**Model**	**Data**	**Model**	**Data**
All	0.43	0.42	0.16	0.15
No IC	0.60	0.50	0.19	0.19
IC	0.32	0.35	0.12	0.10
Married				
All	0.22	0.27	0.10	0.11
No IC	0.54	0.54	0.12	0.14
IC	0.17	0.23	0.09	0.10

Notes: Medicaid recipiency in Panel B is calculated only for households where at least one member is 65+ and is highly disabled.

Table 5: Statistics on Negligible Wealth and Median Wealth, Model and Data

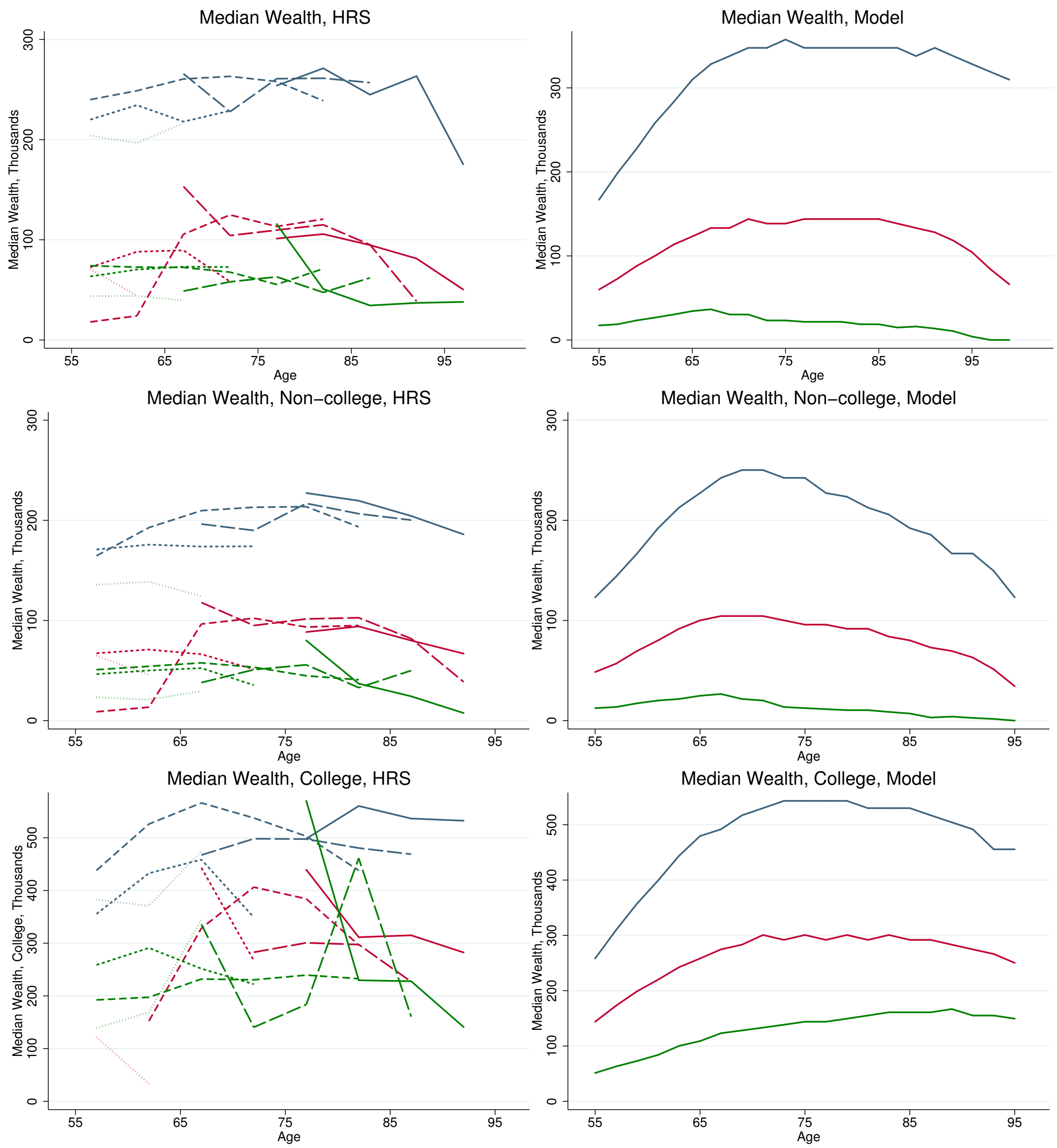
	Non-college		**College**	
Moment	**Model**	**Data**	**Model**	**Data**
Fraction w/ assets<10K, ages 65-69				
Singles	0.31	0.32	0.12	0.15
Married	0.10	0.09	0.01	0.03
Median wealth, singles, period before death	123.13	127.02	283.19	289.72
Median wealth left to widows	198.89	173.49	367.65	358.02

Notes: Median wealth in thousands of dollars.

The model matches very well the median assets at retirement and the median assets inherited by widows/widowers (both targeted in the calibration), as well as median assets of singles in the period before death (not targeted) (see Table 5). In regards to the wealth distribution, another important aspect of the model is capturing the fraction of households with negligible wealth since this is related closely to reliance on Medicaid LTC and the absence of a bequest. The model matches well the fraction of households with negligible wealth (lower than $10K) at the age of retirement, separately for singles and married households (not targeted), as well as in the last period before death for singles (targeted).

Figure 4 plots the median household wealth by age, for intact couples (blue), widows/widowers (red), and always single households (green). The model performs well in matching the median levels for married and widowed households, by education. However, it generates median asset profiles that are lower than the data for singles. It also matches well the shape of the assets profile for college educated married individuals where median wealth does not decline until very late in life. However, it predicts a somewhat faster dis-saving rate for the non-college group.

Figure 4: Median Wealth, Model and Data



Notes: Blue= Married households; Red= Widows and widowers; Green= Singles. We exclude observations where assets exceed $2 million. The medians are taken within cohort/marital status/5-year age groups, dropping groups with fewer than 10 observations. The cohorts plotted in the HRS data are: AHEAD, CODA, HRS, Warbabies, and Early Babyboomers. In married households, the age and education correspond to those of the husband.

5 Results

To begin, we present the frequency of high disability by demographic group. Table 6, panel A, shows the distribution of the number of model periods of high disability. For example, among single men without a college degree who reach 65, 79% experience zero disability periods, 12% one period, 5% two periods and 4% three or more periods of high disability. We see that women (who live longer) are more likely to experience disability and for a higher number of periods. Non-college men and women have slightly higher disability occurrence than their college educated counterparts. Panel B shows frequencies of high disability in the absence of IC. As we will see later in the analysis, these states are significantly worse. Single college educated women are most likely to experience disability periods and for longer in the absence of IC.

Table 6: Distribution of individuals, by high disability periods per lifetime

A. Number of model periods highly disabled					
Demographic Group, at age 65	**0**	**1**	**2**	**3+**	**Total**
Single NC Male	78.9	12.0	5.4	3.7	100
Single C Male	81.1	11.1	4.6	3.2	100
Single NC Female	69.0	15.8	7.9	7.3	100
Single C Female	69.5	15.6	7.8	7.1	100
Married NC Male	73.5	14.8	6.9	4.9	100
Married C Male	77.5	13.1	5.5	3.9	100
Married NC Female	68.0	16.3	8.3	7.4	100
Married C Female	68.6	16.1	8.1	7.1	100
B. Number of model periods highly disabled and without IC					
Demographic Group, at age 65	**0**	**1**	**2**	**3+**	**Total**
Single NC Male	90.0	6.5	2.4	1.1	100
Single C Male	87.2	8.3	3.2	1.3	100
Single NC Female	85.8	8.8	3.5	2.0	100
Single C Female	82.8	10.4	4.3	2.6	100
Married NC Male	92.9	5.7	1.1	0.4	100
Married C Male	89.9	7.8	1.7	0.6	100
Married NC Female	87.0	8.6	2.8	1.6	100
Married C Female	84.1	10.4	3.6	2.0	100

Notes: The reported marital status is at the age of 65. The model period is 2 years. NC=non-college; C=college.

5.1 The Effect of a High Disability Shock

We first study the effects of a high disability shock with and without IC in our model. We run several counterfactuals: (1) no men (women) experience a high disability shock at age 73, (2) all men (women) experience a shock at age 73 and draw IC according to our estimated probabilities, (3) all men (women) have a shock at 73 and have IC , and (4) all men (women) have a shock at

73 and no IC.[30] We allow disability shocks at all other ages to occur according to the estimated benchmark model probabilities and spouses are not affected, so we run all experiments separately for men and women. Tables 7 and 8 show the effects on household expenditures at ages 73/74, assets in the next period (at age 75), the fraction qualifying for Medicaid LTC (in the cross-section of individuals aged 73+), and the fraction dying without leaving a bequest.

While we restrict/force high disability shocks only at age 73, these shocks are very persistent so their occurrence has long lasting large effects. Single men with a shock at age 73 qualify for Medicaid LTC 16% of the time vs. only 2% if they did not have a shock (Tables 7). They die leaving zero bequests 50% of the time vs. only 39% without the shock. Assets in the next period are $38K lower compared to when no shock occurs, and spending is $19K higher.

We see striking differences across the counterfactuals where individuals have IC at the time of the shock vs. when they do not. For single men, in the absence of IC, spending is $15K higher, assets are lower, Medicaid LTC recipiency is 8pp higher and dying without leaving a bequest is 12pp more likely.

We see similar patterns for married men, but because they have higher assets to begin with, the effects of the LTC shock at age 73 on Medicaid and bequests are smaller. The LTC shock implies they qualify for Medicaid LTC 7% of the time vs 2% without the shock. The probability of dying without leaving a bequest increases only slightly, driven entirely by married men without IC.

Table 8 presents the same results for women. Interestingly, we see that household spending at age 73 increases by approximately $10K less for women than for men when the LTC shock occurs ($17K less when no IC is present).[31] This is because women are much more likely to live longer with high disability and without IC (see Table 6), so the household needs to save more for the future.

[30]The probability if a high disability shock at age 73 is 3.7% for men and 2.8% for women.

[31]Without the LTC shock at age 73, spending is similar for men and women even though the average age of the spouse differs depending on whether we look at wives or husbands at age 73.

Table 7: Effect of a High Disability Shock at age 73, Men

	Counterfactual			
	No LTC Shock	LTC Shock	LTC Shock, has IC	LTC Shock, no IC
Marital Status				
Single				
Medicaid LTC (%)	0.02	0.16	0.13	0.21
Zero Bequest (%)	0.39	0.50	0.46	0.58
Assets, age 75	138.49	100.46	111.07	85.55
HH Spending, age 73	66.11	84.79	74.18	99.70
Married				
Medicaid LTC (%)	0.02	0.07	0.07	0.14
Zero Bequest (%)	0.20	0.23	0.21	0.38
Assets, age 75	390.97	328.85	336.45	270.13
HH Spending, age 73	120.89	166.33	158.73	225.05

Note: Marital status corresponds to that at age 73. If the individual was married at 73, he is included in the "married" sample until death.

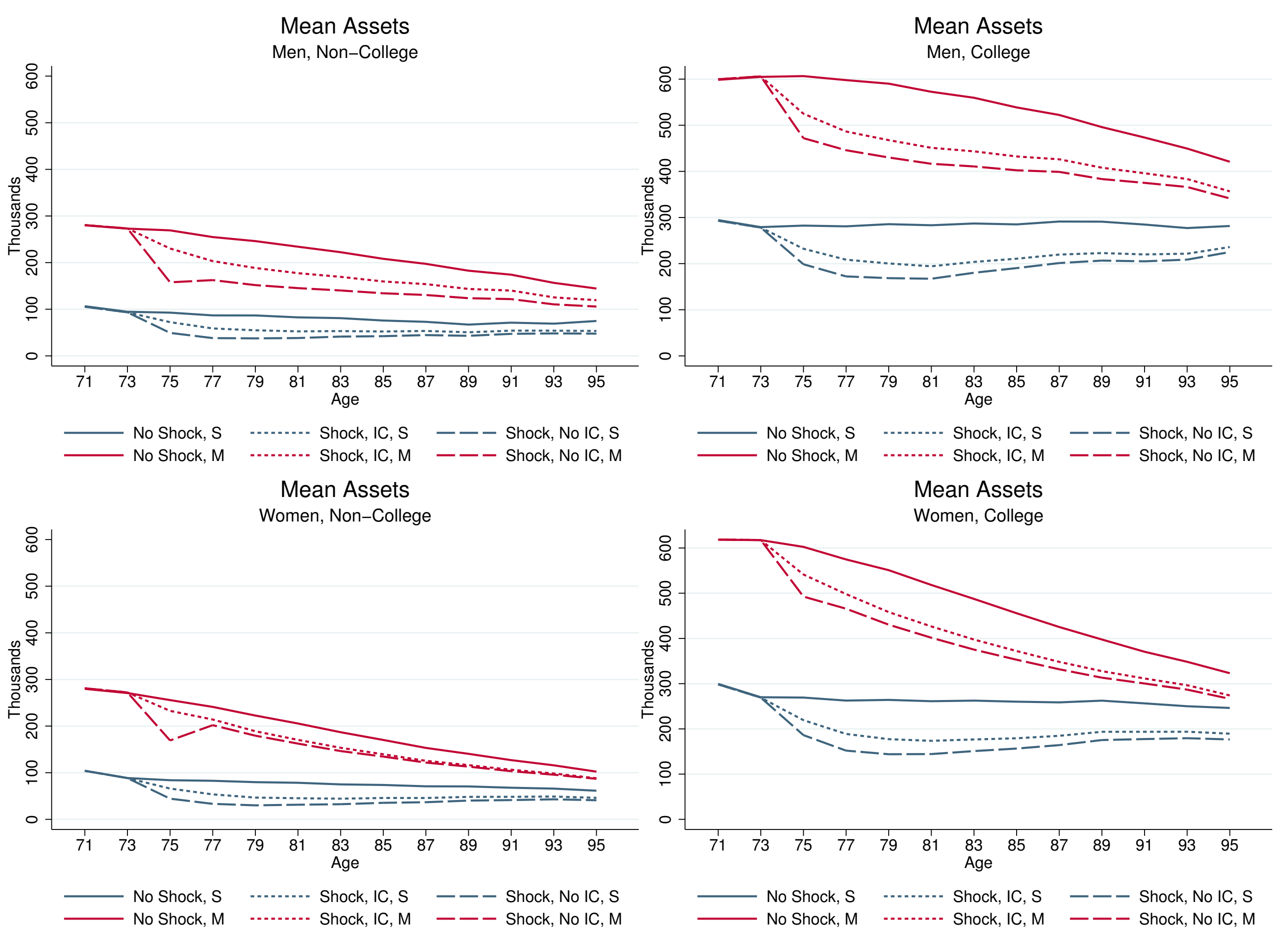
Table 8: Effect of a High Disability Shock at age 73, Women

	Counterfactual			
	No LTC Shock	LTC Shock	LTC Shock, has IC	LTC Shock, no IC
Marital Status				
Single				
Medicaid LTC (%)	0.03	0.15	0.13	0.19
Zero Bequest (%)	0.43	0.54	0.50	0.61
Assets, age 75	126.35	93.04	100.67	76.47
HH Spending, age 73	60.22	76.27	68.63	92.84
Married				
Medicaid LTC (%)	0.02	0.08	0.07	0.12
Zero Bequest (%)	0.26	0.29	0.26	0.38
Assets, age 75	393.75	344.55	353.73	292.91
HH Spending, age 73	121.64	156.99	147.82	208.64

Note: Marital status corresponds to that at age 73. If the individual was married at 73, she is included in the "married" sample until death.

