Intergenerational Mobility and Long-Term Care

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Abstract

This project investigates how long-term care risk facing grandparents impacts the economic mobility of grandchildren in the United States. In order to understand the mechanisms that underpin this relationship, I develop an overlapping generations model in which parents and grandparents interact with limited commitment to make both long-term care and childcare choices, as well as investments in children. I estimate the model using data from the Panel Study of Income Dynamics and the Health and Retirement Study. I use the model to quantify the impact of long-term care on intergenerational mobility. I find long-term care needs explain 12.2% of the correlation between parent and child income rank.

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1 Introduction

Poverty tends to persist across generations in the United States. The correlation between parent and child income is 0.34 (Chetty et al., 2014), and nearly 60% of this relationship reflects differences that emerge during childhood (Huggett et al., 2011). While the existing literature emphasizes how parent-child interactions shape intergenerational mobility, long-term care risk faced by grandparents may also impact parents' ability to invest in their children, thereby affecting intergenerational mobility.

Long-term care is the largest risk facing aging adults: nearly 70% of those aged 65 will need long-term care at some point, and a substantial fraction of this care is provided by family members. Further, 1 in 5 elder-caregivers also cares for at least one child under the age of 12 (Chari and Valli, 2021). As a result, long-term care risk facing grandparents may impact time and monetary investments in children, both of which are important for development (Heckman and Mosso, 2014; Caucutt and Lochner, 2020; Cunha et al., 2010a). In this project, I ask how long-term care risk facing grandparents affects the economic mobility of grandchildren. Understanding this link is important for quantifying how changes in long-term care policy may affect not only parents and grandparents, but children as well.

In order for long-term care risk to perpetuate inequality across generations, it must be the case that long-term care risk differentially impacts families across the wealth distribution. There are several reasons that the impacts may be more pronounced for children from lower-income families. These families are more likely to rely on informal long-term care, and parents who provide such care to grandparents may have less time to invest in their children. Further, many parents, especially single parents, depend on grandparent-provided childcare (Anstreicher and Venator, 2022). When grandparents develop long-term care needs they are no longer able to provide such care. Losing access to grandparent-provided childcare may make it more difficult for lower income families to invest in their children, either because they must pay for formal childcare or work less to cover these childcare needs themselves. However, the effect of losing grandparent-provided childcare on intergenerational mobility is ambiguous, as parents may replace grandparent provided childcare with higher or lower quality alternatives.

In addition to time costs, long-term care needs may also impact parents' ability to make monetary investments in their children. Depending on how families make care arrangements, long-term care needs can lead to increases in both childcare and eldercare expenses and decreases in earned income, leaving fewer financial resources for investments in children. Further, parents who provide intensive eldercare are 20% less likely to

have an educational savings account than otherwise similar parents (Bogan, 2015). This suggests that eldercare responsibilities can constrain parents' ability to finance their children's education, which is an important determinant of economic mobility.

Long-term care risk may also influence the behavior of families who never develop long-term care needs. Because long-term care is risky, it can impact savings decisions. Parents may accumulate assets to self-insure against their own future care needs. Grandparents may retain wealth late in life as a precaution, reducing transfers that could support investments in children. Medicaid, which covers formal long-term care costs for individuals with low income and low assets, has ambiguous effects on intergenerational mobility. Asset limits may prevent intergenerational wealth transfers by requiring individuals to spend all their savings on care costs. However, asset limits for Medicaid eligibility may also incentivize families to invest more in children if they anticipate relying on Medicaid rather than savings to cover long-term care costs.

In this paper, I ask how long-term care risk faced by grandparents impacts the economic mobility of children. To quantify these effects, I develop an overlapping generations model in which parents and grandparents interact with limited commitment. Families make joint decisions over childcare, eldercare, labor supply, savings, and time and monetary investments in children. Within this framework, parents and grandparents each hold their own savings, which is critical for capturing the effects of Medicaid's asset limits on savings behavior and intergenerational transfers.

I use an overlapping generations framework to capture how long-term care risk affects the persistence of inequality across generations. I model interactions between parents and grandparents with limited commitment to capture the fact that decisions about long-term care and childcare require a level of coordination beyond what is typically captured in economic models of intergenerational mobility, where parent-child interactions effectively end when the child reaches adulthood. Further, empirical evidence also rejects full insurance among the extended family (Hayashi et al., 1996; Attanasio et al., 2019). Using limited commitment allows parents and grandparents to coordinate on care decisions while each makes their own savings decisions. This approach maintains the separation of assets between parents and grandparents, which is important for capturing the effects of Medicaid's asset test.

I estimate the model using data from the Panel Study of Income Dynamics and the Health and Retirement Study. The model is able to match key moments related to care and savings decisions. I use the model to quantify the impact of long-term care needs and long-term care risk on the intergenerational correlation in income. I find that long-term care increases the correlation between parent and child income by 12.2%, and 40% of this

increase is driven by the fact that long-term care is risky. That is, even when care needs are never realized, the presence of long-term care risk impacts families' outcomes. The remainder of the gap is largely driven by parental time investments in young children and monetary investments older children.

This paper makes several contributions to the literature. First, the existing literature on long-term care and the family has largely focused on the impact of care needs on the economic outcomes of aging parents and their adult children. The availability of informal care reduces Medicaid utilization (Barczyk and Kredler, 2018) and slows nursing home entry (Barczyk et al., 2022). Further, informal care suppresses demand for long-term care insurance (Mommaerts, 2024) and exacerbates adverse selection issues in the long-term care insurance market (Ko, 2022). This project, in contrast, investigates the effects of long-term care on not only grandparents and parents, but on children as well. Accounting for the impacts on children is important for quantifying the impact of policies that provide families with insurance against long-term care risk.

Beyond the effects of long-term care, there are also several studies that document how informal insurance within families shapes economic decisions. Parents save to insure their children against income risk, with the amount varying by the riskiness of the child's occupation (Boar, 2021). For young men, the option for coresidence with one's parents provides labor market insurance and helps explain why that group has a low elasticity of labor supply (Kaplan, 2012). Thus family-provided insurance plays an important role in determining outcomes across generations. I build on this literature by investigating how long-term care risk facing grandparents may impact not only parents but their children as well, and how changes in long-term care insurance policy impact the persistence of inequality across generations.

A largely separate literature documents several factors that contribute to the persistence of economic outcomes across generations, including the role of human capital investments made by parents (Becker and Tomes, 1986; Lee and Seshadri, 2019), borrowing constraints facing parents (Caucutt and Lochner, 2020), parents' ability to access credit (Braxton et al., 2023), and neighborhood and migration decisions (Anstreicher, 2024; Chetty et al., 2016). Further, the structure of the immediate family, namely the presence of two parents, positively impacts a child's future income (Chang et al., 2024). I extend this literature by accounting for the impacts of a third generation, the grandparent generation, on the intergenerational mobility of children in the United States. In order to do so, I develop a model of overlapping generations in which parents and grandparents interact with limited commitment to make choices over the entire life-cycle–a novel contribution to this literature.

The results of this study shed light on the impact of long-term care risk on the persistence of inequality across generations. In Section 2 I provide more information on long-term care policy and arrangements in the United States and in Section 3 I provide empirical evidence on the relationship between intergenerational mobility and long-term care. In Section 4 I describe the model and in Section 5 I describe the estimation procedure. In Section 6 I report the results from the counterfactuals and Section 7 concludes.

2 Long-term care in the United States

Long-term care (LTC) needs arise when individuals have difficulty with Activities of Daily Living (ADLs) or Instrumental Activities of Daily Living (IADLs). These include activities such as bathing, dressing, managing medications, and housekeeping. These needs are not acute medical events but rather long-term difficulties, and 70% of individuals aged 65 will need long-term care at some point. However, there is substantial heterogeneity in both the timing and amount of care needed.

In the United States, over half of long-term care needs are met informally, usually by family members. In addition to informal care, formal long-term care is available but expensive. The average price for a home health aide is $20 an hour and a semi-private room in a nursing home costs $111,325 (CareScout, 2024). These costs are not covered under Medicare, which provides coverage for short-term medical needs, but does not cover long-term care. Instead, Medicaid covers long-term care for aging adults, and recipients are therefore subject to strict income and asset requirements.

2.1 Informal care

Informal care is the largest source of long-term care in the US (Gruber and McGarry, 2023) with most care provided by spouses and adult children. Many adult children who provide informal care also have children of their own. Among all informal caregivers, 20% are also caring for at least one child under the age of 18. For these parents, the opportunity costs of providing long-term care include not only lost wages, but time they could have spent with their children.

Figure 1: Fraction Receiving Informal Care

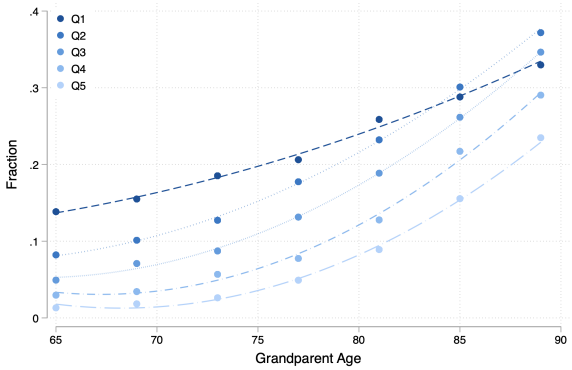
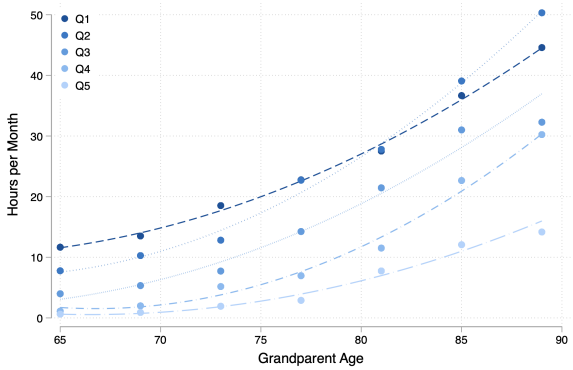


Figure 2: Hours of Informal Care



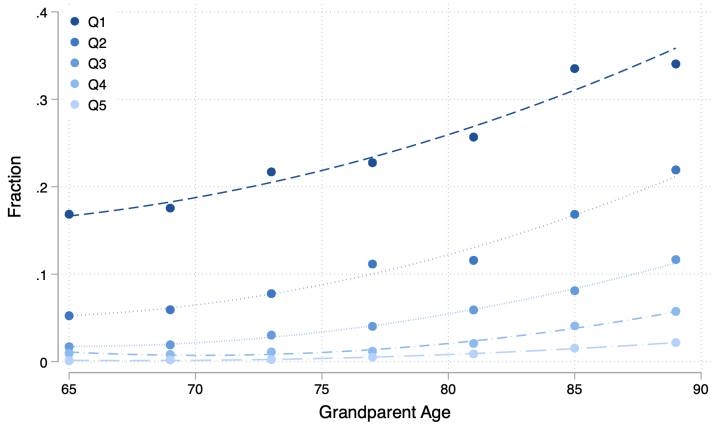
Further, the provision of informal care by parents is not evenly distributed across the wealth distribution. Using data from the Health and Retirement Study, Figure 1 shows that poorer grandparents are more likely to receive informal care from parents, and Figure 2 shows that conditional on receiving informal care from parents, less wealthy grandparents receive more informal care than their wealthier counterparts.

2.2 Medicaid

Medicaid, rather than Medicare, covers long-term care for aging adults, meaning that coverage is means-tested. In 2023, Medicaid spent 257 billion dollars on long-term care, making up 46% of all long-term care spending in the United States. Because Medicaid is a means-tested program, recipients must satisfy the income and asset requirements. In most states, individuals are subject to an income limit of $3,000 in monthly income and an asset limit of $2,000[1] (KFF, 2019).

