Long-Term Care Insurance and the Family

Corina Mommaerts*

November 29, 2016

Abstract

I examine whether informal care by family members explains the limited demand for long-term care insurance. Motivated by evidence that the availability of potential informal caregivers is correlated with lower insurance demand and that informal caregivers substitute for formal care, I estimate a dynamic model of long-term care decisions between an elderly parent and her adult child. The availability of informal care lowers the demand for insurance by 14 percentage points overall. An insurance policy that compensates informal care can generate substantial increases in insurance demand and family welfare, and decreases in Medicaid spending.

1 Introduction

The elderly in the United States face significant risk of incurring large and persistent long-term care expenses. Formal long-term care expenditures totaled over $300 billion in 2013 and are projected to rise dramatically with the aging of the population, raising concerns about the burden that these costs place on both families and social programs such as Medicaid. These costs are not evenly distributed among individuals: while 60% of 65-year-olds will never enter a nursing home, 10% will spend over three years in institutional care at an average annual cost of $94,000 in 2015.[1] Despite this risk, very few individuals own long-term care insurance. While several studies have proposed reasons for the puzzling low demand for insurance, none have quantitatively addressed the fact that the majority of long-term care is provided informally by family members. This paper fills this gap by examining the

*University of Wisconsin - Madison and NBER. Telephone: 330-289-3184. E-mail: cmommaerts@wisc.edu. First draft: November 11, 2015. I am extremely grateful to my advisors, Costas Meghir, Joseph Altonji, and Jason Abaluck for their guidance and support. I also thank Brant Abbott, Noriko Amano, Sriya Anbil, Daniel Barczyk, Benjamin Friedrich, Julia Garlick, Ran Gu, Rebecca McKibbin, Ross Milton, Emily Nix, Ana Reynoso, Joseph Shapiro, Alessandra Voena, Yu Jung Whang, and seminar participants at Yale, Penn State, Rochester, Princeton, Harvard Kennedy, Wisconsin, Chicago, Chicago Booth, Rice, Wharton, Federal Reserve Board, Georgetown, Mathematica, the Congressional Budget Office, Queen's, McGill, and the Center for Retirement Research at Boston College for helpful comments and discussions. I gratefully acknowledge the NSF Graduate Research Fellowship program and the NBER Pre-Doctoral Fellowship in Economics of an Aging Workforce program for financial support.

[1] Source for nursing home and total long-term care costs: Kaiser Commission on Medicaid and the Uninsured (2015). Source for nursing home utilization rates: Brown and Finkelstein (2008).

effect of informal care – and family interactions more broadly – on the demand for long-term care insurance.

There are two main objectives. The first is to assess whether the availability of informal care can explain the low demand for long-term care insurance. The primary mechanism by which informal care may reduce the demand for insurance relies on the fact that insurance policies do not cover informal care. If the family can replace formal services as a preferable or less costly substitute source of care, then elderly individuals and their families face a trade-off between (a) insurance that provides financial protection against (undesirable) formal care and (b) preferable family care[2] whose indirect costs are uninsured. The second objective of the paper is to quantify the welfare costs and the burden on social programs of current insurance policies relative to alternative policies that include coverage of family care.

I first present two empirical facts that suggest that the family, and particularly family care, may be an important determinant of long-term care insurance demand. I show that, controlling for a range of demographic and health characteristics, individuals who have more potential sources of informal care (e.g. individuals with children, siblings, friends, etc.) are significantly less likely to own long-term care insurance policies than individuals who do not have these potential sources of informal care. Second, I show that family care is a substitute for formal care, which provides a plausible mechanism for the difference in insurance demand between individuals with and without children. To do this, I exploit policy changes in state Medicaid eligibility rules to show that elderly individuals who are subject to more generous Medicaid eligibility thresholds are more likely to reside in a nursing home than with their child.

I use these facts to motivate a dynamic model of decision-making between an elderly parent and her adult child. The model provides a framework to study demand for long-term care insurance, family care, savings behavior, and the labor supply of adult children in an environment that offers Medicaid benefits and private insurance of (formal) long-term care services. The family faces three sources of risk: long-term care shocks that require either formal care or informal care by the child, uncertainty over the longevity of the parent, and shocks to the adult child's permanent wage that influence the opportunity cost of informal care. The parent and child interact with strategic and altruistic concerns, but cannot commit to future allocations of resources, and hence cannot fully cooperate (Kocherlakota, 1996). I obtain estimates of the parameters of the model using data from the Health and Retirement Study and the Panel Study of Income Dynamics. The model replicates important features of long-term care behavior, particularly insurance demand across the wealth dis-

[2] I use the terms *informal care* and *family care* interchangeably and to mean family care. Moreover, most informal care is provided by family members, particularly spouses and adult children.

tribution, savings rates, and informal care usage.

Using the estimates of the parameters, I find that removing the availability of family care increases overall demand for insurance by less than 14 percentage points overall, but the effect varies greatly with wealth. These differences across the wealth distribution are due to two main opposing effects. On the one hand, removing the availability of family care *increases* demand for insurance because the costs of the remaining source of care – formal care – are covered by insurance. This is the dominant effect for wealthy individuals, whose demand rises by 20 to 40 percentage points. On the other hand, long-term care becomes more expensive for some parents whose children had low opportunity costs of time. The expected increase in cost of long-term care acts as a wealth effect, which induces these parents to spend down to Medicaid in lieu of purchasing insurance (i.e. Medicaid 'crowd-out' (Brown and Finkelstein, 2008)). This effect is more relevant for poor and moderately wealthy individuals, whose insurance demand only slightly increases.

Next, I evaluate a set of alternative policy tools that introduce financial compensation for family care by replacing formal care benefits with cash benefits. This idea is not without basis: many other countries have long-term care policies with cash options.[3] First, I find that modifying Medicaid to provide cash benefits has little effect on private insurance demand, implying that wealthy individuals place a high value on protecting their assets over spending down to Medicaid. However, modifying a private insurance policy to provide cash benefits leads to a 58 percentage point increase in insurance demand and a $33,000 welfare gain to families, on average. In addition, it lowers Medicaid spending on long-term care by 40%. I find that these results are muted but still substantial if premiums must rise to pay for potential moral hazard problems created by cash benefits.

This paper makes several contributions. First, it expands upon models of elderly savings and health risk by incorporating a new channel of care: the family. Work by Hubbard, Skinner, and Zeldes (1995), and in the specific case of long-term care insurance Pauly (1990) and Brown and Finkelstein (2008), show that means-tested social insurance such as Medicaid can reduce the propensity to save or privately insure. De Nardi, French, and Jones (2010) show that large out-of-pocket medical expense risk and life expectancy risk can reduce the propensity to *dis*-save among higher income retirees, and De Nardi, French, and Jones (2016) show that the Medicaid program has important implications throughout the wealth distribution.[4] This paper expands on these analyses by

[3]For a summary of long-term care systems in several European countries, see Da Roit and Le Bihan (2010). In the United States, several states have piloted the use of cash benefits through Medicaid 'Cash and Counseling' experiments. In addition, the 2010 Affordable Care Act proposed a public long-term care insurance option that compensated family care called the Community Living Assistance Services and Supports (CLASS) Act. This provision was repealed in 2013.

[4]Many others have also contributed to this literature: Kotlikoff (1989), Gruber and Yelowitz (1999), Palumbo (1999), Scholz, Seshadri, and Khitatrakun (2006), Kopecky and Koreshkova (2014) on medical versus nursing home risk, Lock-

introducing family interactions and private insurance as an important channel for understanding elderly savings patterns.

Second, this paper develops a new model of intergenerational family decision-making. Most recent studies of intergenerational dynamics assume non-cooperation as the decision process between parents and children (Kaplan, 2012; Fahle, 2014; Barczyk and Kredler, 2014b) and often impose stringent assumptions on behavior, such as an inability of both individuals to save (Barczyk and Kredler (2014b) is an exception). In contrast, this paper adopts a limited commitment framework, which allows for higher levels of cooperation that may be particularly relevant for long-term care decisions in which many aspects of the lives of parents and adult children are intertwined. Limited commitment models are increasingly being applied to models of marital interactions (Mazzocco, 2007; Yamaguchi, Ruiz, and Mazzocco, 2014; Voena, 2015; Bronson, 2014; Low, Meghir, Pistaferri *et al.*, 2016) but this paper is the first to show that this type of model is suitable for capturing intergenerational interactions.

Third, the results of this paper shed light on issues related to long-term care in the United States and potential policy solutions. As the baby boomers age into retirement, policymakers will need to address the growing demand for long-term care services. Demographic implications for caretakers, such as decreased fertility and rising female labor force participation, may shift long-term care towards increased formal services and put further strain on social programs. A better understanding of why individuals forgo private long-term care insurance may help target policies to combat potentially inefficient growth in these programs. Other explanations for the lack of demand, such as Medicaid (Brown and Finkelstein, 2008), bequest motives (Lockwood, 2014), home equity (Davidoff, 2010), beliefs about needs (Brown, Goda, and McGarry, 2012), and market imperfections and product flaws (Finkelstein and McGarry, 2006; Ameriks, Briggs, Caplin *et al.*, 2015a), still leave a large portion of the lack of demand unexplained. Furthermore, while Medicaid may account for much of this, interactions with the family may be important to determining optimal Medicaid policies.[5] This study quantifies these interactions and shows that the extended family accounts for a modest portion of the lack of demand for insurance, but that the consequences for individual welfare and Medicaid spending of ignoring family care in the design of long-term care policy may be large.

In the next section, I describe key features of long-term care in the United States. Section 3 provides reduced form evidence on the impact of the family on long-term care insurance and evaluates the substitutability between formal and informal care. In Section 4 I describe the model.

wood (2014) on bequest motives, Low and Pistaferri (2010) on disability, and Ameriks, Briggs, Caplin *et al.* (2015a,b) on elicited preferences over long-term care.

[5]For instance, theoretical work by Bernheim, Shleifer, and Summers (1985) and Pauly (1990) suggests that intrafamily moral hazard may cause parents to forgo insurance.

Data and estimation results are in Section 5, and Section 6 reports results from counterfactuals. Section 7 concludes.

2 Long-Term Care in the United States

Long-term care in the United States, defined as assistance performing Activities of Daily Living (ADLs) or Instrumental Activities of Daily Living (IADLs),[6] is expensive. In 2013, formal long-term care costs in the United States added up to $310 billion, or 10 percent of *all* health expenditures for *all* ages.[7] Although over 75% of elderly individuals will depend on long-term care at some point, utilization is not distributed evenly across the population: 40% of 65-year-olds will enter a nursing home at some point , but 10% of them will remain in a nursing home for over 3 years (Brown and Finkelstein, 2008). Formal long-term care costs are financed through three main sources: out-of-pocket spending, private insurance, and public insurance, of which the largest payer is Medicaid. Additionally, over half of long-term care is provided informally by family members. As detailed below, each of these actors play important and inter-related roles in individual long-term care decisions.

2.1 Private long-term care insurance

The long right tail of nursing home utilization suggests that insurance against costly long-term care expenses could produce large gains to individual welfare. Nevertheless, the private long-term care insurance market is small: only 7 percent of formal long-term care expenditures are paid by private insurance policies, and less than 10 percent of elderly individuals own a private insurance policy. Individuals purchase policies at an average age of 67, at which point they lock in an annual nominal premium. A typical policy includes maximum payouts (e.g. $100 per day in 2000) and pays out 18% less in expected benefits than expected contributions. These price mark-ups and the lack of comprehensiveness in policies suggest that this market suffers from supply-side inefficiencies such as imperfect competition (indeed, five companies provide the majority of policies), transaction costs, and an inability to diversify aggregate risk (see Brown and Finkelstein (2007) for more details). Private long-term care insurance may also suffer from asymmetric information that leads to an adversely

[6] The set of ADLs in the data I use include walking across a room, dressing, bathing, eating, getting in and out of bed, and using the toilet. The set of IADLs include: using a map, using a telephone, managing money, taking medications, shopping for groceries, and preparing hot meals.

[7] In 2015, the average price of a private (semi-private) room at a nursing home was $91,000 and the average hourly price of a home care aide was $20 per hour (Kaiser Commission on Medicaid and the Uninsured, 2015).

selected market. Finkelstein and McGarry (2006) find that subjective expectations over health can predict both nursing home entry and insurance coverage, suggesting that the market is adversely selected. However, they conclude that the long-term care insurance market is not overall adversely selected because it is also advantageously selected: individuals who have lower-than-average risk but are more risk-averse are also more likely to purchase insurance. In addition, Hendren (2013) demonstrates that most high-risk individuals would not be able to purchase insurance anyway due to stringent rejection practices of insurers.

Despite the existence of supply side market failures, Brown and Finkelstein (2007) argue that they alone cannot explain the small size of the private long-term care insurance market. Several studies have found that demand side forces may also significantly limit the market: bequest motives reduce the opportunity cost of precautionary savings (Lockwood, 2014), wealth stored in housing can be used to pay for a nursing home (Davidoff, 2010), individuals have limited information about risks or insurance coverage, and Medicaid can act as a substitute source of coverage (Brown and Finkelstein, 2008). Aside from Mellor (2001), who shows empirically that demand for long-term care insurance is negatively associated with the number of children, this study is the first to carefully model and estimate the effect of available family care on insurance demand.

2.2 Medicaid

Public expenditures for long-term care are shouldered almost entirely by Medicaid. While Medicare is the primary source of *medical* insurance for individuals 65 and over, it notably does not cover most long-term care costs.[8] Medicaid, on the other hand, is a means-tested program and thus only available to impoverished elderly. To become eligible, an individual must spend-down their income and assets to sufficiently low levels (monthly income of around $681 and financial assets of around $2,650 (Brown and Finkelstein, 2008), though this varies by state). At that point, Medicaid will pay for long-term care services and provide a consumption floor. Like private insurance, Medicaid currently only reimburses formal services.[9] In addition, Medicaid is a secondary payer for individuals who hold private insurance policies, meaning that Medicaid will only pay for services above the private insurance payout. Brown and Finkelstein (2008) show that this feature induces a significant

[8]Medicare will only cover 'post-acute' long-term care expenses. For example, Medicare covers up to 100 days of nursing home care but only following at least a 3-day hospital stay. Because these post-acute long-term care needs are relatively well-insured by Medicare, they are not the focus of this paper.

[9]Historically, Medicaid also excluded most home-based services in favor of nursing home services (its so-called "institutional bias"). However, in the 1980s Medicaid began offering more home and community-based services (HCBS). This was both an effort to lower Medicaid's long-term care costs by shifting to potentially cheaper home care, and an acknowledgement that most individuals would prefer to remain in the community than receive long-term care in a nursing home (see the Supreme Court's 1999 Olmstead decision, Olmstead v. L.C., 527 U.S. 581, 1999).

'implicit tax' on private insurance. Indeed, given the high costs of formal long-term care and the fact that very few individuals are covered by private insurance, Medicaid ends up paying 60 percent of formal long-term care services.

2.3 Informal care

Because most individuals do not purchase private insurance and Medicaid is a payer of last resort, around one-third of formal long-term care expenditures are paid out of pocket. Absent from this institutional framework and the discussion of its costs, however, is the role of informal care and its indirect costs.

Over half of the elderly in need of long-term care rely solely on family members for help with everyday activities. Table 1 shows that among retirees 65 and over who report receiving long-term care, over 50% of main caregivers are family members. For married individuals, most informal care is provided by spouses, and for single individuals with children, almost all informal care is provided by their adult children. When care is not provided by family members, over 90% of caretakers are paid. The fact that some individuals elect to purchase formal care in lieu of family care suggests that there are important implicit costs of informal care. These indirect costs, such as lost wages, are not included in the annual $310 billion price tag of long-term care, suggesting that definitions of long-term care risk that only capture formal care outcomes may drastically mis-measure the amount of risk that individuals face.[10]

Table 1: Relationship of Respondent to Caregivers

	Everyone	Married	Single with children
Spouse	.220	.425	–
Child	.259	.190	.389
Other family	.056	.033	.052
Non-family	.465	.352	.558
Total	1.00	1.00	1.00
% non-family paid	*.941*	*.949*	*.942*
Observations	11287	5850	4560

Note: The sample includes retirees aged 65 and over who report receiving help with (I)ADLs in the Health and Retirement Study, 1998-2010. Rows denote the type of caregiver, and columns denote sample restrictions. The *% non-family paid* row reports the percent of caregivers who are paid among all non-family caregivers (row 4).

Despite the extensive use and potential costs of family care, as mentioned above, neither private insurance nor Medicaid currently offer policies that reimburse informal care costs. As I will show

[10]Using time-use and wage data, Chari, Engberg, Ray *et al.* (2015) place the annual implicit cost of informal caregiving at an additional $520 billion.

in the rest of the paper, offering policies that compensate families for the cost of informal care could greatly improve welfare and alter the spending structure of the long-term care market.

