Long-Term Care and Family Caregiving

PRELIMINARY DRAFT

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1 Introduction

Demography is rapidly aging and those 65 and older are projected to surpass one fifth of the population by 2050 (Kochhar and Oates 2014). As the demography ages, the demand for long-term care is expected to rise rapidly. So far, family care is the major source of long-term care in the United States[1]. Family care is not without cost to the caregivers. In fact, Chari et al. (2015) estimates that families spend 30 billion hours each year caring for the elderly, which comes down to $522 billion in foregone earnings. Although family care can be rewarding, care burnout is widely recorded in terms of physical and mental deterioration (Reinhard et al. 2019; Wolff 2007; Ingersoll-Dayton, Neal, and Hammer 2001). Due to high time intensity, family care can affect the employment trajectory of caregivers, often adult children who are still in the labor force, which has long-term effects on their career, earnings and wealth accumulation (Reinhard et al. 2019; Vangen 2021; Van Houtven, Coe, and Skira 2013). My paper thus sheds light on the effect of parent's long-term care needs on adult children, the mechanisms behind sibling decision making on family care and its implications on who among them provides majority of the care to the elderly.

Caring for an elderly parent is not a stand-alone decision but rather made as a result of sibling interaction. Though many studies have focused on the family interaction behind care decisions[2], not many have looked at the role and the potential sources of heterogeneity in preferences among adult children to provide care. Often times, relative opportunity costs in the labor market are regarded as the main source governing which child provides care (e.g., Skira 2015). However, in addition to opportunity costs, caring for an elderly parent may mean different things to different adult children. Stern (2021) provides a game-theoretical

[1]Family care is defined as unpaid, eldercare received from spouse, adult children, relatives or friends.

[2]See Sovinsky and Stern (2016) for a review.

model of multiple adult children who make decision to stay in proximity to the parent in the case of future care needs, based on their birth order. M. Brown (2006) examines the bequest motive of adult children when deciding whether and how much to care for their aging parent. One dimension that is often neglected in the literature is the role of social and cultural norms in family decision making on caring for the elderly. Given the empirical evidence that gender norm plays a strong role in who among the adult children provides care (Grigoryeva 2017) or the interaction of gender norm in any caregiving roles (Bertrand, Kamenica, and Pan 2015; Ichino et al. 2019; Kleven, Landais, and Søgaard 2019), it is critical to understand theoretically and empirically how this may affect adult children's decision making in provisioning of family care.

To fill this gap, I develop a game-theoretic model with multiple children who have heterogeneous preferences for family care in addition to facing different opportunity costs. When a parent needs long-term care, adult children enter a Cournot-Nash game where their parent's well-being enters as a public good in their utilities. Each adult child has the option to contribute to the public good with their family care hours. In this way, I focus on heterogeneous preferences among adult children for their 'taste' for public good. Differences in preferences along with differences in wages govern the asymmetry between adult children's contribution to the public good. The Cournot-Nash approach allows for two main features regarding the interaction between siblings. First, the presence of shared public good allows for interdependency between siblings such that they decide their consumption, employment and family care not only based on their own wages and preferences but also based on their sibling's. Since an adult child lowers their care hours in response to an increase in the family care hours of their sibling, the Cournot-Nash approach allows for risk-sharing between siblings. For example, a drop in wage for an adult child may lead to lower family care hours (income effect) but in response, their sibling increases their contribution to public good. Second, since public good increases with any of the sibling's family care hours, which benefits both siblings regardless of who provided the care, the framework also allows for 'crowding-out'. An adult child may end up providing no family care if their wage is too high (substitution effect) compared to their sibling's. In this case, the individual may still enjoy public good in their per-period utility because their sibling is contribution all of the family care hours.

I model family care decision as a contribution to public good, which entails that adult children have altruistic motive to provide care[3]. This is supported by empirical evidence that children respond altruistically to parent's care needs rather than for an exchange motive (Engers and Stern 2002; Liliana E. Pezzin and Schone 1999; Mukherjee 2020; Checkovich

[3]See Laferrère and Wolff (2006) for a review on behavioral models of family decision making with altruistic motive.

and Stern 2002). For instance, Checkovich and Stern (2002) finds that adult children do not compete for family care hours in order to elicit parental transfers and Mukherjee (2020) finds that a positive income shock to a parent lowered rather than increased adult children's care hours. Furthermore, in line with Becker (1993), other studies have modeled adult child's decision not to provide care for their parent as a disutility (Barigozzi, Cremer, and Roeder (2017); Mommaerts (2021)). This suggests that adult children provide family care out of 'guilt' rather than out of altruism. I refrain from this specification given the large empirical evidence that adult children act out of altruism.