[1]Maine has a $10,000 limit, South Carolina's is $9,090, Nebraska, DC, and Rhode Island have a $4,000 limit, North Dakota has a $3,000 limit, New Hampshire and Maryland have a $2,500 limit, and Connecticut has a $1,600 limit (Choice Mutual, 2024).

Figure 3: Medicaid LTC Rate by Wealth



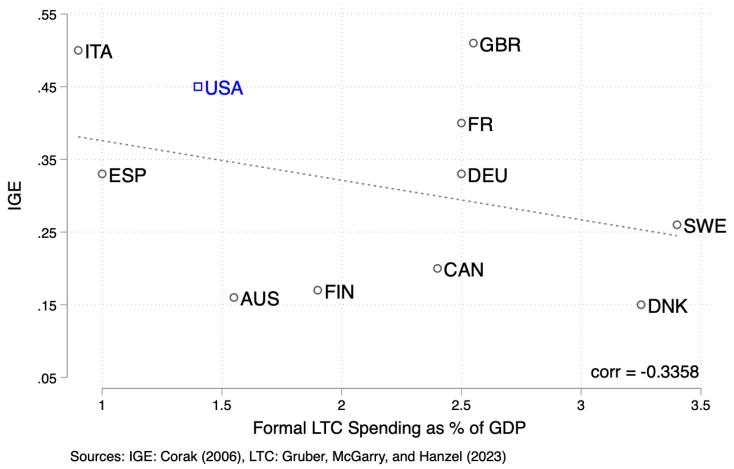
Note: The sample includes all grandparents aged 65+ in the Health and Retirement Study, 1992-2018. Asset quintiles are computed using all assets (housing and non-housing) at age 65.

There are two ways to meet Medicaid's eligibility criteria. First, individuals are categorically eligible if they have very low assets and income prior to incurring long-term care costs. Second, individuals may become eligible by spending down their assets and income on medical expenses until they meet the threshold. While Medicaid's long-term care coverage is most prevalent among the least wealthy, it is still relevant for wealthier individuals. Figure 3 plots the rate of Medicaid utilization for long-term care by wealth, and while take-up is highest for the least wealthy, there is an uptick for wealthier individuals as they age.

2.3 Long-term care across countries

The US spends less on formal care per capita and has a higher intergenerational earnings elasticity (Figure 4). Given that long-term care spending is correlated with general spending on social insurance, this is not meant to establish a causal relationship, but suggests that social insurance may help explain why poverty is more persistent across generations in the United States than in many of these countries.

Figure 4: Intergenerational Earnings Elasticity and Formal Long-Term Care Spending



Sources: IGE: Corak (2006), LTC: Gruber, McGarry, and Hanzel (2023)

3 Empirical evidence

In order for long-term care to impact intergenerational mobility, it must be the case that long-term care impacts families differently over the income distribution and these effects also impact children. Informal care from parents is more prevalent among less wealthy families (subsection 2.1) and Medicaid utilization for long-term care varies over the wealth distribution (subsection 2.2). In this section I provide evidence on how long-term care needs facing grandparents impact investments in children over the wealth distribution, and thus may impact intergenerational mobility.

Variation in investments in children is one of the main drivers of the persistence of income across generations. Nearly 60% of the correlation between parent and child income is explained by differences that emerge during childhood (Huggett et al., 2011). These differences reflect differences in inherited skill as well as parental investments in their children. Both time and monetary investments are important for children's skill development (Cunha et al., 2010b), and here I show that long-term care impacts both of them.

First, I show that parents who provide more eldercare also provide less childcare, suggesting that this tradeoff is relevant. I then investigate the role of long-term care policy. Using variation in Medicaid spending across states and over time, I find that increased access to formal long-term care for grandparents increases parental time spent with children. Finally, while parents are the main source of time investments in their children, I find that grandparents with long-term care needs are less able to provide childcare to their grandchildren. This is another mechanism through which long-term care impacts

time investments families make in children.

After describing the effects of long-term care on time investments, I turn to monetary investments. Using the Health and Retirement Study, I provide suggestive evidence that parents' education levels are related to not only grandparents' long-term care needs, but also their expectations of these needs.

3.1 Parental time investments

3.1.1 Descriptive evidence

Parents who spend more time on eldercare spend less time with children. To document the impact of eldercare on parental time investments in their children, I use the American Time Use Survey (ATUS). The ATUS is a nationally representative repeated cross-section conducted annually since 2003. It includes detailed data on how subjects spend their time, including time spent on childcare and eldercare, as well as some demographic data.

I restrict the sample to all parents whose youngest child is less than 18 in the ATUS between 2003 and 2020. It is important to note that in the ATUS I cannot identify all families with long-term care needs, only families in which parents provide informal eldercare. Summary statistics for the sample are reported in Table 1. 11.4% of the sample provides eldercare, and there are differences between parents who provide eldercare and those who do not.

Parents who provide eldercare earn less and are slightly less likely to be working than parents who do not provide informal care. They also provide less childcare and have slightly older children, though these differences are small.

Table 1: Summary statistics by eldercare provision

	No eldercare	Eldercare	p-value
Weekly earnings	581.39	516.70	0.000
Fraction working	0.64	0.62	0.002
Weekly earnings | working	909.52	827.65	0.000
Eldercare	0.00	46.44	0.000
Childcare	71.87	66.90	0.000
Fraction provide childcare	0.59	0.64	0.000
Childcare | childcare provider	121.71	104.27	0.000
Age	37.04	37.32	0.025
Female	0.57	0.60	0.000
Age of youngest household child < 18	7.47	7.83	0.000
Number of children	1.89	1.82	0.000
N	83,477	10,764	.

Source: ATUS, 2003-2020. Sample includes all parents with at least one child under 18.

From Table 1, it's clear that parents who provide eldercare spend less time providing childcare. However, this may be due to the fact that their children are older or that they have slightly fewer children under 18. To get a better sense of the relationship between childcare and eldercare, I regress the number of minutes of childcare an individual i provides (cc_i) on a measure of eldercare provision (ec_i), including controls for individual i's age, number of children, education, marital status, sex, age, working hours, and whether a partner works. The regression is given by:

$$cc_i = \beta_0 + \beta_1 ec_i + \beta_2 work_i + \alpha X_i + \epsilon_i \tag{1}$$

The coefficient β_1 is the coefficient of interest. Column 1 reports the results for a continuous measure of eldercare: the number of minutes of eldercare a parent provides, while column 2 uses a binary indicator for whether or not a parent provides eldercare. The results, summarized in Table 2, indicate that parents who spend more time on eldercare spend less time with their children. For each additional hour of eldercare a parent provides, she provides 10 fewer minutes of childcare, on average. The magnitude is similar in size to the effect of working on childcare hours provided.

Table 2: Impacts on Childcare Time

	(1) Continuous eldercare	(2) Binary eldercare
Eldercare	-0.096***	-8.218***
	(0.009)	(0.965)
Work	-0.100***	-0.100***
	(0.001)	(0.001)
Age of youngest household child < 18	-7.242***	-7.234***
	(0.066)	(0.066)
Number of children	1.170***	1.168***
	(0.337)	(0.338)
Years of education	4.627***	4.650***
	(0.113)	(0.113)
Age	-0.103***	-0.108***
	(0.028)	(0.028)
Female	27.132***	27.304***
	(0.656)	(0.656)
Partnered	7.663***	7.634***
	(1.090)	(1.090)
Partner works	12.806***	12.910***
	(0.941)	(0.941)
Constant	38.653***	38.776***
	(1.998)	(2.000)
N	94,241	94,241
Adjusted R^2	0.246	0.245

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

These results reflect the fact that parents make tradeoffs between not just work and childcare, but work, childcare, and eldercare. Chari and Valli (2021) find that increasing childcare availability leads to increases in eldercare provision from parents, rather than increases in labor supply. Further, parents who provide more eldercare spend less time with their children, suggesting that the long-term care needs of grandparents impact parental time investments in children.

3.1.2 The role of long-term care policy

Parents spend more time with children when they have more access to long-term care. Given that informal eldercare reduces the amount of time invested in children, I use the ATUS to investigate how long-term care policy impacts this tradeoff. To do so, I use variation across state and time in Medicaid's Home and Community-Based Spending (HCBS), which provides support for low-income individuals at home, rather than in a nursing home.

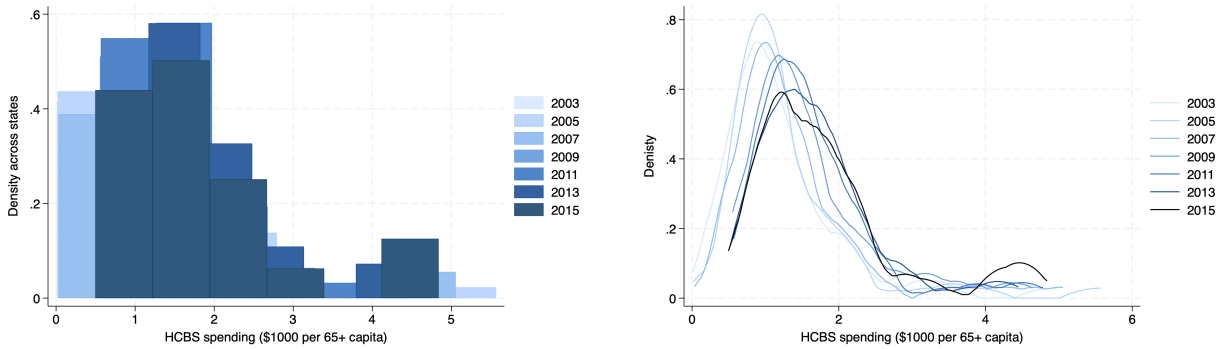
Historically, Medicaid has primarily covered institutional long-term care, and individuals typically wait to enter a nursing home until their care needs are fairly severe. However, given that these care needs develop over time, individuals entering a nursing home likely needed support while they were still at home. This support could come in the form of a home health aide, paid out of pocket, or informal care. Over the past two decades, Medicaid coverage has expanded to include options for care at home through HCBS. This reduces the barrier to accessing formal care, particularly for low-income families, given that individuals who meet Medicaid's eligibility requirements do not have to pay out of pocket for care and can receive care at home. Table 3 summarizes the distribution of HCBS spending per aging adult, as well as total Medicaid spending.

Table 3: Summary Statistics: Medicaid Spending Per 65+ Capita

Variable	Mean	Median	P10	P25	P75	P90
HCBS	1,679	1,370	796	1,001	2,022	2,893
Total Medicaid spending	9,819	9,181	6,579	7,447	11,034	13,454

Expansions in HCBS varied across states and time, which can be seen in Figure 5. Zai (2024) shows that HCBS expansion led to small but positive effects on the health of aging adults. I use the same variation to investigate the impacts of expansions in access to Medicaid care at home for grandparents on parents' time spent on childcare, eldercare, and labor supply.

Figure 5: Medicaid HCBS over time



To quantify the effects of the policy on how parents allocate their time, I run the following specification:

$$Y_{ist} = \beta_0 + \beta_1 M_{st} + \mu_t + \eta_s + X_{ist}\delta + \epsilon_{ist} \tag{2}$$

The outcome, Y_{ist}, is the minutes of an activity performed on the ATUS diary day of individual i in state s at time t. The outcomes of interest are childcare, eldercare, and time spent working. The independent variable, M_{st}, is Medicaid spending on Home and Community Based Services per 65+ capita. in state s in year t. I also include year and state fixed effects, μ_t and η_s respectively. Finally, X_{ist} includes age, sex, number of children, years of education, whether an individual is partnered, whether an individual's partner works, the age of the youngest child, and day of the week indicators. Standard errors are clustered at the state level.