Figure 5 shows how average wealth evolves after the shock at age 73 for the different counterfactuals. The figures show the patterns by gender, education and marital status, where the marital status category is constructed based on the marital status at the age of 73. First, we note that for all groups, assets drop at age 75 due to an LTC shock, and they drop by much more if no IC is present. The drop in assets is greatest among the college educated groups with higher initial wealth. The average dis-saving at the time of the shock is substantial, especially in households where the male experiences the shock at 73.[32][33] These graphs highlight the large impacts of LTC shocks on savings in old age and the cushioning effects of IC.

Figure 5: Mean Assets - Experiments with and without LTC shocks at 73



Note: Marital status corresponds to that at age 73. If the individual was married at 73, he/she is included in the "married" sample until death. S=single, M=married.

[32]However, the dis-saving is fastest for women who were married at the time of the shock. Women are more likely to become widowed in subsequent periods, losing significant wealth with the death of the husband.

[33]When reading these graphs, we keep in mind that fewer individuals are present as age increases, and more individuals die early in the counterfactual where all experience a shock at age 73.

5.2 LTC Impact on Expenditures and Consumption

5.2.1 Household Expenditures by LTC state

We now describe the model's predictions about household spending, separating the cases where a member is highly disabled (i.e., has LTC needs) vs. when no member needs LTC. We compare our results for single households with findings from the existing literature (i.e., De Nardi et al. (2016a) and Ameriks et al. (2020)) and then consider how the distribution of spending differs for married households where a member is highly disabled.

In the previous section, we looked at the effects of LTC shocks for the *same* individuals. Here, we compare individuals in the benchmark model who have LTC shocks with those who do not. Therefore, differences in spending by LTC state and across single/married couples arise from a variety of factors, including different demographics (age, sex), education, permanent income and wealth.

Household Expenditures of Singles

Figure 6 shows the cross-sectional distribution of annual expenditures for singles aged 75 and above who are not widows/widowers and who do not receive Medicaid. The left panel shows the distribution for singles without LTC needs and the right panel the distribution for those who need LTC. The median household spending for singles without high disability is around $19K (including both non-medical and out-of-pocket medical expenditures). This figure is comparable with consumption patterns presented in De Nardi et al. (2016a).[34] When one becomes highly disabled and in need of LTC, the distribution of household spending shifts to the right and the median increases to $37K. Around 10% of single individuals in need of LTC (and without Medicaid) spend more than $80K.

Ameriks et al. (2020) employ a model similar to the one used here and find that median spending of singles without LTC needs is around $40K, and it increases to about $90K when LTC needs are present. These figures are significantly higher than ours ($19K and $37K in our benchmark). However, the sample of individuals they study, using data from the Vanguard Research Initiative, is much wealthier than ours – the median wealth in their model is generally above $400K for singles of age 75-90 and for us it is about $100K (our 90th percentile of wealth is approximately $400K). The spending of singles at the 90th percentile in our benchmark model is $55K without LTC needs and $80K when LTC becomes necessary. Hence, the spending pattern of singles in our benchmark is approximately in line with previous literature.

[34] In De Nardi et al. (2016a), the average individual non-medical consumption of the middle permanent income quantile is around $12K and the average out-of-pocket medical consumption without Medicaid payment for the same income quantile (age 74 and older in their model) is approximately $6K. This sums to $18K.

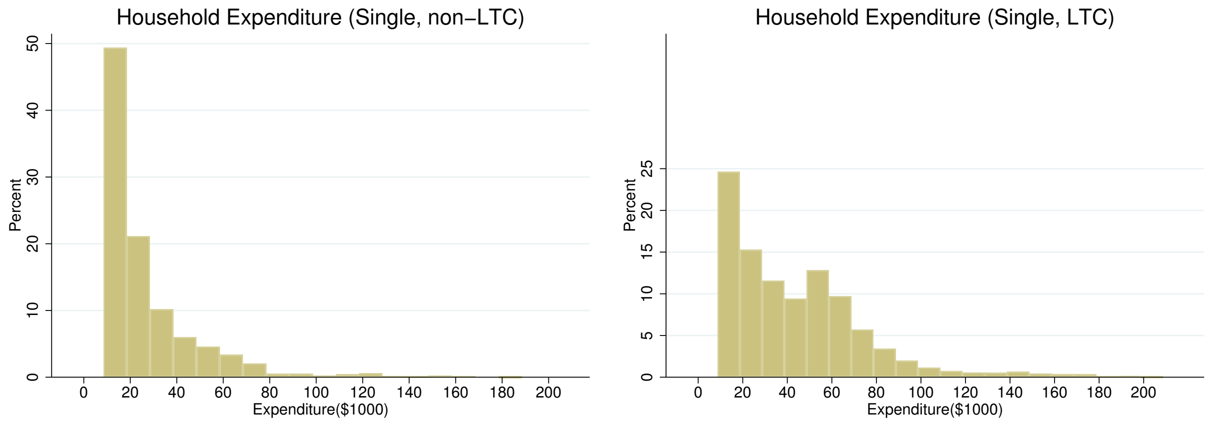
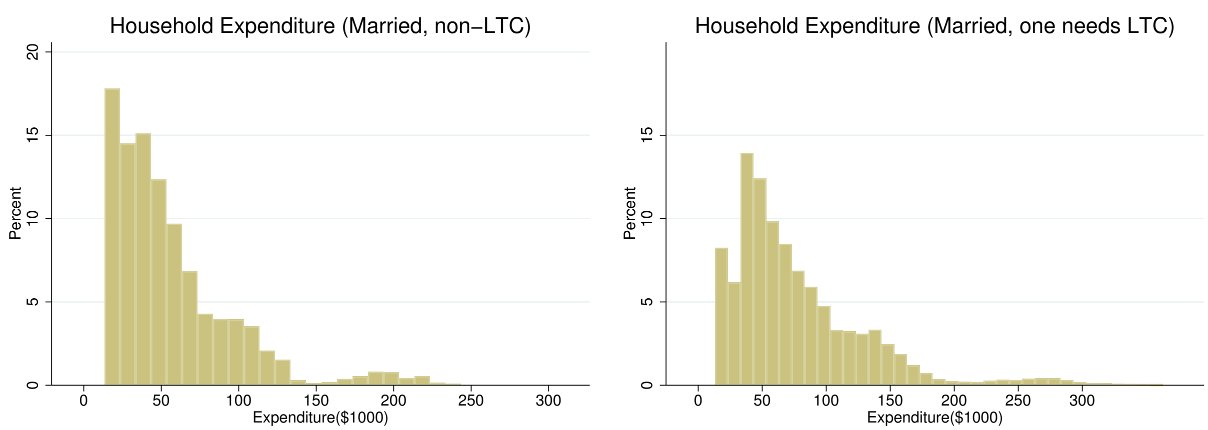


Figure 6: Distribution of household spending age 75+ (single, no Medicaid/Social Insurance)

Household Expenditures of Married Couples

Figure 7 shows the cross-sectional distribution of household expenditures by LTC status for married couples with husbands aged 75+ who do not receive Medicaid. The median household spending is around \$45K when no LTC is needed, and it becomes \$64K when one spouse is in need of LTC. The shift in the spending distribution is less strong than for singles.[35]

Figure 7: Distribution of household spending age 75+ (married couples, no Medicaid/Social Insurance)



Informal Care and Expenditures

Informal care serves as an important form of insurance against LTC risk for the elderly, in particular for those who are married (see Figure 3). Table 9 displays household spending conditional

[35]Note that these are households who are not receiving Medicaid. De Nardi et al. (2016a) finds that Medicaid provides valuable insurance for singles against LTC risk. Indeed, about 36% of singles receive Medicaid when they become highly disabled and require LTC. However, the Medicaid recipiency rate is much lower, about 19%, for married households with LTC needs.

on LTC needs and IC. We observe that spending is much lower for households with IC.

Table 9: Household Spending by LTC Status: Role of Informal Care

	No LTC	LTC Needed		
Household Type	Spending mean ($)	No IC ($)	With IC ($)	Fraction with IC
Single	26.6	71.3	32.5	56.1%
Married Couple	56.3	114.3	71.2	81.0%

Notes: Age 75 and above. Those receiving Medicaid LTC are excluded from the sample. All values are in thousands of 2010 US dollars.

Allocation of Household Expenditures and Consumption for Married Couples

We now consider how household expenditures and consumption are allocated to each member in married households where only one member needs LTC. As described in section 3.11, when informal care is available, married couples enjoy additional insurance against LTC shocks that singles do not because of consumption sharing. A married household's expenditure on consumption is $(1+\lambda)c$ if there are no LTC needs, and when one member needs LTC, expenditure is $x^F + c + ME$ if there is no IC, and $x^F + \lambda c + ME$ when IC is available.

Table 10 decomposes married household spending into formal LTC spending and non-LTC spending by wealth level. We leave out households with wealth less than $300,000 and those receiving Medicaid.

Table 10: Allocation of Household Spending (Married Couples)

	No LTC	One spouse in need of LTC					
		No IC			With IC		
Wealth	Total spending	Total. spending	LTC x^F	Other spending $(c+ME)$	Total spending	LTC $(x^F - c)$	Other spending $(1+\lambda)c+ME$
300-350K	41.3	82.0	65.4	16.6	53.0	21.2	31.9
350-400K	48.2	86.0	68.1	17.9	66.4	26.4	40.0
400-450K	54.8	97.6	75.9	21.7	79.1	31.4	47.7
450-600K	67.3	117.6	89.4	28.2	96.2	38.1	58.1
600K+	118.1	188.7	137.3	51.3	158.1	62.3	95.8

Notes: Age 75 and above. Those receiving Medicaid LTC are excluded from the sample. All values are in thousand US dollars in 2010 and are per year.

The columns labeled "total spending" display the average annual total spending of married households. The columns labeled "LTC" and "other spending" decompose total spending into spending on formal care (x^F) excluding shared consumption, and "other household spending" which includes non-LTC consumption (c) and medical expenses (ME). When informal care is not available, LTC spending is equal to expenditure on formal care for the disabled spouse and other spending is equal to consumption (c) plus medical expenditures (ME). When IC is available, LTC spending is equal to $(x^F - c)$ and "other spending" includes expenditures on joint consumption and the medical expenses of the spouse who is not highly disabled, $(1+\lambda)c+ME$.

Table 10 reveals that among households without IC, a large share of expenditure goes towards the LTC spouse: at lower wealth levels of $300-350K, the share is 80%, and at high wealth levels of $600K+, the share is slightly smaller but still very high at 73%. Total household expenditures are lower among households with IC relative to those without IC by approximately $20 to $30K. LTC specific expenditures ($x^F - c$) are only 39% of total expenditures when IC is present, and this fraction remains constant as wealth increases. Regular non-LTC spending is approximately double in households where IC is available (see last column) compared to households that lack IC, while LTC spending is approximately 1/3 to 1/2 lower.

In Table 11 we report the actual consumption enjoyed by members of married households where one partner has LTC needs, with and without IC. The table indicates that both c and x are lower at all wealth levels for households lacking IC, in spite of the fact that expenditures are significantly higher for these households. This is not surprising given that the value of IC is estimated to be approximately $59K. In households where neither spouse requires LTC (see first column in Table 11), the consumption (c) enjoyed by both spouses is higher than if LTC care needs are present, independent of IC status. When one spouse is highly disabled, the non-disabled spouse sacrifices some consumption. However, the sacrifice made by the healthy spouse is lower when informal care is available.

Table 11: Consumption of Married Households with LTC Needs

	No LTC	One spouse in need of LTC			
		No IC		With IC	
Wealth	c	c	$x\ (=x^F)$	c	$x\ (=x^F+x^I)$
300-350K	20.0	13.7	65.4	17.4	67.9
350-400K	24.3	15.2	68.1	22.4	78.1
400-450K	28.5	18.8	75.9	27.1	87.8
450-600K	36.1	25.8	89.4	33.2	100.6
600K+	66.6	48.5	137.3	55.7	147.2

Notes: Age 75 and above. c denotes the consumption of the spouse who is not highly disabled and x denotes the consumption of the highly disabled spouse.

5.3 LTC Shocks, Medicaid and Informal Care

The analysis in section 5.2 on household expenditures and consumption has been limited to households who do not receive Medicaid. However, entering a Medicaid LTC state is associated with very low utility so Medicaid aversion is an important driver of savings in old age (e.g. Ameriks et al. (2020), De Nardi et al. (2021)). In this section, we study in more detail the model predictions regarding Medicaid, and in particular, the importance of IC for different groups.

Borella et al. (2018) show that permanent income is a main determinant of Medicaid in old age in addition to household demographics. Table 12 shows the fractions of individuals receiving Medicaid in our model by marital status, education, and permanent income decile, keeping only highly disabled individuals. College educated individuals only qualify at low income levels. However, among non-college educated households, even the high income decile groups qualify for Medicaid, especially among singles. As documented in previous literature, Medicaid is an important source of insurance valued by even high income groups (e.g., De Nardi et al. (2016a), Braun et al. (2017)).