Using the adult children of single elderly individuals[4] in the pooled 1998-2014 Health and Retirement Study, I then test empirically for three main predictions of the model. First, by analyzing the behaviors of daughters and sons based on the gender composition of their sibling groups, I test whether heterogeneity in preferences can be explained by the presence of gender norm. The role of gender norm among sibling in family care is relatively scant compared to the large literature on the role of gender norm and household production in married households (e.g., Bertrand, Kamenica, and Pan 2015; Ichino et al. 2019; Ngai and Petrongolo 2017). The exception is Grigoryeva (2017) who finds that sons respond differently in their care provision to the presence of an additional sister whereas the presence of brothers does not affect daughter's decision to provide care. By decomposing siblings groups based on their gender composition, I utilize an event-study approach around the event that elderly parent needs long-term care and explore the medium run effects of parent's long-term care shock on caregiving behaviors of daughters and sons. I find suggestive evidence supporting my model prediction that heterogeneous preferences among adult children are, to some extent, shaped by gender norm.

Second, I test two channels of the model in terms of time constraint and opportunity cost. In my model, adult children value family care but they also value time spent on other activities such as caring for their own children, spending time with their own family or leisure activities. In this way, the model captures the effect of "sandwich generation" where individuals face dual care responsibilities in providing childcare to their own children at the same time caring for their elderly parent (Miller 1981). Thus I explore how number of own children affects adult child's decision to provide family care to their parent using a pooled cross-section bivariate probit model. According to my model prediction, due to time constraint, number of own children are predicted to lower adult child's contribution to pubic good. However, number of own children can also affect adult child's care decision

[4]I restrict the sample to single elderly individuals since the major source of family care for these individuals come from their adult children, in contrast to married elderly individuals who rely on their spouses for care (Barczyk and Kredler 2019)

due to its effect on wages. That is, studies find that children affect men's wages positively but women's wages negatively (Ingersoll-Dayton, Neal, and Hammer 2001; Kleven, Landais, and Søgaard 2020). In this way, the opportunity cost channel predicts that number of own children is expected to increase adult daughter's family care provision but should lower adult son's family care hours. I find that adult daughters have higher propensity to provide family care to their aging parent regardless of how many own children they have. On the other hand, adult sons are significantly less likely to provide care as they have more own children. Given the strong correlation of number of own children and wages in the data, this effect is likely explained by the fact that own children lowers adult sons' family care to their elderly parent due to opportunity cost channel.

This paper contributes to two main strands of literature. First, I contribute to a line of research on bargaining and strategic interaction between multiple family members to provide care for an aging parent (Barigozzi, Cremer, and Roeder 2017; Byrne et al. 2009; Engers and Stern 2002; L. E. Pezzin, Pollak, and Schone 2007; Liliana E. Pezzin and Schone 1999; M. Brown 2006). Engers and Stern (2002) incorporates all family members of the elderly in a non-cooperative framework in a static model and allows for a transfer between family members in order to maximize the level of public good produced. Liliana E. Pezzin, Pollak, and Schone (2015) proposes a bargaining model between a parent and their adult children, in which coresidency and family care concurrently decided. Byrne et al. (2009) uses a game-theoretic model of family members providing family care and assisting with the cost of formal care to their parent. By specifically focusing on adult children, M. Brown (2006) is the closest to my model but her focus is on the bequest motive of adult children to provide care rather than differences in preferences. My model adds another dimension to these models by incorporating heterogeneity in preferences for family caregiving among adult children and the role of social norms in shaping this heterogeneity.

Second, I contribute to a long standing literature on household and care production in household models (e.g., Biddle and Hamermesh 2020; Chiappori 1997; Lundberg and Pollak 1996; Lundberg and Pollak 2008, 1993). All of these studies focus on married couples and their interaction to provision childcare and household production. My model captures time spent on care activities other than family care, which includes childcare and time spent on household production. By including family care to an elderly parent, I add another important dimension to the household model and in the context of interaction between siblings.