Given that Medicaid primarily provides support to low-income families, in the main results, presented in Table 4, I focus on parents with incomes below $12,500. I find that going from the 25th percentile in HCBS spending to the 75th percentile ($1000 increase in spending per adult over 65) increases childcare by approximately 12.5 minutes. The coefficient on eldercare hours is negative, as expected, but insignificant, likely due to the small sample size.

Table 4: Regression Results

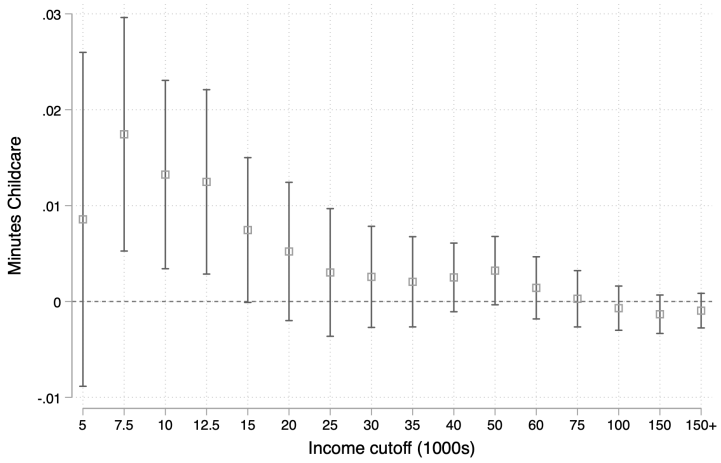
	(1) childcare	(2) eldercare
HCBS spending per 65+ capita	0.012**	-0.002
	(0.005)	(0.002)
Age	0.011	0.106**
	(0.099)	(0.042)
Female	36.086***	-0.689
	(2.885)	(1.416)
Number of children	3.740***	-1.095***
	(1.049)	(0.385)
Years of education	2.118***	-0.002
	(0.401)	(0.213)
Partnered	1.250	2.611
	(3.967)	(1.683)
Partner works	10.140*	-0.380
	(5.763)	(2.560)
Age of youngest household child < 18	-6.663***	0.033
	(0.271)	(0.108)
N	6,464	6,464
Adjusted R^2	0.149	0.003

Standard errors in parentheses

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

These results indicate that expansions in Medicaid HCBS do increase parents' time spent with children, particularly for low income families. In Figure 6, I plot the coefficient on childcare minutes across income cutoffs. The results are largest for lower-income families, and fade out as more higher income families are added to the sample.

Figure 6: Impact over income cutoffs



Medicaid funding is likely to have the largest effects for the lowest income groups, and these results suggest that long-term care policy can impact the investments parents make in their children. This, in turn, might increase parental time investments in children of lower income families, which may help those children develop the skills needed to rise in the income distribution.

3.2 Grandparent time investments

Grandparents with long-term care needs spend less time providing childcare than healthy grandparents. While parents provide the main source of time investments in children, grandparents may also help provide care for children. Grandparent-provided childcare is particularly prevalent among low-income and single parent households (Anstreicher and Venator, 2022). However, grandparents with long-term care needs are less able to provide childcare.

To show this, I use data from the Health and Retirement Study (HRS). The HRS is a longitudinal panel of approximately 20,000 people, with information collected biennially beginning in 1992. I restrict my sample to individuals who are at some point in the sample grandparents (i.e. they have at least one child and that child has at least one child). I define four levels of long-term care need: no care, light care, full-time care, and round-the-clock care. Light care is defined as having slight difficulty with ADLs, and these individuals receive, on average, 50 hours of care a month. Full-time care is defined as having moderate difficulty with ADLs, and these individuals receive an average of 132 hours of care per month. Finally, round-the-clock care is defined as having significant

difficulty with ADLs, and these respondents receive about 310 hours per month of care. The HRS also asks respondents whether they provide childcare to their grandchildren and around 50% of grandparents provide such care.

To investigate the impact of grandparents' long-term care needs on childcare provision, I run the following regression:

$$CC_i = \beta_0 + \beta_1 light_i + \beta_2 heavy_i + \beta_3 rtc_i + \alpha X + \epsilon_i \tag{3}$$

CC_i is an indicator for whether a grandparent provides childcare. The coefficients of interest are β_1, β_2, and β_3. In column 1 of Table 5 I report the coefficients from a regression that includes a vector of covariates, X, with a quadratic in age, gender, years of education, wealth, and the age of the grandparent's youngest and oldest child. In column 2, I include an individual fixed effect (and omit gender and years of education), using changes within an individual to identify the effect of long-term care needs on childcare provision. The results in both specifications are similar, and indicate that grandparents with long-term care needs are less likely to provide childcare for parents, with the magnitude increasing as care needs increase.

Table 5: Results

	Grandparent provides childcare	
Light care needs	-0.065***	-0.061***
	(0.005)	(0.005)
Full time care needs	-0.097***	-0.096***
	(0.006)	(0.007)
Round-the-clock care needs	-0.115***	-0.121***
	(0.007)	(0.008)
Individual Fixed Effects	No	Yes
N	18,404	18,404
N × Year	153,326	153,326

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As grandparents develop long-term care needs, they're less able to provide childcare. Parents who rely on grandparent-provided childcare will have to fill this time themselves or with market-based childcare. This is compounded for parents who step in to provide informal eldercare and lose grandparent-provided childcare. However, this can may have an ambiguous effect on intergenerational mobility, depending on the type of care children

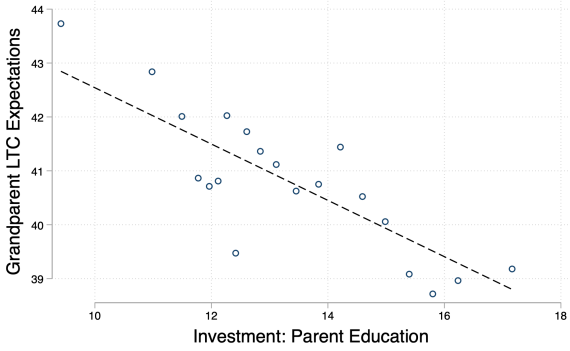
receive in lieu of care from grandparents.

3.3 Monetary investments

Parents health expectations and long-term care needs are correlated with investments in child's education. One of the largest monetary investments families make in their children is their education. Using the Health and Retirement Study, I investigate the relationship between grandparents' long-term care expectations and parents' education. I show that grandparents' expectations of health, as well as their realizations, are correlated with their children's education.

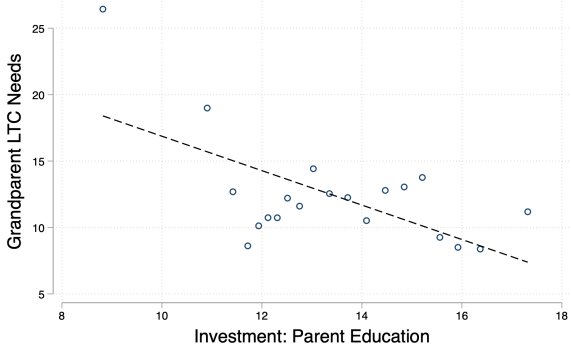
The HRS asks healthy respondents how likely they are to have a work-limiting health limitation within the next 10 years. Grandparents who say they are more likely to have such a limitation are also more likely to have children with lower levels of education. This correlation is summarized in Figure 7. Further, this relationship does not only exist in expectation. Grandparents who develop long-term care needs are more likely to have children with lower levels of education.

Figure 7: Health Expectations



Source: HRS. Controlling for grandparent age, wealth, education and parent's ages

Figure 8: Health Needs



Source: HRS. Controlling for grandparent age, wealth, education and parent's ages

These results show that grandparents' health expectations and long-term care needs are related to parents' education. While there are several reasons this may be the case, Bogan (2015) finds that parents who provide intensive eldercare are 20% less likely to have an educational savings account than otherwise similar parents. This suggests that long-term care concerns impact investments in education, and that these impacts can be seen before care needs are realized.

4 Model

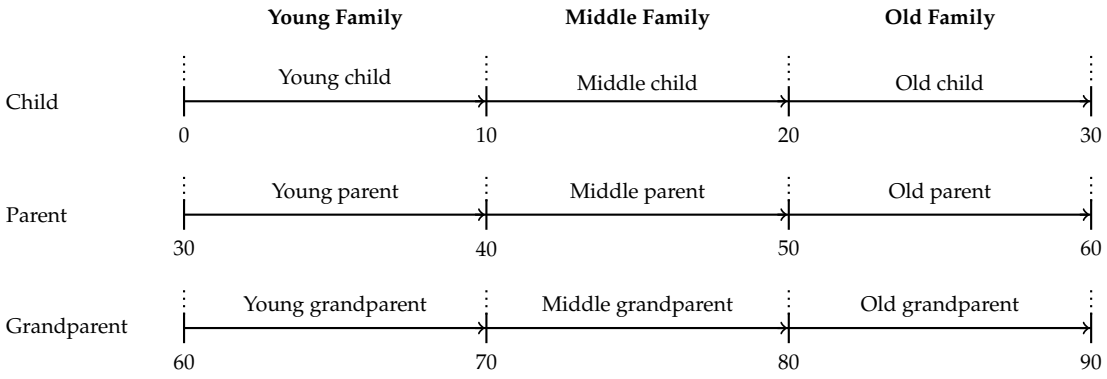
In order to quantify the importance of direct and indirect effects of long-term care risk on intergenerational mobility, I develop a model in which families make childcare and eldercare choices, save, and invest in children. While it may be possible to capture some of the effect of long-term care risk on children through exogenous variation in things like grandparent mortality or changes in long-term care policy, these strategies cannot address the relative impacts of direct versus indirect effects. Using a structural model also allows me to evaluate a range of counterfactual policies. Further, data with suitable sample sizes necessary for these empirical strategies in the US context is sparse. Using a structural model allows me to utilize data from multiple data sets.

Thus, I develop a model to understand how families facing long-term care risk make care and investment decisions in children. Dynasties in the model are infinitely lived and made up of overlapping generations. There are three generations within a family alive at any given time–a child, a parent, and a grandparent. The child is cared for by their parent, and parents and grandparents interact with limited commitment to make consumption, savings, childcare, and eldercare choices as well as monetary and time investments in children. Limited commitment is important to capture the degree of coordination around these choices while maintaining the separation of each agent's assets.

4.1 Timeline

Time is discrete and runs forever. A period in the model is 10 years. I model infinitely lived dynasties and within each dynasty there are three overlapping generations: a child (k), a parent (p) and a grandparent (g). Each agent in the model spends three periods in each generation: three as a child, then three as a parent, and then three as a grandparent. Thus, a family within a dynasty may be in one of three stages: young ($t = y$), middle-age ($t = m$), or old ($t = o$).

Figure 9: Model Timeline



In the model, children receive time and monetary investments from parents and require childcare in the first two periods of their lives. In the third period, they may or may not attend college. These children then become parents, and enter the labor market where they face earnings risk and make childcare, eldercare, and labor supply choices. Parents also make a savings decision. After three periods as a parent, the parent becomes a grandparent and the child becomes a parent. Grandparents face eldercare risk, may help with childcare, and make a savings decision. At the end of three periods as a grandparent, the grandparent passes away, and may leave a bequest to the parent, who becomes a grandparent. Thus, while individuals in the model live for nine periods, a new generation is born every three periods and thus the dynasty is infinitely lived. This structure is outlined in Figure 9. Below, I outline these life stages within each generation in more detail.