3 Empirical evidence on insurance and family care

In this section I present two other pieces of evidence that the family, and particularly family care, is an important consideration in long-term care decisions. I first establish that single retirees with children are significantly less likely to own a long-term care insurance policy than single retirees without children. I then exploit variation in state Medicaid eligibility rules over time to show that informal care by children can substitute for formal care. Together, these findings suggest that an important determinant of insurance purchase is the future availability of substitute caretakers. I use this evidence as motivation for the model in Section 4.

3.1 Insurance coverage by family characteristics

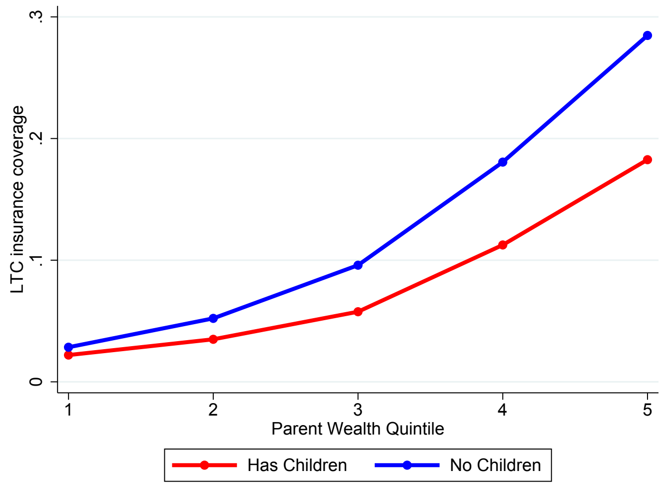
I start by providing empirical evidence on the relationship between long-term care insurance demand and the presence of future potential informal caregivers. Using a pooled sample of single individuals aged 60-69 in the 1998-2010 Health and Retirement Study (see Section 5.1 for a full description of the data), I examine whether individuals who have more potential future sources of informal care - e.g. individuals with children, siblings, friends, etc. - are significantly less likely to hold long-term care insurance policies than individuals who do not have these potential future sources of care.

Figure 1 shows long-term care insurance coverage across the wealth distribution, broken down by whether the individual has children or not. Overall, 9 percent of these individuals have long-term care insurance policies. However, there is large variation by wealth: less than 5 percent of individuals in the poorest wealth quintile have insurance, while over 20 percent of individuals in the wealthiest quintile own a policy.[11]

Importantly, there are large differences in policy holdings by family type. Across the distribution, individuals with children are much less likely to own a long-term care insurance policy. Table 2 reports the relationship between long-term care insurance coverage and children in a linear regression framework using the same sample as the figure above, controlling for a large host of demographic characteristics. Column (1) shows that individuals with children are 5 percentage points less likely overall to own an insurance policy, which is a very large effect on a base of 9 percent ownership.

[11] Appendix Figure 1 includes additional breakdowns such as having no siblings and having no future helpers. A similar pattern emerges: individuals who have neither children *nor* siblings *nor* future helpers are even more likely to hold an insurance policy than individuals with children.

Figure 1: Long-term care insurance coverage by wealth quintile



Note: The sample includes single individuals aged 60-69 in the pooled 1998-2010 Health and Retirement Study. The red line graphs the percent of individuals *with children* who own a long-term care insurance policy, by wealth quintile (from the poorest quintile on the left to the wealthiest quintile on the right). The blue line graphs the percent of individuals *without children* who own a long-term care insurance policy.

Columns (2) and (3) show that, perhaps surprisingly, this effect does not depend on the gender or (a crude measure of) proximity of the child, but that individuals who believe that their children will be helpful to them in the future are less likely to have insurance. Column (4) distinguishes the main effect by wealth quintile and shows that the effect is larger and more significant for wealthier parents.

Table 3 reports the effects of children on other outcomes that could be related to long-term care insurance demand. Column (1) examines the relationship between children and life insurance, which protects an individual's benefactors in the event of the individual's death. The results show that individuals with children are 7 percentage points more likely to have a life insurance policy than individuals without children.[12] Column (2) shows that having children greatly reduces the probability of being in a nursing home for individuals over age 80. To check that this is not a result of individuals with children simply being healthier (and therefore buying less insurance), column (4) verifies that having children is not related to the probability of having difficulty with an Activity of Daily Living.

On the whole, the results in this section suggest that elderly individuals make insurance decisions with their children in mind. Additionally, the life insurance findings imply that it is not the case that individuals with children are less likely to buy insurance in general; instead, buying insurance may

[12]Additionally, Appendix Figure 2 replicates Figure 1 for life insurance. The expected effect of children on life insurance demand is actually ambiguous: insurance protects the children against losing the parent's eventual retirement income, but death spares the children from either having to care for the parent or from having a lower bequest due to costly later long-term care expenses.

Table 2: Relationship between LTC insurance coverage and children characteristics

Dependent variable:	Long-Term Care Insurance Coverage			
	(1)	(2)	(3)	(4)
Has child	-0.052***	-0.058***	-0.047**	
	(0.015)	(0.018)	(0.019)	
Has daughter		0.007	0.011	
		(0.011)	(0.012)	
Has child within 10 miles			-0.007	
			(0.009)	
Child helpful in future			-0.017**	
			(0.007)	
Has child, wealth Q1 (poorest)				-0.012
				(0.012)
Has child, wealth Q2				-0.020
				(0.017)
Has child, wealth Q3				-0.036
				(0.023)
Has child, wealth Q4				-0.068**
				(0.031)
Has child, wealth Q5 (wealthiest)				-0.095***
				(0.035)
Means				
LTC insurance rate	0.089	0.089	0.090	0.089
Has child	0.867	0.867	0.859	0.867
Has daughter		0.725	0.719	
Has child within 10 miles			0.255	
Child helpful in future			0.424	
N	10164	10159	9622	10164

Note: The sample includes single individuals aged 60-69 in the pooled 1998-2010 Health and Retirement Study. Estimates are from a linear probability model of whether the individual owns a long-term care insurance policy on child characteristics and controls. Controls include wealth, income, age, gender, race, education, region, health status, religion, and year fixed effects. Standard errors, clustered by individual, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

be economically motivated by the presence of children.

3.2 Substitutability of informal and formal care

As shown in Table 1, long-term care is provided both formally and informally. What is less clear is whether formal and informal care are substitutes or whether, instead, they provide different services for different types (or severity) of needs. Intuitively, the activities that individuals need help with that define long-term care are basic activities that any able-bodied adult should be able to assist with.

Several studies have tried to causally determine the substitutability of informal and formal care using a variety of methods, margins, and data sources. Using variation in childrens' characteristics as instruments, Charles and Sevak (2005) find strong evidence of substitution between informal care and nursing home care.

Table 3: Relationship between other outcomes and children

Dependent variable:	Life insurance	Nursing home (80+)	Any ADL (80+)
	(1)	(2)	(3)
Has child	0.067***	-0.045***	-0.012
	(0.022)	(0.013)	(0.013)
Dependent variable mean	0.617	0.134	0.429
Observations	10230	12514	12521

Note: The sample includes single individuals in the pooled 1998-2010 Health and Retirement Study. Estimates are from a linear probability model of the dependent variable on whether the individuals has a child and controls. In column (1) the sample is restricted to individuals aged 60-69 and the dependent variable is whether the individual owns a life insurance policy. In columns (2) and (3), the samples are restricted to ages 80 and above. The dependent variable in column (2) is whether the individual resides in a nursing home, and the dependent variable in column (3) is whether the individual reports difficulty with an ADL. Controls include wealth, income, age, marital status, gender, race, gender, education, region, self-reported health status, religion, and wave fixed effects. Standard errors, clustered by individual, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Another set of studies exploit variation in the price of formal care. In other work (Mommaerts, 2016), I exploit policy changes over time in state Medicaid eligibility generosity - specifically, 'Medically Needy' and similar spend-down policies - as exogenous variation in the price of nursing homes for individuals.[13] While traditional Medicaid eligibility is defined by strict asset and income tests, income in spend-down states is defined as income *net of health expenses*. Effectively, this allows individuals with higher income to qualify for Medicaid when they incur large health expenses. Table 4 shows the effects of these policies using a difference-in-difference strategy with the pooled 1980-2000 Census and 2006-2009 American Community Survey. Column (1) reports that individuals over age 80 who live in spend-down states are 2 to 3 percentage points less likely to live with their children (a proxy for informal care) and column (2) shows that they are 1 to 4 percentage points more likely to live in a nursing home, particularly for poorer individuals who are closer to Medicaid eligibility. These results are consistent with a story of substitution between formal and family care.

Other studies find similar results. The Channeling Demonstration, an experiment that expanded the generosity of publicly-funded home care for low-income elderly in the 1980's, led to small reductions in informal care (Pezzin, Kemper, and Reschovsky, 1996), and a recent study using a 1998 reform to home care subsidies in Sweden found evidence of substitution between informal care and formal home care (Løken, Lundberg, and Riise, 2014). Finally, but perhaps most relevant to this paper, Coe, Goda, and Van Houtven (2015) use state variation in subsidies to long-term care insurance policies as an instrument for insurance coverage. They find that an increase in long-

[13] Several states changed their spend-down policies at different times over the 30 year period that I examine, allowing for a difference-in-difference strategy. Specifically, I run the following specification: $Y_{ist} = \beta_q(SD_{st} * q_{ist}) + \gamma X_{ist} + \alpha_s + \delta_t + \varepsilon_{ist}$ in which i indexes the individual, s the state, and t the year. SD_{st} is an indicator for whether the state has a spend-down provision, q_{ist} is the income quintile of the individual, and β_q are the main coefficients of interest. Y_{ist} is an indicator for coresidence with a child or an indicator for nursing home use.

Table 4: Effect of spend-down provisions on coresidence and nursing home use

	(1)	(2)
Sample:	Age 80+	Age 80+
Dependent variable:	Coresidence	Nursing Home
Spend-down, income Q1 (poorest)	-0.025*	0.035***
	(0.014)	(0.011)
Spend-down, income Q2	-0.026***	0.012*
	(0.008)	(0.006)
Spend-down, income Q3	-0.021**	-0.001
	(0.010)	(0.008)
Spend-down, income Q4	-0.007	-0.000
	(0.014)	(0.010)
Spend-down, income Q5 (richest)	0.001	-0.004
	(0.018)	(0.011)
Mean dependent variable	0.210	0.140
N	1,047,313	1,047,313

Note: From Mommaerts (2016). The sample includes single individuals aged 80 and over in the pooled 1980-2000 Census and 2006-2009 American Community Survey. The estimates in each column are from a linear probability model in which the dependent variable in column (1) is whether the individual coresides with an adult child and in column (2) is whether the individual is institutionalized. The main independent variables are whether the individual lives in a state with a Medicaid spend-down provision, interacted with the income quintile of the individual. In addition, each regression is weighted using person-weights and includes controls for year, state, income quintile, age quintile, race, education, gender, and marital status. Standard errors, clustered by state, are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

term care insurance coverage, which significantly lowers the marginal cost of formal care, induces significantly less informal caregiving.

Overall, the evidence in this section has three main implications. First, it suggests that the type of long-term care that individuals receive is to some extent a choice. Second, this choice is influenced by economic motives, such as the relative price of formal and informal care. Third, because individuals have the option to use informal care as a substitute for formal services, the presence of the family may affect decisions of whether to purchase long-term care insurance, and indeed how much to precautionary save. I now turn to a model of long-term care and the family that incorporates these insights.

4 Model

To understand the mechanisms by which the presence of adult children affects long-term care insurance purchase decisions and to evaluate potential welfare-improving policies, I develop a model with four main features that capture the key trade-offs that elderly individuals and their families face when choosing whether to purchase insurance and which type of care to receive. First, the model is dynamic because savings is an important factor in long-term care decisions: it acts as a self-insurance device, a barrier to Medicaid, and a means of transferring wealth across generations. Second, the model includes the behavior of an elderly individual as well as her adult child to account for both formal and informal costs of long-term care.[14] Third, the parent and adult child face risk: long-term care shocks to the parent that require formal care or informal care by the child, uncertainty over the longevity of the parent, and permanent shocks to the adult child's wage that influence the opportunity cost of informal care. Fourth, long-term care insurance and Medicaid provide alternative means for paying for long-term care expenses.

Within this environment, the parent and child decide how much to individually save and consume, how the child allocates her time between market work, family care, and leisure, and whether the parent buys long-term care insurance at retirement. I model the decision-making process between the parent and child as cooperative, but with limited commitment, for two main reasons. First, prior studies have shown that parents and children do not fully insure each other (Hayashi, Altonji, and Kotlikoff, 1996; Attanasio, Meghir, and Mommaerts, 2015), suggesting that a fully cooperative model is unrealistic. The fact that full commitment results in an indeterminate asset distribution between family members is also unappealing in this setting, particularly from a legal standpoint since Medicaid depends on the resources of the parent but not the child. Second, the level of interaction observed in the data, such as the fact that one-quarter of parents and adult children co-reside and one-quarter of adult children help parents with their finances, suggests a level of coordination beyond a non-cooperative game. For these reasons, I characterize the decision-making process using a model of *limited* commitment in which the parent and child make joint decisions but cannot commit to future allocations of resources.

4.1 Preferences

The model analyzes the relationship between a single elderly parent and her adult child in every period from $t = 1, ...T$ in which period $t = 1$ corresponds to retirement (age 65) of the parent. The parent and child have time-separable, expected utility preferences over consumption, leisure, and care arrangements. The parent's per-period utility is:

$$U_t^P(c_t^P, F_t, U_t^K) = u(c_t^P, \ell_t^P) + z * \mathbb{1}_{F_t} + \eta U_t^K \tag{1}$$

[14]As shown in Table 1, married retirees receive a significant amount of care from spouses *and* children, while single retirees receive the vast majority of informal care from their children. I model only single retirees in order to focus on a simpler set of set of informal caregivers. I restrict the model to one child for the same reason. See Section 5.1 and Appendix A for further discussions of this choice.

where c_t^P is parent consumption and ℓ_t^P is parent leisure, which is set to the total amount of allocatable hours.[15] z is disutility for formal care, which is denoted by an indicator F_t and reflects the notion that parents, all else equal, may prefer care from their child over a hired caregiver. The parent may also care about the child's well-being, which enters the parent's utility function as permanent altruism η over the child's utility U_t^K.[16]

The adult child's per-period utility is:

$$U_t^K(c_t^K, \ell_t^K, NC_t) = u(c_t^K, \ell_t^K) - g * \mathbb{1}_{NC_t} \tag{2}$$

where c_t^K is child consumption and ℓ_t^K is child leisure. Instead of pure altruism towards their parents, adult children experience 'guilt' g if they do not cooperate with their parents ($NC_t = 1$). This is in the spirit of Becker (1992), who argues that children are more likely to provide support in old age if they otherwise would feel guilty.[17] I use this specification instead of pure altruism for two main reasons. First, the empirical literature on child altruism toward parents at this stage of life finds small effects.[18] Second, Li, Rosenzweig, and Zhang (2010) find that guilt is an empirically important motive for family interactions. Finally, there are many issues in dynamic non-cooperative[19] games involving altruism that pose problems for tractability and make stark predictions on transfers, as detailed in Altonji, Hayashi, and Kotlikoff (1997) and Barczyk and Kredler (2014a). See Appendix C for a further discussion of these issues.

The preferences over consumption and leisure for both the parent and child take the following

[15]Note that this specification does not allow for health-state dependent utility (except through a separable disutility for formal care). While a relaxation of this would be interesting, the direction of dependence is unclear: estimates from other studies vary in sign on whether poor health increases or decreases the marginal utility of consumption. Moreover, the dependence is likely to be specific to the type of health shock. For long-term care specifically, Brown, Goda, and McGarry (2012) directly ask individuals about preferences and find very weak and heterogeneous evidence of state-dependent utility, while Ameriks, Briggs, Caplin *et al.* (2015b) uses elicited preferences in a life-cycle model and finds a higher marginal utility of consumption when in need of long-term care.

[16]Several papers argue against a model of altruism by showing that monetary transfers are not very responsive to monetary shocks (Altonji, Hayashi, and Kotlikoff, 1997; Attanasio, Meghir, and Mommaerts, 2015). However, these studies do not allow for exchange motives to additionally influence transfer behavior (see Cox (1987) for an early model of both altruistic- and exchange-motivated transfers). In addition, the structure of family interactions matter for transfer behavior; for example Foster and Rosenzweig (2001) show that limited commitment models with altruism can generate both increases and decreases in the responsiveness to shocks.