Table 12: Fractions with Medicaid if Highly Disabled, by Permanent Income

	Income Decile									
	1	2	3	4	5	6	7	8	9	10
Single										
College	1.00	0.37	0.13	0.06	0.03	0.01	0.01	0.00	0.00	0.00
Non-college	1.00	0.99	0.85	0.61	0.30	0.24	0.16	0.09	0.03	0.00
Married										
College	0.95	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Non-college	1.00	0.67	0.22	0.14	0.11	0.07	0.03	0.01	0.01	0.00

We run logit regressions of an indicator equal to one if the person receives Medicaid LTC on the following characteristics: informal care, income decile, sex, and age.[36] We run these separately by education and marital status, keeping only highly disabled individuals. Table 13 presents the results. Our focus is on the informal care coefficients. We see that these coefficients are negative and statistically significant for all groups. However, the coefficient on IC for married non-college individuals is by far the largest in absolute value, followed by non-college singles. This shows that IC protects married non-college households the most, holding everything else fixed.

[36] We estimated various specifications including with income deciles as categorical. The coefficients on IC change little.

Table 13: Logit Regression Results of Medicaid LTC, Households with High Disability

	Single, NC	Single, C	Married, NC	Married, C
Has IC	-3.78***	-1.25***	-9.89***	-2.09***
	(0.04)	(0.06)	(0.17)	(0.21)
Income Decile	-1.41***	-1.78***	-2.68***	-6.77***
	(0.01)	(0.03)	(0.04)	(0.24)
Female	0.79***	0.39***	0.11*	-0.35**
	(0.03)	(0.07)	(0.06)	(0.15)
Age	0.04***	0.03***	0.15***	0.15***
	(0.00)	(0.00)	(0.00)	(0.01)
Observations	76131	27902	38416	6460
Pseudo R^2	0.664	0.621	0.777	0.816

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: For college educated married individuals, we keep only the lowest 5 income decile groups as those above never qualify for Medicaid.

5.4 LTC Risk and Life-Cycle Saving

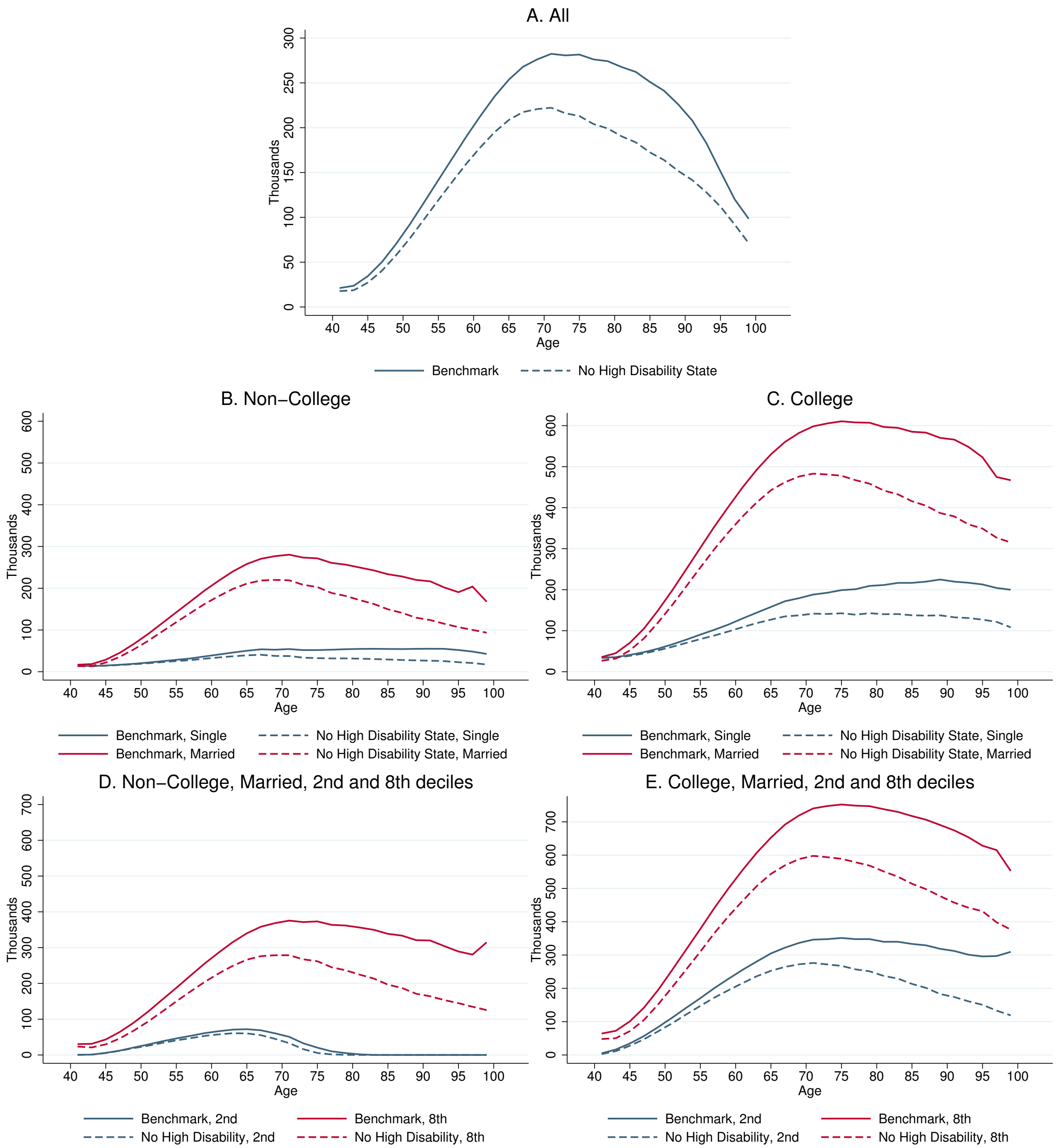
We now describe the impact of LTC and the availability of informal care, as well as Medicaid LTC, on household saving. To do this, we perform a series of counterfactual experiments where we change various aspects of the model (i.e., LTC risk, IC probabilities, Medicaid) and compare the results to the benchmark.

5.4.1 Precautionary Savings Due to LTC Risk

Our first experiment investigates the impact of LTC on savings behavior. We conduct a counterfactual experiment where we eliminate the possibility of the high disability (LTC) state. Specifically, we set the probability of transitioning to the high disability state from any other health state to zero, and we add these transition probabilities to those of transitioning to low disability status. Individuals with low disability do not require LTC, consume regular consumption c and incur medical expenditures ME.

Figure 8 shows mean asset holdings by age in the benchmark and counterfactual, for all and by education and marital status. There are several channels through which asset profiles are affected in the counterfactual. First, households no longer need to save for LTC expenditures. Second, households save more for longevity since they survive to older ages. Third, the shape of the assets profile depends on which groups have higher survival rates: higher educated individuals who are wealthier survive to older ages, raising average assets profiles. When we remove high disability, more low wealth individuals survive longer, lowering average assets in old age. Overall, in the absence of the LTC state, average assets profiles are considerably lower and start declining at a much younger age. Compared to the benchmark, average assets at age 65 are \$43K (18%) lower.

Figure 8: Counterfactual: Asset Holdings without LTC Risk



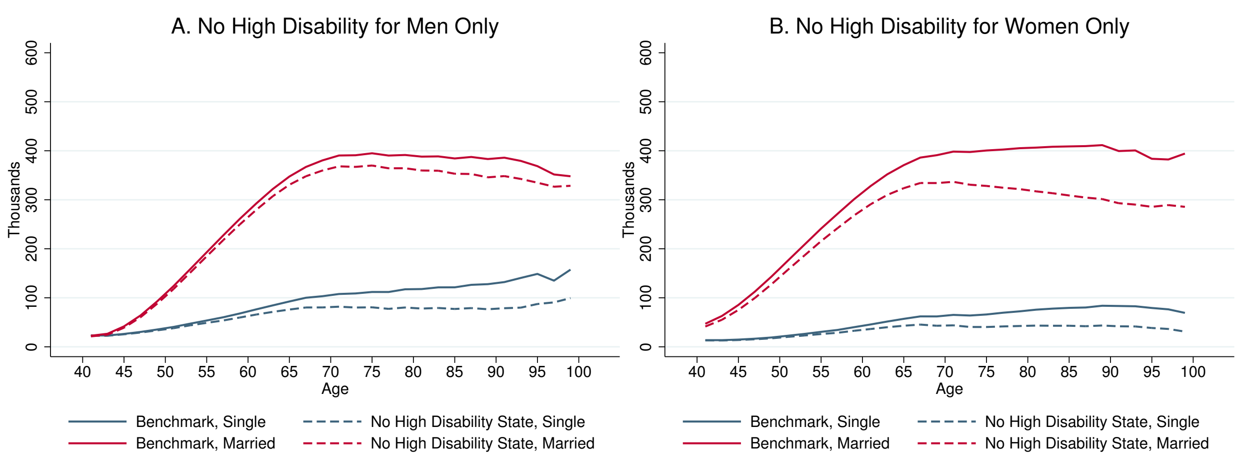
Note: Singles in the figure are individuals who have always been single. We exclude widows and widowers in Panels B and C.

Looking by marital status and education, we see that it is the married individuals, and especially the college educated whose savings decline the most in the absence of LTC risk. As noted by De Nardi et al. (2021), because couples hold most of the wealth, their saving behavior in response to LTC risk is particularly important. Married couples hold significantly higher wealth levels than singles, and average assets decline by much larger amounts in the counterfactual.

The last two panels in Figure 8 focus on married individuals, by education, comparing the 2nd and 8th deciles. College educated married households in the second decile have considerable wealth, and they react strongly to the elimination of LTC risk. The non-college educated in the 8th permanent income decile are very similar to the 2nd decile married households. But among the non-college married households, the low permanent income groups have little wealth and react little in the counterfactual. When we look at singles (not shown), we also find similar to non-college married households that only the top income groups hold significant assets and react to LTC risk. These results are consistent with findings in previous literature that higher income singles choose to self-insure against LTC risk while lower income singles rely heavily on Medicaid. However, we note that all income deciles (within education and marital status groups) decrease their savings in response to removing LTC risk.

Finally, we compare the effects of LTC risk for men and women only. We run two separate counterfactuals, first removing LTC risk only for men, and second removing it only for women. Figure 9 shows the results for single and married men (Panel A) and single and married women (Panel B). We see that the average household assets of married men decline by a relatively small amount when LTC risk is eliminated for men only compared to the much bigger decline in average household assets when women's LTC risk is eliminated. Women are considerably more likely to experience periods of disability in the benchmark (see Table 6), so much of the married households' savings are due to women's LTC risk.

Figure 9: Counterfactual: Asset Holdings without LTC Risk, by Sex



Note: Singles in the figure are individuals who have always been single. We exclude widows and widowers. Panel A shows household wealth for always single males and married couples (by the age of the men). Panel B shows household wealth for always single women and married households (by the age of the women).

5.4.2 The Role of Informal Care

In this section, we focus on the role played by informal care in particular in determining saving behavior. We conduct a counterfactual where we eliminate informal care for all households and compare asset patters with the benchmark. Panel A in Figure 10 shows that average asset holdings rise substantially in aggregate. At age 65, average assets are $25K (10%) higher. Assets rise substantially for married couples, by $35K or 10% at age 65 since a high fraction of them have IC in the benchmark, and when removed, they accumulate higher precautionary savings. In contrast, singles' savings increase by only $6K at age 65.

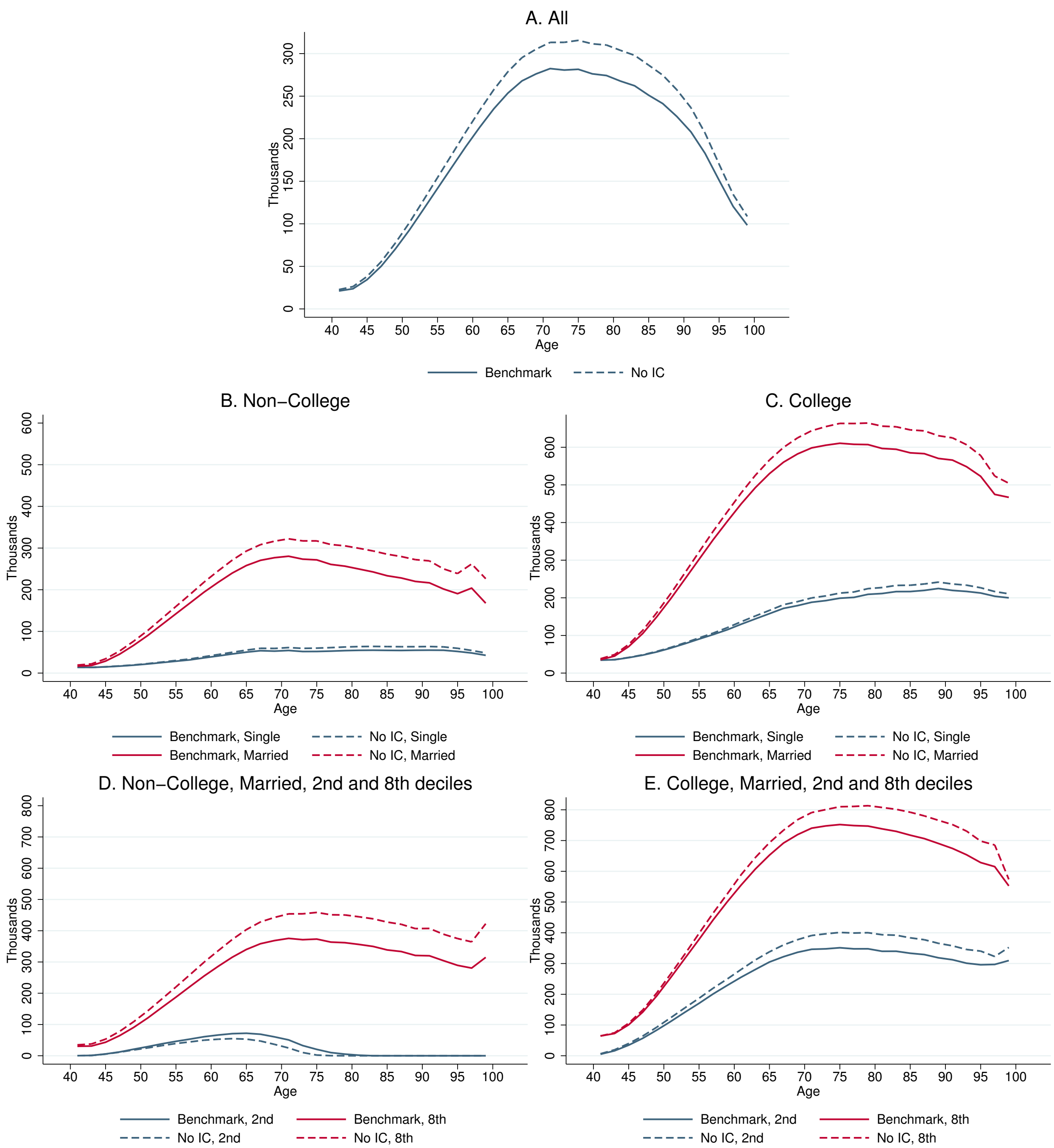
However, these aggregate patterns mask heterogeneous effects by income groups. The bottom two panels of Figure 10 present assets by education for married households by permanent income group. For the college educated group, the absence of IC leads to substantial increases in assets for both the low and high permanent income groups. However, for the non-college, this is the case only for the high income groups. Interestingly, the assets of the low income non-college group *decrease* in the absence of IC. This is because they are more exposed to LTC risk, and Medicaid LTC becomes even more likely. It is well known that means-tested programs discourage asset accumulation since they act as a tax on savings in times of need (e.g., Hubbard et al. (1995)). The absence of IC strengthens this channel.