4.2 Children

When children are born into the model, their initial skill level depends on the skill of the parent and a randomly drawn component. The persistence of ability across generations is governed by ρ_s. A child who enters the model at time t has an initial skill level is given by

$$s_y^k = \rho_s s_y^p + (1 - \rho_s)d \tag{4}$$

where the random component of a child's initial skill, d, is drawn from a normal distribution with mean μ_{sk} and variance σ_{sk}^2.

In the first two stages of life, the child's skill development depends on the skills she brings into the period as well as monetary (x_t) and time (T_t) investments.

$$s^k_{t+1} = (1-\delta_k)s^k_t + (s^k_t)^{1-\omega_s}(J(T_t, x_t))^{\omega_s} \tag{5}$$

The parameter δ_k controls depreciation of skills from one period to the next. The child's existing skill increases the productivity of investments, the degree of which is captured by ω_s. Time investments and monetary investments are also complements, and enter the child skill development function as

$$J(T_t, x_t) = T_t^{\omega_t} x^{1-\omega_t} \tag{6}$$

This formulation incorporates dynamic complementarity as skills in the next period depend on the skills the child has today, which is an important feature of child skill development (Heckman and Mosso, 2014; Caucutt and Lochner, 2020; Cunha et al., 2010a). This functional form also captures the complementarity of monetary and time investments, which are particularly important in this context as eldercare may crowd out the parent's ability to invest time and money in the child. The relative productivity of time and monetary investments varies over the two stages and is captured by ω_t.

The time input (T_t) in the child's skill development function is a composite of time from parents (hp^k_t), grandparents (hg^k_t), or market-based childcare (hm^k_t). I assume that young and middle-age children require Hk_t hours of care, and that these childcare hours can be met by the parent, grandparent, or market (or any combination therein). However, each of these inputs has a different productivity in the child's skill development, such that the time investment component is given by:

$$T_t = \left[(\frac{s_p}{\hat{s}})\omega_p (\frac{hp^k_t}{H_k})^{\rho_\omega} + \omega_g (\frac{hg^k_t}{H_k})^{\rho_\omega} + \omega_m (\frac{hm^k_t}{H_k})^{\rho_\omega} \right]^{\frac{1}{\rho_\omega}} \tag{7}$$

where $\omega_p + \omega_g + \omega_m = 1$. In this formulation, the productivity of parent time scales with parent skill, scaled by median parent skill, $\hat{s}$.

Old children do not require childcare, but may or may not attend college. Thus their skill development is a function of the skills they have accumulated thus far and a linear return to college education.

$$s^p_y = s^k_o + \omega_X X_o \tag{8}$$

I model college-going as a binary choice, such that $X_o = \{0, 1\}$. Thus, the skills that a young parent has in the model are the result of the skills accumulated over her childhood, culminating in a college choice.

4.3 Parents

Parents receive a wage offer that correspond to their skill level plus a shock. Earnings risk follows a normal distribution with mean of zero and variance σ_ϵ^2.

$$log(w_t) = s_t^p + \epsilon_t \tag{9}$$

Parents then make a discrete labor supply choice, where they may choose not to work, to work part-time or to work full-time such that $L_t^p = \{0, \text{part-time}, \text{full-time}\}$. Their labor income is then given by $w_t L_t^p$. In addition to labor income, the total earnings of parents includes an exogenous component that is a function of the parent's skill ($I(s_t^p)$). Exogenous earnings here are meant to represent those of a spouse or partner, and are correlated with the skill level of the parent given that spouses tend to have similar levels of education in the data.

$$I_t^p = w_t L_t^p + I(s_t^p) \tag{10}$$

Parents' skills also develop over their three stages as a parent:

$$s_{t+1}^p = \alpha_{s_p} s_t^p + \alpha_L L_t^p \tag{11}$$

Where the return to last period's skills are given by α_{s_p} and the return to experience is given by α_L.

4.4 Grandparents

Grandparents do not make labor market choices, and spend all their time on leisure or childcare. They receive income I^g, meant to represent pension and social security income. Middle-age and old grandparents face risk in the form of shocks to the number of long-term care hours needed (H_t^g). In order to help cover these shocks, I model a Medicaid benefit given by:

$$M_t = \max\{0, c_f + p^g hm_t^g - max\{a_t^g - a_{lim}, 0\} - I^g\} \tag{12}$$

Grandparents are eligible for Medicaid if their care costs ($p^g hm_t^g$), asset holdings (a_t^g) above the Medicaid asset limit (a_{lim}), and income (I^g) exceed a consumption floor (c_f). Additionally, only healthy grandparents are able to provide childcare.

4.5 Constraints

Families face both time and budget constraints. Children in young and middle-age families require Hk_t hours of childcare. These hours may be met by the parent (hp_t^k), the grandparent (hg_t^k), or market care (hm_t^k) for price p^k.

$$H_t^k = hp_t^k + hg_t^k + hm_t^k \tag{13}$$

Similarly, middle-age and old families may face eldercare needs. The total number hours of eldercare a grandparent requires (H_t^g) are drawn randomly. These hours may be met by the parent hp_t^g or by market-based formal eldercare (hm_t^g), at price p^g such that:

$$H_t^g = hm_t^g + hp_t^g \tag{14}$$

Given these care needs, the parent's time constraint is given by:

$$T = hp_t^k + hp_t^g + L_t^p + \ell_t^p \tag{15}$$

where she spends her time on labor, leisure, childcare, and eldercare depending on her choices and the childcare and eldercare needs a family faces in a given period.

The grandparent's time constraint is given by:

$$T = hg_t^k + \ell_t^g \tag{16}$$

where she spends all her time on leisure and childcare if she provides it. I model childcare provision as subtracting from the leisure of the grandparent. While many grandparents likely enjoy spending time with their grandchildren, the model captures a level of care that is more intensive than occasional visits or time supervised by a parent.

Turning to the family budget constraint, in all stages, families make consumption (c_t^p, c_t^k, c_t^g) and savings (a_t^p, a_t^g) choices. Parent's income is made up of their labor income ($w_t L_t^p$) and spousal income ($I_t^p(s_t^p)$). Grandparents receive income I^g each period, meant to approximate pension income. Finally, care and educational costs vary over each stage, and are summarized by B_t. Thus, the family budget constraint is given by:

$$c_t^k + c_t^p + c_t^g = w_t L_t^p + I_t^p(s_t^p) + I^g + R(a_{t-1}^p + a_{t-1}^g) - a_t^p - a_t^g - B_t \tag{17}$$

Young families make monetary investments in their child (x_t) and may pay for formal childcare if they choose to use it (hm_t^k) Thus, the care and investment cost for young

families is given by:

$$B_y = x_y + p^k hm_y^k \tag{18}$$

Middle-age families also make monetary investments in children and decide whether to pay for formal childcare. Middle-age grandparents are also subject to eldercare shocks, and the family may choose to use for formal eldercare (hm_t^g). Additionally, grandparents may qualify for Medicaid (M_t) to help cover care costs. The Medicaid benefit is described in Equation 12. Grandparents are only eligible for Medicaid if they use formal care. Thus, care and investment costs for middle-age families is given by:

$$B_m = x_m + p^k hm_m^k + p^g hm_m^g - M_m \mathbb{1}_{hm_m^g > 0} \tag{19}$$

Finally, old families may also require eldercare, and may receive a Medicaid benefit if eligible. Children in old families no longer require childcare, but may go to college, and thus families incur the cost of college (p^X) if the child goes to college. So, the care and educational costs old families face is given by:

$$B_o = p^X X_o + p^g hm_o^g - M_o \mathbb{1}_{hm_m^g > 0} \tag{20}$$

I describe the budget constraint of the family in each stage, though it could equivalently have been written as one for the parent and one for the grandparent with transfers between the parent and grandparent.

4.6 Preferences

In each stage, parents have preferences over their own consumption, c^p, and the consumption over their child, c^k, weighted by λ. Because parents make all choices for the child, the child's consumption is a component of the parent's utility function. Parents also have preferences over leisure, weighted by α_ℓ.

$$u_t^p(c_t^p, c_t^k, \ell_t^p) = \frac{c^{p(1-\gamma_c)} - 1}{1-\gamma_c} + \lambda \frac{c^{k(1-\gamma_c)} - 1}{1-\gamma_c} + \alpha_\ell \frac{\ell^{p(1-\gamma_\ell)} - 1}{1-\gamma_\ell} \tag{21}$$

Grandparents have preferences over their own consumption, c^g, and leisure, ℓ^g, as well as the type of eldercare that they receive. Currently grandparents may rely on informal care from parents or formal care, which may be covered by Medicaid. The parameter z_F gives the (dis)-utility from receiving formal care ($F_t = 1$). The parameter z_M gives the additional (dis)-utility from receiving Medicaid-funded formal care. This reflects the fact

that Medicaid-funded care is often of lower quality than other formal care options. The Medicaid benefit is described in Equation 12. Grandparent preferences are given by:

$$u_t^g(c_t^g, \ell_t^g) = \frac{c^{g(1-\gamma_c)} - 1}{1-\gamma_c} + \alpha_\ell \frac{\ell^{g(1-\gamma_\ell)} - 1}{1-\gamma_\ell} + z_M \mathbb{1}_{M_t>0} + z_F \mathbb{1}_{F_t=1} \tag{22}$$

The γ_c and γ_ℓ parameters govern the curvature of consumption and leisure and α_ℓ controls the how much weight individuals place on leisure relative to consumption.

4.7 Family Problem

Each dynasty maximizes the Pareto weighted sum of the parent and grandparent utilities in every period. Agents discount the future at rate β. Grandparents are altruistic and place a weight of η on the parent's utility in each period. Thus, the problem facing a dynasty is given by:

$$V_0 = E_0 \left\{ \sum_{t=0}^{\infty} \beta^t \{\theta_t u_t^p + (1-\theta_t)[u_t^g + \eta u_t^p]\} \right\} \tag{23}$$

I model the interactions between the parent and grandparent with limited commitment. A unitary model would imply full insurance between the parent and grandparent, and the literature generally rejects full insurance within extended family networks (Hayashi et al., 1996; Attanasio et al., 2019). A cooperative model would also imply that the family has only a single asset pool shared by the parent and grandparent. However, maintaining separation between the assets of the parent and the grandparent is particularly important in this context given that Medicaid covers long-term care, and thus beneficiaries are subject to Medicaid's asset test[2].

Given that the data rejects a fully cooperative model, both non-cooperative and limited commitment models are common when modeling complex family interactions (Kaplan, 2012; Voena, 2015; Mommaerts, 2024). I have chosen limited commitment because the level of coordination between families suggests a level of cooperation beyond that in a non-cooperative model (Mommaerts, 2024). Further, non-cooperative models require strict timing assumptions. Limited commitment models are also constrained efficient, whereas non-cooperative models need not be.

The individual value functions for the parent and the grandparent respectively are give by

[2]Individuals may not have more than $2000 in liquid assets in most states.

$$V_t^p(z_t) = \max_{j_t} u_t^p + \beta E V_{t+1}^p(z_{t+1}) \tag{24}$$

$$V_t^g(z_t) = \max_{j_t} u_t^g + \beta E v_{t+1}^g(z_{t+1}) + \eta V_t^p(z_t) \tag{25}$$

where $v(z_t) = u_t^g + \beta E v_{t+1}^g(z_{t+1})$ Appendix F gives more details on grandparent's altruism. Then, since parents become grandparents at the end of the old stage, the parent's continuation value when $t = o$ is given by $V_{o+1}^p(z_{o+1}) = V_y^g(z_y)$. Since grandparents pass away at the end of the old family stage, their continuation value at $t = o$ is given by $v_{o+1}^g(z_{o+1}) = 0$.