The rest of the paper is organized as follows. Section 2 provides background on the rising long-term care needs and the different provisions of long-term care in the United States. Section 3 presents the theoretical model and explain its underlying mechanisms, and Section 4 describes the data. The results testing the model predictions are reported in

two separate sections. I provide empirical strategy and results for the role of gender norm and heterogeneity in preferences among adult children in Section 5 and for the role of own children on family are provision in Section 6.

2 Long-Term Care in the United States

Population is aging rapidly in the United States. The share of individuals aged 65 and over is projected to outnumber children for the first time in history in 2034 (Bureau 2018). Due to higher life expectancy, the elderly individuals will live longer requiring long-term care (LTC) assistance, defined as assistance with activities of daily living (ADLs) or instrumental activities of daily living (IADLs), for an extended period of time[5]. Due to a high risk of experiencing physical limitations or cognitive impairment, the elderly individuals face significant health and financial risks. Majority of long-term care is provided by informal (unpaid) caregivers, which comprise of mostly family members of the elderly. Formal (paid) long-term care is expensive in the United States with Medicaid covering more than 50% percent of LTC spending. This section reviews the intensity of long-term care needs the elderly are facing today, and what means they use in order to meet their long-term care needs by either using formal care services or receiving informal caregiving from their family members.

2.1 Long-Term Care Needs

Approximately two thirds of individuals aged 65 and over will need long-term care at some point (J. Brown and Finkelstein 2008). While some individuals may never need long-term care, a fifth of them will need long-term care for more than five years (Upadhyay and Weiner 2019). In addition to physical limitations, cognitive impairment is another factor in long-term care risk that the elderly faces, which is exacerbated by the rising dementia rate among the elderly. In addition, long-term care needs vary across population with women needing care longer for 3.7 years on average compared to men needing for 2.2 yearson average (Upadhyay and Weiner 2019).

According to (J. Brown and Finkelstein 2008), 75% of individuals aged 65 and over will not enter a nursing home but 10% of those who enter will spend more than 3 years there. On average, women have higher probability of using formal care services such as nursing home, assisted living facilities and paid home care (i.e. home health care). For example,

[5]ADLs refer to activities such as walking across a room, dressing, bathing, eating, getting in and out of bed, and using the toilet. IADLs include activities such as using a telephone, managing money, taking medications, shopping for groceries, and preparing hot meals.

men have 27% probability of using nursing home at some point in their lives compared to 44% of probability of it happening to women. Numbers are similar but lower for assisted living facilities (12% for men and 20% for women). As for paid home care, men have 29% of probability of using paid home care for an average of 2.3 years while women have 35% of probability for an average of 2.9 years[6].

Formal care services are costly. Monthly expenses for paid home care services is around $4,500 and a private room in nursing home costs $8,821 per month[7]. Assisted living facilities cost $4,300 per month whereas adult day health care is around $1,600 per month. Given the significant chance of needing long-term care, the price tags of formal care services are large[8]. Long-term care is not considered as "medical care" under federal legislation, thus prohibiting individuals to use either Medicare or private health insurance for the cost (Nordman 2016).

Instead, the cost of long-term care is financed through three options: out-of-pocket spending, private long-term care insurance, and public insurance of which Medicaid is the largest payer. The out-of-pocket spending is only possible for individuals in the the upper wealth quintile and for most elderly individuals, it is beyond their financial means. In addition, the private insurance take-up rate is low and the premium is still very expensive (e.g. $100 per day in 2000). Medicaid pays for half of the long-term care spending in the United States. However, the strict means-tested eligibility of Medicaid make it only available for the impoverished.

2.2 Private Long-Term Care Insurance and Medicaid

According to Nordman (2016), 52% of long-term care spending is paid for by Medicaid, 16% by out-of-pocket, 11% by private long-term care insurance (LTCI), and the rest of the 20% is paid for by other public and private insurances. Given the higher amount of out-of-pocket spending than private LTCI spending, the market for the LTCI is small. In fact, less than 10% of individuals own LTCI policy. Coverage rates increase with wealth, covering 19.2% in the top quartile (J. Brown and Finkelstein 2007). Given the high financial risk posed by LTC needs but the low take-up rate of LTCI, an extensive amount of research has studied the puzzle.