Table 14 shows average assets by marital status, education, permanent income deciles, across the experiments, aggregating all ages in the cross-section. We see that for non-college singles, it is only the top 4 deciles that increase precautionary savings in the absence of IC. Generally, in each sub-group, the bottom deciles reduce their savings. IC is an important factor that raises the savings of low income households, encouraging them to accumulate precautionary savings since it helps them stay off Medicaid LTC.

In light of this finding, we explore the extent to which IC affects wealth inequality across individuals at age 65, before any LTC shocks take place. Table 15 Panel A shows that the fraction of 65 year old individuals in households with negligible assets (defined as less than $10K) increases from 13% to 14% in the absence of IC. The 25th percentile of wealth declines from $66K to $60K, but the higher percentiles shown in the table rise significantly in the absence of IC. Panel B shows the share of wealth held by different percentiles among households where the male is 65 years old. We see that the shares held by the bottom 40% and the top 20% decline, but the shares held by the 40th to 70th percentiles increase. More wealth is concentrated in this middle part of the distribution as it is these households that increase their savings most significantly when IC is absent.

Table 16 displays Medicaid recipiency rates when hit by LTC shocks by marital status and education in the benchmark and in the "No IC" counterfactual experiment. We see that when informal care is removed, non-college groups qualify at much higher rates for Medicaid LTC: there is an increase of 19pp for individuals always single, 21pp for married households, and 9pp for widows/widowers. Overall, the Medicaid recipiency rate of those in the LTC state increases from 31% in the benchmark to 42% without IC. Government expenditures on Medicaid LTC increase by 145% from the Benchmark in the cross-section. This highlights the high value of IC and the associated Medicaid LTC savings associated with the presence of IC.

Figure 10: Counterfactual: Removing Informal Care



Note: Singles in the figure are individuals who have always been single. We exclude widows and widowers in Panels B and C.

Table 14: Average Assets (thousands), Benchmark and no Informal Care (IC), by Permanent Income

	Income Decile									
	1	2	3	4	5	6	7	8	9	10
Always Single										
College										
Benchmark	0.0	5.0	27.0	47.0	64.1	86.4	111.2	158.6	230.8	421.6
No IC	0.0	4.2	30.4	53.8	73.3	94.6	119.9	167.5	239.5	429.3
Non-college										
Benchmark	0.0	0.0	1.1	5.7	10.6	16.0	25.7	40.8	70.8	164.1
No IC	0.0	0.0	1.1	5.2	8.5	15.7	30.6	49.6	81.9	174.3
Married										
College										
Benchmark	13.2	181.1	209.6	233.6	264.7	314.7	360.9	414.5	500.0	812.3
No IC	11.4	203.5	236.1	260.2	294.8	348.4	389.3	441.2	532.9	835.6
Non-college										
Benchmark	0.0	29.6	71.8	91.5	113.1	142.2	168.1	197.3	239.5	386.8
No IC	0.0	21.7	52.0	105.6	154.8	179.6	206.3	235.0	275.8	414.1
Widows/Widowers										
College										
Benchmark	0.5	135.9	183.7	219.9	254.1	298.1	344.2	408.3	499.1	843.1
No IC	0.4	154.3	213.7	254.0	291.7	336.3	380.3	443.0	534.7	870.4
Non-college										
Benchmark	0.0	3.6	28.3	51.2	77.5	107.8	133.4	163.4	205.9	357.2
No IC	0.0	2.0	13.5	59.0	117.3	146.8	173.5	205.5	248.9	393.3

Table 15: Wealth Inequality, Benchmark and no IC

Panel A	Mean	Wealth Percentile				
	% Negligible Assets	25th	50th	75th	90th	95th
Benchmark	0.13	66.25	227.26	399.15	641.21	800.85
No IC	0.14	59.94	300.70	455.56	686.63	835.67

Panel B: Share of household wealth by percentile					
	0-20	**20-40**	**40-60**	**60-80**	**80-100**
Benchmark	0.003	0.053	0.147	0.263	0.533
No IC	0.003	0.047	0.156	0.277	0.517

Note: Panel A is the distribution of wealth among individuals. This sample includes men and women in married households separately, at the age when they are 65. Assets are in thousands. Panel B is constructed keeping only households where the male is 65, so this is the distribution of households level wealth.

Table 16: Medicaid Recipiency Rate, Highly Disabled Individuals, Benchmark and No IC

	Benchmark	No IC
Always Single		
College	0.24	0.29
Non-college	0.51	0.69
Married		
College	0.11	0.13
Non-college	0.23	0.44
Widows/Widowers		
College	0.14	0.16
Non-college	0.39	0.48

5.4.3 The Role of Medicaid LTC Insurance

In this section, we aim to better understand how LTC Medicaid affects singles and couples. We perform a counterfactual where we reduce the Medicaid LTC benefit, x_{med}, by 10%. Figure 11 presents mean asset holdings by age. Overall, assets increase by 5.4% at age 65. The fraction of individuals aged 65+ that receive Medicaid when in an LTC state declines from 31% to 22%. The largest drop in Medicaid recipiency is among the always single non-college group who experience a decline from 51% to 35% (see Table 17). We also see in Figure 11 that it is the non-college group and the lower income deciles that increase their assets the most in response to lower Medicaid benefits. It is the groups that are at highest risk of relying on Medicaid in the Benchmark that increase asset holdings as to now reduce their chances of qualifying for the limited benefit Medicaid program. College educated married individuals experience very little change in assets on the other hand. Among them, only the low income deciles increase precautionary savings due to increased public care aversion. In sum, Medicaid insurance affects mostly the low-middle income groups that have high chances of qualifying and for whom higher precautionary savings are feasible.

Figure 11: Counterfactual: Reducing Medicaid LTC Benefit

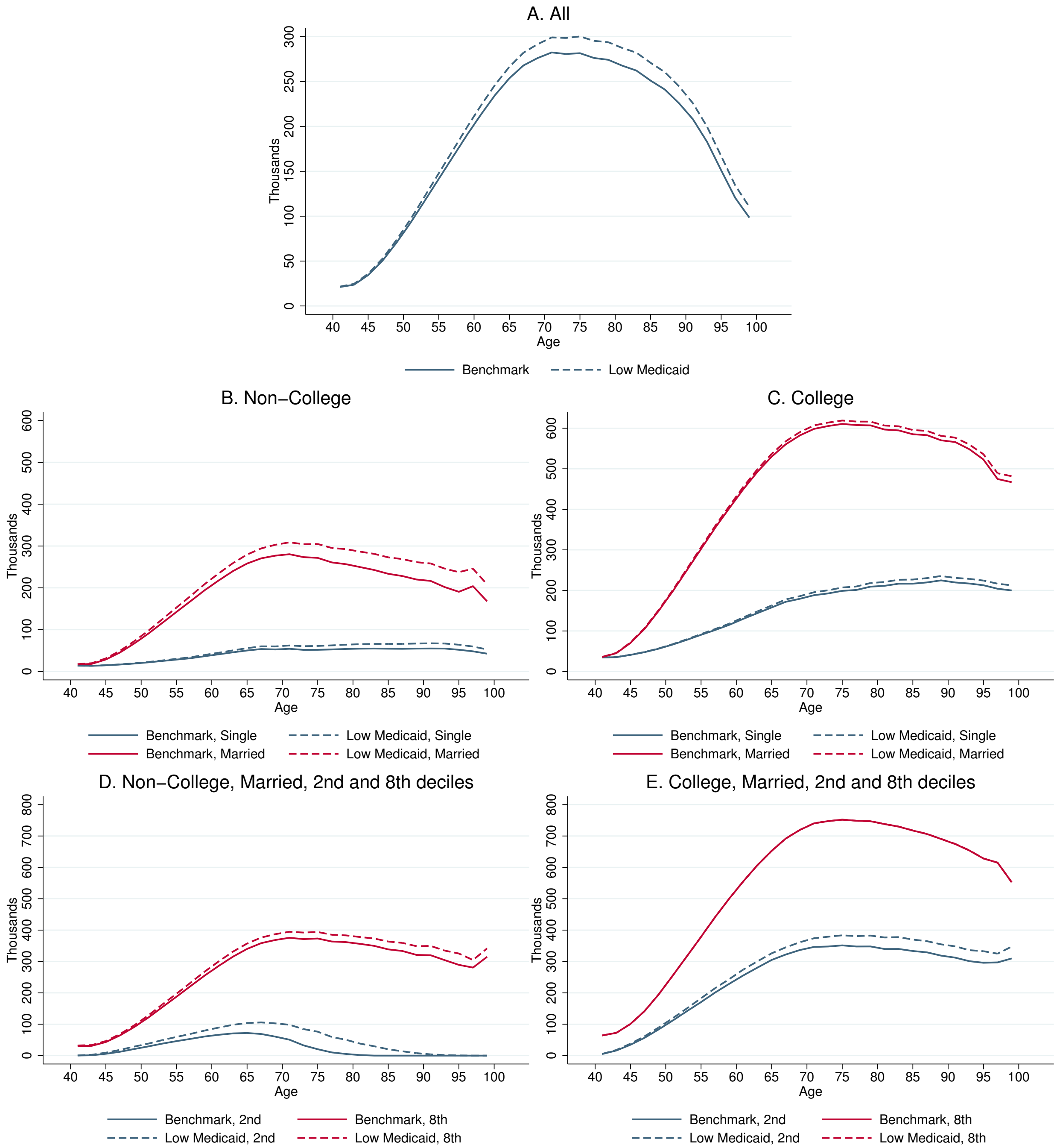


Table 17: Medicaid Recipiency Rate Among Highly Disabled Individuals, Benchmark and Lower Medicaid Counterfactual

	Benchmark	Lower Medicaid Benefits
Always Single		
College	0.24	0.17
Non-college	0.51	0.35
Married		
College	0.11	0.09
Non-college	0.23	0.16
Widows/Widowers		
College	0.14	0.12
Non-college	0.39	0.26

5.4.4 LTC Risk for Married Couples

In our final experiment, we consider how asset accumulation changes if LTC risk were eliminated for married couples *while they are married* only. That is, to the extent that the costs associated with needing LTC are attenuated by the higher probability of informal care and consumption sharing, it might be possible that couples do not change their saving behavior substantially relative to the benchmark. Instead, married couples save because one member is very likely to eventually be alone and single.

Figure 12: Mean Assets for Married Couples: No LTC Risk While Married v.s. No LTC Risk Always

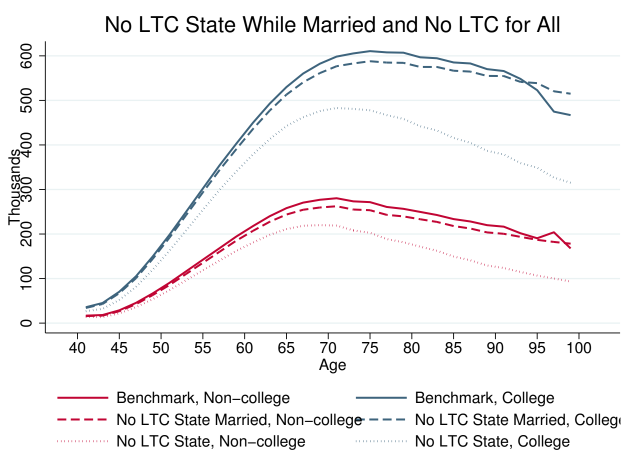


Figure 12 confirms this hypothesis. The decline in mean assets is very modest if LTC risk is eliminated only for individuals in households where a spouse is present. This shows the strength of intra-household insurance through IC and consumption sharing. If LTC risk is eliminated entirely, there is a much more dramatic decrease in mean assets. Clearly, the savings by married households in response to LTC risk are primarily in response to the risk associated with becoming a widow or widower with LTC needs. As we saw in Figure 9, it is mainly the women's need for LTC that dominates this precautionary saving motive.

6 Conclusion

In this paper we have studied a calibrated life cycle model with both single and married households in order to better understand the differential impact of LTC shocks and informal care on these households' consumption and saving behavior. Using the HRS, we estimate IC probabilities for heterogeneous individuals, taking into account education, marital status, age, and spousal characteristics. IC provision in married couples occurs at high rates and provides substantial insurance against LTC shocks together with the ability to share consumption since IC provisions often prevents institutionalization. Singles are forced to rely more heavily on Medicaid as insurance when hit by LTC needs. We explore the importance of IC and Medicaid insurance for different groups.

Informal care is an important determinant of saving behavior in old age. Without IC, asset holdings at age 65 would increase by 10%. Middle and high income groups, especially those highly educated and married, increase precautionary savings significantly. However, an interesting finding is that low income households, especially singles, decrease their savings when IC is absent because they become more likely to qualify for the means-tested Medicaid LTC program which taxes away their assets when they are hit by LTC shocks. This is an important finding that indicates that policy that encourages IC provision for the poor and that allows them to live at home while in an LTC state (such as Medicaid LTC benefits for non-institutionalized highly disabled individuals) would encourage asset accumulation for this group and help decrease the costs of public insurance programs. Without IC, the Medicaid LTC recipiency rate increases to 42% from the 31% level in the benchmark. Total expenditures on Medicaid LTC rise by 145%. This highlights the importance of IC and demographic/marital structure of the population for government insurance programs. We also find that while LTC risk is an important savings motive for both single and married households, the savings of married couples associated with LTC risk is primarily attributable to the risk associated with the household becoming a widow or widower with LTC needs. Only a relatively small amount assets are accumulated to insure LTC risk while married.