In the third stage, families also receive a Type I Extreme Value shock over college-going preference. The household sees ξ_X before making the college choice, thus the value function for the old family is given by

$$V(z_t) = E_\xi \max_X V(z_t, X) + \xi_X \tag{26}$$

Taking the expectation over the shocks, the value function can be written as

$$V(z_t) = \sigma_\xi \log \sum_X \exp\left(\frac{V(z_t, X)}{\sigma_\xi}\right) \tag{27}$$

and the probability of college-going is given by

$$\Pr(X|z_t) = \frac{\exp(V(z_t, X)/\sigma_\xi)}{\sum_{\hat{X}} \exp(V(z_t, \hat{X})/\sigma_\xi)} \tag{28}$$

The recursive family problem can be represented as the weighted sum of the parent and grandparent values:

$$V_t(z_t) = \max_{j_t} \theta_t V_t^p + (1 - \theta_t) V_t^g \tag{29}$$

and is subject to the time constraints (equations 13, 14, 15, and 16) and the budget constraint (equation 17). Because parents and grandparents interact with limited commitment, each is also subject to their own voluntary participation constraint. The state variables are given by z_t and the choice variables are given by j_t. These are summarized in Table A.1.

The voluntary participation constraints for each stage are given by:

$$\mu_t^p : V_t^p(z_t) \geq W_t^p(z_t) \tag{30}$$

$$\mu_t^g : V_t^g(z_t) \geq W_t^g(z_t) \tag{31}$$

Where the outside options W_t^p and W_t^g reflect an inability of parents and grandparents to coordinate on transfers or care within a dynasty. However, grandparent are still altruistic and may leave a bequest. The Lagrange multipliers on these constraints, μ_t^p and μ_t^g dictate how the Pareto weights evolve over time in order to maintain cooperation while feasible. Appendix B provides more details on the outside options.

Because grandparents are altruistic towards parents, V_o^g depends on V_y^g. This makes the problem an infinite horizon problem. The solution to this problem is a set of state specific allocations $Z(z_t)$, for consumption, savings, labor supply, and care for each stage t: young, middle and old, where $Z(z_t) = \{c_t^k, c_t^p, c_t^g, a_t^p, a_t^g, L_t^p, \ell_t^p, x_t, hm_t^k, hp_t^k, hg_t^k, \ell_t^g, \mu_t^p, \mu_t^g, hm_t^g, hp_t^g\}$. These allocations are obtained by maximizing the weighted sum of parent and grandparent values V_t for each $t = \{y, m, o\}$. Details on the numerical solution method can be found in Appendix E.

4.8 Model discussion

The model allows me to capture how parents and grandparents interact to make investments in children and care choices across generations. It also captures how long-term care risk influences these choices, and thus impacts intergenerational mobility. However, the model does make a number of abstractions from the real world, including marriage, divorce, and fertility choices. While these mechanisms may be important, I do not consider them here in order to focus on intergenerational interactions while maintaining tractability. The model does incorporate heterogeneity in spousal income, earnings risk, and single parent households, which help to capture the effects of marriage and divorce without introducing another choice variable. Further, while large expansions in long-term care policies may have impacts on fertility decisions, many European countries have extensive long-term care insurance programs and persistently low birth rates, so these effects may be secondary.

The model also assumes all families face the same timing structure in terms of birth, the development of care needs, and death over the wealth distribution. While in the data, lower wealth families have children at earlier ages and develop care needs and die earlier than their wealthier counterparts, the timing between these three events is similar across the wealth distribution (see Appendix C for details). While the timing assumptions of the model are reflected in the data, differences in the age at which these events occur may matter for wealth accumulation.

Families who have children earlier are not able to save as much before they have chil-

dren, and thus may not be able to invest as much in their children. Similarly, they may have less time to save before they develop care needs. The model does not account for this directly, as a model period is 10 years. The focus of the model is on long-term care risk, and to the extent that wealth accumulation prior to the development of care needs is an important mechanism, the model will understate the impact of long-term care risk on intergenerational mobility.

Finally, I assume all families are made up of two grandparents, two parents, and one child. In doing so, I abstract from the existence of siblings as well as a second set of grandparents. This is again to focus on interaction across generations, but it is also informed by what is available in the data. Details on the assumptions around family structure can be found in Appendix D.

5 Estimation

To evaluate the impact of long-term care on intergenerational mobility, I estimate the model using data from the Panel Study of Income Dynamics and the Health and Retirement Study. I first set a number of parameters outside the model and then use the simulated method of moments to structurally estimate the remaining parameters.

5.1 Data

The Panel Study of Income Dynamics (PSID) is a longitudinal survey that has followed a representative sample of descendants from approximately 5,000 families since 1968. The main survey of the PSID contains detailed data on the labor market choices and outcomes of parents, and the Child Development Supplement (PSID-CDS) has information on the investments and educational outcomes of grandchildren. Given the PSID follows families, I can link individuals across generations which is particularly useful in this context.

For more detailed information on the grandparent generation, I use the Health and Retirement Study (HRS). The HRS is a longitudinal panel of approximately 20,000 people. Surveys have been conducted biennially since 1992, with extensive information about respondents' health and care needs, long-term care arrangements, insurance, and assets. The survey also contains some information about the children of the respondents.

For statistics related to savings, earnings, and labor supply choices of parents and investments in and educational outcomes of children, I use the PSID. My sample consists of children in the 1997, 2002 and 2007 waves of the CDS and their parents. While the CDS has also sampled children more recently, I restrict to these years to observe children

sampled at later ages. A 12-year-old child sampled in 1997 would be 34 in 2019, which allows me to capture some earnings data for these children. Additionally, the CDS includes investments made in children, so I restrict to parents of CDS children to capture their investment decisions in tandem with their labor supply choices.

Summary statistics for the children are presented in Table 6, and information on their children is reported in Table 7. In total, the sample is made up of 6,185 children in 4,444 households. About 35% of these households are headed by single parents. One-third of the children in my sample eventually attend college.

Table 6: PSID Children Summary Statistics

	Mean	Std. Dev.
Age	7.20	3.50
Mean investment	217.16	1024.87
Mean letter-word test score	33.64	14.79
Fraction attend college	0.33	0.47
Observations	6,185	

Table 7: PSID Parents Summary Statistics

	Mothers		**Fathers**	
	Mean	Std. Dev.	Mean	Std. Dev.
Age	35.99	8.36	38.45	8.75
Years of education	13.63	2.39	13.46	2.60
Fraction married	0.69	0.46	0.96	0.20
Fraction working full-time	0.38	0.49	0.82	0.38
Mean family income	42,412	44,534	51,530	48,555
Mean family Assets	312,859	1,116,205	418,322	1,313,276
Observations	4,401		3,147	

For more detailed information on the grandparent generation, including detailed information on long-term care needs, I turn to the HRS. I use data from 1992 to 2022 and keep individuals who respond in at least three waves. I also drop respondents who do not have children or grandchildren throughout the sample period. My sample consists of 31,789 individuals in 18,575 households. Summary statistics for this sample are presented

in Table 8. In my sample, 33% of grandparents provide childcare at some point in their lives, and 53% need eldercare beyond what is provided by their spouse.

Table 8: HRS Grandparent Summary Statistics

	Mean	Std. Dev.
Age	68.45	10.84
Fraction married	0.54	0.50
Ever provide childcare	0.33	0.47
Ever need LTC	0.53	0.50
Family income	53,115	186,927
Family assets	363,445	1,026,418
Observations	18,575	

5.2 First-stage parameters

Before estimating parameters inside the model, I set a number of parameters outside the model. These include parameters that do not require the full structure of the model to estimate.

Externally calibrated parameters

First, I set the number of hours available to an individual in the model to be equal to 16 hours a day $\times$ 7 days a week. I also take the discount rate and the interest rate as given.

Table 9: Parameters set externally

Parameter	**Description**	**Value**
T	Total hours (annual)	5824
β	Discount (annual)	0.975
R	Interest Rate (annual)	1.034
H_y^k	Hours childcare - young (annual)	2400
H_m^k	Hours childcare - middle (annual)	1040
p^k	Price of childcare (hourly)	10
P_X	College cost (four years)	90,000

Young children in the model are between the ages of 0 and 10. From the ages between 0 and 4, I assume children need full-time childcare: 8 hours per day 7 days a week.

While a day is 16 hours, I limit this to active care time, rather than time that would be spent with the child anyways (i.e. secondary care time). After age 4, children likely enter kindergarten, and thus some care time is taken up by school hours. Between the ages of 5 and 10, I assume children need 4 hours of active care time 5 days a week and 8 hours two days a week (on the weekends). Averaging these, we get 2,400 hours annually.

Middle children in the model are middle and high school aged, and thus even outside of school time need fewer active care hours. I assume they need four hours per day five days a week. This is time that may be filled by parents, grandparents or "childcare", which may include things like after-school extracurriculars or tutoring. Thus, these children need 1,040 hours of active care.

Turning to the cost of childcare, a full day of childcare can range from $6,500 to $15,600. Assuming 8 hours a day, this is 3 to 7.5 per hour. Half-day care ranges from $5,900 to $9,200, which works out to 5 to 9 per hour. Hourly caregivers range from $15 to $35 per hour (Poyatzis and Livingston, 2024). Given these, I set the cost of childcare to be $10 per hour.

The cost of college is also taken as the sum of an average over four years. Two years of average tuition ($9,750 each) and two years of tuition plus room and board ($35,248 each) which gives an annual cost of $22,500, or $90,000 for four years (Hanson, 2026). These values are summarized in Table 9.

Child skill development

Turning to the parameters that govern child skill development (Table 10), the weights on time in the child skill production function are based on the values in (Lee and Seshadri, 2019). There, a model-period is 6 years, thus, I rescale their parameters to fit a ten-year period. Time is more important for young children than middle-age children. The substitutability of skill inputs is set to be 0.60, implying that market care, parental care and grandparent care are imperfect substitutes in the child skill production function. The weight on child consumption in the parent's utility function λ and the intergenerational persistence of ability ρ_s are also based on values from Lee and Seshadri (2019).

The mean and standard deviation of child skills are based on the mean and variance of the letter-word tests in the PSID-CDS. The return to college is based on the earnings difference between children in the CDS who attend college and those who do not, accounting for initial skill differences.

Table 10: Child skill parameters

Parameter	Description	Value
λ	Weight on child consumption	0.30
ρ_s	Persistence of ability	0.23
μ_d	Mean initial child skill	0.91
σ_d	Std. dev initial child skill	0.30
δ_k	Skill depreciation	0.15
ω_1	Weight on time (young)	0.81
ω_2	Weight on time (middle)	0.75
ω_s	Weight on investment	0.90
ρ_ω	Substitutability of skill inputs	0.60
ω_p	Weight on parent time	0.35
ω_g	Weight on grandparent time	0.32
ω_m	Weight on market time	0.33
$\hat{s}$	Parent skill scaler	3.0
ω_X	Return to college	0.48
σ_ξ	Variance of TIEV shock	0.00005

Parent skill development & earnings

The parameters that govern the returns to parental skills and labor market experience are based on a regression regression of hourly earnings on lagged earnings, experience, and age for working mothers in my PSID sample. The standard deviation of income shocks comes from the variance of the residual in a regression of family income on age, year, and education for working-age parents of CDS children. These parameters are summarized in Table 11.