[17]This is also similar in spirit to the punishment of leaving a risk-sharing arrangement proposed in Thomas and Worrall (1988), or to the match-specific effect, though non-stochastic, of being in a relationship in the marriage literature (Voena, 2015; Yamaguchi, Ruiz, and Mazzocco, 2014; Bronson, 2014). Analogies can also be drawn to guilt in 'pro-social' (Bénabou and Tirole, 2006) or 'free-rider' (Gachter and Fehr, 2000) problems.

[18]Barczyk and Kredler (2014b) finds that child altruism parameters are less than half the size of parent altruism parameters, and Fahle (2014) finds almost zero child altruism compared to relatively large parent altruism.

[19]In a fully cooperative model, altruism would be absorbed into the Pareto weights.

form:

$$u(c,\ell) = \frac{[c^{\alpha}\ell^{1-\alpha}]^{1-\gamma}}{1-\gamma}. \tag{3}$$

Preferences are not separable over consumption and leisure, as past studies have shown that non-separability is empirically important (Blundell, Browning, and Meghir, 1994; Attanasio and Weber, 1995). I consider the case where individuals are relatively risk averse ($\gamma > 1$) and consumption and leisure are Frisch substitutes ($\alpha \in \{0,1\}$).

At the time of the parent's death t_d, any remaining assets of the parent $a^P_{t_d}$ are bequeathed to the child. Consistent with the parent's flow utility, the parent realizes a value $V^P_{t^d}$ of:

$$V^P_{t^d} = \eta V^K_{t^d} \tag{4}$$

where V^K is the value to the child, which will be defined in more detail in Section 4.5. The value to the parent is a form of bequest function that is consistent with the parent's lifetime preferences.[20]

The child's behavior after the parent's death is a simple consumption-labor-supply-savings problem through time T, which roughly corresponds to the retirement age of the child (see Appendix B for the precise definition of the problem). The model closes at the end of time T with a terminal condition in order to match the fact that in the data, the adult child values savings for their retirement:

$$V^K_{T+1}(a^K_{T+1}) = \phi \frac{\left(a^K_{T+1}\right)^{1-\gamma}}{1-\gamma} \tag{5}$$

In this parameterization, ϕ governs the tradeoff between consumption in time T and assets for the terminal function.

4.2 Sources of risk

The parent and child face three key sources of risk when making long-term care decisions. The parent faces uncertainty over future long-term care needs and the timing of death, both of which will influence insurance and precautionary savings choices. The child faces a stochastic wage process, which will directly impact the opportunity cost of family care.

[20] This 'pure altruism' setup, in which parents care about their child's utility, is in contrast to bequest functions that exhibit 'impure altruism', such as a 'warm glow' in which the parent cares about the amount of bequest rather than the well-being of the child (De Nardi, 2004; De Nardi, French, and Jones, 2010; Lockwood, 2014).

Long-term care needs and death

I discretize the parent's long-term needs into three categories $h_t \in \{0; 1000; 2000\}$ corresponding to: (1) they do not need care ($h = 0$), (2) they need 1,000 hours of care each year ($h = 1000$, corresponding to 20 hours per week), or (3) they need 2,000 hours of care each year ($h = 2000$, corresponding to 40 hours per week).[21] The transition probabilities for long-term care status depend on prior status, income, and age:

$$h_{t+1} = h_{t+1}(h_t, y^P, t)$$

Parents who need care either receive it formally from a paid source ($F_t = 1$) or informally from their child ($F_t = 0$). The probability of parent death is modeled analogously, so that the probability of survival to time $t+1$ is $s_{t+1}(h_t, y^P, t)$.

It is important to note that the type of care, F_t, affects the *utility* function but does not enter as inputs into long-term care transition function $h_t(\cdot)$ or the survival function $s_t(\cdot)$. I do this for two main reasons. First, long-term care concerns the ability to perform basic personal tasks, in contrast to other types of health care whose quality may more acutely affect subsequent life-or-death outcomes. Second, a small literature has found no effects of the type of long-term care on mortality (Applebaum, Christianson, Harrigan *et al.*, 1988), and a larger literature on elderly health more generally has found negligible effects, positing that health stock is largely determined by health investments made at much earlier ages (Finkelstein and McKnight, 2008; Card, Dobkin, and Maestas, 2008).

Income processes

The child's wage is subject to a permanent shock each period that follows a random walk process:

$$\log w_t^K = \log w_{t-1}^K + \xi_t$$

where $\xi_t \sim N(0, \sigma_\xi^2)$. This assumption follows from several previous studies that show empirically that income shocks are well-characterized as a random walk (MaCurdy, 1982; Abowd and Card, 1989; Meghir and Pistaferri, 2004).[22] The child's income follows as $y_t^K = w_t^K L_t$, in which labor supply is a discrete choice between not working, working part-time (20 hours per week), or working full-time (40 hours per week):

[21] It is conceptually straightforward to discretize long-term care needs into additional, finer categorizations; I select three for computational tractability in estimation.

[22] I do not model an additional transitory shock, as Blundell, Pistaferri, and Preston (2008) showed that transitory shocks are well smoothed by savings.

$$L_t = \begin{cases} 0 & \text{if not working} \\ 1000 & \text{if part time (20 hrs/wk)} \\ 2000 & \text{if full time (40 hrs/wk)} \end{cases} \tag{6}$$

The parent's income process is a constant (real) stream of non-asset income y^P (De Nardi, French, and Jones, 2010; Lockwood, 2014). This is a reasonable approximation since most income for retirees comes from annuitized Social Security and pension wealth.

4.3 Long-term care costs and insurance

I define the cost of long-term care as the pre-insurance, 'direct' cost of care. This cost, ltc_t, depends on health status (h_t) and whether the care is provided formally or by the child (F_t): $ltc_t(h_t, F_t)$. When care is hired formally ltc_t is equal to \$20,000 for $h_t = 1,000$ (light care) and \$61,700 for $h_t = 2,000$ (intensive care). This roughly corresponds to hiring a home care aide at \$20 per hour for light care and the non-consumption cost of a mid-range nursing home for intensive care.

When care is provided informally by the child, the direct cost of care is zero for both care needs states.[23] The implicit cost to the child of family care is the hours of care needed: $fam_t = h_t$. For light care, this corresponds to 20 hours per week, and for intensive care this corresponds to 40 hours per week.

The model includes two main sources of insurance against long-term care risk. The first is private insurance, which covers formal long-term care costs in the event of illness, at the cost of annual premiums during good health. Importantly, this product does *not* reimburse any (implicit) costs associated with family-provided care. The benefit is denoted by $\lambda_t(h_t, F_t, ltci)$ and depends on direct long term care needs state h_t, whether care is provided formally F_t, and whether the individual has insurance $ltci$. The contract is a typical contract as described by Brown and Finkelstein (2007) which has a maximum benefit of \$44,350 (corresponding to \$100 per day in 2000 dollars) and an 18% load.[24] Note that because the maximum benefit is less than the cost of long-term care when $h_t = 2,000$, the net formal long-term care cost to the individuals will remain positive, $ltc_t - \lambda_t \geq 0$. The decision to purchase this insurance product is modeled as a once-and-for all decision at age 65, or $t = 1$.[25] I do not allow people who are initially in poor health to purchase insurance, a restriction used to match the fact that around a third of individuals are ineligible to purchase long-term care

[23] In practice, family care may entail direct expenses, such as specialized equipment.

[24] The load on an insurance product is defined as 1-(EPDV benefits/EPDV premiums), so an 18% load means that the policy pays \$0.82 in expected benefits for every \$1.00 in expected premiums.

[25] This roughly corresponds to the average age of insurance purchase, which is 67 (Brown and Finkelstein, 2007).

insurance due to health conditions (Hendren, 2013).[26]

The second source of long-term care insurance is Medicaid, a means-tested public insurance program (see more details in Section 2). The Medicaid benefit, m_t, is modeled as a consumption floor similarly to De Nardi, French, and Jones (2010). Specifically,

$$m_t = \max\{0, \underline{c} + ltc_t - \lambda_t - [a_t^P + y^P]\}. \tag{7}$$

The Medicaid benefit is positive if the parent's 'net' resources are less than the consumption floor $\underline{c}$. For parents with zero long-term care expenditures, 'net' resources are simply the sum of income y^P and assets a_t^P, and the consumption floor is equivalent to the benefits received by the Supplemental Security Income (SSI) program.[27] For parents with positive long-term care expenditures ($ltc_t > 0$), 'net' resources are the sum of income and assets minus *out-of-pocket* formal long-term care expenditures ($ltc_t - \lambda_t$). The distinction between total long-term care expenditures (ltc_t) and out-of-pocket long-term care expenditures ($ltc_t - \lambda_t$) is important: by law, Medicaid is a secondary payer, meaning that private insurance must pay benefits for an individual with an insurance policy before Medicaid will pay.[28]

4.4 Family budget constraint

The family can transfer resources across time through savings according to the following budget constraint:

$$a_{t+1}^P + a_{t+1}^K = (1+r)[a_t^P + a_t^K + y^P + L_t w_t^K - c_t^P - c_t^K - ltc_t + \lambda_t + m_t + SSI_t^K]. \tag{8}$$

Because the parent and child make joint decisions, resources are constrained by a single budget constraint defined over the sum of their resources as opposed to individual budget constraints. This family budget constraint is more flexible than two individual budget constraints because it allows for insurance between family members. In other words, cooperation allows transfers between the parent and child such that individual budget constraints need not hold.

[26] As Hendren (2013) notes, "if an insurer were to offer contracts to these individuals, they would be so heavily adversely selected that it would not deliver positive profits, at any price." This is empirically supported in my sample: only 2.6% of individuals who are initially in bad health own a long-term care insurance policy, while 11.5% of individuals who are initially in good health own one.

[27] In this sense, the child also has a consumption floor denoted $SSI_t^K = \max\{0, \underline{c} - [a_t^K + y_t^K]\}$.

[28] Brown and Finkelstein (2008) argue that Medicaid's secondary payer status is an important reason that Medicaid crowds out demand for private insurance because part of insurance premiums pay for benefits that would otherwise be paid by Medicaid (an 'implicit tax').

However, although resources can be transferred freely between the parent and child, they still own separate assets a_t^P and a_t^K. In a model of full commitment, the distribution of resources would be determined purely by Medicaid eligibility, resulting in the unrealistic outcome that the child would own all of the resources. With limited commitment, individual assets affect the threat points to cooperation, so in each period the family decides the optimal distribution of assets with the parent and child's outside options in mind.

4.5 Family problem

In each period t, the parent and child solve a Pareto problem with participation constraints in which the weight on the parent's utility is θ_t^P and the weight on the child's utility is θ_t^K.[29] These weights capture any current or prior renegotiation necessary to support cooperation, and can be interpreted as the relative decision power of each individual. The family solves:

$$V_t(\omega_t) = \max_{q_t} \ \theta_t^P U_t^P(c_t^P, F_t, U_t^K) + \theta_t^K U_t^K(c_t^K, \ell_t^K, NC_t = 0) + \beta E_t V_{t+1}(\omega_{t+1}|\omega_t) \tag{9}$$

where the decision variables are $q_t = \{c_t^P, c_t^K, a_{t+1}^P, a_{t+1}^K, F_t, L_t\}$ and the state variables are $\omega_t = \{a_t^P, a_t^K, y^P, w_t^K, h_t, ltci, \theta_{t-1}^P, \theta_{t-1}^K\}$,[30] subject to the following sets of constraints. The first are monetary constraints consisting of the family budget constraint (equation 8), the Medicaid benefit (equation 7), and no-borrowing constraints: $a_{t+1}^P \geq 0$ and $a_{t+1}^K \geq 0$. The second is the child's time constraint:

$$\mathcal{T} = L_t + \ell_t^K + fam_t. \tag{10}$$

Finally, the evolution of the Pareto weights θ_t^P and θ_t^K follow:

$$\theta_t^P = \theta_{t-1}^P + \mu_t^P$$
$$\theta_t^K = \theta_{t-1}^K + \mu_t^K$$

in which $\mu_t^P \geq 0$ and $\mu_t^K \geq 0$ are chosen to satisfy the following participation constraints:

$$V_t^P(\omega_t) \geq Z_t^P(\omega_t) \tag{11}$$
$$V_t^K(\omega_t) \geq Z_t^K(\omega_t) \tag{12}$$

[29] If the parent dies before time T, the problem reverts to the child's problem in Appendix B.

[30] In the first period, $ltci$ is a decision variable and not a state variable.

which state that the value of cooperation, $V_t^P(\omega_t)$ and $V_t^K(\omega_t)$, must be larger than the value of non-cooperation, $Z_t^P(\omega_t)$ and $Z_t^K(\omega_t)$, respectively. Marcet and Marimon (2011) show that if person i's participation constraint is not satisfied, μ_t^i is set so as to shift just enough resources to them to satisfy them in cooperation under a new weight θ_t^i.[31] The left-hand side of these constraints, for choices $\{q_t^*(\omega_t)\}_{t=1}^T$, are equal to:

$$V_t^P(\omega_t) = U_t^P(c_t^{*P}(\omega_t), F_t^*(\omega_t), U_t^{*K}(\omega_t)) + \beta E_t V_{t+1}^P(\omega_{t+1}|\omega_t)$$
$$V_t^K(\omega_t) = U_t^K(c_t^{*K}(\omega_t), \ell_t^{*K}(\omega_t), NC_t^*(\omega_t) = 0) + \beta E_t V_{t+1}^K(\omega_{t+1}|\omega_t)$$

and are defined recursively using the terminal condition in equation (5):

$$\begin{aligned} V_T^P(\omega_T) =& U_T^P(c_T^{*P}(\omega_T), F_T^*(\omega_T), U_T^{*K}(\omega_T)) + \eta\, \beta V_{T+1}^K(a_{T+1}^{*K}(\omega_T)) \\ V_T^K(\omega_T) =& U_T^K(c_T^{*K}(\omega_T), \ell_T^{*K}(\omega_T), NC_T^*(\omega_T) = 0) + \beta V_{T+1}^K(a_{T+1}^{*K}(\omega_T)) \end{aligned}$$

in which $V_T(\omega_T) = \theta_T^P V_T^P(\omega_T) + \theta_T^K V_T^K(\omega_T)$. If the parent dies before time T, the parent's terminal value is simply $V_T^P(\omega_T) = \eta\, \beta V_T^K(\omega_T)$.

The right-hand sides of equations (11) and (12), Z_t^P and Z_t^K, are the values of non-cooperation to the parent and child. I define non-cooperation as a breakdown in family ties in which the parent and child make separate decisions in all future periods, and all opportunities for family care cease. The only monetary transaction between the parent and child is a potential bequest at the death of the parent, which arises through the parent's altruism, η, towards the child.[32] The model incorporates these restrictions on behavior to capture the notion that family care is a complex decision that requires a level of coordination that is infeasible when families cannot make joint decisions.

The value of non-cooperation to the parent is thus the solution to:

$$Z_t^P(\omega_t) = \max_{c_t^P} \; U_t^P(c_t^P, F_t, U_t^K) + \beta E_t[Z_{t+1}^P(\omega_{t+1}|\omega_t)]. \tag{13}$$

in which the expectation is over future long-term care needs, survival, and the child's income,[33]

[31] Indeed, μ_t^P and μ_t^K correspond to the Lagrange multiplier of the sequential participation constraints. This shift in the Pareto weight is the constrained efficient solution to limited commitment problems. Under full commitment, the efficient solution fixes the Pareto weight at the original level μ_0. As Kocherlakota (1996) shows, the allocation under limited commitment that delivers a solution nearest the efficient solution while satisfying participation constraints is the minimal adjustment in Pareto weights.

[32] The parent may want to make inter-vivos transfers to the child as well. However, because of strategic incentives, I restrict transfers to only occur as bequests (see Appendix C for a more complete discussion about this issue).

[33] Since bequests depend on the well-being of the child, the circumstances of the child factor into the parent's consumption and savings decisions, even in this non-cooperative state. A similar argument applies to the parent's circum-

subject to her own budget constraint:

$$a_{t+1}^P = (1+r)[a_t^P + y^P - c_t^P - ltc_t + \lambda_t + m_t] \tag{14}$$

and a no-borrowing constraint $a_{t+1}^P \geq 0$. In the first period, the parent also chooses whether to buy long-term care insurance $ltci$.

The value of non-cooperation to the child is the solution to:

$$Z_t^K(\omega_t) = \max_{c_t^K, L_t^K} U_t^K(c_t^K, \ell_t^K, NC_t = 1) + \beta E_t[Z_{t+1}^K(\omega_{t+1}|\omega_t)] \tag{15}$$

subject to her time constraint: $\mathcal{T} = L_t + \ell_t^K$ and her own budget constraint:

$$a_{t+1}^K = (1+r)[a_t^K + L_t^K w_t^K - c_t^K + SSI_t^K] \tag{16}$$

as well as a no-borrowing constraint $a_{t+1}^K \geq 0$ and consumption floor $\underline{c}$. Equation (16) is slightly modified at the parent's death at time t_d: at that point, the child also receives the remaining assets of the parent $a_{t_d}^P$.