Our paper abstracts from housing which could interact in important ways with the availability of informal care and formal care demand. Nakajima and Telyukova (2020) study how home ownership affects retirees' saving decisions, and Barczyk et al. (2022) build a model where family members bargain over home ownership and care arrangements. We also abstract from endogenous marriage and divorce decisions. Persson (2020) finds that marital behavior is a key component of couples' strategies to plan for financial security in old age. Given the value of marriage for insuring LTC risk, it would be interesting to take this into account when studying marital decisions and the distribution of the marital surplus across genders in future research.

References

Ameriks, J., J. Briggs, A. Caplin, M. D. Shapiro, and C. Tonetti (2018, October). The long-term-care insurance puzzle: Modeling and measurement. Working Paper 22726, National Bureau of Economic Research. 1, 6

Ameriks, J., J. Briggs, A. Caplin, M. D. Shapiro, and C. Tonetti (2020). Long-term-care utility and late-in-life saving. *Journal of Political Economy 128*(6), 2375–2451. 1, 2, 7, 3.8, 3.13, 4.3, 27, 28, 5.2.1, 5.2.1, 5.3

Ameriks, J., A. Caplin, S. Laufer, and S. Van Nieuwerburgh (2011). The joy of giving or assisted living? Using strategic surveys to separate public care aversion from bequest motives. *The journal of finance 66*(2), 519–561. 1, 23

Arrow, K. J. (1974). Optimal insurance and generalized deductibles. *Scandinavian Actuarial Journal 1974*(1), 1–42. 6

Attanasio, O., H. Low, and V. Sanchez-Marcos (2008, September). Explaining changes in female labor supply in a life-cycle model. *American Economic Review 98*(4), 1517–52. 4.2

Barczyk, D., S. Fahle, and M. Kredler (2022). Save, Spend, or Give? A Model of Housing, Family Insurance, and Savings in Old Age. *Review of Economic Studies*, rdac081. 21, 6

Barczyk, D. and M. Kredler (2018). Evaluating long-term-care policy options, taking the family seriously. *The Review of Economic Studies 85*(2), 766–809. 1, 2, 3.7, 18, 27, C

Bonsang, E. (2009). Does informal care from children to their elderly parents substitute for formal care in Europe? *Journal of health economics 28*(1), 143–154. 10

Borella, M., M. De Nardi, and E. French (2018). Who receives Medicaid in old age? Rules and reality. *Fiscal Studies 39*(1), 65–93. 2, 5.3

Braun, R. A., K. A. Kopecky, and T. Koreshkova (2017). Old, sick, alone, and poor: A welfare analysis of old-age social insurance programmes. *The Review of Economic Studies 84*(2), 580–612. 2, 3.13, 5.3

Braun, R. A., K. A. Kopecky, and T. Koreshkova (2019). Old, Frail, and Uninsured: Accounting for Features of the U.S. Long-Term Care Insurance Market. *Econometrica 87*(3), 981–1019. 1

Brown, J. R. and A. Finkelstein (2007). Why is the market for long-term care insurance so small? *Journal of Public Economics 91*(10), 1967–1991. 1

Brown, J. R. and A. Finkelstein (2008). The interaction of public and private insurance: Medicaid and the long-term care insurance market. *The American Economic Review 98*(3), 1083–1102. 1, 1

Brown, J. R. and A. Finkelstein (2011). Insuring long-term care in the United States. *The Journal of Economic Perspectives 25*(4), 119–141. 1

Brown, J. R., G. S. Goda, and K. McGarry (2016). Heterogeneity in state-dependent utility: evidence from strategic surveys. *Economic Inquiry 54*(2), 847–861. 6

De Nardi, M. (2004). Wealth inequality and intergenerational links. *The Review of Economic Studies 71*(3), 743–768. 3.8

De Nardi, M., E. French, A. Gooptu, and J. B. Jones (2012). Medicaid and the elderly. *Economic Perspectives 36*(Q I), 17–34. 2

De Nardi, M., E. French, and J. B. Jones (2010). Why do the elderly save? The role of medical expenses. *Journal of Political Economy 118*(1), 39–75. 1, 2, 6, 4.3

De Nardi, M., E. French, and J. B. Jones (2016a). Medicaid insurance in old age. *The American Economic Review 106*(11), 3480–3520. 1, 2, 3.13, 4.3, 23, 5.2.1, 5.2.1, 34, 35, 5.3

De Nardi, M., E. French, and J. B. Jones (2016b). Savings after retirement: A survey. *Annual Review of Economics 8*(1), 177–204. 2, 23

De Nardi, M., E. French, J. B. Jones, and R. McGee (2021, May). Why Do Couples and Singles Save during Retirement? Household Heterogeneity and its Aggregate Implications. Working Paper 28828, National Bureau of Economic Research. 2, 3.13, 4.3, 5.3, 5.4.1

Dynan, K. E., J. Skinner, and S. P. Zeldes (2002). The importance of bequests and life-cycle saving in capital accumulation: A new answer. *American Economic Review 92*(2), 274–278. 2

Finkelstein, A., E. F. Luttmer, and M. J. Notowidigdo (2009). Approaches to estimating the health state dependence of the utility function. *American Economic Review 99*(2), 116–21. 6

Gruber, J. and K. M. McGarry (2023, November). Long-term care in the united states. Working Paper 31881, National Bureau of Economic Research. 2

Guner, N., Y. Kulikova, and J. Llull (2018). Reprint of: Marriage and health: Selection, protection, and assortative mating. *European Economic Review 109*, 162–190. Gender Differences in the Labor Market. 4.2

Hendren, N. (2013). Private information and insurance rejections. *Econometrica 81*(5), 1713–1762. 1

Hubbard, R. G., J. Skinner, and S. P. Zeldes (1995). Precautionary saving and social insurance. *Journal of political Economy 103*(2), 360–399. 5, 5.4.2

Hurd, M. D. (1989). Mortality risk and bequests. *Econometrica: Journal of the econometric society*, 779–813. 2

Jones, J. B., M. De Nardi, E. French, R. McGee, and R. Rodgers (2020, March). Medical spending, bequests, and asset dynamics around the time of death. Working Paper 26879, National Bureau of Economic Research. 2, 3.12

Ko, A. (2022). An equilibrium analysis of the long-term care insurance market. *The Review of Economic Studies 89*(4), 1993–2025. 1, 2

Kopecky, K. A. and T. Koreshkova (2014). The impact of medical and nursing home expenses on savings. *American Economic Journal: Macroeconomics 6*(3), 29–72. 1, 2, 4

Kotlikoff, L. J. and L. H. Summers (1981). The role of intergenerational transfers in aggregate capital accumulation. *Journal of political economy 89*(4), 706–732. 2

Lakdawalla, D. and T. Philipson (2002). The rise in old-age longevity and the market for long-term care. *The American Economic Review 92*(1), 295–306. 1, 2

Lillard, L. A. and Y. Weiss (1997). Uncertain health and survival: Effects on end-of-life consumption. *Journal of Business & Economic Statistics 15*(2), 254–268. 2, 6

Lockwood, L. M. (2018, September). Incidental bequests and the choice to self-insure late-life risks. *American Economic Review 108*(9), 2513–50. 1, 2, 23, 29

Mommaerts, C. (2022). Long-term care insurance and the family. 2

Nakajima, M. and I. A. Telyukova (2020). Home equity in retirement. *International Economic Review 61*(2), 573–616. 21, 6

Nakajima, M., I. A. Telyukova, et al. (2018). Medical expenses and saving in retirement: the case of US and Sweden. *Federal Reserve Bank of Minneapolis Opportunity and Inclusive Growth Institute Working Paper 8*. 21

Persson, P. (2020). Social insurance and the marriage market. *Journal of Political Economy 128*(1), 252–300. 6

Poterba, J., S. Venti, and D. Wise (2011). The composition and drawdown of wealth in retirement. *Journal of Economic Perspectives 25*(4), 95–118. 2

Appendix to “Long Term Care Risk For Couples and Singles”

A Data and Sample Selection

The main data set used in our analysis is the Health and Retirement Study (HRS). We use three user-friendly versions of the HRS produced by the RAND Center for the Study of Aging: (1) the RAND HRS Longitudinal File 2016 (V1) which contains 13 waves of data from 1992 to 2016, (2) the Harmonized HRS data which contains 12 waves from 1992-2014, and (3) the RAND HRS Family data files (V1) which also contains 12 waves from 1992 to 2014. The first longitudinal file contains variables that include demographics, health, income, assets, medical expenditures and insurance. The second harmonized file contains detailed information on ADLs, IADLs, and formal and informal care and costs of care. The third family file contains information on transfers to and from children.

Our analysis is conducted using data from waves 5 to 12, covering years 2000 to 2014. We use all seven cohorts of the HRS: Initial HRS, AHEAD, Children of Depression (CODA), War Baby, Early Baby Boomer, Mid Baby Boomer and Late Baby Boomer cohorts. All statistics are calculated using the combined respondent weight and nursing resident weight variable (r*wtcrnh). We exclude all households who own private long term care insurance.

B Education

The two education groups are: (1) non-college (less than 16 years of education) and (2) college (16 or more years of education). For married households, we assume that household’s education is given by that of the husband. We also assume that if the husband dies, the widow continues as a single individual, keeping the same education level. We find that non-college women married to college educated husbands have health transitions and medical expenditures that are more similar to college single women than non-college single women. Therefore, our assumptions regarding household education are reasonable.

In all the data work, when constructing any statistics by education for married/widowed women, we change their education status to that of the husband. In the HRS, the education of the late husband is available if he was alive at the time of the first interview. If a female respondent is widowed before the first interview, this information is missing, and we keep her own education status. In MEPS, the education of the late husbands is usually not available as MEPS is a short panel, so we use the widows’ own education levels. Since we use MEPS only for statistics on non-retirees, there are very few widows.

C Health Variable Construction

In the HRS, we construct health using information on self reported health, 6 ADLs, 5IADLs, and informal and professional care received. The self-reported health measure is the standard variable where respondents rate their health as excellent, very good, good, fair or poor. The 6 ADL variables used ask whether the respondent gets help with: (1) walking across a room, (2) dressing, (3) bathing, (4) eating, (5) getting in and out of bed, and (6) using the toilet. In each case, the respondent answers "yes" or "no."

The HRS also has information on total hours of care received from a spouse/children/others. Following Barczyk and Kredler (2018), we classify individuals as highly disabled if they receive at least 90 hours of care per month. We also categorize them as highly disabled when they answer yes to having professional care (PC) or when they report living in a nursing homes (NH) at the time of interview.

The following table summarizes how the health variable is constructed using this information.

Health	Self Reported Health	Hours of IC/ Has PC/ NH	No. of ADLs
Good	Good/V. Good/Excellent	any IC, no PC/NH	0
Bad	Fair or Poor	any IC, no PC/NH	0
Low Disability	any	<90 hrs/month, no PC/NH	1+ ADL or IADL
High Disability	any	90+ hrs/month OR PC/NH	1+ ADL or IADL

We assume that there is no disability at ages younger than 65. In the MEPS, where we use data only on individuals younger than 65, we construct the health variable based on self reported health only, coding it as Good or Bad.

D Age Structure

The model period is 2 years. All ages in the model are odd numbers starting with 35.

D.1 Married Couples: Age Differences Between Spouses

While on average wives are a few years younger than their husbands, there is a large variance in age differences between spouses across households. Table L.2 shows the distribution of wive's ages in the HRS for married men at the age of 65. We are interested in capturing this heterogeneity while keeping the model simple and tractable. We discretize the possible age differences into three groups based on the following analysis.

Table L.2 reveals that the distribution of age differences between spouses is very similar across education groups. Based on the distribution in this table, we construct three groups as follows: the first group contains wives who are 8 or more years younger than the husbands; the second groups contains wives who are between 1 and 7 years younger; and the third group contains wives who are the same age or older than their husbands. The first and the third groups each contains approximately 20% of couples, while the second group contains approximately 60% of couples. The mean and median age difference in each one of these groups is given in

Table L.3. We assign these median values as the age difference corresponding to each group in the model. (Minor adjustments are made to accommodate the fact that all ages are odd numbers in the model.) Specifically, the wives in the model have the following ages relative to the husband: (1) 10 years younger; (2) 4 years younger; and (3) 2 years older.

E Initial Distributions

E.1 Demographic Structure at Age 35

Since our paper is focused on ages 65 and above, it is important to have the right demographic structure at these ages. Note that because we abstract from marriage and divorce, we cannot simply start the model with the demographic structure observed in the data at the age of 35. If we did this, the model would not deliver the correct demographic distribution at the age of 65 and older.

Our strategy is to calibrate an initial demographic structure at the age of 35 such that, given our estimated survival probabilities, we obtain a demographic structure at the age of 65 that matches the data. Because we abstract from marriage and divorce, the demographic structure in the model at young ages will not match the data perfectly.

The initial demographic structure at the age of 35 is given by $\Lambda^{35}(d)$. The state d summarizes the type of household, depending on education, on whether it is a single or married household, on sex in the case of singles, and on the age difference between husband and wife in the case of married households. There are 10 possible values of d corresponding to different types of households:

d	Marital status	Education	Sex	Wife Age-Husband Age
1	single	college	f	-
2	single	non-college	f	-
3	single	college	m	-
4	single	non-college	m	-
5	married	college	-	-10
6	married	college	-	-4
7	married	college	-	+2
8	married	non-college	-	-10
9	married	non-college	-	-4
10	married	non-college	-	+2

The specific strategy for calibrating $\Lambda^{35}(d)$ is the following:

1. We guess a demographic structure at the age of 35 given by $\Lambda^{35}_{guess}(d)$.

2. We simulate a large number of households that evolve according to our estimated health transitions and survival probabilities.

3. We compare the distribution of d at the age of 65 in the simulated data with that observed in the data (HRS).

4. We iterate on $\Lambda^{35}_{guess}(d)$ until the distribution at the age of 65 is as in the data: $\Lambda^{65}_{model}(d) = \Lambda^{65}_{HRS}(d)$.