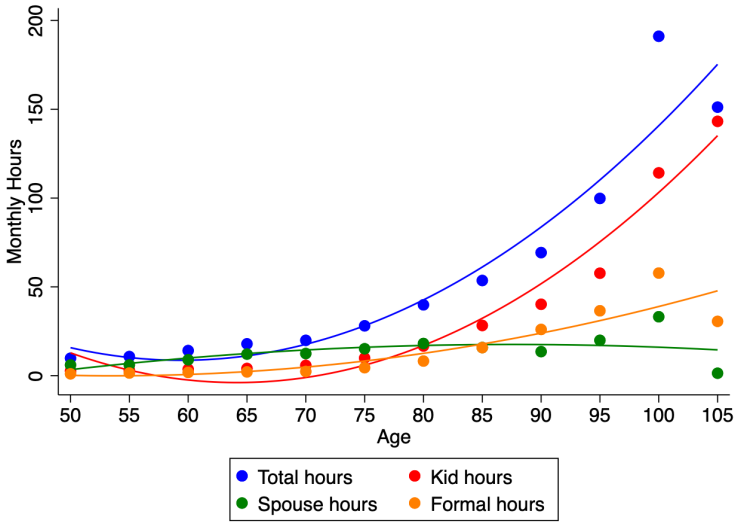
Table 11: Parent skills & earnings parameters

Parameter	Description	Value
α_{sp}	Return to parental skill	1.10
α_L	Return to parental experience	0.16
σ_ϵ	Std. deviation of wage shocks	0.20

Long-term care & grandparent income

For information on long-term care risk, I use my HRS sample. To calculate the probabilities of needing long-term care, I compute the total hours of care needed by a household (so that of both grandparents if two are present). I then remove the hours of care from spouses and use the number of hours met formally and by children when calculating the risk of developing care needs. This implicitly assumes that spouses cover care before any other source, when they do not have care needs of their own. The number of hours of care across each care source is summarized in Figure 10. Grandparent income is set to $20,000 annually, to approximate social security and pension income.

Figure 10: Care Hours by Care Source



Finally, part-time care costs $20,000 annually which is $20/hour and full-time care is $61,700 annually or $30/hour (Brown and Finkelstein, 2007). Further, a semi-private room in a nursing home ranges from $112,420-186,000 ($25/hour assuming 12 hours of care a day). Home care is around $51,000 annually or $33 per hour and assisted living is $66,132 annually ($15/hour assuming 12 hours of care a day) (OPM, 2026). Averaging these, I set the hourly cost of care at $20 per hour in the model. The parameters related to grandparent income and long-term care are summarized in Table 12.

Table 12: Grandparent income and long-term care parameters

Parameter	Description	Value
I^g	Grandparent income (annual)	20,000
p^g	Price of eldercare (hourly)	20
P_m^{Hg}	Middle-age LTC risk	[0.85, 0.09, 0.06]
P_o^{Hg}	Old-age LTC risk	[0.69, 0.14, 0.17]

5.3 Estimated parameters

Taking the first stage parameters as given, I estimate the remaining parameters using the simulated method of moments. I estimate the curvature on consumption and leisure (γ_c and γ_ℓ), the weight on leisure (α_ℓ), the formal care and Medicaid utility parameters (z_M and z_F), the consumption floor for Medicaid eligibility (c_f), and the degree to which grandparents are altruistic towards parents (η). These parameters are summarized in Table 13.

Table 13: Estimated parameters

Parameter	Description	Value
γ_c	Consumption curvature	1.59
γ_l	Leisure curvature	1.55
α_ℓ	Leisure weight	0.56
z_M	Medicaid dis-utility (10^{-5})	-33.35
z_F	Formal care dis-utility (10^{-5})	-8.3
c_f	Consumption floor	8,435.57
η	Altruism	0.12

In order to match the data moments, I use the Nelder-Mead algorithm to minimize equation 32 with respect to the parameter vector Θ,

$$M(\Theta) = (m_d - m_M(\Theta))' W (m_d - m_M(\Theta)) \tag{32}$$

where W is a diagonal weighting matrix which puts equal weight on each of the moments, m_d is a vector of moments from the HRS and PSID data, and $m_m(\Theta)$ is a vector of moments calculated from simulated data.

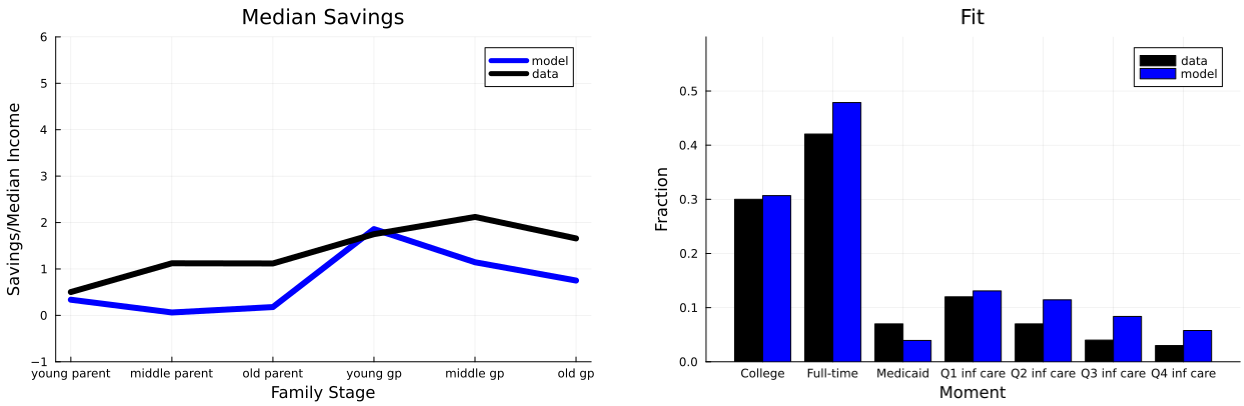
To interpret the parameters that govern Medicaid and formal care utility, I convert the values into consumption units. To do so, I calculate the additional consumption a grand-

parent receiving formal or Medicaid care would need to be indifferent between receiving formal care and median consumption and informal care and median consumption in a given period, all else equal. I find that grandparents are willing to pay $1,411 annually to avoid formal care and $8,943 annually to avoid Medicaid-funded long-term care. The consumption floor value is in line with the value in Mommaerts (2024).

5.4 Model fit

To estimate the parameters, I target the the fraction of parents working full-time, the college-going rate, the Medicaid rate, and informal care rates over the wealth distribution (Figure 11). I also target the savings of families over the life course (Figure 11). These moments are chosen to identify the key parameters, and identification is discussed in subsection 5.5.

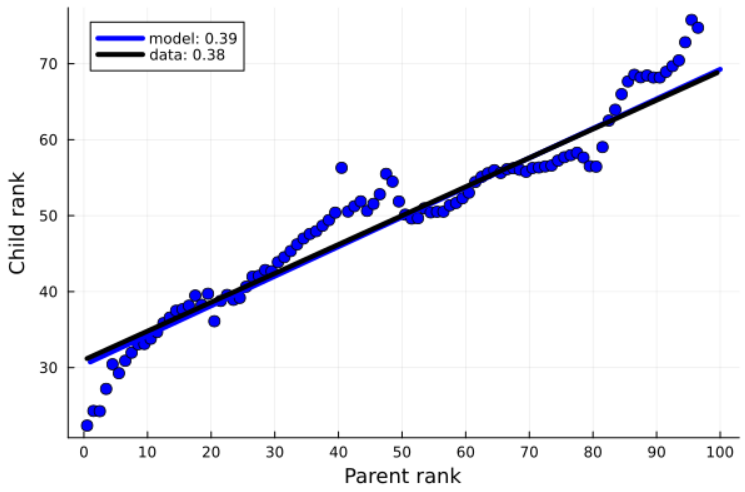
Figure 11: Targeted moments



Intergenerational mobility

The model is also able to fit key moments that are not targeted by the estimation procedure. The rank-rank correlation in the model is 0.39, compared to 0.38 in the PSID data. In Figure 12, I plot the model-generated correlation between parent and child income rank (in blue) as well as the trend from the data (in black).

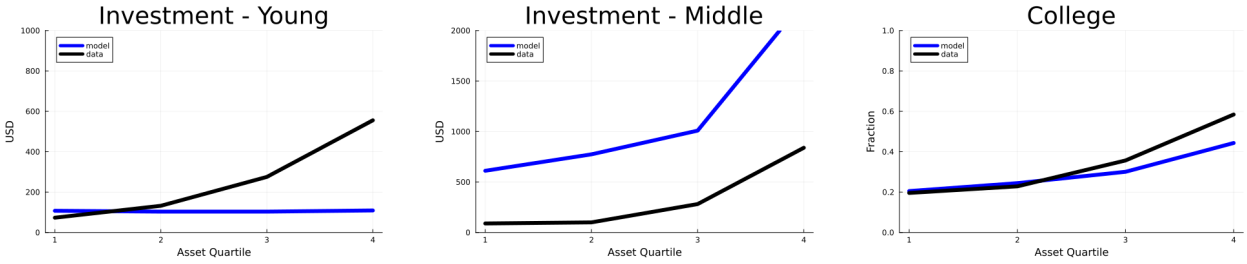
Figure 12: Rank-Rank Income Correlation



Investments in children

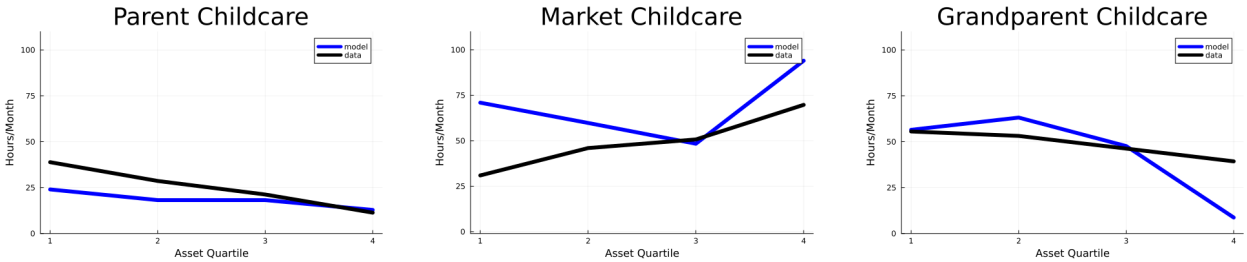
Figure 13 shows moments related to investments in children over the wealth distribution. Monetary investments in young children are flatter in the model than the data, middle-age investments match the gradient in the data quite well, albiet at different levels. The model is able to match college-going rates fit quite well.

Figure 13: Monetary investments by asset quartile



In Figure 14 I show how time investments from parents, grandparents, and formal childcare compare to the data. While the magnitudes do not match exactly, the gradients over wealth are present. Richer families use more market-based childcare and rely less on grandparent-provided childcare.

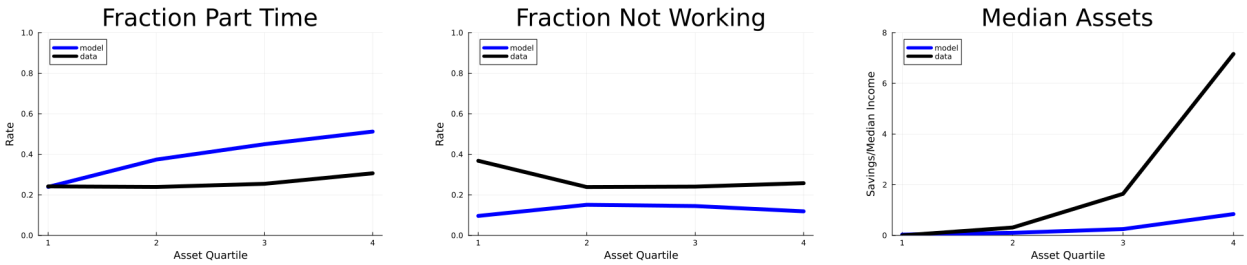
Figure 14: Time investments by asset quartile



Parent labor supply and savings

The model fits the fraction of parents working part-time quite well, but under-predicts the fraction not working in the lowest wealth quartile. In the final panel of Figure 15, the model tracks the first two asset quartiles well but under-predicts the last two.