The values of the parent and child's non-cooperative problems are dependent on each others' decisions because of the parent's altruism, which may result in a bequest. In each period, I assume the following timing: First, the parent chooses her own consumption (and, in the first period, whether to buy insurance), all the while anticipating the child's response functions. Second, the child chooses her consumption and labor supply. Because this problem can be defined recursively and all decisions are based on payoff-relevant state variables, the equilibrium concept to this game is a Markov perfect equilibrium.

While non-cooperation can be threatened by both the parent and child, it will never materialize in equilibrium. This is because, as other models of risk-sharing with limited commitment have shown (see for example Ligon, Thomas, and Worrall (2002)), both the parent and child will always be at least as well off cooperating as non-cooperating due to a positive surplus of cooperation. In the model above, this surplus consists of risk-sharing opportunities, as well as monetary savings by the ability to substitute family care for formal long-term care, preferences over family care, and child guilt.[34] Indeed, the surplus in this problem allows for a greater degree of cooperation than risk-

stances in the child's decisions.

[34] As pointed out by Kandel and Lazear (1992), feeling guilty, or 'guilt aversion', will minimize limited commitment problems.

sharing alone would.[35] This is in contrast to recent marriage models with limited commitment (e.g. Voena (2015), Bronson (2014), Yamaguchi, Ruiz, and Mazzocco (2014)), in which non-cooperation (divorce) is feasible because negative preference shocks can eliminate any marital surplus that previously made marriage desirable.[36]

4.6 Model discussion

I numerically solve the model using backward induction from the final period T (see Appendix D for details). However, there are several features of the model that can be discussed informally. I focus the discussion on the implications for the two main mechanisms through which families choose to insure long-term care risk: private insurance and savings.

In a model of long-term care insurance demand without family care (e.g. a single agent life-cycle model), demand for insurance is largely dictated by Medicaid and savings. First, Medicaid crowds out the demand for private insurance: since Medicaid pays formal care expenses for individuals with no resources, private insurance is redundant for Medicaid enrollees. This is particularly salient for low-wealth individuals with few assets to protect, but may also be releveant further up the wealth distribution. Second, the ability to save, or 'self-insure', may act as a substitute for private insurance (particularly if insurance does not offer actuarially fair policies): individuals can transfer their own resources across time to smooth consumption. This feature may also reduce the demand for insurance, and is particularly salient for high-wealth individuals. Nonetheless, Brown and Finkelstein (2008) find that a single agent model with Medicaid and self-insurance can generate the positive correlation between insurance demand and wealth found in the data, but it cannot explain the relatively muted demand for insurance by wealthy individuals.

Adding the family to this model introduces new implications for insurance demand through family care, altruism, and risk-sharing channels. Family care may reduce the demand for insurance through the budget constraint and preferences. First, wage rates and the value of leisure determine the opportunity cost of family care to the child. A relatively low opportunity cost of time makes family care cheaper than formal care. Cheaper care effectively lowers the riskiness of becoming sick, and therefore may lower the demand for insurance. Second, the parent's preference for family care may lower the demand for insurance because insurance does not cover family care.

[35] The parent's altruism toward the child may also alleviate risk-sharing constraints (see Foster and Rosenzweig (2001) for a discussion on this issue).

[36] Arguably, the threat of non-cooperation may not be credible: there may arise future opportunities in which it may become profitable to cooperate. However, this feature is not unique to this setting; this issue could arise in most other dynamic limited commitment problems as well.

Parent altruism, such as bequest motives or pure altruism, has an ambiguous effect on insurance demand. On the one hand, the desire to leave a bequest (or transfer assets to a child) increases the value of long-term care insurance because insurance protects assets (Pauly, 1990). On the other hand, bequests lower the value of insurance by reducing the opportunity cost of precautionary savings (Lockwood, 2014).

The ability of the parent to share the financial risk of long-term care with the child will also lower the demand for insurance: the ability of the parent to spread long-term care cost shocks between both members of the family is a form of insurance in and of itself, thereby displacing the role of a formal insurance product.[37] Limited commitment decreases the overall ability to share risk, which will mute the effect of risk-sharing on insurance demand.[38]

The model also has implications for savings, a form of 'self-insurance' against long-term care risk. First, the means-tested nature of Medicaid and SSI decreases the value of saving in the model, as shown in Hubbard, Skinner, and Zeldes (1995). Second, uncertainty over future long-term care needs and mortality increases the value of savings, as do bequest motives, as shown in De Nardi, French, and Jones (2010). Third, analogously to the insurance argument, the value of savings is lower when cheap family care is available and when the family is able to share risk.

Finally, limited commitment will affect savings behavior. This paper is one of the first to incorporate individual saving in an empirical model of limited commitment.[39] Theoretically, Ligon, Thomas, and Worrall (2000) show that larger asset holdings makes non-cooperation more attractive through an enhanced ability to self-insure, but that a risk-sharing network can use savings as a partial substitute for commitment by strategically transferring savings between members. The member that receives most of the surplus of the risk-sharing relationship optimally stores most of the assets, creating a "liquidity constraint" on the member that may otherwise find non-cooperation more attractive. Thus, in my model the fraction of the surplus captured by each member will have implications for the distribution of assets between the parent and the child.

[37] See Mobarak and Rosenzweig (2012) for an interesting application of the interaction of informal risk-sharing and formal insurance to agricultural risk.

[38] Technically, the more the participation constraints bind due to the limited commitment nature of the problem, the less effective is the risk-sharing component of the relationship.

[39] Savings is joint in almost all empirical marriage models with limited commitment. An exception to this is Bayot and Voena (2014), who study prenuptial agreements.

5 Estimation

To quantify the effect of the family on long-term care insurance demand and evaluate counterfactual policies, I structurally estimate the model using data from the Health and Retirement Study and the Panel Study of Income Dynamics. I use a two-step procedure following Gourinchas and Parker (2002) and De Nardi, French, and Jones (2010). In the first step, I estimate certain parameters of the model directly from the data and calibrate others from the literature.[40] In the second step, I numerically solve the model and structurally estimate the remaining parameters conditional on the first stage parameters as well as some calibrated parameters. I estimate the model using simulated method of moments (McFadden, 1989; Pakes and Pollard, 1989).

5.1 Data

To estimate the model, I mainly use data from the Health and Retirement Study, a nationally representative longitudinal survey of individuals aged 50 that began in 1992. The survey contains detailed questions about health, wealth, income, and demographic and family information, including some key characteristics of their children.

My sample consists of single (divorced, widowed, or never married) individuals aged 65 and above who are retired and have at least one child.[41] Following Lockwood (2014), I restrict the sample to individuals who do not miss an interview between 1998 and their death and to individuals with annual labor earnings of less than \$3,000 to better ensure they are retired.[42] All dollar amounts are converted to 2010 dollars using the CPI.

Table 5 reports summary statistics for this sample of parents. 92% of the parents are widowed and 83% are female. This reflects the fact that women often outlive their spouses. On average, the parent has over 3 children, 20% of them are on Medicaid, and only 8% own a long-term care insurance policy.

I measure long-term care needs by the amount of help the parent reports receiving for activities of daily living or instrumental activities of daily living.[43] I categorize their needs as $h_t = 0$ if

[40]In theory, some of these parameters could be estimated within the model. In practice, repeatedly solving the model is computationally burdensome due to the numerous continuous state variables as well as numerous continuous choice variables.

[41]While the model includes only one child, I do not restrict my sample to parents with one child because this would significantly reduce my sample. For parents with multiple children, I use selection criteria to choose which child's characteristics to use in estimation, as described below.

[42]From the sample of 9,141 individuals age 65 and over in 1998 who do not miss a future interview, the restriction to single individuals reduces the sample size to 3,480. The restriction to annual labor earnings less than \$3,000 reduces the sample size to 3,186. Finally, the restriction to individuals with at least one child reduces the sample size to 2,630.

[43]The set of ADLs asked about are: walking across a room, dressing, bathing, eating, getting in and out of bed, and

Table 5: Parent Characteristics

	Mean	Median
Female	.83	
Widowed	.92	
Children	3.4	3
Medicaid	.20	
Own LTC insurance	.08	
Need light care	.17	
% Family care	.61	(7.5 hrs/wk)
Need intensive care	.20	
% Family care	.42	(52.5 hrs/wk)
Permanent income	\$18,308	\$14,157
Wealth	\$225,253	\$78,427
# Individuals	2,630	

Note: The sample includes single retired individuals aged 65 and over in the pooled 1998-2010 Health and Retirement Study. Light care is defined as 1-100 hours per month; intensive care is defined as over 100 hours per month. The first column of the 'family care' rows denote the percent of care that is provided by family members, and the second column denotes the median hours per week of family care received for those who receive family care. Income is defined as the average over all periods of total income less asset income and government transfers. Wealth is defined as the sum of all assets less debts.

they do not need any care, $h_t = 1000$ if they need 1-100 hours per month of help (light care), and $h_t = 2000$ if they need over 100 hours per month (intensive care). In addition, I categorize their needs as $h_t = 1000$ and $h_t = 2000$ if the parent reports living in an assisted living facility or a nursing home, respectively. Table 5 shows that 17% of the sample needs light care and 20% needs intensive care at a given point in time.

I assign the type of care (formal or family care) based on the relationship of the helper to the parent as well as the residential status of the parent. If the parent receives any help from the child, the help is categorized as family care. Otherwise, it is categorized as formal care. The only exception to this is if the parent resides in an assisted living facility or a nursing home, in which case the help is categorized as formal care.[44] In my sample, 61% of light care is provided informally for 8 hours per week at the median, and 42% of intensive care is provided informally for 53 hours per week at the median.

using the toilet. The set of IADLs asked about are: using a map, using a telephone, managing money, taking medications, shopping for grocieries, and preparing hot meals. The exact wording of the question is: "Because of a health or memory problem do you have any difficulty with...?" and the respondent is specifically asked to "exclude any difficulties you expect to last less than three months". If the respondent reports any difficulty, s/he is asked "Does anyone ever help you...". The look-back period for the hours of care is only the previous month. Because the length of a period in the model is two years, the implicit assumption in the model is that this monthly amount is consistent over the course of two years.

[44] 41% of parents categorized as formal care recipients also receive some amount of family care (a median of 4 hours per week conditional on any family care), but the vast majority of these cases are nursing home residents whose main source of care is formal. 27% of parents categorized as receiving family care also receive some amount of formal care (a median of 15 hours per week conditional on any formal care).

Permanent income of the parent is the average over all periods observed of total income less asset income and government transfers such as Supplemental Security Income (SSI) that I explicitly account for in the model. On average 80% of this income comes from Social Security, and most of the remainder from pension income. Median income is around $14,000 a year in my sample.

I measure parent assets as the sum of all assets less debts. The HRS has a rich set of asset questions that includes the value of housing and real estate, vehicles, the value of a business or farm, savings accounts and other liquid assets, individual retirement accounts, Keoghs, stocks, mutual funds, bonds, and other assets. Because of inaccuracies in the wealth variables in early survey years, I only use data from 1998 onward (see Lockwood (2014) and the references cited therein for more details). Because I model a parent from age 65 through death but only have data from 1998-2010, I rely on multiple cohorts to trace out life-cycle savings paths. To isolate life-cycle effects from potential cohort effects,[45] I regress assets on age and cohort dummies. From these regression coefficients, I predict median assets by age for the cohort that is 65-69 in 1998. These values, which are purged of cohort effects, will be used as moments for estimation.[46] Across all ages, median wealth is $78,000.

For child characteristics, I use a combination of the Health and Retirement Study and the Panel Study of Income Dynamics. The first step is to determine which child to use in the sample when a parent has multiple children (82% of the sample has multiple children). To do this, I first choose the child who provides the highest number of hours of family care over the sample period. This determines 53% of the sample with multiple children. For the remaining sample, I sequentially apply the following rules until a tie is broken: (1) the child who lives closest to the parent, as determined by whether the child lives within 10 miles of the parent (this determines an additional 28%), (2) whether the child is a daughter (8%), (3) the oldest child (10%), and (4) for the remaining few ties, I randomly select a child. A comparison of sample children and all children of the parents is shown in Table 6. Selected children are more likely to be female and more likely to be educated but less likely to be working full time. They are much more likely to live within 10 miles or even live with their parent. These effects are all magnified for selected children who eventually provide long-term care for their parent.

In the HRS, demographic information about the child is limited and stems from questions asked to the parents. In the model, children are differentiated by their potential wage and their savings. To measure the child's potential wage, I use the child's education instead of the child's household

[45]Different cohorts may have very different rates of return on their wealth. The model, on the other hand, captures only life-cycle effects, so for this reason I take out cohort effects.

[46]The left panel of Appendix Figure 3 shows median raw assets and median assets purged of cohort effects.

Table 6: Child Characteristics

	Non-Selected	Selected	Selected Caregivers
Age	53	54	55
Age gap with parent	29	28	29
Female	0.45	0.60	0.64
Married	0.67	0.62	0.61
Number of children	2.3	2.1	2.2
Less than high school	0.14	0.08	0.10
High school	0.41	0.37	0.40
Not working	0.29	0.33	0.38
Part-time work	0.08	0.09	0.10
Owns home	0.60	0.57	0.56
Lives w/in 10 miles of parent	0.32	0.70	0.72
Coresides with parent	0.05	0.20	0.27
Receives childcare from parent	0.03	0.05	0.04
Average care when parent sick (hrs/wk)	2.0	17.2	20.7
Child in will	0.81	0.89	0.90
Transfer to child $500+ past year	0.07	0.14	0.13
Transfer from child $500+ past year	0.04	0.06	0.08
Observations	6,499	2,630	1,413

Note: The sample includes all children of single retired individuals aged 65 and over in the pooled 1998-2010 Health and Retirement Study. Children who have no siblings are all in the 'Selected' category. When a parent has multiple children, the selected child is determined by a set of 4 criteria: first the child who provides the most care (this determines 53% of the sample of multiple children), then who lives nearby (this determines 28%), then whether the child is a daughter (this determines 8%), and finally the oldest child (this determines 10%). For the few remaining ties, a random child is selected. 'Selected Caregivers' is the subset of 'Selected' children who provide care at any point during the sample period.

income, which is a result of labor supply decisions and only reported in large brackets. I assign children with a high school degree or less as low 'types' and children with more than a high school degree as high 'types' to capture differences in opportunity costs of time.

Child assets are not ascertained in the HRS, so I turn to the Panel Study of Income Dynamics (PSID). The PSID is a nationally representative longitudinal study that started in 1968 that includes detailed information about income and assets. Importantly, it follows children as new sample members after they split off from their parent's household. I follow the same sample restrictions and wealth definitions for parents in the PSID as in the HRS, and link this sample to their children. Like parent assets, I use multiple child cohorts and isolate life-cycle effects from cohort effects (see the right panel of Appendix Table 3). Additionally, I impute child assets onto the HRS sample for initial conditions. Specifically, I use demographic information about the parent and child contained in both datasets, including parent wealth and income percentiles, child income bin corresponding to the child income bins in the HRS, child home ownership, a fourth order polynomial in child age and a quadratic in parent age, child gender, child marital status, child education, child number of children, and year.[47]

5.2 First stage parameters

Prior to estimating the key parameters inside the model, I estimate certain parameters outside the model that do not require the structure of the model. Parent income and long-term care costs can be estimated directly from the data. Because I assume that survival probabilities and transition between long-term care needs states only depend on prior need state, age, and permanent income, these transitions are exogenous to choices made within the model. These values, in addition to values of parameters taken from the literature, are shown in Table 7.

I allow for three values of parent permanent income, which are the medians of each tercile in the sample. I allow the child's income process to vary by whether the child went to college or not. The mean initial income for high school graduates is set to $y_0^K = \$25,000$ and the mean initial wage for children with more than a high school degree is $y_0^K = \$50,000$. The annual variance of permanent shocks to log wages is set to $\sigma_\xi^2 = 0.029$ (Attanasio, Meghir, and Mommaerts, 2015). The consumption floor for Medicaid and SSI is \$7,800 annually (Brown and Finkelstein, 2008). Total hours available is set to 16 hours each day, or 5840 per year. The discount factor is set to 0.94 (Lockwood, 2014) and the return on assets is 3%. The constant relative risk aversion parameter is 2.0 (Lockwood, 2014). Each period in the model is 2 years to match the biennial nature of the HRS data.