Table L.4 presents the distribution of households at ages 64-66 observed in the CPS and the resulting distribution in the model after calibrating $\Lambda^{35}(d)$. We use CPS data from 2000-2014 for this exercise since the CPS has a much larger sample size. We use ages 64-66 instead of only 65 to have more observations in the data. We use the CPS sampling weights, and while the CPS contains only non-institutionalized individuals, not many are in nursing homes at ages 64-66. We see in Table L.4 that our model does a very good job approximating the demographic distribution seen in the data. Table L.5 presents the calibrated distribution $\Lambda^{35}(d)$.

E.2 Initial Health

The initial distribution of health for households aged 35 is estimated using the MEPS. We keep all respondents aged 33-36 inclusive in order to have enough observations. The distribution is estimated by marital status, sex, education of the household, and for married women, by their age relative to the husband. The estimated distribution is presented in Table L.6. We observe that in general, singles and lower educated groups are less healthy.

E.3 Initial Assets

We use CEX data to estimate the initial assets distributions $A_{s,j=1}(g,e,\eta)$ and $A_{m,j=1}(j^*,e,\eta)$. We keep single households and married households with male heads aged 33-36, and divide these into demographic groups by: gender and education (singles) and education and relative age of the wife (married). We then divide each group into wealth deciles (which we assume correspond to our 10 permanent income types) and calculate mean total wealth in each decile. We use total household wealth adjusted to 2010 dollars.

F Survival Probabilities

Survival probabilities are given by $\rho_s(j,g,e,h)$ for single individuals, $\rho_m(j,e,h)$ for husbands, and $\rho^*_m(j^*,e,h^*)$ for wives. We use the HRS to estimate biennial survival probabilities for ages 55 to 109. We then use linear interpolation to obtain survival for ages 35 to 53, assuming that the survival probability is 1 at the age of 35.

The HRS contains information on the exact date of death for each respondent who dies during the survey period. We first construct an indicator variable equal to 1 if the respondent dies within 2 years of the current interview date, and equal to 0 if he/she is known to be alive 2 years later. We then run logit regressions of this indicator on various controls:

1. For those in good health, we estimate logit models that include age, age squared, and marital status, separately by education and sex.

2. For those in bad health and those with low disability, we estimate logit models that include age, age squared, and marital status, separately by sex. Differences across education groups are not statistically significant, so the predicted mortality probabilities from these regressions are assigned to both groups.

3. For those in a high disability state, we estimate logit models that include age and age squared, separately by sex. Differences across education and marital status groups are not statistically significant. The predicted mortality probabilities from these regressions are assigned to both education groups and to both single and married individuals.

The mortality probabilities used in the model are the predicted probabilities from these regressions. Note that we do not use sampling weights when estimating mortality since that would leave very few observations among the very old (nursing home residents have sampling weights of zero). Also, since there are very few observations for ages greater than 99, we assume that survival probabilities at these ages are the same as at age 99. Figures M.1 and M.2 plot the estimated biennial mortality probabilities by age, for men and women, respectively.

G Health Status Transitions

Health status evolves according to a Markov process that depends on age, marital status, sex and education. It is given by $H_s(h', h, j, g, e)$ for singles, $H_m(h', h, j, e)$ for husbands, and $H_m^*(h^{*'}, h^*, j^*, e)$ for wives.

We begin by estimating health transition probabilities for ages 35-63 using the MEPS. At these ages, we assume that health takes one of two possible states (Good or Bad), so we estimate a total of 4 transition probabilities.[37] The MEPS has five rounds of interview over a two year period, so we use information from Rounds 1 and 5 to estimate biennial health transition probabilities. We treat health in Round 5 as h' and heath in Round 1 as h. We condition on the age and marital status reported in Round 1.

For each value of h, we construct an indicator equal to 1 if the respondent was in that state in both Rounds 1 and 5, and equal to 0 if the respondent was in that state in Round 1 but not in Round 5. We then run logit regressions of these indicators on age, age squared and marital status, separately for each sex-education group. Sampling weights are used. Finally, we use the predicted probabilities from these regressions as our estimated transition probabilities.

We then estimate health transition probabilities for ages 63-109 using the HRS. Starting with the age of 65, disability states become possible, so we estimate a total of 4x4=16 transition probabilities. We construct indicator variables capturing each possible transition and run probit regressions of these indicators. For transitions from good health, we include age, age squared, age cubed, marital status, and run separate probit regressions for each sex-education group. For transitions from bad health, we have fewer observations, so we do not run the regressions separately, but instead include sex and education as controls in the same regression. For transitions from disability states, we run the probit regressions on age, age squared and age cubed separately

[37] Figure M.3 shows that the fraction of individuals younger than 65 with disabilities is very small.

by gender, but we do not control for education and marital status due to the small number of observations.[38] At ages 95 and over, the number of observations becomes too small. Predicting probabilities out of sample at these ages is problematic due to the sharp exponential increase in some transitions. We therefore set the health transition probabilities at these ages equal to those at age 93.

Figures M.4 to M.7 plot all the estimated health transition probabilities, separately for men and women. Note that there are small discontinuities between the ages of 61 and 63 when we switch from the probabilities estimated using MEPS to those estimates using the HRS. These discontinuities are in part due to the different data sets used, but mainly due to the fact that starting with age 63, it becomes possible to transition to disability states.

H Informal Care

H.1 Does IC vary with income or wealth?

A potential concern is that high income or high wealth households might choose to buy formal care rather than receive informal care. This might be due to preferences or a concern for the welfare of those providing the informal care. If this is the case, IC should be endogenous in the model. However, we find that IC does not significantly depend on income or wealth in most cases. We run a probit model of IC on income and wealth group controlling for Medicaid, age, sex, education, wife age (if married), and cohort and year effects. The results are presented in Table L.7. We see that only married women in the top wealth group have a significant lower IC probability. Otherwise, IC does not vary with wealth. Household income is significant only for singles, where higher incomes are associated with a lower probability of having IC. However, we note that the number of observations in these regressions is relatively small. Also, wealth is endogenous in these regressions because more periods spent in an LTC state without IC lead to lower wealth. Therefore, these results provide mainly descriptive evidence of a lack of correlation between IC and wealth.

I Income Profiles

We estimate household income profiles using CPS data (ASEC supplement) from years 1990-2007. The income variable used is constructed as total personal income minus income from welfare, interest, dividends and rent. We CPI adjust this to 2010 US dollars. For married households, we add up the incomes of the two spouses. We then apply a formula that approximates the after-tax household income.

We then construct subgroups defined by age, health (good or bad), education, marital status, sex (if single) and the relative age of the wife to that of the husband and her health (if married).

[38] We use sampling weights, so nursing home residents (who have 0 sampling weights) are excluded. While we tried to run all regressions without weights, we found that the results were very similar until very old ages, but at very old ages the estimated transitions were not reasonable. We therefore use the estimating with weights, and predict probabilities at very old ages (when many respondents are in nursing homes) out of sample.

Within each sub-group, we calculate the household's income decile. We keep all individuals aged 35 to 84 and use sampling weights. We ultimately want to estimate the average incomes within these deciles, in each sub-group.

To obtain smooth income profiles, we run an OLS regression of log after tax household income on age, age squared, age cubed, income decile (categorical), college, health, and a categorical variable capturing marital status, sex if single and the relative age of the wife and her health if married. The age and education variables are those of the household head in the case of married households. We obtain the predicted values from this regressions. We multiply them by 2 since our model period is 2 years. Since income profiles are almost flat after age 83 and there are few observations at old ages, we assume that incomes remain flat from age 83 until the terminal age of 109.

Figure M.9 shows samples of the estimated smooth income profiles.

J Medical Expenditures

Each individual's OOP medical expenditures are given by $ME(j,g,e,h)$. They depend on the individual's age, sex, and health and on the household's education.

We estimate out-of-pocket (OOP) medical expenditures using the MEPS for individuals younger than 65, and using the HRS for those aged 65 and over. All medical expenditures are estimated at the individual level. (Household medical expenditures are equal to the sum of its members' medical expenditures.) Medical expenditures are only estimated for good, bad and low disability health states. For the high disability state, they are set to zero, as we assume all expenditures become part of LTC costs.

In both data sets, we CPI adjust medical expenditures to 2010 dollars. In MEPS, total out of pocket medical expenditures are provided at the annual level, for both (consecutive) years of interview. Since the model period is two years, we add these annual expenditures together. We then run an OLS regression of the 2-year OOP medical expenditures on age, age squared, sex, education, and health, using all individuals aged 35 to 63.[39] In this regression, we use the age and health status measured in Round 1, which covers on average the first 3 months of the first year of interview. We then use the predicted values from this regression, for each state, to estimate $ME(j,g,e,h)$.

We use the HRS to estimate medical expenditures for individuals in households aged 65 and over. Since households with heads 65 and over can include women as young as 55 (10 years younger than the husbands) we estimate $ME(j,g,e,h)$ for ages 55 to 109. In waves 3 and later, the RAND HRS reports the total out of pocket medical expenditures since the previous interview date, so these expenditures are for a period of approximately 2 years. We run an OLS regression of these medical expenditures on age, age squared, sex, education and health, using sampling weights. The age and health status are those at the interview date just prior to the two years when the medical expenditures are incurred. We exclude all households who receive Medicaid since Medicaid is endogenous in the model. Table L.8 presents the regression coefficients from the

[39] Sex, education and health are included as categorical variables.

MEPS and HRS regressions.

K Notes on Calibration and Computation

K.1 Fraction of individuals on Medicaid: Gender Differences

Using the HRS, we tabulate the fraction of individuals in an LTC state who report receiving Medicaid benefits. We show that these fractions vary very little with age or sex. Table L.9 reports the fractions of highly disabled individuals receiving Medicaid by marital status and sex. We see that in general, the differences between men and women are very small. In addition, while it appears that for singles the fractions decrease with age, there is little variation by age for the married groups. Table L.10 shows the fractions on Medicaid only for highly disabled married individuals, conditional on the health state of the spouse. Again, in general the differences across genders and age groups are relatively small and/or non-systematic. In addition, we see that the fractions for individuals with spouses in Bad and Low Disability states are very similar, so we combine these groups. Table L.11 shows the fractions of LTC individuals on Medicaid, combining men and women. Differences by age groups are small and non-systematic, with the exception of singles. Given these findings, our targets on the fractions of highly disabled individuals on Medicaid are constructed aggregating all age groups and combining men and women. (Table L.12 also shows that gender matters very little when statistics are aggregated across age groups, and constructed by household wealth. Women have only slightly higher fractions on Medicaid than men.)

K.2 Assets

We use data on assets from the HRS. Assets are constructed by adding (1) the net value of non-housing financial wealth (HwATOTF) and (2) the net value of IRA and Keogh accounts (HwAIRA). In the HRS, the net value of non-housing financial wealth is calculated as the sum of the appropriate wealth components less debt. Specifically, it is the sum of (1) the net value of stocks, mutual funds, and investment trusts (HwASTCK), (2) the value of checking, savings, or money market accounts (HwACHCK), (3) the value of CD, government savings bonds, and T-bills (HwACD), (4) the net value of bonds and bond funds (HwABOND), (5) the net value of all other savings (HwAOTHR), minus the value of other debt (HwADEBT).

K.3 Medicaid: spousal impoverishment rules

The U.S. Department of Health and Human Services provides information on the special Medicaid eligibility rules that apply to married couples. These are as follows. If one spouse is in an institution such as a nursing home and the other spouse is still living in the community, special spousal impoverishment rules apply. These are designed to prevent the community spouse from becoming impoverished. The community spouse is allowed to keep a portion of the couple's assets, usually equal to one-half of the couple's combined assets, up to a maximum of $115,920 in 2013. In about half of the states, if the couple has less than that in total assets the community spouse can keep all of the couple's assets. Also, at least some of the institutionalized spouse's income can be protected for the community spouse to use. In 2013, the maximum amount of the institutionalized spouse's income that can be protected for the community spouse is $2,898 per month ($69,552 per 2 years - our model period).

K.4 Model Computation

We solve the model backwards using value function iteration. At each age (corresponding to the household head), we solve the model for 2 education groups, 10 permanent income groups, 2 genders (for singles), 4x4 health states (for the household heads and spouses), 2x2 informal care states (for the household heads and spouses if highly disabled), 3 possible relative ages of the spouse (if married), and 200 grid points for assets. We then use the optimal decision rules and simulate the life-cycle profiles of 200,000 individuals randomly drawn from the initial distributions at the age of 35. We use this to construct simulated moments which we compare to the empirical moments from the actual data.

L Appendix Tables

Table L.1: Descriptive Statistics, HRS

Panel A.	(1) Married	(2) Singles	(3) Widowed
Age	73.75	73.14	80.81
Female	0.44	0.66	0.81
Total Wealth	400088.87	210716.26	226317.34
HH Annual Income	72280.56	44365.96	31118.88
In LTC State	0.06	0.09	0.18
Has Medicaid	0.04	0.19	0.13
Observations	45522	11598	23230

Panel B.	(1) Married	(2) Singles	(3) Widowed
Age	78.53	77.62	85.37
Female	0.46	0.70	0.84
Total Wealth	250986.64	87758.62	138892.38
HH Annual Income	49221.26	26306.78	23758.47
ADLs (max=6)	2.48	2.42	2.73
IADLs (max=5)	3.11	3.06	3.45
Has Informal Care (IC)	0.82	0.53	0.54
Lives in NH	0.19	0.38	0.44
Nursing Home (>100 days/past 2 yrs)	0.16	0.34	0.40
Has Medicaid	0.19	0.49	0.34
Observations	3012	1216	4652

Notes: Panel A presents statistics on all households in the HRS where the head is 65+, for years 2000-2014, constructed using sampling weights. Households where a member has private LTC insurance are excluded. Panel B presents statistics keeping only highly disabled individuals.