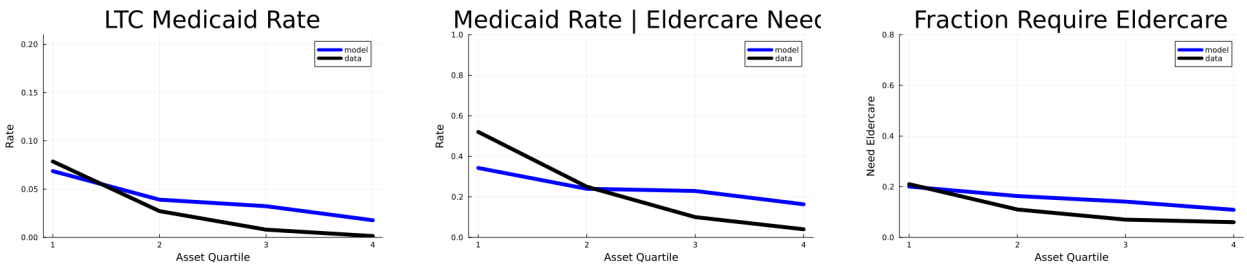
Figure 15: Parent labor supply and savings by asset quartile



Long-term care

Figure 16 shows how the model fits moments related to long-term care over the wealth distribution. The model is able to match the rate of Medicaid utilization for long-term care over the wealth distribution among the whole population and among those who have long-term care needs. The model also matches the the gradient of long-term care needs over the wealth distribution.

Figure 16: Long-term care moments by asset quartile



5.5 Identification

Identification of the parameters is based on the moments that are most heavily influenced by these parameters. While all the parameters influence each of the moments chosen, here I outline which moments are most influential for each parameter.

The altruism parameter η governs how much families care about the future of the dynasty, and thus how much they invest in their children. More weight on the future of the dynasty results in higher investments in children which in turn translates into higher future earnings. A high degree of altruism also means that grandparents care more about the parent's utility today. When the parent's utility receives more weight, she receives a higher share of consumption relative to the grandparents. Unfortunately, I do not directly observe consumption data, but the weight grandparents place on parents' utility will influence how much the Pareto weight needs to shift to keep both agents in the cooperative arrangement. This in turn influences the split of assets between parents and grandparents.

Turning to the grandparent's preferences over formal and Medicaid-funded long-term care, all else equal, it is likely that grandparents would prefer to receive care from someone they know rather than a stranger. I use the rates of informal care over the wealth distribution to identify the degree to which grandparents wish to avoid formal care z_F. Additionally, given Medicaid-funded care is of a lower quality than formal care paid out of pocket, the informal care rate of lowest wealth quartile as well as the overall Medicaid rate help identify grandparent's dis-utility from Medicaid funded care, z_M. The Medicaid consumption floor c_f is identified by the overall Medicaid rate.

Turning to the parameters that govern how agents in the model value leisure, the rates of full-time work as well as informal helps identify the curvature on leisure γ_ℓ. The overall rate of full-time work also helps identify how much weight leisure receives in the utility function α_ℓ. The curvature on consumption γ_c governs risk aversion as well as how much families are willing to substitute consumption over time. A family's savings over each stage in the model helps identify γ_c. For higher γ_c families save more when young and spend down less as they age.

6 Counterfactuals

6.1 The impact of long-term care on intergenerational mobility

In order to quantify the impact of long-term care needs on intergenerational mobility, I shut down long-term care needs in the model. This results in a 12.2% decrease in the correlation between parent and child income rank (from 0.39 to 0.34).

This is driven by changes in both time and monetary investments. Parental time with young children increases, which is when time is most productive (Figure 17). Additionally, both monetary investments in middle children and the fraction of children who attend college increase in the absence of long-term care (Figure 18). Finally, the fraction of parents working full-time increases. This is largely driven by parents at the bottom of the wealth distribution, who would have otherwise been providing informal long-term care.

Figure 17: Time Investments

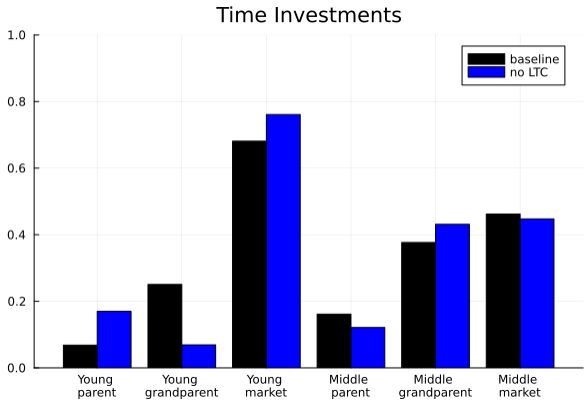
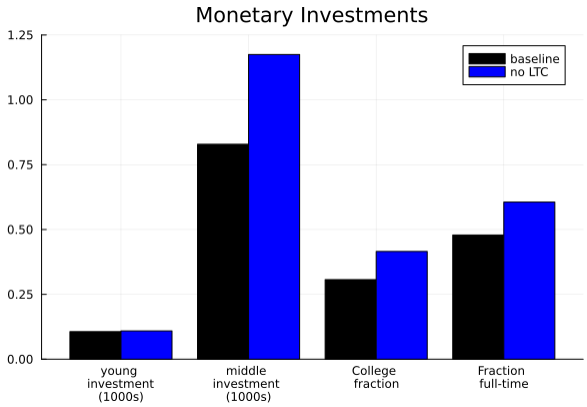


Figure 18: Monetary Investments



To quantify the impact of long-term care needs versus long-term care risk, I simulate the model using the policy functions from the baseline model, but I set all long-term care realizations to zero. This captures the effect of the expectation of long-term care, even when the risk is never realized. I find that how agents respond to risk, even when it is never realized, accounts for 40% of the decrease in the rank-rank correlation between parent and child income (Table 14).

Table 14: Rank-Rank Correlation Decomposition

	Rank-Rank Correlation
PSID	0.38
Baseline	0.39
Risk, no long-term care needs	0.37
No long-term care needs	0.34

7 Conclusion

This paper quantifies the impact of long-term care risk facing grandparents on the economic mobility of grandchildren. To do so, I construct a structural model in which families make care and savings decisions, as well as investments in children. The model features overlapping generations to capture the impact of long-term care on the persistence of inequality across generations. Parents and grandparents in the model interact with limited commitment in order to capture the coordination needed to make care choices while maintaining separate asset holdings of parents and grandparents.

I find that the presence of long-term care risk decreases the correlation between parent and child income by 5 percentage points. This is largely driven by parental time investments in young children and monetary investments older children. Additionally, the fact that long-term care is risky accounts for 40% of the decrease in the correlation between parent and child income: when families face risk, even if the risk is never realized, they change their behavior. This result highlights the importance of accounting for the fact that long-term care is a risky outcome.

Understanding how long-term care policy impacts not only grandparents and parents but also children is important as long-term care becomes more salient for many families. This project focuses on how long-term care risk and long-term care policies inform intergenerational interactions. These interactions impact not only parents and grandparents, but children as well, with implications for their economic mobility.

In order to focus on intergenerational interactions, I make a number of simplifying assumptions about the family structure. In the real world, families may have between zero and four grandparents, siblings may help with long-term care, and families may break up and reform. All of these facts complicate long-term care decisions. While I capture some of these dynamics when taking the model to the data, the model is largely focused on interactions across, rather than within, generations. While this is an important

limitation of this project, I develop a framework for understanding how two generations – parents and grandparents– impact the economic mobility of children. The results of this project shed light on how long-term care policies impact future generations and I leave complications related to family structure for future work.

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Appendix

A Model details

Appendix Table A.1: State and Choice Variables

Type	Variable	Elements
State	z_y	$\{\theta_y, a_y^p, a_y^g, s_y^p, s_y^k, \epsilon_y\}$
State	z_m	$\{\theta_m, a_m^p, a_m^g, s_m^p, s_m^k, \epsilon_m, H_m^g\}$
State	z_o	$\{\theta_o, a_o^p, a_o^g, s_o^p, s_o^k, \epsilon_o, H_o^g\}$
Choice	j_y	$\{c_y^k, c_y^p, c_y^g, a_m^p, a_m^g, L_y^p, \ell_y^p, x_y, hm_y^k, hp_y^k, hg_y^k, \ell_y^g, \mu_y^p, \mu_y^g\}$
Choice	j_m	$\{c_m^k, c_m^p, c_m^g, a_o^p, a_o^g, L_m^p, \ell_m^p, x_m, hm_m^k, hp_m^k, hg_m^k, hm_m^g, hp_m^g, \ell_m^g, \mu_m^p, \mu_m^g\}$
Choice	j_o	$\{c_o^k, c_o^p, c_o^g, a_y^p, a_y^g, L_o^p, \ell_o^p, X_o, hm_o^g, hp_o^g, \ell_o^g, \mu_o^p, \mu_o^g\}$

B Outside options

I model the outside options of parents and grandparents as a non-cooperative game. I assume that cross-generation time and monetary transfers are not possible, with the exception of a bequest at the end of the grandparent's life. Because it is a non-cooperative game, I assume a timing structure: the grandparent makes her choices first, anticipating parent's choices, and the parent follows.

B.1 Parents

Parents maximize

$$W_t^p(z_t) = \max_{j_t^p} \frac{c^{p(1-\gamma_c)}}{1-\gamma_c} + \lambda \frac{c^{k(1-\gamma_c)}}{1-\gamma_c} + \alpha_\ell \frac{\ell^{p(1-\gamma_\ell)}}{1-\gamma_\ell} + \beta E W_{t+1}^p(z_{t+1}) \tag{B.1}$$

subject to their own budget constraint

$$c_t^p + c_t^k = w_t L_t + R a_{t-1}^p - a^p - p^k hm_t^k - x_t - p^X X_t \tag{B.2}$$

and time constraint

$$T = hp_t^k + L_t^p + \ell_t^p \tag{B.3}$$

Additionally, childcare hours must be met by the market or parent such that

$$H_t^k = hp_t^k + hm_t^k \tag{B.4}$$

The parent's continuation value when $t = o$ is given by $W_{o+1}^p(z_{o+1}) = W_y^g(z_y)$. The parent's choice variables are $j_t^p = \{c_t^p, c_t^k, hk_t^p, hk_t^m, X_t, a_t^p\}$.

B.2 Grandparents

Grandparents maximize their outside value W_t^g. This value includes the grandparent's utility from consumption and leisure, and she is still altruistic toward the parent.

$$W_t^g(z_t) \max_{j_t^g} \frac{c^{g(1-\gamma_c)}}{1-\gamma_c} + \alpha_\ell \frac{\ell^{g(1-\gamma_\ell)}}{1-\gamma_\ell} + z_M \mathbb{1}_{m_t=1} + z_F \mathbb{1}_{F_t=1} + \beta E W_{t+1}^g(z_{t+1}) + \eta u_t^p(c_t^p, c_t^k, \ell_t^p) \tag{B.5}$$

She maximizes her value subject to her own budget constraint, given by:

$$c_t^g = I^g + R a_{t-1}^g - a_t^g - M_t \mathbb{1}_{hm_t^g>0} - p^g h m_t^g \tag{B.6}$$

and time constraint, given by:

$$T = \ell_t^g \tag{B.7}$$

Any eldercare hours must be met formally, such that

$$H_t^g = h m_t^g \tag{B.8}$$

The grandparent's continuation value when $t = o$ is given by $W_{o+1}^g(z_{o+1}) = \eta W_y^g(z_y)$. Where she is still altruistic towards the parent and may leave a bequest. The grandparent's choice variables are given by $j_t^g = \{c_t^g, a_t^g, hm_t^g\}$.