Long-term care and mortality transitions

I estimate the probability of death and transitions between states of long-term care need as logistic functions of previous long-term care need, permanent income percentile, a cubic in age, and age interacted with permanent income rank and previous long-term care need, similarly to De Nardi, French, and Jones (2010).[48] In the model, simulated individuals are assigned actual long-term care need and mortality trajectories of individuals from the data to reduce simulation noise. To form their expectations over future long-term care and mortality shocks, however, they use the estimated

[47] I impute assets using predictive mean matching, which involves using a linear prediction of assets as a distance measure to find a set of nearest neighbors from which a randomly drawn value is assigned. This method preserves the distribution of values from the PSID beyond only a linear prediction, which did not replicate the skewed distribution of assets (Little, 1988).

[48] Brown and Finkelstein (2008) and Lockwood (2014) use an actuarial model of formal services (Robinson, 2002) to calculate health state transitions. Since I assume that using formal services are endogenous, the Robinson model is inappropriate for the context of this paper. Indeed, by only defining long-term care risk over formal services, these models may be critically under-estimating the amount of long-term care risk that individuals face.

Table 7: First stage parameters

Parameter	Description/Source	Value
Income parameters		
y^P terciles	Parent permanent income	\$8,131 / \$14,648 / \$25,007
	(estimated from HRS sample)	
y_0^K	Initial child income	\$25,000 / \$50,000
σ_ξ^2	Child wage shock variance	0.029
	(Attanasio, Meghir, and Mommaerts, 2015)	
LTC parameters		
λ_t	LTC insurance premium	\$3,200 (18% load)
	(estimated from HRS sample)	
	Cost of formal LTC (see text)	\$20,000 / \$61,700
fam_t	Hours of informal LTC needed	1,000 / 2,000
Transition parameters		
LTC probabilities	Estimated from HRS sample	See Table 8
Survival probabilities	Estimated from HRS sample	See Table 8
Other parameters		
$\mathcal{T}$	Total hours available (16*365)	5840
β	Discount factor (Lockwood, 2014)	0.94
r	Market return on assets	1.03
γ	CRRA parameter (Lockwood, 2014)	2.0
$\underline{c}$	Consumption floor	\$7,800
	(Brown and Finkelstein, 2008)	
t	Length of a decision period	2 years

Note: Parameters values are denominated in annual amounts. All monetary values are in 2010 dollars.

transition probabilities.

Table 8 uses the estimated long-term care and mortality transitions to simulate individuals with the initial conditions (but not the actual trajectories for this exercise) found in the data. Conditional on reaching age 65, individuals on average live 15.3 more years, with 31% dying by age 75 and only 7% living past age 93. 84% of the sample initially receives no long-term care, but by age 85, almost half of living individuals need long-term care, and by age 93, 80% will need long-term care. Two-thirds of individuals at 65 will need some amount of long-term care within their life.

Long-term care cost and insurance parameters

For light care, I assume that formal care costs \$20,000 per year (equivalent to around \$20 per hour for a home aide for 1,000 hours) and informal care costs 1,000 hours per year to the child. For heavy care, I assume that formal care costs \$61,700 per year, which is the average non-consumption cost of a nursing home in 2010 (Lockwood, 2014).[49]

[49] This assumes that the average non-health expenditure (e.g. housing, food) is \$7,800. I do not include long-term care costs in total consumption, but include the consumption value of institutional care in consumption. The consumption value of nursing homes can vary in reality: for example, there are private and semi-private rooms, so my specification allows this to enter the consumption decision.

Table 8: Simulated mortality and long-term care use

	Age 65	Age 75	Age 85	Age 93	Ever
Life expectancy at 65	15.3				
Percent dead	0.0	0.31	0.66	0.93	
Long-term care status					
Percent healthy	0.84	0.83	0.54	0.20	–
Percent need light care	0.13	0.10	0.21	0.27	0.48
Percent need intensive care	0.03	0.07	0.25	0.53	0.43
Percent need any care					0.66

Note: This table reports simulated long-term care and mortality statistics. The simulations use the initial health and income conditions of the sample of parents reported in Table 5; simulated individuals are assigned long-term care needs and mortality status based on the estimated transition probabilities. Transitions are estimated at a biennial rate. Light care is defined as 1-100 hours per month; intensive care is defined as over 100 hours per month.

Following Lockwood (2014), I use a simple long-term care contract in which premiums are paid annually in exchange for benefits in years in which the parent needs and uses formal long-term care services, up to a maximum daily benefit of \$100 in 2000 dollars, which in 2010 amounts \$44,350 per year. Using the average long-term care needs distribution in my estimation sample, I calculate expected benefits and set the premium to exceed expected benefits by 18%, which is the average load in the US (Brown and Finkelstein, 2007). This amounts to premiums of \$3,200 per year.

5.3 Internally estimated parameters

In the second stage, I use the method of simulated moments to estimate the remaining parameters inside the model: the parent's preference for family care z, the parent's altruism η, the child's guilt g, the consumption floor $\underline{c}$, the terminal value parameter ϕ, and the initial weight on the parent's value function, θ_0. These estimates, $\hat{\boldsymbol{\psi}}$, are chosen to match the simulated moments from the model as closely as possible to the moments from the data. I use 40 moments that capture the tradeoffs discussed in Section 4.6: 15 parent median assets and 15 child median assets corresponding to ages 65 to 93 of the parent (taken every other year), the percent of parents with long-term needs who receive family care for each wealth quintile of the parent's assets at age 65, and the percent of parents who own private long-term care insurance for each wealth quintile of the parent's assets at age 65.

The optimal choice of $\hat{\boldsymbol{\psi}}$ is the solution to the criterion function

$$\hat{\boldsymbol{\psi}} = \arg\min_{\boldsymbol{\psi}} (\mathbf{m}_{\text{data}} - \mathbf{m}_{\text{sim}}(\boldsymbol{\psi}))\mathbf{G}(\mathbf{m}_{\text{data}} - \mathbf{m}_{\text{sim}}(\boldsymbol{\psi}))' \tag{17}$$

where $\mathbf{m}_{\text{data}}$ is the vector of empirical moments and $\mathbf{m}_{\text{sim}}(\boldsymbol{\psi})$ are the corresponding simulated moments calculated at $\boldsymbol{\psi}$.[50] The weighting matrix $\mathbf{G}$ is the inverse of the diagonal of the variance-covariance matrix of the data, $[Var(\mathbf{m})]^{-1}$ (Altonji and Segal (1996) show the potential biases introduced by the optimal weighting matrix). Standard errors are calculated using the standard sandwich formula, taking as given the first stage estimates.[51]

Table 9: Internally estimated parameters

Parameter	Description	Estimate	Standard error
z	Parent formal care preference (10^{-7})	-1.00	0.871
g	Child guilt (10^{-5})	1.12	0.122
η	Parent altruism	0.09	0.002
α	Consumption-leisure tradeoff	0.52	0.001
ϕ	Terminal value weight	0.43	0.003
θ_0	Initial weight on parent	0.60	0.080

Note: This table reports estimates of the structurally estimated parameters of the model. The parameters are estimated by method of simulated moments. The weighting matrix is the diagonal of the variance-covariance matrix of the data. Standard errors are calculated using the standard sandwich formula, taking the first stage estimates as given.

The parameter estimates are shown in Table 9. The first two preference parameters indicate that parents have a distaste for formal care and children feel guilty if they do not cooperate with their parent. Parent altruism is similar to Kaplan (2012), whose estimate is 0.04 for parents at a younger stage in life. The low value of altruism is also consistent with Cox (1987) and Bernheim, Shleifer, and Summers (1985) who find that exchange motives are more important than altruistic motives in long-term care decisions. The weight that the child places on the terminal value is 0.43. The consumption-leisure trade-off of 0.52 is consistent with that used elsewhere (Low, 2005), and the initial Pareto weight for the parent of 0.6 signifies that at age 65, they have somewhat higher initial bargaining power in the relationship than their children, though this is mediated by their altruism.

The model fit based on these moments are in Table 10 and Figure 2. The simulated moments match most of the empirical moments pretty well, and the parameter estimates that accompany these moments are also sensible. The model is able to capture both the overall low demand for insurance as well the increase in demand with wealth. It also matches median wealth over time for parents and children. The model captures the mean rate of informal care use among unhealthy parents (50.3% in the model and 50.2% in the data), but it has more difficulty matching the inverse-U shape across the wealth distribution in the data. One reason for this may be that the model does not capture variation

[50] I first search for a global minimum using a genetic algorithm, and enhance the precision using a simplex method after the global optimizer converged.

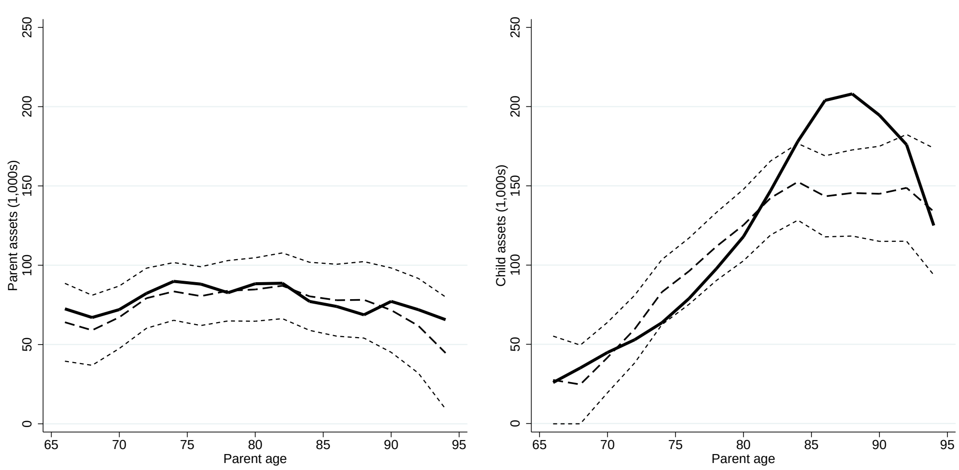
[51] I use numerical methods to calculate gradients. In an effort to deal with the lack of smoothness, I use simulated moments generated by 10,000 simulated individuals.

Table 10: Moments matched in estimation

	Insurance rates		Informal care rates	
	Data [95% CI]	Model	Data [95% CI]	Model
Parent wealth quintile				
1 (poorest)	0.025	0.008	0.400	0.144
	[0.014,0.037]		[0.373,0.428]	
2	0.040	0.020	0.497	0.457
	[0.028,0.051]		[0.464,0.529]	
3	0.061	0.070	0.627	0.557
	[0.049,0.072]		[0.589,0.665]	
4	0.084	0.074	0.569	0.743
	[0.073,0.096]		[0.526,0.612]	
5 (wealthiest)	0.177	0.178	0.542	0.690
	[0.166,0.189]		[0.498,0.585]	

Note: Table reports data and simulated moments for long-term care insurance coverage by parent wealth quintile and informal care usage among parents with long-term care needs by parent wealth quintile. Data 95% confidence intervals in brackets. Median parent and child assets are also matched and shown in Figure 2.

Figure 2: Median wealth of parents and children



Note: Figure reports median wealth (in $1,000s) of parents (left graph) and children (right graph) over time. The dashed lines denote the data moments (from the HRS for parents and the PSID for children), with 95% confidence intervals denoted by the short-dashed lines. The model moments are denoted by the solid lines. Insurance and informal care rates by parent wealth quintile are also matched and shown in Table 10.

in nursing home quality, particularly the low quality of Medicaid nursing homes.[52] A second reason may be that the model does not capture other inputs to the opportunity cost of informal care, such as complementarities between leisure and informal care that may arise in coresident households (which are more common among less wealthy families). Finally, the model may mis-measure (most likely, understate) the correlation between child wages and parent wealth, which could result in heightened informal care among wealthy parents.

Figure 3 shows graphically the variation in the data that helps identify the formal care preference parameter and the child guilt parameter. For each graph, the solid purple horizontal line denotes the value of the moment in the data, and the solid black line denotes the value of the simulated moment as the value of the parameter on the x-axis changes.[53] The left panel shows that the prevalence of informal care in the data provides identification for the parent's preference over formal care, z. The simulated moment increases as the preference for formal care decreases. The empirically high prevalence of informal care in the data suggests that this preference parameter should be sufficiently high that high earning children choose to provide care informally, even though their opportunity cost of time may be higher than the monetary cost of formal care. The child guilt parameter g influences the degree to which the parent and child are able to cooperate.[54] As g decreases, the likelihood that the child can effectively threaten non-cooperation increases and the ability to risk-share may break down. The right panel of Figure 3 shows that this 'instability' increases the appeal of long-term care insurance, and therefore the average long-term care insurance coverage in the data provides information to estimate g.

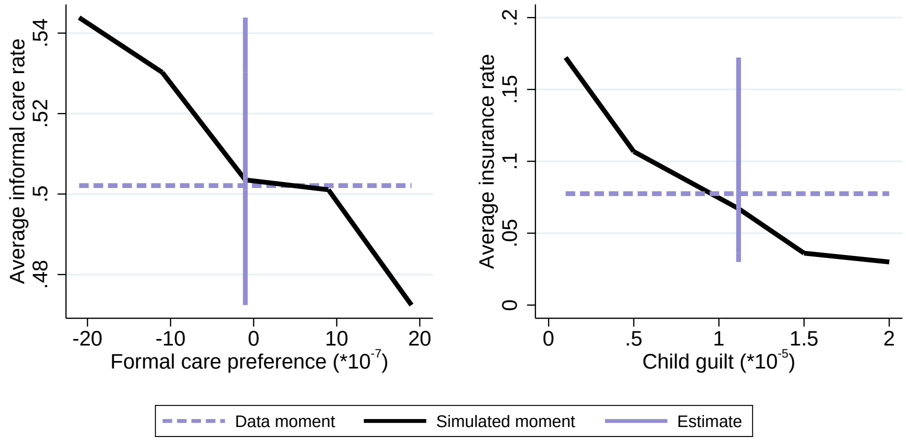
The median asset paths of parents and children and Medicaid recipiency rates of parents provide information to identify the remaining parameters. The amount of assets the child holds towards the end of the model directly informs the parameter of the terminal value function, ϕ. The asset holdings of the child throughout the model informs the consumption-leisure trade-off parameter, α: the more leisure is valued, the less consumption, and therefore assets, are valued. The parent's altruism toward the child, η, influences the rate at which the parent decumulates assets: the larger the altruism parameter, the more the parent wishes to bequeath upon death. Since strategic storage of assets can help ensure cooperation (see the model discussion in Section 4.6), altruism and guilt parameters will also affect the distribution of assets between parent and child.

[52] Medicaid nursing homes are of significantly lower quality than nursing homes that do not accept Medicaid residents (Hackmann, 2015). The model does not explicitly capture this difference in care except through consumption choices, which are limited for Medicaid enrollees through $\underline{c}$.

[53] The parameter estimate is not exactly at the intersection of the two solid lines in part because the moments shown in Figure 3 are an average of all of the quintiles, while in estimation the moment for each quintile is matched.

[54] Indeed, threat points are important: in 73% of the simulations, the Pareto weights must adjust to accommodate threats.

Figure 3: Identification of z and g



Note: The figure on the left shows identification of the formal care preference z, and the figure on the right shows idenfication of the child guilt parameter g. For each, the x-axis is the value of the parameter, and the y-axis is the moment that identifies the parameter. The black line denotes the simulated moment, and the vertical purple line denotes the estimated value. The horizontal dotted line denotes the data moment.

6 Counterfactuals

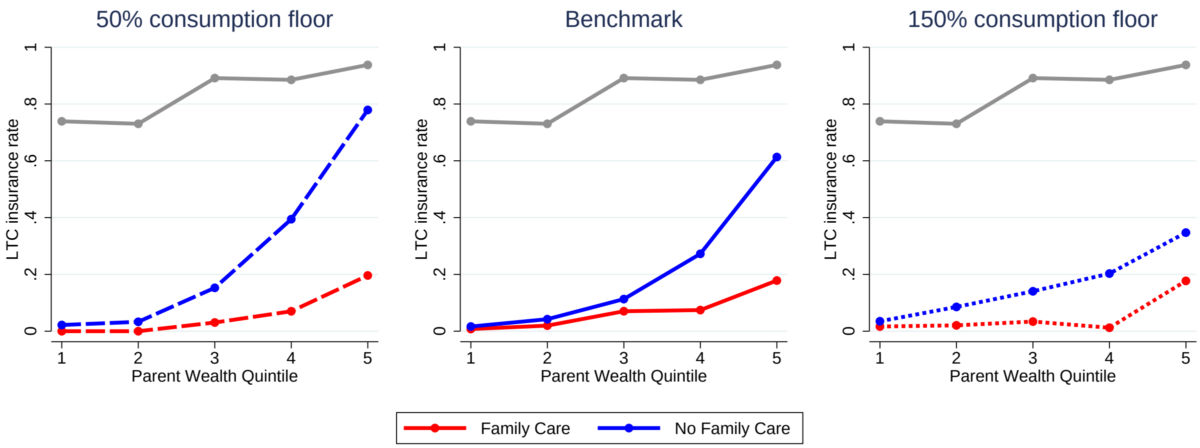
With these estimates of the structural parameters, I evaluate alternative environments and policies to understand how they may affect long-term care behavior and welfare.