Table L.2: Distribution of Wive's Ages when Husbands are 65, HRS

Age	Percent	Cumulative	Percent	Cumulative
	Non-College		College	
33	0.06	0.06	-	-
36	0.06	0.12	0.19	0.19
37	0.06	0.18	-	-
38	0.12	0.3	0.56	0.74
39	0.12	0.42	-	-
40	0.24	0.67	0.37	1.11
41	0.36	1.03	0.37	1.48
42	0.12	1.15	-	-
43	0.12	1.27	0.37	1.85
44	0.42	1.7	0.37	2.22
45	0.18	1.88	0.56	2.78
46	0.42	2.3	0.37	3.15
47	0.55	2.85	0.37	3.52
48	0.42	3.27	0.56	4.07
49	0.42	3.7	0.19	4.26
50	0.97	4.67	1.11	5.37
51	0.61	5.27	0.74	6.11
52	0.97	6.24	0.37	6.48
53	1.39	7.64	1.11	7.59
54	2.55	10.18	1.85	9.44
55	3.45	13.64	3.33	12.78
56	3.03	16.67	3.15	15.93
57	3.52	20.18	3.52	19.44
58	4.91	25.09	3.52	22.96
59	7.27	32.36	5.56	28.52
60	7.39	39.76	7.96	36.48
61	10.48	50.24	11.48	47.96
62	10.12	60.36	8.7	56.67
63	10.91	71.27	11.85	68.52
64	8.79	80.06	10.37	78.89
65	7.58	87.64	10.56	89.44
66	3.76	91.39	3.52	92.96
67	3.03	94.42	1.48	94.44
68	1.21	95.64	1.48	95.93
69	1.09	96.73	1.48	97.41
70	0.61	97.33	0.37	97.78
71	0.55	97.88	0.56	98.33
72	0.48	98.36	0.19	98.52
73	0.55	98.91	0.74	99.26
74	0.36	99.27	-	-
75	0.18	99.45	0.37	99.63
76	0.18	99.64	0.19	99.81
77	0.06	99.7	0.19	100
81	0.06	99.76	-	-
83	0.12	99.88	-	-
85	0.06	99.94	-	-

Table L.3: Mean and Median Ages for Wives Within Groups, HRS

Age Group	Mean Age	Mean Age	Median Age	Median Age
	Non-College	College	Non-College	College
33-57	52.8	52.3	54	55
58-64	61.4	61.6	61	62
65+	67.3	66.8	66	66

Notes: The women in this sample are married to husbands who are 65 years old.

Table L.4: Distribution of Households, Age of Head 64-66, Data (CPS) and Model

Marital Status	Sex	Education	Wife Relative Age	CPS	Model
single	f	college	-	6.1	5.8
single	f	non-college	-	24.1	22.9
single	m	college	-	4.3	3.6
single	m	non-college	-	12.3	12.0
married	-	college	-10	2.9	3.7
married	-	college	-4	9.6	9.8
married	-	college	+2	4.9	5.0
married	-	non-college	-10	5.8	6.3
married	-	non-college	-4	19.1	20.5
married	-	non-college	+2	10.8	10.4

Notes: The wife's relative age equals to the age of the wife minus the age of the husband. The distribution is constructed using only singles and married men aged 64-66.

Table L.5: Calibrated Distribution of Households at Age 35

Marital Status	Sex	Education	Wife Relative Age	Distribution (%)
single	f	college	-	3.2
single	f	non-college	-	10
single	m	college	-	2.0
single	m	non-college	-	10.5
married	-	college	-10	4.5
married	-	college	-4	10.7
married	-	college	+2	5.7
married	-	non-college	-10	10.0
married	-	non-college	-4	31.7
married	-	non-college	+2	11.6

Table L.6: Initial Distribution of Health, at Household Age 35, MEPS

Marital Status	Sex	Education	Wife Relative Age	% by Health	
				Good	**Bad**
single	m	non-college	-	0.86	0.14
single	m	college	-	0.95	0.05
single	f	non-college	-	0.80	0.20
single	f	college	-	0.92	0.08
married	m	non-college	-	0.90	0.10
married	m	college	-	0.97	0.03
married	f	non-college	-10	0.86	0.14
married	f	college	-10	0.94	0.06
married	f	non-college	-4	0.87	0.13
married	f	college	-4	0.96	0.04
married	f	non-college	2	0.87	0.13
married	f	college	2	0.96	0.04

Notes: The initial distribution is calculated keeping respondents aged 34-36 inclusive.

Table L.7: Probit Regression Results of Informal Care on Income and Wealth

	Singles	Married M	Married W
HH Income	-0.007***	-0.002	0.001
	(0.001)	(0.002)	(0.002)
Wealth group =2	0.161	-0.102	-0.216
	(0.131)	(0.248)	(0.253)
Wealth group =3	0.113	0.140	-0.346
	(0.194)	(0.307)	(0.289)
Wealth group =4	0.167	0.194	-0.019
	(0.152)	(0.286)	(0.265)
Wealth group =5	0.237	0.353	-0.545**
	(0.151)	(0.289)	(0.243)
HH has Medicaid	-0.331***	-0.710***	-1.150***
	(0.086)	(0.196)	(0.184)
Year Effects	Yes	Yes	Yes
Cohort Effects	Yes	Yes	Yes
Age Effects	Yes	Yes	Yes
Educ & Sex (& Wife age if married)	Yes	Yes	Yes
Observations	1340	368	460

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table L.8: OLS Regression of OOP Medical Expenditures, MEPS and HRS

	MEPS	HRS
age	-46.346***	-171.629**
	(4.376)	(87.343)
agesq	1.023***	1.318**
	(0.056)	(0.582)
female	459.152***	426.899***
	(16.015)	(87.144)
college	448.631***	990.517***
	(18.664)	(102.054)
health=bad	968.763***	1460.437***
	(38.008)	(122.893)
health=low disability		2059.815***
		(438.195)
R^2	0.079	0.006

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: In MEPS, the regression are estimated using individuals aged 35 to 63. In the HRS, they are estimated using individuals aged 65 to 99. OOP medical expenditures cover a period of 2 years and are CPI adjusted to 2010 dollars.

Table L.9: Fraction of Highly Disabled Individuals Receiving Medicaid, by Sex and Marital Status, HRS

		Single		**Married**
Age Group	**Male**	**Female**	**Male**	**Female**
65-69	0.66	0.68	0.29	0.25
70-74	0.47	0.60	0.31	0.31
75-79	0.48	0.49	0.30	0.29
80-84	0.44	0.43	0.18	0.34
85+	0.36	0.47	0.27	0.26

Table L.10: Fraction of Highly Disabled Individuals Receiving Medicaid, if Married, by Spouse Health, HRS

Wives				**Health Spouse**
Age Group	**Good**	**Bad**	**Low Disability**	**High Disability**
65-69	0.12	0.36	0.33	0.71
70-74	0.23	0.36	0.44	0.60
75-79	0.22	0.29	0.50	0.67
80+	0.17	0.32	0.55	0.59
Husbands				**Health Spouse**
Age Group	**Good**	**Bad**	**Low Disability**	**High Disability**
65-69	0.21	0.38	0.33	0.50
70-74	0.19	0.43	0.44	0.67
75-79	0.16	0.47	0.22	0.67
80+	0.18	0.24	0.18	0.53

Table L.11: Fraction of Individuals with LTC Needs Receiving Medicaid, HRS

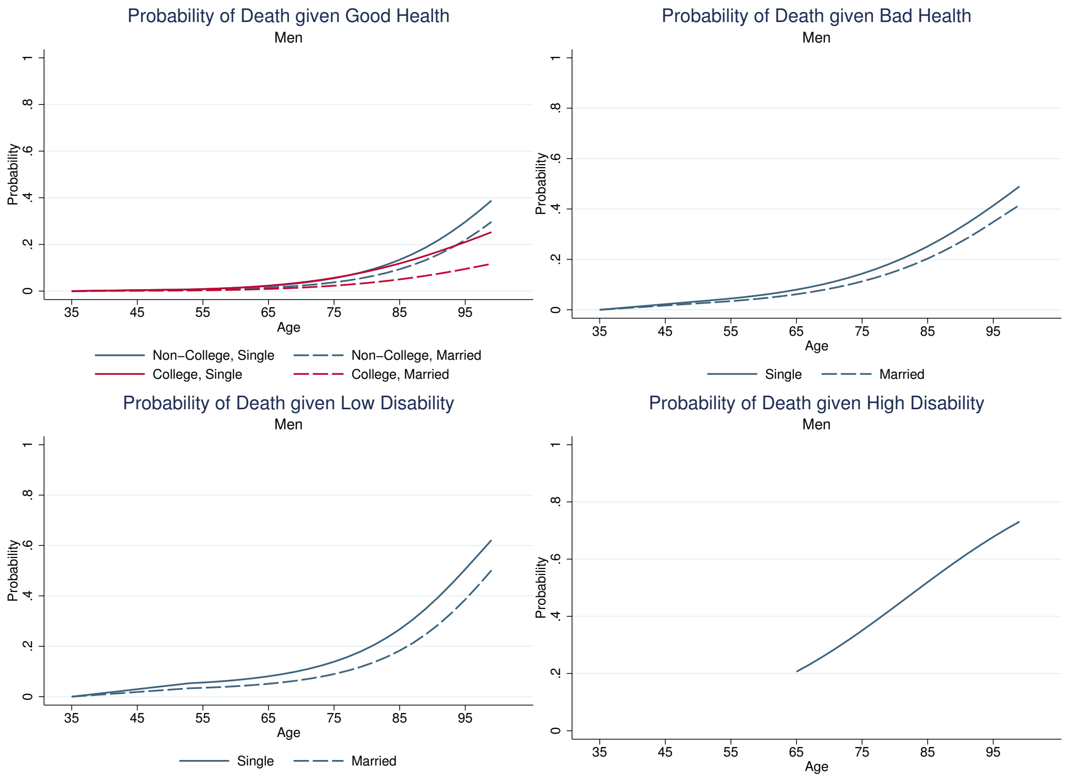
	Single	Married	Married, by Spouse Health		
Age Group	All	All	Good	Bad/Low disability	High disability
65-69	0.68	0.27	0.16	0.36	0.60
70-74	0.56	0.31	0.21	0.40	0.63
75-79	0.48	0.30	0.18	0.39	0.67
80-84	0.43	0.25	0.15	0.32	0.70
85+	0.45	0.26	0.21	0.27	0.49

Table L.12: Fraction of Individuals with LTC Needs Receiving Medicaid, HRS

	Single	Married	Married, by Spouse Health		
Sample	All	All	Good	Bad/Low disability	High disability
All	0.47	0.28	0.18	0.35	0.59
All, Wealth<120,000	0.54	0.36	0.25	0.41	0.76
All, Wealth<70,000	0.57	0.39	0.27	0.44	0.80
Men	0.43	0.27	0.18	0.34	0.57
Men, Wealth<120,000	0.52	0.34	0.24	0.39	0.73
Men, Wealth<70,000	0.54	0.37	0.26	0.42	0.73
Women	0.48	0.29	0.18	0.36	0.62
Women, Wealth<120,000	0.55	0.38	0.26	0.44	0.79
Women, Wealth<70,000	0.57	0.41	0.28	0.47	0.79

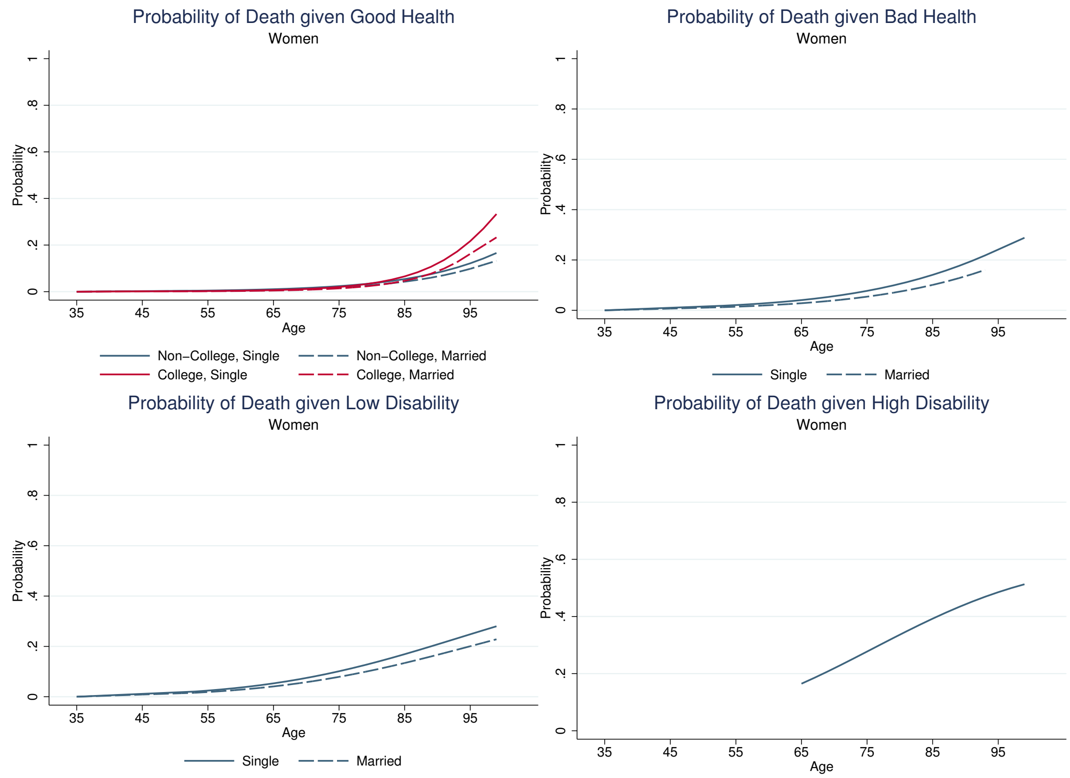
M Appendix Figures

Figure M.1: Estimated Biennial Mortality Probabilities, Men, HRS



Notes: We use the HRS to estimate biennial survival probabilities for ages 55 to 109. We then use linear interpolation to obtain survival for ages 35 to 53, assuming that the survival probability is 1 at the age of 35. Mortality probabilities for ages 101-109 are assumed to be equal to those at age 99. High disability is only possible at ages 65+ in the model.

Figure M.2: Estimated Biennial Mortality Probabilities, Women, HRS



Notes: We use the HRS to estimate biennial survival probabilities for ages 55 to 109. We then use linear interpolation to obtain survival for ages 35 to 53, assuming that the survival probability is 1 at the age of 35. Mortality probabilities for ages 101-109 are assumed to be equal to those at age 99. High disability is only possible at ages 65+ in the model.