On the supply side, J. Brown and Finkelstein (2007) uses an actuarial model of formal long-term care utilization probabilities and finds that LTCI market suffers from a monopolistic competition with an average markup of 18 percent for policies sold in 2002. In addition, Finkelstein and McGarry (2006) argues that the market faces multiple sources of private

[6]The numbers are taken from the simulated transition probabilities in (J. Brown and Finkelstein 2008).
[7]The annual expense of a private room in nursing home sits at around $90,000.
[8]The estimated costs can be found here: www.genworth.com/aging-and-you/finances/cost-of-care.html.

information and is adversely selected due to subjective knowledge about individual's nursing home risks. Braun, Kopecky, and Koreshkova (2019) considers the problem of a monopolist insurer who incurs high fixed and variable costs, and of individuals who have access to means-tested Medicaid benefits and private information about nursing home entry risks. They find that LTCI take-up rates are low across all levels of wealth. Low income individuals are denied LTCI coverage due to their eligibility to Medicaid benefits while middle income individuals are influenced by both Medicaid and administrative costs resulting in low take-up rates. As for wealthy individuals, the low take-up rate is due to administrative cost and private information.

On the demand side, the wealth stored in home ownership can be used to pay for nursing home (Davidoff 2010) or an incentive to leave bequest for the outliving spouse in a form of home ownership (Chang and Ko 2021). Bernheim, Shleifer, and Summers (1985) and Pauly (1990) considers a strategic non-purchase of long-term care insurance because individuals can leave bequests to their children and mitigate the opportunity cost of precautionary savings. Moreover, Courbage and Zweifel (2011), Zweifel and Struwe (1996), and Lockwood (2018) also provide evidence that a bequest motive drives people not to buy insurance, which leads to the fact that the elderly individuals rely on their adult children for long-term care needs. Recent studies have also studied the role of informal caregiving in explaining the low take-up rate of LTCI Fahle (2020), which will be discussed in the next section in details.

Given the low take-up rate of LTCI, Medicaid is another option that is available to the elderly to pay for formal care services. J. Brown and Finkelstein (2007) argue that Medicaid can crowd out LTCI but they cannot alone explain the market failures associated with the LTCI market. Though Medicaid may be a substitute for LTCI for low to middle income households, not many individuals can qualify for Medicaid. The coverage varies state by state and they usually qualify individuals for Medicaid if the individuals is eligible for Supplemental Security Income (SSI) benefits. Some states may extend Medicaid eligibility to those with higher incomes[9]. Individuals who want to enroll need to spend down their assets to the state's threshold, which is $2,000 for an individual and $3,000 for a couple. The strict means-tested nature of Medicaid makes it only accessible for low wealth individuals leaving many others having to incur costs on their own or turn to their family members for informal caregiving.

2.3 Family Care

Given the health and financial risks involving long-term care needs, a majority of caregiving is provided by family members of the elderly. Spousal caregiving and adult children caregiving

[9]See "Medicaid's Role in Meeting Seniors' Long-Term Services and Supports Needs" (2016)

are most common. Chari et al. (2015) estimates the opportunity costs of informal caregiving, in lost earnings and reduced labor, to be $522 billion a year, which is in contrast to total spending on formal LTC services, estimated at $211 billion a year in the United States. For married individuals, spousal caregiving is more prevalent whereas for single individuals, adult children provide bulk of the caregiving. According to the Health and Retirement Study (HRS) data, most adult children caregivers are adult daughters (Barczyk and Kredler 2019).

More than 75% of the adult children caregivers are female and they are less active in the labor market than other comparable children. In the HRS and the Survey of Health, Ageing, and Retirement in Europe (SHARE) data, having a daughter matters heavily in informal care decisions in all regions (except the North European countries with high public LTC spending) is more important than the numbers of children, which reflects the large share of women as heavy-helpers (those who provide more than 20 hours of care per week). Empirical studies have also demonstrated that working-age children that are caregivers face heavy demands on their time, and informal caregiving can come with significant opportunity costs Van Houtven, Coe, and Skira (2013). Moreover, Mommaerts and Truskinovsky (2020) finds that elasticity of time is higher for informal caregiving to adults as opposed to childcare.