6.1 Family care and the demand for long-term care insurance

First, I calculate the demand for long-term care insurance without the option to use family care. From this, I can quantify how much family care can explain the lack of demand for long-term care insurance. In the model, this is equivalent to setting $F_t = 1$ whenever $h_t \neq 0$ (and hence $fam_t = 0$ for all h_t). This counterfactual is depicted in the middle panel of Figure 4. The gray line denotes the percent of parents who are initially healthy, and therefore eligible to purchase insurance. The solid red line is the benchmark model with family care and the solid blue line is the counterfactual model without family care.

The middle graph shows that the availability of family care decreases the overall demand for insurance by 14 percentage points, and that virtually none of this change in demand comes from the lower 60% of the parent wealth distribution. The intuition behind this result is a wealth effect: parents are effectively poorer without family care because some of them face higher long-term care expenses. This wealth effect induces people to spend down to Medicaid (Medicaid 'crowd-out', Brown and Finkelstein (2008)) in lieu of purchasing insurance, despite the fact that private insurance now covers the (sole) source of care. For the wealthier 40% of parents, in contrast, insurance demand

Figure 4: Counterfactual LTC insurance coverage by wealth: the impact of family care and Medicaid



Note: All figures report the percent of parents with long-term care insurance coverage at age 65, by parent wealth quintile. The gray line denotes the percent of parents who do not need long-term care at age 65 (and thus are eligible for long-term care insurance). In the middle panel, the red line denotes the matched long-term care insurance coverage reported in Table 10, and the blue line denotes the insurance coverage rate when family care is unavailable ($fam_t = 0$). In the left (right) panel, the red line denotes the insurance coverage rate when the Medicaid floor ($\underline{c}$) decreases (increases) by 50%, and the blue line denotes the insurance coverage rate when additionally family care is unavailable ($fam_t = 0$).

increases from 13% to 44%. Although they are subject to a wealth effect, they also have a stronger desire to protect their assets than less wealthy parents. Insurance increases in the absence of family care because there is no longer a trade-off between the risk-protection value of insurance and the value of using family care. The only source of care available is covered by insurance.

These results suggest that insurance demand generally, and the effect of family care on insurance demand more specifically, may be sensitive to Medicaid policy. The left and right panels of Figure 4 modify the generosity of Medicaid by changing $\underline{c}$ to 50% and 150% of the benchmark $\underline{c}$ of $\$7,800$, respectively. The dotted red lines show that there is almost no change in insurance demand in an environment with family care (compared to the solid red line of the middle panel), implying that insurance decisions are insensitive to the consumption floor when family care is available. In contrast to the middle panel, the removal of family care coupled with a less generous consumption floor (left panel) increases the overall demand for insurance by 24 percentage points overall. This implies that the downside to forgoing insurance is much worse when the consumption floor is cut in half and family care is absent, and results in less Medicaid crowd-out. Similarly, the removal of family coupled with a more generous consumption floor (right panel) decreases the overall demand for insurance by 11 percentage points. Overall, these results imply that neither Medicaid nor family care alone can explain the low demand for private insurance. Rather, the interaction between Medicaid and the ability to substitute to family care jointly play a large role in the demand for long-term care insurance.

6.2 Insurance with cash benefits

While family care does not solely account for the low demand for insurance, the neglect of family care in available insurance policies may have large welfare consequences. Specifically, families must trade off (1) a preference and potential cost savings of family care with (2) the insurance value of a contract that only covers formal care. Alternatively, an insurance product that covers both formal and family care would allow families to use family care without foregoing risk protection of indirect family care costs.

I next analyze a counterfactual insurance policy that pays cash to the parent whenever the parent is sick. This product has the same premium structure and pays the same dollar benefits in cash to the parent instead of to a formal care provider, or $\lambda^{cash}(h_t, ltci) = \lambda(h_t, F_t = 1, ltci)$.[55] This allows the parent to choose whether to hire a formal service or simply cover all or some of the costs of family care.[56] The left panel of Figure 5, which replicates the percent of healthy parents for each wealth quintile (gray line) and the benchmark insurance demand (red line), reports the insurance demand for the cash benefit counterfactual (solid green line). The demand for this insurance policy is over 40% for the lowest wealth quintile and rises to over 80% for the highest wealth quintile. This is not surprising for wealthy parents, who no longer must trade off insurance and family care.[57] The fact that even poorer parents choose to purchase insurance in lieu of spending down to Medicaid (which does not reimburse family care) implies that they highly value family care.

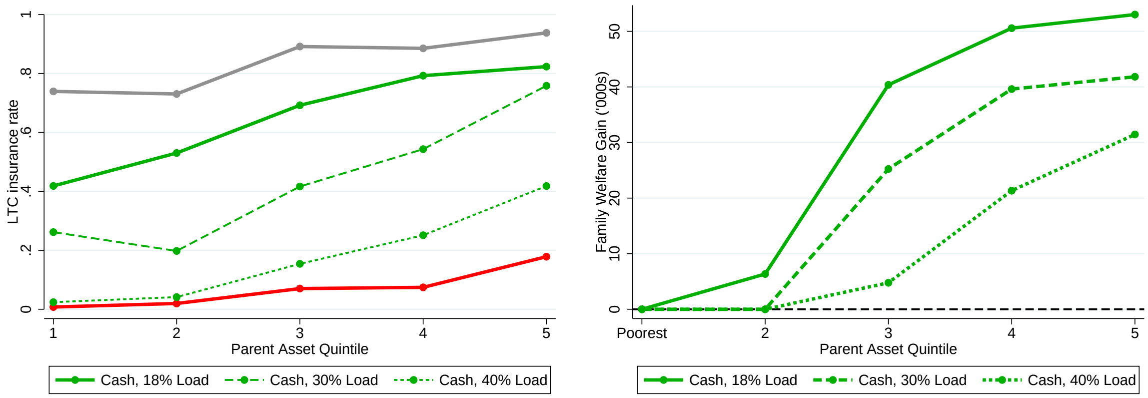
I then calculate the welfare gain of an insurance policy with cash benefits, defined as the value the family places on cash benefits *above and beyond* the value of insurance that only covers formal care expenses. The 'value' of each product is the willingness to pay for the product, or in other words, the amount of money the parent would have to be given in the absence of the insurance product to be indifferent between having the insurance product and not. The solid green line in the right panel of Figure 5 shows that the median welfare gain by quintile is \$0-\$6,000 for the poorest two wealth quintiles and rapidly increases to \$40,000-\$50,000 for the wealthier quintiles. One of the reasons for this welfare gain is that cash benefits allow parents to be cared for by their child without forgoing risk protection. The welfare gain for poorer parents is much lower than the welfare gain for wealthier parents, however, because they must weigh the relative value of cash benefits against

[55] This is, in a sense, analogous to the benefits and drawbacks of 'cash' vs. 'in-kind' transfers for other goods (e.g. the Food Stamp program (Moffitt, 1989)). With this set-up, this product ignores moral hazard problems. I discuss these issues and attempts to combat moral hazard in Section 6.2.1.

[56] Since child wages vary and are not necessarily equal to the formal cost of long-term care, the cash benefit will be either more or less than the wage-value of the child's time, depending on the child's wage.

[57] The 10% of wealthy parents who continue to forego insurance most likely do so because they are more willing to self-insure with their assets than incur the 18% load on the insurance policy.

Figure 5: Counterfactual LTC insurance coverage and welfare gain: cash benefits



Note: The left panel reports the percent of parents with long-term care insurance coverage at age 65, by parent wealth quintile. The gray line denotes the percent of parents who do not need long-term care at age 65 (and thus are eligible for long-term care insurance). The red line denotes the matched long-term care insurance coverage reported in Table 10, and the solid green line denotes the insurance coverage rate when the insurance policy provides cash benefits at the same loads as an insurance policy that provides formal care benefits. The dashed green line denotes the insurance coverage rate when the insurance policy provides cash benefits at a 30% load, and the dotted green line denotes the insurance coverage rate when the insurance policy provides cash benefits at a 40% load. The right panel reports the welfare gains to the family of insurance policies with cash benefits at different loads relative to an insurance policy that only covers formal care at an 18% load. Welfare gains are defined as the asset transfer to the parent in the absence of the cash benefit that would make the family indifferent between formal care benefits and cash benefits. The green lines correspond to the same insurance policy definitions as in the left panel.

the risk protection afforded by the Medicaid program.

6.2.1 Combating moral hazard

An important concern with provision of cash benefits vis-a-vis 'in-kind' benefits is the potential for moral hazard. In other words, individuals have an incentive to feign sickness to obtain cash that they can use for ordinary consumption. In contrast, with in-kind benefits (i.e. only formal care), individuals do not gain any utility from using formal services unless they are sick.

I run a simple counterfactual exercise that evaluates a potential effect of moral hazard on insurance and welfare. To do this, I assume that subjecting individuals to lengthy doctor evaluations and home checks provides perfect verification of long-term care need. Under this assumption, parents cannot feign sickness, however these evaluations are costly. To accommodate these extra costs, I increase the insurance premiums from a load of 18% to loads of 30% and 40%. The changes in insurance demand and changes in welfare gain of these policies are depicted by the dotted green lines in Figure 5. Insurance demand decreases, but even with a 40% load, the demand for insurance with cash benefits is still 8 percentage points greater than in the benchmark model, and welfare gains over the in-kind insurance contract are still substantial for wealthier parents.

6.3 Medicaid cash

As shown above, an insurance policy with cash benefits has the potential to generate large welfare gains to families, but in practice might be difficult to implement. One policy lever that could be implemented within the existing set of social programs is to replace Medicaid's 'in-kind' benefit with a cash benefit. Indeed, several states have piloted this type of program (see Lieber and Lockwood (2013)). In terms of model parameters, this is equivalent to a Medicaid benefit of

$$m_t = \max\{0, \underline{c} + ltc_t^{cash} - \lambda_t - [a_t^P + y^P]\} \tag{18}$$

where $ltc_t^{cash} = ltc_t(h_t, F_t = 1)$. In other words, Medicaid pays the cost of long-term care services regardless of whether the parent uses formal or family care.

Table 11 reports the impact of a Medicaid cash benefit on private insurance demand in column (2). There is virtually no change in private insurance demand. This null effect for poor individuals is unsurprising, since they enrolled in Medicaid even without cash benefits. Individuals with more wealth are not induced to spend down to Medicaid eligibility, however. The fact that they still choose to purchase private insurance in spite of Medicaid's increased attractiveness implies that they place a high value on protecting their assets. Columns (3) additionally converts the private insurance benefit to cash and shows that this induces all but the lower 40% of the wealth to purchase private insurance. However, private insurance demand is even higher when the private insurance benefit is cash but the Medicaid benefit is in-kind (column (4)) because spending down to Medicaid is relatively less attractive when the Medicaid benefit is in-kind rather than cash.

Table 11: Counterfactual insurance demand with Medicaid cash policy

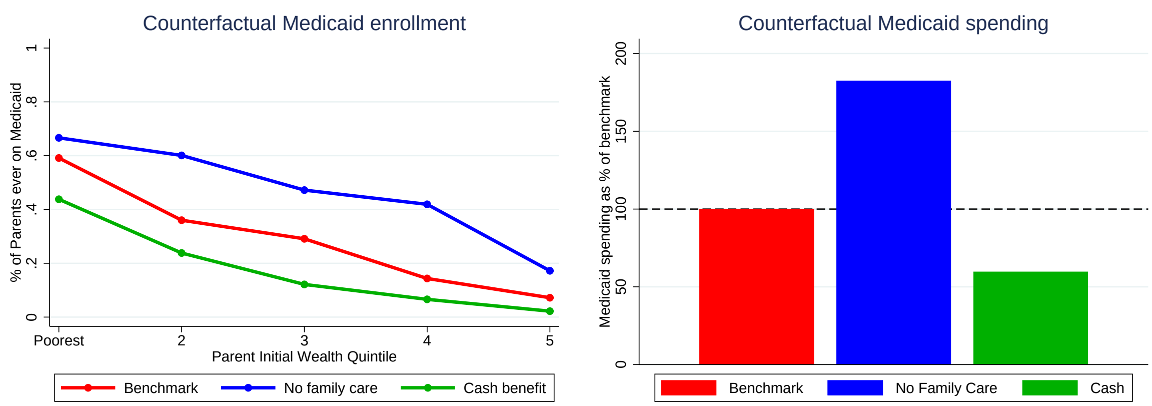
	Private insurance demand			
Private insurance benefit:	In-kind	In-kind	Cash	Cash
Medicaid benefit:	In-kind	Cash	Cash	In-kind
Parent wealth quintile				
1 (poorest)	0.01	0.01	0.02	0.42
2	0.02	0.00	0.03	0.53
3	0.07	0.00	0.13	0.69
4	0.07	0.09	0.33	0.79
5 (wealthiest)	0.18	0.19	0.75	0.82
Average	0.09	0.06	0.26	0.67

Note: Table reports long-term care insurance demand by parent wealth quintile. The first column reports the matched insurance coverage rates reported in Table 10. The second column reports insurance demand when Medicaid provides cash benefits. The third column reports insurance demand when Medicaid provides cash benefits and private insurance benefits are also cash, while the fourth column reports insurance demand when private insurance benefits are cash but Medicaid benefits are in-kind (as in Figure 5).

6.4 Impacts of counterfactual policies on Medicaid spending

Family care, and its coverage through cash benefits, has potentially large implications for Medicaid enrollment and spending. In the model, parents without available family care spend down to Medicaid for much of the wealth distribution. This suggests that demographic changes in the United States that affect the availability of family care, such as lower fertility rates and higher female labor force participation rates, may place a heavy burden on Medicaid. In contrast, cash benefits - modeled above as a policy in which total premiums pay total costs (i.e. revenue neutral from a government standpoint) - allow parents to insure family care and, as a result, they are less likely to spend down to Medicaid.

Figure 6: Consequences for Medicaid



Note: The left panel reports the percent of parents who ever enroll on Medicaid, by parent wealth quintile. The red line denotes the percent of parents who ever enroll on Medicaid in the estimated scenario, the blue line denotes the percent of parents who ever enroll on Medicaid when family care is unavailable ($fam_t = 0$), and the green line denotes the percent of parents who ever enroll on Medicaid when the insurance policy provides cash benefits. The right panel reports the total cost to Medicaid over the lifetime of the parent for the same scenarios.

The left graph of Figure 6 shows the percent of parents at each wealth quintile who ever qualify for Medicaid in the model. The benchmark scenario, depicted in red, shows that 60% of the poorest parents eventually end up on Medicaid, and this decreases to around 10% for the wealthiest parents. Shutting down the availability of family care increases these rates significantly (shown in blue), with the largest increases in the middle of the distribution. Intuitively, there are small changes in Medicaid expenditures for poor and wealthy individuals, since poorer parents use Medicaid regardless of the availability of family care, and wealthy parents either have enough savings or purchase insurance. In contrast, parents in the middle of the wealth distribution are the most financially vulnerable to long-term care shocks since they are less able to rely on savings and they do not purchase insurance. Without family care, many spend down to Medicaid eligibility. Insurance with cash benefits (shown in green) lowers the percent of parents who end up on Medicaid compared to the benchmark scenario.

The right graph of Figure 6 reports the percentage difference in total Medicaid spending between the three models: the blue bar shows that total Medicaid spending on long-term care would almost double if families could not provide informal care. In contrast, insurance with cash benefits would provide relief to the Medicaid program: Medicaid spending would be around 60% of the benchmark amount of spending. Overall, these results reveal that family care and its insurance coverage is an important determinant of Medicaid long-term care spending.

7 Conclusion

This paper argues that informal care by family members plays an important role in long-term care decisions. I build and estimate a dynamic model of long-term care decisions between an elderly parent and her adult child to examine (1) whether the availability of informal care can explain the low demand for long-term care insurance and (2) what the interaction between informal care and insurance reveals about optimal long-term care policy.

I find that the availability of informal care lowers the demand for long-term care insurance by 30 percentage points for the wealthier 40% of parents. In contrast, insurance demand for the rest of the wealth distribution is largely crowded out by Medicaid. In counterfactual insurance exercises, I show that introducing a policy that compensates the family for providing long-term care induces much greater take-up and can generate large welfare gains to families. These results suggest that the fact that current insurance policies do not cover informal care is a key reason for the low demand for insurance.