C Timing

In the model, all families face the same timing structure. That is, regardless of wealth, all families face childcare and eldercare concerns at the same time. In the data, the *ages* at which families face these concerns are not the same, but the *timing* is very similar. Table C.2 gives the average ages at which women first give birth in the PSID and aging households first develop care needs and die in the HRS over the wealth distribution. From the data, it is clear that less wealthy families have children and develop care needs earlier.

Appendix Table C.1: Age at event

Asset quartile	Age at first birth	Age at first care need	Age at death
Q1	19.9	67.5	82.0
Q2	21.4	70.3	83.9
Q3	22.1	72.5	85.4
Q4	24.1	74.0	86.0
Q5	26.9	75.8	87.0
Observations	25,236	56,484	56,484

The gap between the lowest quartile and the highest quartile is 7 years for fertility timing, 8.3 years for developing care needs, and 5 years for death. Thus, while less wealthy

families develop care needs earlier and have children earlier, the timing of childcare and eldercare needs is very similar across the wealth distribution. These differences are summarized in Table C.2. This is not to say that wealth causes earlier first births and earlier care needs. It very well could be the case that earlier care needs impede families' ability to save and accumulate wealth. Indeed, the model captures the fact that less wealthy families require more care without imposing different care timing across the wealth distribution.

Appendix Table C.2: Timing

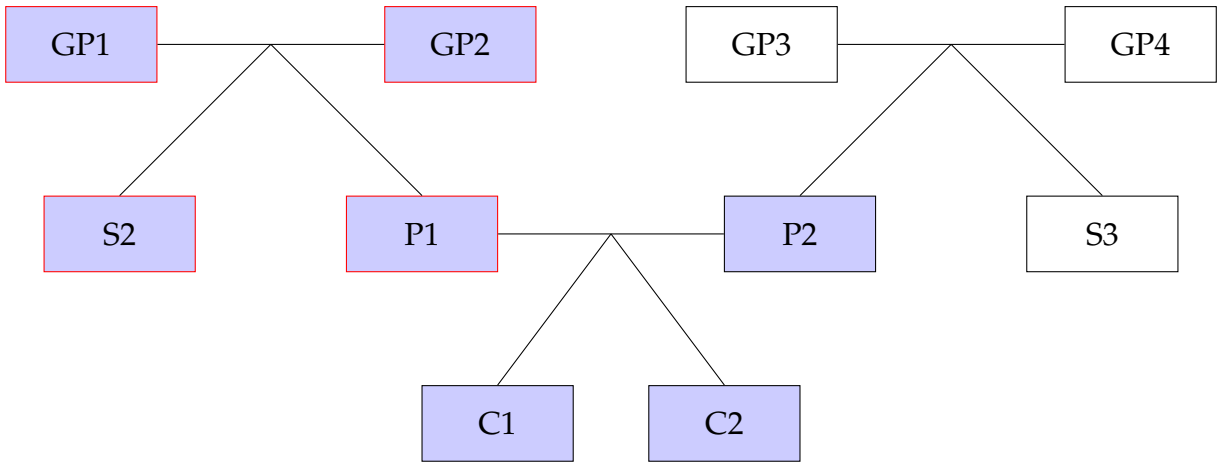
Asset quartile	First care need - first birth	Death - first care need	Death - first birth
Q1	47.6	14.5	62.1
Q2	48.9	13.6	62.5
Q3	50.4	12.9	63.3
Q4	49.9	12.0	61.9
Q5	28.9	11.2	60.1
Observations	25,236	56,484	56,484

The fact that less wealthy families have children, develop care needs, and die at earlier ages means that the timing of the model fits the timing of these concerns in the data, though not the exact ages.

D Family structure

In the model I also make assumptions about family structure. Namely, I abstract from the existence of siblings and a second set of grandparents. This is again to maintain tractability and focus on intergenerational interactions, but it is also informed by what is available in the data. Figure D.1 outlines an example of a family tree across three generations. In this family, there are four grandparents, each parent has a sibling, and there are two children. However, in the data, I am at most able to observe half of this family tree (shaded in blue).

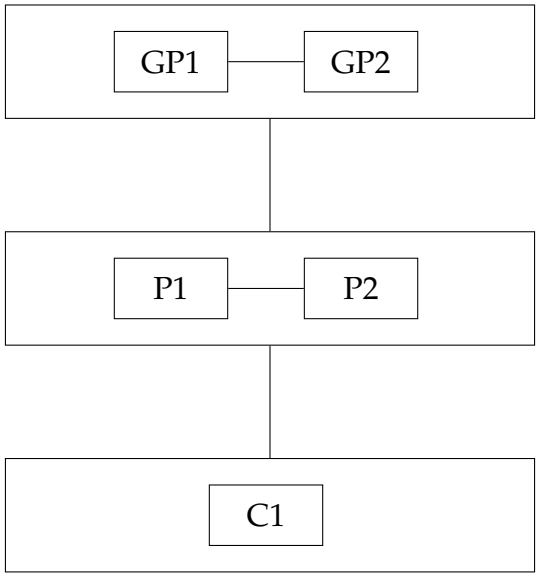
Appendix Figure D.1: Family Tree: Data



Note: Red boxes indicate data available in the HRS. Blue shading indicates data available in the PSID.

Given this, along with a focus on intergenerational interactions, the structure of them model collapses this family tree into a grandparent generation, made up of two grandparents, a parent generation, made up of two parents, and a child generation, currently made up of one child. This is described in Figure D.2.

Appendix Figure D.2: Family Tree: Model



E Model solution

To solve the model, I use value function iteration. The young grandparent's value function appears in the old parent's value function and the grandparent is altruistic, thus the

parent's value function appears in the grandparent's value function, which makes it an infinite horizon model. Further, because families make decisions jointly, I solve the family problem in each family stage by maximizing the Pareto-weighted value functions of the parent and grandparent. The solution algorithm is given by the following:

1. Solve the non-cooperative problem.
2. Use the solution to the non-cooperative model as the outside option value in the limited commitment model. Update the Pareto weights and asset distribution to ensure both parties remain in the arrangement. The solution proceeds as follows:
   (a) For each combination of state variables, solve the problem at each θ.
   (b) For a given set of state variables, check the commitment constraints at each θ. There are three possible scenarios (because there are always gains from cooperation, both constraints will never bind at the same time):
      i. Neither constraint binds.
      ii. The parent's binds. In this case, find μ_t^p such that $V_t^p(z_t, \mu_t^p) - V_t^{po}(z_t) = 0$. This gives the solution to the problem:

$$\max_{j_t} (\theta_t + \mu_t^p) V_t^p(z_t) + (1 - \theta_t) V_t^g(z_t)$$

      I then update and normalize the Pareto weight to reflect the commitment constraints, such that $\hat{\theta}_t = \frac{\theta_t + \mu_t^p}{1 + \mu_t^p}$.
      iii. The grandparent's binds. In this case, find μ_t^g such that $V_t^g(z_t, \mu_t^g) - V_t^{go}(z_t) = 0$. This gives the solution to the problem:

$$\max_{j_t} (\theta_t) V_t^p(z_t) + (1 - \theta_t + \mu_t^g) V_t^g(z_t)$$

      I then update and normalize the Pareto weight to reflect the commitment constraint, such that $\hat{\theta}_t = \frac{\theta_t}{1 + \mu_t^g}$.
   (c) Iterate until convergence of the value functions.

This solution method follows the method described in Marcet and Marimon (2019) given the optimization problem has includes forward looking constraints. When these constraints are present, the problem does not satisfy the standard Bellman equation because feasible choices depend on future decisions (i.e. allocations are restricted by resources and whether decisions will keep agents in the contract).

To solve such a problem recursively Marcet and Marimon (2019) show that one may solve a recursive saddle point problem which includes a co-state variable. The co-state variable is necessary because the problem is generally time-inconsistent due to the presence of forward looking constraints. However, solving the planner's problem in the future with the current state and costate variables gives the same continuation value that was obtained from the original optimal allocation – the co-state summarizes previous

commitments reflected in past Lagrange multipliers. The continuation problem is then formulated with the costate variable as a weight in the objective function. Consider the Lagrangian that incorporates the commitment constraints:

$$\mathcal{L} = \max_{j_t} \theta_t V_t^p(z_t) + (1-\theta_t) V_t^g(z_t) + \mu_t^p (V_t^p(z_t) - V_t^{po}(z_t)) + \mu_t^g (V_t^g(z_t) - V_t^{go}(z_t)) \quad \text{(E.1)}$$

Then, by complementary slackness either the multiplier must be zero or the constraint must be slack, such that

$$\mu_t^p = 0$$

or

$$V_t^p(z_t) - V_t^{po}(z_t) \leq 0$$

So, if $V_t^p(z_t) < V_t^{po}(z_t)$ then we must find μ_t^p such that $(\theta_t + \mu_t^p) V_t^p(z_t) = V_t^{po}(z_t)$. Then, we evaluate the objective function at the new optimum j_t^* implied by the updated Pareto weight $\hat{\theta}_t$. However since $\mu_t^p (V_t^p(z_t) - V_t^{po}(z_t)) = 0$ after the adjustment, we evaluate the objective at θ_t rather than $\hat{\theta}_t$.

Prior to this formulation, the problem was often solved by adding a state variable for the promised utility of one agent and constraining the allocation to result in a value above that promised utility (see Ligon et al. (2000) for an example). This gives the same result but is more computationally burdensome than the approach in Marcet and Marimon (2019).

F Altruism

Grandparents are altruistic towards parents to degree η. let v_t^g be the grandparent's value without altruism for $t = \{y, m, o\}$ such that the grandparent's value is her utility from consumption plus her discounted value tomorrow.

$$v_t^g = u_t^g + \beta v_{t+1}^g \quad \text{(F.1)}$$

When the grandparent is old, her value from her own utility tomorrow is zero, that is $v_{o+1}^g = 0$. Without altruism, the model collapses to a finite horizon life-cycle model that can be solved with backward induction.

Now consider the altruism term. The grandparent weights the parent's value by η, such that she cares about the parent's utility today u_t^p and her value tomorrow V_{t+1}^p. Denote the grandparent's total value V_t^g.

$$V_t^g = v_t^g + \eta u_t^p + \beta \eta V_{t+1}^p \quad \text{(F.2)}$$

Then, we can re-write V_t^g as:

$$\begin{aligned} V_t^g &= u_t^g + \beta v_{t+1}^g + \eta u_t^p + \beta \eta V_{t+1}^p \\ &= u_t^g + \eta u_t^p + \beta V_{t+1}^g \end{aligned}$$

Then, for each stage:

$$V_y^g = u_y^g + \eta u_y^p + \beta V_m^g \tag{F.3}$$

$$V_m^g = u_m^g + \eta u_m^p + \beta V_o^g \tag{F.4}$$

$$V_o^g = u_o^g + \eta u_o^p + \beta V_{o+1}^g = u_o^g + \eta u_o^p + \beta\eta V_y^g \tag{F.5}$$

In the last period, grandparents care about their discounted future value βV_{o+1}^g, which includes their own value $v_{o+1}^g = 0$ and their altruism toward the parent's future value when she becomes the young grandparent V_y^g.