Figure M.3: Fractions by Health and Disability, HRS

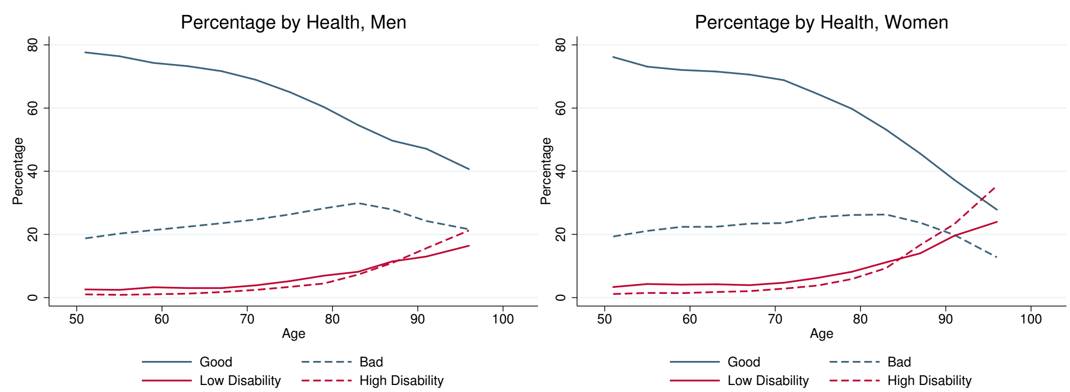
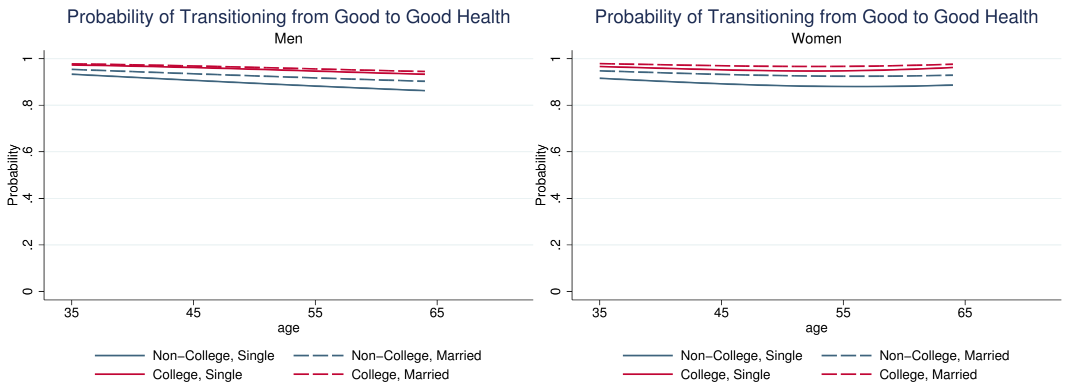
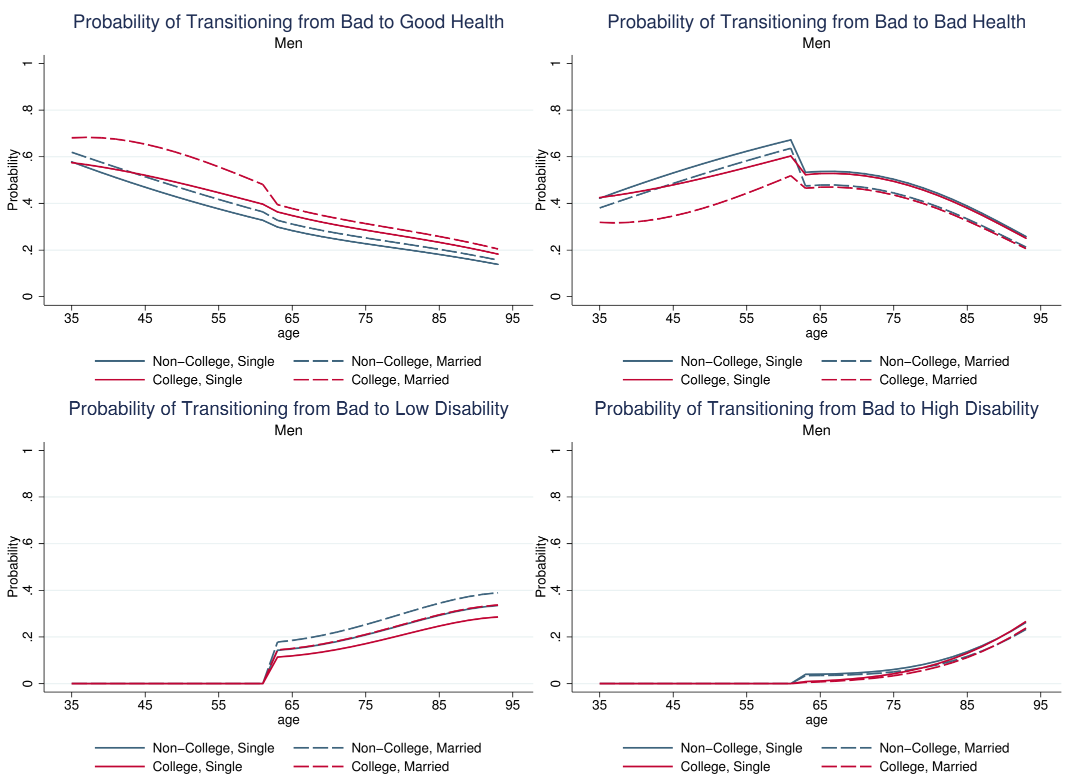


Figure M.4: Health Transitions from Good Health, MEPS



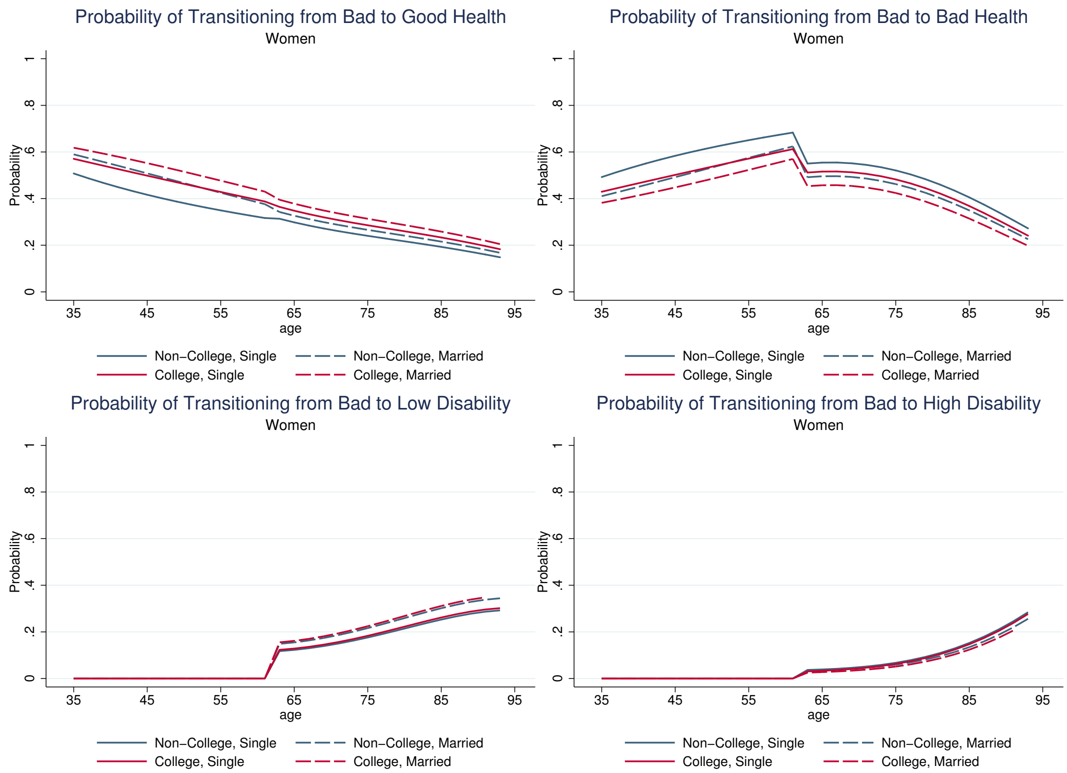
Notes: MEPS data. Since we do not allow for low or high disability states before age 65, the probabilities of transitioning from good to bad health are equal to one minus the levels shown in the above figures.

Figure M.5: Health Transitions from Bad Health, Men, MEPS and HRS



Notes: MEPS data at ages 35-61 and HRS data at ages 63+. The discontinuities at age 63 arise since low and high disability states become possible starting with age 65 in the model.

Figure M.6: Health Transitions from Bad Health, Women, MEPS and HRS



Notes: MEPS data at ages 35-61 and HRS data at ages 63+. The discontinuities at age 63 arise since low and high disability states become possible starting with age 65 in the model.

Figure M.7: Health Transitions from Low and High Disability States, HRS

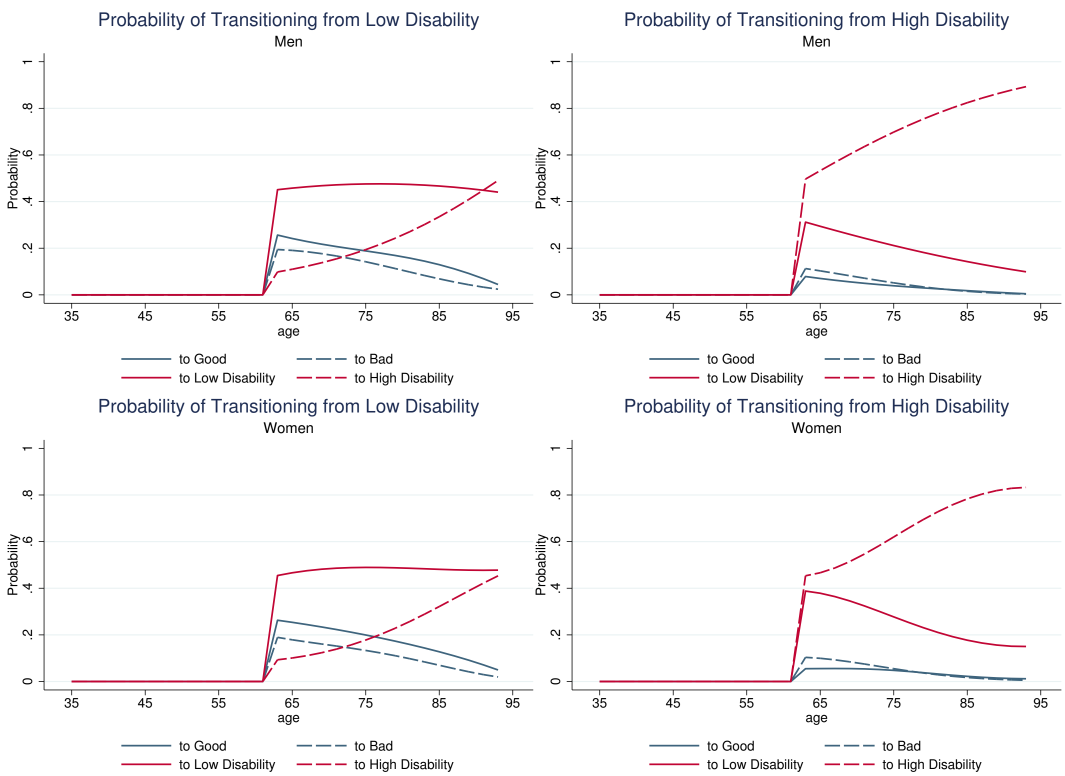
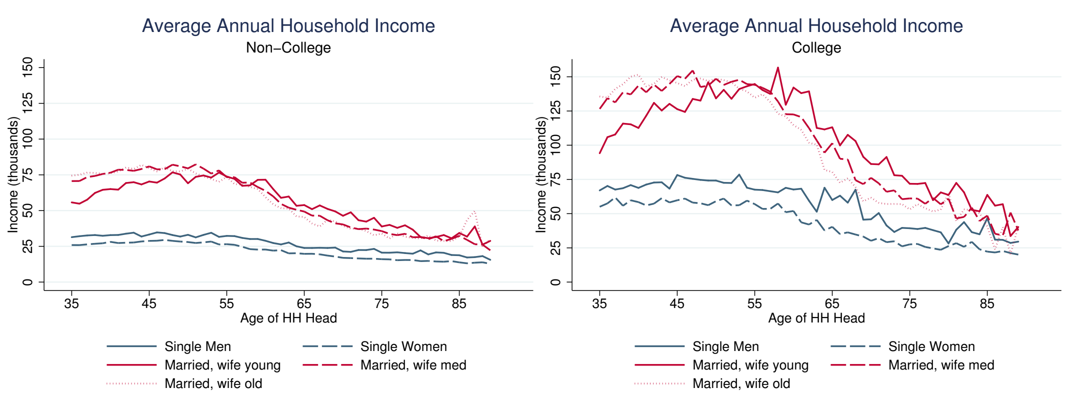
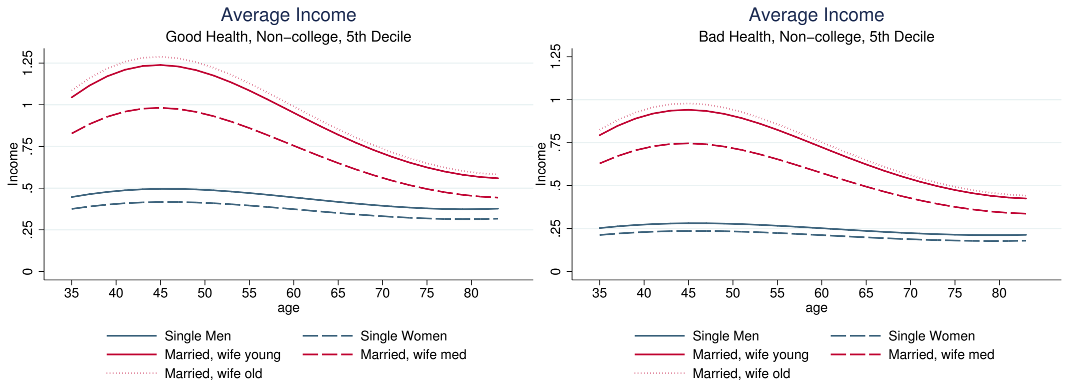


Figure M.8: Household Income Profiles, CPS



Notes: Annual household incomes in thousands of 2010 US dollars, averaged over years 1990-2007. Income includes all income minus income from welfare programs, and from interest, dividends, and rent.

Figure M.9: Household Income Profiles, 5th decile, Non-College, by Health, CPS



Notes: The figures show 2-year household income (after-tax), normalized by dividing by $105,430 to convert to model units.