More generally, the prevalence of informal care has important implications for long-term care policy in the United States. The availability of informal care can have substantial effects on the size of the Medicaid program: I find that the removal of informal care would almost double Medicaid expenditures for long-term care. These results suggest that future demographic changes that impact the availability of informal care (through lower rates of fertility, for example) may impose a heavy burden on Medicaid. Second, insurance that compensates the family not only is welfare-improving to families, but also significantly reduces Medicaid spending. Several countries around the world have implemented such insurance programs; policy discussions in the United States should continue to consider them.

References

Abowd, J. M. and Card, D. (1989). 'On the Covariance Structure of Earnings and Hours Changes.' *Econometrica*, vol. 57(2): 411–45.

Altonji, J. G., Hayashi, F., and Kotlikoff, L. J. (1997). 'Parental Altruism and Inter Vivos Transfers: Theory and Evidence.' *Journal of Political Economy*, vol. 105(6).

Altonji, J. G. and Segal, L. M. (1996). 'Small-sample bias in GMM estimation of covariance structures.' *Journal of Business & Economic Statistics*, vol. 14(3): 353–366.

Ameriks, J., Briggs, J., Caplin, A., Shapiro, M. D., and Tonetti, C. (2015a). 'Late-in-Life Risks and the Under-Insurance Puzzle.' *Unpublished working paper*.

Ameriks, J., Briggs, J., Caplin, A., Shapiro, M. D., Tonetti, C., and Stanford, G. (2015b). 'Long-Term Care Utility and Late in Life Saving.' *Unpublished working paper*.

Applebaum, R. A., Christianson, J. B., Harrigan, M., and Schore, J. (1988). 'The evaluation of the National Long Term Care Demonstration. 9. The effect of channeling on mortality, functioning, and well-being.' *Health Services Research*, vol. 23(1):page 143.

Attanasio, O., Meghir, C., and Mommaerts, C. (2015). 'Insurance in extended family networks.' *National Bureau of Economic Research working paper*.

Attanasio, O. P. and Weber, G. (1995). 'Is Consumption Growth Consistent with Intertemporal Optimization? Evidence from the Consumer Expenditure Survey.' *Journal of Political Economy*, 1121–1157.

Barczyk, D. and Kredler, M. (2014a). 'Altruistically motivated transfers under uncertainty.' *Quantitative Economics*, vol. 5(3): 705–749.

Barczyk, D. and Kredler, M. (2014b). 'Evaluating long-term care policy options, taking the family seriously.' *Working paper*.

Bayot, D. and Voena, A. (2014). 'Prenuptial Contracts, Labor Supply and Household Investments.' *Working paper*.

Becker, G. S. (1992). 'The Economic Way of Looking at Life.' In *Nobel Lecture in Economics*. Citeseer.

Bénabou, R. and Tirole, J. (2006). 'Incentives and Prosocial Behavior.' *American Economic Review*, vol. 96(5): 1652–1678.

Bernheim, B. D., Shleifer, A., and Summers, L. H. (1985). 'The strategic bequest motive.' *The Journal of Political Economy*, 1045–1076.

Blundell, R., Browning, M., and Meghir, C. (1994). 'Consumer demand and the life-cycle allocation of household expenditures.' *The Review of Economic Studies*, vol. 61(1): 57–80.

Blundell, R., Pistaferri, L., and Preston, I. (2008). 'Consumption inequality and partial insurance.' *The American Economic Review*, 1887–1921.

Bronson, M. A. (2014). 'Degrees Are Forever: Marriage, Educational Investment, and Lifecycle Labor Decisions of Men and Women.' *Unpublished manuscript*.

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

Brown, J. R. and Finkelstein, A. (2008). 'The Interaction of Public and Private Insurance: Medicaid and the Long-Term Care Insurance Market.' *American Economic Review*, vol. 98(3): 1083–1102.

Brown, J. R., Goda, G. S., and McGarry, K. (2012). 'Long-term care insurance demand limited by beliefs about needs, concerns about insurers, and care available from family.' *Health Affairs*, vol. 31(6): 1294–1302.

Brown, M. (2006). 'Informal care and the division of end-of-life transfers.' *Journal of Human Resources*, vol. 41(1): 191–219.

Card, D., Dobkin, C., and Maestas, N. (2008). 'The Impact of Nearly Universal Insurance Coverage on Health Care Utilization: Evidence from Medicare.' *American Economic Review*, vol. 98(5): 2242–2258.

Chari, A. V., Engberg, J., Ray, K. N., and Mehrotra, A. (2015). 'The Opportunity Costs of Informal Elder-Care in the United States: New Estimates from the American Time Use Survey.' *Health Services Research*, vol. 50(3): 871–882.

Charles, K. K. and Sevak, P. (2005). 'Can family caregiving substitute for nursing home care?' *Journal of Health Economics*, vol. 24(6): 1174–1190.

Coe, N. B., Goda, G. S., and Van Houtven, C. H. (2015). 'Family Spillovers of Long-Term Care Insurance.' Working paper.

Cox, D. (1987). 'Motives for private income transfers.' *The Journal of Political Economy*, 508–546.

Da Roit, B. and Le Bihan, B. (2010). 'Similar and Yet So Different: Cash-for-Care in Six European Countries Long-Term Care Policies.' *Milbank Quarterly*, vol. 88(3): 286–309.

Davidoff, T. (2010). 'Home equity commitment and long-term care insurance demand.' *Journal of Public Economics*, vol. 94(1): 44–49.

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

De Nardi, M., French, E., and Jones, J. B. (2016). 'Medicaid Insurance in Old Age.' *American Economic Review*, vol. 106(11): 3480–3520.

De Nardi, M., French, E. B., and Jones, J. B. (2010). 'Why Do the Elderly Save? The Role of Medical Expenses.' *Journal of Political Economy*, vol. 118(1): 39–75.

Engers, M. and Stern, S. (2002). 'Long-term care and family bargaining.' *International Economic Review*, 73–114.

Fahle, S. (2014). ‘Harnessing the Potential of Family Caregivers: A Solution to the US Long-Term Care Crisis?’ *Working paper*.

Finkelstein, A. and McGarry, K. (2006). ‘Multiple dimensions of private information: evidence from the long-term care insurance market.’ *American Economic Review*, vol. 96(4): 938–958.

Finkelstein, A. and McKnight, R. (2008). ‘What did Medicare do? The initial impact of Medicare on mortality and out of pocket medical spending.’ *Journal of Public Economics*, vol. 92(7): 1644–1668.

Foster, A. D. and Rosenzweig, M. R. (2001). ‘Imperfect commitment, altruism, and the family: Evidence from transfer behavior in low-income rural areas.’ *Review of Economics and Statistics*, vol. 83(3): 389–407.

Gachter, S. and Fehr, E. (2000). ‘Cooperation and Punishment in Public Goods Experiments.’ *American Economic Review*, vol. 90(4): 980–994.

Gourinchas, P.-O. and Parker, J. A. (2002). ‘Consumption over the life cycle.’ *Econometrica*, vol. 70(1): 47–89.

Gruber, J. and Yelowitz, A. (1999). ‘Public Health Insurance and Private Savings.’ *Journal of Political Economy*, vol. 107(6): 1249–1274.

Hackmann, M. B. (2015). ‘Incentivizing Better Quality of Care: The Role of Medicaid and Competition in the Nursing Home Industry.’ *Working paper*.

Hayashi, F., Altonji, J. G., and Kotlikoff, L. J. (1996). ‘Risk-Sharing between and within Families.’ *Econometrica*, vol. 64(2): 261–94.

Hendren, N. (2013). ‘Private information and insurance rejections.’ *Econometrica*, vol. 81(5): 1713–1762.

Hiedemann, B., Sovinsky, M., and Stern, S. (2013). ‘Will You Still Want Me Tomorrow? The Dynamics of Families’ Long-Term Care Arrangements.’ *Working paper*.

Hubbard, R. G., Skinner, J., and Zeldes, S. P. (1995). ‘Precautionary Saving and Social Insurance.’ *Journal of Political Economy*, vol. 103(2): 360–99.

Kaiser Commission on Medicaid and the Uninsured (2015). ‘Medicaid and Long-Term Care Services and Supports: A Primer.’ Technical report.

Kandel, E. and Lazear, E. P. (1992). ‘Peer pressure and partnerships.’ *Journal of Political Economy*, 801–817.

Kaplan, G. (2012). ‘Moving Back Home: Insurance against Labor Market Risk.’ *Journal of Political Economy*, vol. 120(3): pp. 446–512. ISSN 00223808.

Kocherlakota, N. R. (1996). ‘Implications of efficient risk sharing without commitment.’ *The Review of Economic Studies*, vol. 63(4): 595–609.

Kopecky, K. A. and Koreshkova, T. (2014). 'The impact of medical and nursing home expenses on savings.' *American Economic Journal: Macroeconomics*, vol. 6(3): 29–72.

Kotlikoff, L. J. (1989). 'What determines savings?' *MIT Press Books*, vol. 1.

Li, H., Rosenzweig, M., and Zhang, J. (2010). 'Altruism, Favoritism, and Guilt in the Allocation of Family Resources: Sophie's Choice in Mao's Mass Send-Down Movement.' *Journal of Political Economy*, vol. 118(1): 1–38.

Lieber, E. M. and Lockwood, L. M. (2013). 'Costs and Benefits of In-Kind Transfers: The Case of Medicaid Home Care Benefits.' *Unpublished manuscript*.

Light, A. and McGarry, K. (2004). 'Why Parents Play Favorites: Explanations for Unequal Bequests.' *American Economic Review*, 1669–1681.

Ligon, E., Thomas, J. P., and Worrall, T. (2000). 'Mutual insurance, individual savings, and limited commitment.' *Review of Economic Dynamics*, vol. 3(2): 216–246.

Ligon, E., Thomas, J. P., and Worrall, T. (2002). 'Informal insurance arrangements with limited commitment: Theory and evidence from village economies.' *The Review of Economic Studies*, vol. 69(1): 209–244.

Lindbeck, A. and Weibull, J. W. (1988). 'Altruism and time consistency: the economics of fait accompli.' *The Journal of Political Economy*, 1165–1182.

Little, R. J. (1988). 'Missing-data adjustments in large surveys.' *Journal of Business & Economic Statistics*, vol. 6(3): 287–296.

Lockwood, L. M. (2014). 'Incidental bequests: Bequest motives and the choice to self-insure late-life risks.' *NBER Working Paper*.

Løken, K. V., Lundberg, S. J., and Riise, J. (2014). 'Lifting the Burden: State Care of the Elderly and Labor Supply of Adult Children.' Working paper.

Low, H., Meghir, C., Pistaferri, L., and Voena, A. (2016). 'Marriage, Social Insurance, and Labor Supply.' *Unpublished manuscript*.

Low, H. and Pistaferri, L. (2010). 'Disability Risk, Disability Insurance and Life Cycle Behavior.' *NBER Working Paper*, (w15962).

Low, H. W. (2005). 'Self-insurance in a life-cycle model of labour supply and savings.' *Review of Economic Dynamics*, vol. 8(4): 945–975.

MaCurdy, T. E. (1982). 'The use of time series processes to model the error structure of earnings in a longitudinal data analysis.' *Journal of Econometrics*, vol. 18(1): 83–114.

Marcet, A. and Marimon, R. (2011). 'Recursive contracts.' *Unpublished manuscript*.

Mazzocco, M. (2007). 'Household intertemporal behaviour: A collective characterization and a test of commitment.' *The Review of Economic Studies*, vol. 74(3): 857–895.

McFadden, D. L. (1989). ‘A Method of Simulated Moments for Estimation of Discrete Response Models without Numerical Integration.’ *Econometrica*, vol. 57(5): 995–1026.

Meghir, C. and Pistaferri, L. (2004). ‘Income variance dynamics and heterogeneity.’ *Econometrica*, vol. 72(1): 1–32.

Mellor, J. M. (2001). ‘Long-term care and nursing home coverage: are adult children substitutes for insurance policies?’ *Journal of Health Economics*, vol. 20(4): 527 – 547. ISSN 0167-6296.

Mobarak, A. M. and Rosenzweig, M. R. (2012). ‘Selling formal insurance to the informally insured.’

Moffitt, R. (1989). ‘Estimating the Value of an In-Kind Transfer: The Case of Food Stamps.’ *Econometrica*, vol. 57(2): 385–409.

Mommaerts, C. (2016). ‘Are Family Care and Nursing Homes Substitutes? Evidence from Medicaid Spend-Down Provisions.’ *Unpublished manuscript*.

Pakes, A. and Pollard, D. (1989). ‘Simulation and the asymptotics of optimization estimators.’ *Econometrica*, 1027–1057.

Palumbo, M. G. (1999). ‘Uncertain Medical Expenses and Precautionary Saving Near the End of the Life Cycle.’ *Review of Economic Studies*, vol. 66(2): 395–421.

Pauly, M. V. (1990). ‘The Rational Nonpurchase of Long-Term-Care Insurance.’ *Journal of Political Economy*, vol. 98(1).

Pezzin, L. E., Kemper, P., and Reschovsky, J. (1996). ‘Does Publicly Provided Home Care Substitute for Family Care?: Experimental Evidence with Endogenous Living Arrangements.’ *Journal of Human Resources*, vol. 31(3): 650–676.

Robinson, J. (2002). ‘A long-term care status transition model.’ *Unpublished paper*.

Scholz, J. K., Seshadri, A., and Khitatrakun, S. (2006). ‘Are Americans Saving ‘Optimally’ for Retirement?’ *Journal of Political Economy*, vol. 114(4).

Thomas, J. and Worrall, T. (1988). ‘Self-enforcing wage contracts.’ *Review of Economic Studies*, vol. 55(4): 541–554.

Voena, A. (2015). ‘Yours, Mine, and Ours: Do Divorce Laws Affect the Intertemporal Behavior of Married Couples?’ *American Economic Review*, vol. 105(8): 2295–2332.

Yamaguchi, S., Ruiz, C., and Mazzocco, M. (2014). ‘Labor Supply, Wealth Dynamics and Marriage Decisions.’ *Unpublished manuscript*.

FOR ONLINE PUBLICATION ONLY

Appendix A Multiple Children

The model in Section 4 is restricted to interactions between a parent and only one child. In my sample of single elderly retirees, however, most parents have multiple children. In what follows, I show that despite the existence of multiple potential caretakers, parents receive the majority of care by one child. I then discuss potential additions to the model to allow for multiple children.

Appendix Table A1 reports statistics for families in the sample that report at least one child caregiver over the sample period, similarly to Fahle (2014). The first row shows that the majority (85.3%) of parents have multiple children. The second row shows the percent of parents who receive care from only one child caregiver over the 1998-2010 sample period, split by the number of children. In the majority of cases, a single caretaker provides all family care hours. For parents with two children, in 76% of cases only one child provides care; for parents with four children this decreases to 61%. However, though there is a significant number of parents with multiple caregivers, the third and fourth rows show that most of the hours of care are provided by one caregiver. Across all families in this sample, 92% of child caregiver hours over the sample period are provided by one child. Conditional on having multiple caregivers, the percent decreases to 73%, but that is applicable to less than one-third of the sample. Overall, these numbers show that despite the presence of several multiple child-caregiver families, the vast majority of hours are provided by a single child caregiver.

Table A1: Caregiving characteristics of families with multiple children

	Number of Children					
	1	2	3	4	5+	Total
% of sample	14.7	25.5	19.7	13.8	26.4	100
% with only one caregiver	100	76.1	66.0	60.6	50.0	68.6
% of hours by main caregiver	100	94.1	92.3	88.3	85.5	91.5
% of hours by main caregiver | multiple caregivers	–	75.3	77.3	70.4	70.9	73.0

Note: Table reports the caregiving characteristics of children of single retirees aged 65 and over who receive long-term care from their children at some point in the 1998-2010 HRS. The main caregiver is defined as the child who provides the most hours of care (ties broken randomly).

Several studies have examined long-term care decisions within a multiple caregiver framework. Most of these studies are static (e.g Brown (2006)), with a few exceptions (Hiedemann, Sovinsky, and Stern, 2013), and none within a structural, life-cycle framework. From the results of Table A1 and the findings from previous studies that key drivers of long-term care decisions are inherently dynamic (i.e. savings and spend-down to Medicaid), this paper abstracts from the modeling complexities of multiple children to concentrate on the life-cycle dimension of long-term care.

The approach minimizes the biases that could arise in a one-child model by selecting the child most likely to care. There are two main outcomes that may cause bias: (1) the model gives the entire bequest to one child, and (2) the model assigns all family care to one child. Most studies have found that the majority of bequests are split equally between children, but of the 20% of cases of unequal bequests, most are a result of altruistic and exchange motives involving elderly care (Light and McGarry, 2004). In order to match child assets, the model may underestimate the parent altruism parameter (η), which affects bequest size and therefore future assets of the child. By assigning all informal care one child, the model may overestimate guilt (g), underestimate the value of leisure ($1-\alpha$), and overestimate in absolute terms the disutility of formal care (z). Many of these effects lower the opportunity cost of a child's time, which in turn would lower the demand for insurance. On the other hand, side payments by non-caregiving children to caregiving children (as discussed in Engers and Stern (2002)) would mute these biases.

Appendix B Child problem after parent's death

After the death of the parent at time $t = t_d$, I continue to model the child until time T, which is roughly the retirement age of the child. The child continues to face wage risk, and chooses consumption and labor supply to maximize:

$$V_t^K(a_t, w_t) = \max_{c_t^K, \ell_t^K} u(c_t^K, \ell_t^L) + \beta E_t V_{t+1}(a_{t+1}, w_{t+1}) \tag{19}$$

subject to her time constraint: $\mathcal{T} = L_t + \ell_t$ and her per-period budget constraint:

$$a_{t+1} = (1+r)[a_t + L_t w_t - c_t^K] \tag{20}$$

in which $a_{t_d} = a_{t_d}^K + a_{t_d}^P$, again with a consumption floor $c_t^K \geq \underline{c}$ and $a_t \geq 0$. The child's per-period utility remains the same over consumption c_t^K and leisure ℓ_t but excludes potential guilt:

$$u(c_t^K, \ell_t^K) = \frac{[(c_t^K)^\alpha (\ell_t^K)^{1-\alpha}]^{1-\gamma}}{1-\gamma} \tag{21}$$

The model ends with the terminal value as shown in equation (5).

Appendix C Dynamic models of altruism

In the model in Section 4, parents exhibit altruism to their children, but children do not exhibit altruism to their parents. This appendix discusses the theoretical challenges in dynamic models with one- and two-sided altruism. I restrict the discussion to a model with non-cooperation (in a model with full commitment, altruism simply adjusts the Pareto weights).

I begin by reviewing the fact that even a very simple dynamic model with one-sided altruism has stark predictions over transfer behavior. Consider a two-period model of one-sided altruism between a parent and child in which both parent and child can save and the child's second period income is uncertain. In this model, Altonji, Hayashi, and Kotlikoff (1997) show that transfers depend critically on the child's second period income and the degree to which the child is liquidity constrained. If the child is not liquidity constrained, the parent will refrain from transfers in the first period. She does this first to avoid regretting a first period transfer if the child receives a high income realization in the second period. She also does this to overcome the 'Samaritan's dilemma' (Lindbeck and Weibull, 1988) in which the child would over-consume in the first period in order get more transfers. By restricting transfers to the second period, the parent restricts over-consumption in the first period because of the threat of zero transfers in the second period if the child receives a high income realization. On the other hand if the child is liquidity constrained, she cannot intertemporally smooth her income without transfers. In this case, the parent may provide transfers in the first period by trading off the benefit to the child and the costs mentioned above.

This simple model demonstrates that even with one-sided altruism, dynamic interactions lead to the stark prediction that the parent will withhold most transfers until all uncertainty is revealed. The non-cooperative solution in my model adopts this feature: by assumption, the parent provides a bequest at death, but no inter-vivos transfers. However, in equilibrium the parent and child cooperate and inter-vivos transfers occur.[58] In this way, my model still rationalizes the fact that transfers occur in the data.

A few studies have examined two-sided altruism in a dynamic model, but few without restrictions to dynamic behavior. Foster and Rosenzweig (2001) use a limited commitment model with two-sided altruism with no savings. Fahle (2014) estimates a life-cycle model between a parent and child with two-sided altruism, but does not allow the child to save. Two main exceptions in which both agents can save are Barczyk and Kredler (2014a) and Barczyk and Kredler (2014b). These models, which are somewhat stylized, show that the mechanisms of the two-period model extend to an infinite-horizon setting. They characterize a 'dynamic Samaritan's dilemma' in which both agents over-consume. In addition, transfers are delayed until an agent is constrained (a 'race to the bottom'). However, these predictions are not fully borne by the data: if anything, parents continue to accumulate assets well into old-age. To avoid these stark predictions, the model in this paper assumes partial commitment, which is able to match asset accumulation paths of both parents and children.

Appendix D Numerical Solution

There is no analytic solution to this model. Instead, I numerically solve the model using backward induction from the final period T with the terminal value function $V^K_{T+1}(a^K_{T+1}) = \phi\frac{\left(a^K_{T+1}\right)^{1-\gamma}}{1-\gamma}$. I first describe the solution to the child's problem after the parent's death, then I describe the solution to the non-cooperative problem, and finally the solution to the cooperative problem.

The problem of the child after the parent's death has two state variables in addition to age: assets and wage and two decision variables: consumption and labor supply. I discretize the state space and solve by backward induction. At each point in the state space, I solve conditional value functions for each labor supply option and choose the maximum conditional value function. For each conditional value function, I use a golden search to obtain optimal consumption/savings and use linear interpolation to evaluate continuation values between asset gridpoints.[59]

The non-cooperative problem has six state variables in addition to age: parent and child assets, parent permanent income, child wage, parent long-term care needs, and whether the parent owns long-term care insurance. The parent chooses consumption/savings (and long-term care insurance

[58] In my sample, parents transfer money to their children over a two-year period in fewer than 10% of cases. In those cases, the mean and median amounts are \$6,900 and \$2,700, respectively.

[59] As Low and Pistaferri (2010) discuss, value functions are not necessarily concave in assets – even conditional on labor supply in time t – because of future changes in labor supply. However, enough uncertainty should make the expected future value function concave.

in the first period) and the child chooses consumption/savings and labor supply. I again discretize the state space and solve the problem by backward induction with the terminal value function. Within each period, I additionally discretize the consumption/savings decisions of the parent and child and compute conditional value functions for all possible consumption and labor supply choices, still using linear interpolation to evaluate continuation values between asset gridpoints. I first assign the child's choice conditional on each parent choice, and then going backward within the period, assign the parent's choice. This pins down the child's decision.

The cooperative problem has the state variables in the non-cooperative problem as well as the Pareto weight.[60] The parent and child jointly make choices over individual consumption/savings for the parent and child, whether the parent uses formal or informal care if she needs long-term care, the labor supply of the child, and whether to purchase long-term care insurance in the first period. The state variables are discretized and I solve the problem by backward induction with the terminal value function. At each point in the state space, I solve conditional value functions for each labor supply and type of care option and choose the maximum conditional value function. For each conditional value function, I discretize the choice over the distribution of future assets and use a golden search to obtain optimal total consumption. I use linear interpolation to evaluate continuation values between asset gridpoints.

The solution method to determine the evolution of the Pareto weights largely follows the solution to limited commitment problems outlined in Voena (2015):

1. Maximize $V_T(\omega_T)$ subject to the family budget constraint and the child's time constraint at weights corresponding to the state variable (i.e. not updated). Call the parent- and child-specific solutions $V_T^{*P}(\omega_T)$ and $V_T^{*K}(\omega_T)$.

2. Check to see if $V_T^{*P}(\omega_T)$ and $V_T^{*K}(\omega_T)$ satisfy their respective participation constraints, equations (11) and (12). In other words, check to see if these values are larger than the respective values of the non-cooperative solution. There are three possibilities.

   (a) If both participation constraints hold for both the parent and the child, then the solution to the cooperative problem at time T is $V_T^{*P}(\omega_T)$ and $V_T^{*K}(\omega_T)$.

   (b) If the parent's participation constraint holds and the child's participation constraint does not hold, then the overall weight must shift such that solving:

   $$\max_{q_T, M_T^K} (\theta_T - M_T^K) U_T^P(c_T^P, F_T, U_T^K) + (1 - \theta_T + M_T^K) U_T^K(c_T^K, \ell_T^K, NC_T = 0)$$

   subject to the family budget constraint and child time constraint leads to the child's value $V_T^{**K}(\omega_T)$ such that $V_T^{**K}(\omega_T) = Z_T^K(\omega_T)$ where $Z_T^K(\omega_T)$ is the child's value of the non-cooperative problem. Then the solution at time T is $V_T^{**P}(\omega_T)$ and $V_T^{**K}(\omega_T)$.[61]

   (c) If the child's participation constraint holds and the parent's participation constraint does

[60] I simplify the state space by normalizing one Pareto weight to θ_t and the other to $1 - \theta_t$, so that I only have to condition on one weight. This does not affect the within-period distribution of resources between the parent and child, though it may slightly affect the cross-period distribution of resources.

[61] In practice I discretize the choice of M_T^K (and M_T^P in the next possibility) so that $(\theta_T - M_T^K)$ falls on one of the same discretized values of θ_T.

not hold, then the overall weight must shift such that solving:

$$\max_{q_T, M_T^P} \quad (\theta_T + M_T^P)U_T^P(c_T^P, F_T, U_T^K) + (1 - \theta_T + M_T^P)U_T^K(c_T^K, \ell_T^K, NC_T = 0)$$

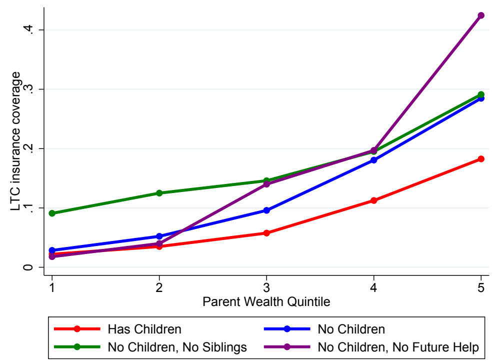
subject to the family budget constraint and child time constraint leads to the parent's value $V_T^{***P}(\omega_T)$ such that $V_T^{***P}(\omega_T) = Z_T^P(\omega_T)$ where $Z_T^P(\omega_T)$ is the parent's value of the non-cooperative problem. Then the solution at time T is $V_T^{***P}(\omega_T)$ and $V_T^{***K}(\omega_T)$.

Because there is always positive surplus to cooperation, a fourth possibility of neither participation constraint satisfied should never occur.

3. With these solutions, the problem continues backwards to time $T-1$, in which the problem is set up analogously and uses the continuation values computed in Steps (1) and (2).

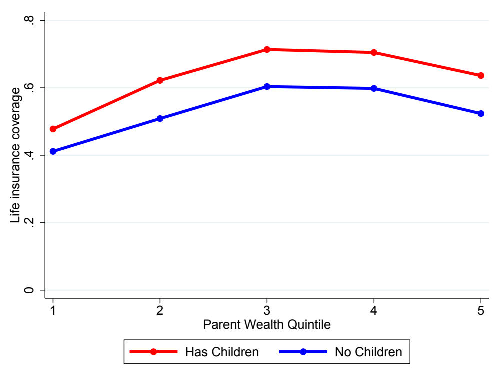
Appendix E Additional tables and figures

Appendix Figure 1: Long-term care insurance coverage by wealth quintile, more categories



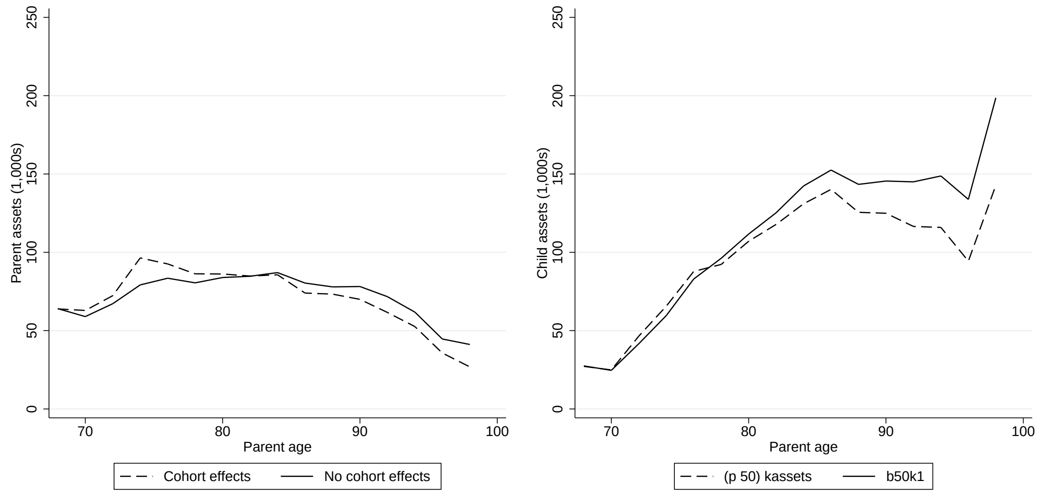
Note: The sample includes single individuals aged 60-69 in the pooled 1998-2010 Health and Retirement Study. The red line graphs the percent of individuals *with children* who own a long-term care insurance policy, by wealth quintile (from the poorest quintile on the left to the wealthiest quintile on the right). The blue line graphs the percent of individuals *without children* who own a long-term care insurance policy. The green line graphs the percent of individuals *without children and without siblings* who own a long-term care insurance policy. The purple line graphs the percent of individuals *without children and without future prospects for informal care* who own a long-term care insurance policy.

Appendix Figure 2: Life insurance coverage by wealth quintile



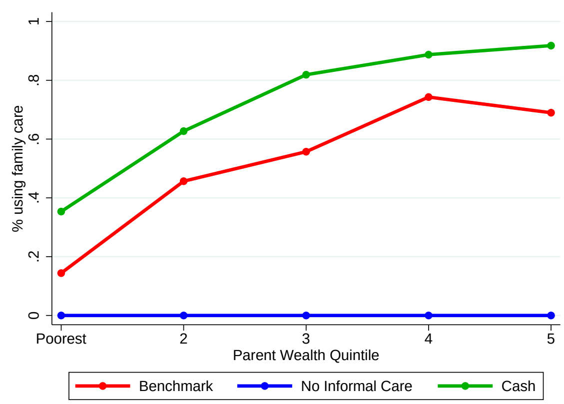
Note: The sample includes single individuals aged 60-69 in the pooled 1998-2010 Health and Retirement Study. The red line graphs the percent of individuals *with children* who own a life insurance policy, by wealth quintile (from the poorest quintile on the left to the wealthiest quintile on the right). The blue line graphs the percent of individuals *without children* who own a life insurance policy.

Appendix Figure 3: Wealth of parent and child, with and without cohort effects



Note: The left figure reports median parent wealth (in \$1,000s) in the HRS. Wealth is defined as total assets less debts. The dashed line denotes the raw wealth data and the solid line denotes median wealth controlling for cohort effects. The right figure reports the same measures for child wealth (in \$1,000s) from the PSID.

Appendix Figure 4: Family care rates among parents with long-term care needs



Note: The figure reports the simulated rate of family care usage among parents with long-term care needs, by parent wealth quintile. The red line denotes the matched family care usage rates reported in Table 10. The blue line denotes family care usage when family care is unavailable ($fam_t = 0$), and the green line denotes family care usage when insurance provides cash benefits.

Appendix Table 1: Model Notation

Symbol	Definition
Functions	
U_t^P, U_t^K	Utility functions of parent, child
V_t^P, V_t^K	Value functions of parent, child
V_{T+1}^K	Terminal value function of child
Z_t^P, Z_t^K	Non-cooperation value functions of parent, child
State variables (ω_t)	
a_t^P, a_t^K	Assets of parent, child
y^P	Permanent income of parent
w_t^K	Wage of child
h_t	Long-term care need of parent
$ltci$	Insurance policy holder indicator
θ_t^P, θ_t^K	Pareto weights
Decision variables (q_t)	
c_t^P, c_t^K	Consumption of parent, child
a_{t+1}^P, a_{t+1}^K	Next period assets of parent, child
ℓ_t^P, ℓ_t^K	Leisure of parent (set), child
L_t	Hours worked for child $\in \{0, 1000, 2000\}$
F_t	Formal care $\in \{0, 1\}$
fam_t	Family care $\in \{0, 1000, 2000\}$
NC_t	Non-cooperation $\in \{0, 1\}$
μ_t^P, μ_t^K	Adjustments to Pareto weights
Model Parameters	
z	Formal care preference
η	Parent altruism
g	Child guilt
α	Consumption-leisure trade-off
ϕ	Terminal value multiplier
γ	RRA
r	Interest rate
β	Discount rate
ξ_t	Child permanent wage shock
Policy environment	
m_t, SSI_t	Medicaid, SSI benefit
$\underline{c}$	Consumption floor
ltc_t	Long-term care cost
λ_t	Net insurance benefit
$\mathcal{T}$	Total hours in a year