Only paper that looks at the role of spousal caregiving in long-term care decision in a structural framework is Chang and Ko (2021) in the context of couples dissaving their housing wealth slower than singles for a bequest motive for their partner who is providing informal care. In terms of adult children providing care, several studies have fully, structurally modelled the role of adult child in long-term care arrangements (Barczyk and Kredler 2018; Fahle 2020; Ko 2021; Mommaerts 2021; Skira 2015).

Mommaerts (2021) uses a cooperative framework between a parent and a child to capture the role of bargaining process between the parent and child in deciding long-term care arrangements. The parent faces a long-term care shock and can use either informal care of formal care with a preference for informal caregiving by the child. In return, the child faces a permanent income shock and chooses to work and/or provide informal care to the parent. The parent can pay for formal long-term care through LTCI or Medicaid. In each period, they bargain with threat points as non-cooperation. For the child, not cooperating with their parent imposes a "guilt", which plays a crucial role in ensuring a cooperative equilibrium exists in every period. t also models the interaction between a parent and a child but in a non-cooperative framework where the parent can strategically not purchase LTCI to induce bequest motive for children to provide care. In both of these studies, parents only use formal care when the child cannot provide informal care, which the parent has preference for.

Barczyk and Kredler (2018) also models the interaction between a parent and a child in a non-cooperative framework (though the model is more stylized). The child first moves and

chooses to provide care if only the financial transfer from the parent in the second period is high enough. Fahle (2020) also looks at a parent and a child and simulates Medicaid expansion policies and finds that providing payments to children or expanding access to home care aides subsidize informal caregiving by families. In all four studies, only one child is selected as the child either provides most informal care hours or most likely to provide care (daughters or those who live within 10 miles to their parent). This assumes that the decision of the caregiver child is exogenous to the behaviors of their siblings. This paper explores the interaction between the siblings and endogenize the caregiving decision of the caregiver child to the decision (to not provide care) of their siblings.

Several studies have examined long-term care decisions within a multiple caregiver framework. Most of these studies are static (e.g (M. Brown 2006; Engers and Stern 2002; Stern 2021)) but none within a structural, life-cycle framework. The interaction between siblings is crucial for long-term care decisions. Since elderly individuals use less formal care as they have more children, potentially relying more heavily on informal care rather than formal care for long-term care needs (Mellor 2001). This can have a wide array of implications for long-term care insurance market as elderly individual's decision to purchase long-term care insurance or formal care use may depend on how many children they have. For instance, Mommaerts (2018) shows that the expansion in Medicaid eligibility for LTC benefits reduces the probability of adult children co-residing with elderly parents and increases the use of nursing home care. (Van Houtven, Coe, and Skira 2013) also finds that significantly lowering the marginal cost of formal care, through state subsidies to LTC insurance coverage, induce less informal caregiving and lower co-residence with adult children.

3 Model

This section proposes a game-theoretic model with three main features. First, I model care decision of an adult child as a result of sibling interaction, in which adult children can either specialize or share caregiving responsibilities with their sibling. Second, I allow for concurrency between consumption, family care decision and employment, and examine their interaction with heterogeneous preferences among adult children. To the best of my knowledge, this is the first paper to incorporate and hone in on heterogeneous preferences among adult children in a theoretical model. Third, I model family care that the parent receives as public good that adult children voluntarily contribute to and the motive for adult children to care as altruistic rather than out of 'guilt'. This section formally introduces the model and illustrate the main theoretical mechanisms of care decision making.

3.1 The family problem

In order to focus on the heterogeneity in preferences to provide family care and its interaction with wages, I present the model as an interaction between a primary caregiver child and their 'representative' sibling. The parent's well-being is represented as public good Q and the two adult children voluntarily provide family care q to the public good through a Cournot-Nash game. In addition to deciding on family care (q), each child chooses private consumption of their own family (c), time spent on other activities such as child care, household production or leisure (l) and time spent on market work (h). Formally, child i solves the following problem:

$$\max_{c_i, l_i, q_i} u(c_i) + \gamma u(l_i) + \theta_i u(Q) \tag{1}$$

subject to the following constraints:

$$Q = f(q_i, q_{-i}) \tag{2}$$

$$c_i = w_i(\alpha_i) \cdot h_i \tag{3}$$

$$\bar{L} = l_i + h_i + q_i \tag{4}$$

$$h_i, q_i \geq 0 \tag{5}$$

where γ refers to how much child i weighs time spent on other care and leisure activities compared to consumption and family care, and θ_i refers to how much child weighs family care over consumption and time spent on other activities. Public good Q is a product of family care hours of the primary caregiver child q_i and and their sibling's q_{-i}. Child i works h_i hours at the wage rate w_i and $w_i(\alpha_i)$ where child's wage is a function of their own number of children α_i. With their earnings, child i spends it on private family consumption c_i. In addition, child i allocates their total available time $\bar{L}$ between family care q_i, market work h_i and other activities such as childcare and leisure l_i. There are non-negativity constraints on h_i and q_i[10]. The utility function includes time spent on activities such as childcare, personal care or social time with own family l_i as well as providing care to an elderly parent q_i. This is important since providing care for a parent often conflicts with adult children's own family responsibilities in terms of time but it is safe to assume adult children value both of these activities. Note that $G'(q_i) > 0$ and $G(q_{-i}) > 0$, which means public good increases with its inputs.

Let us choose the following forms for preferences and public good:

[10]See M. Brown (2006) for a case where h_i does not have non-negativity constraint to allow for the fact that adult child can hire formal care worker at their own wage. I include the non-negativity constraint given that in the HRS data, the incidences of adult child financially with parent's long-term care needs is only 1.4% between 1998 and 2014.

$$U_i(c_i, l_i, q_i) = \frac{c_i^{1-\gamma_c}}{1-\gamma_c} + \gamma \frac{l_i^{1-\gamma_l}}{1-\gamma_l} + \theta_i \frac{(q_i + q_{-i})^{1-\gamma_q}}{1-\gamma_q} \tag{6}$$

where utility is additively separable and strictly quasi-concave. γ_c, γ_l and γ_q are curvatures on consumption, other care activities and leisure, and public good, respectively. Note that q_i and q_{-i} are perfect substitutes. This is motivated by the fact that Checkovich and Stern (2002) finds the care provided by one child reduces the other child's time in providing care to their parent. In addition, I assume adult children weigh their leisure time and time spent with their own family the same at γ but they differ in their preferences for public good Q.

3.2 Marginal Rates of Substitution

Given the problem stated in Equations 1 - 5 and the functional form assumptions in Equation 6, I solve for the following first-order conditions of child i for $i = 1, 2$.
The first-order conditions for Child 1 are as follows:

$$\begin{aligned}
\frac{\partial U_1}{\partial l_1} &: \quad c_1^{-\gamma_c} = \lambda_1) \\
\frac{\partial U_1}{\partial l_1} &: \quad \gamma l_1^{-\gamma_l} = \lambda_1 w_1(\alpha_1) \\
\frac{\partial U_1}{\partial q_1} &: \quad \theta_1 (q_1 + q_2)^{-\gamma_q} = \lambda_1 w_1(\alpha_1)
\end{aligned}$$

Similarly, the first-order conditions for Child 2 are as follows:

$$\begin{aligned}
\frac{\partial U_2}{\partial l_2} &: \quad c_2^{-\gamma_c} = \lambda_2 \\
\frac{\partial U_2}{\partial l_2} &: \quad \gamma l_2^{-\gamma_l} = \lambda_2 w_2(\alpha_2) \\
\frac{\partial U_2}{\partial q_2} &: \quad \theta_2 (q_1 + q_2)^{-\gamma_q} = \lambda_2 w_2(\alpha_2)
\end{aligned}$$

Equating the first-order conditions above, we get the following marginal rates of substitutions between time spent on family care and time spent on other activities:

$$l_1^{\gamma_l} = \frac{\gamma}{\theta_1}(q_1 + q_2)^{\gamma_q} \tag{7}$$

$$l_2^{\gamma_l} = \frac{\gamma}{\theta_2}(q_1 + q_2)^{\gamma_q} \tag{8}$$

and between leisure and consumption:

$$c_1^{\gamma_c} = \frac{w_1(\alpha_1)}{\gamma} l_1^{\gamma_l} \tag{9}$$

$$c_2^{\gamma_c} = \frac{w_2(\alpha_2)}{\gamma} l_2^{\gamma_l} \tag{10}$$

From the marginal rates of substitution in Equations 7 and 8, we can observe that the ratio between time spent on other activities l_i and time spent on family care q_i depends positively on weight on other activities γ and negatively on θ_i. Since γ is assumed to be homogeneous across siblings, the sibling-specific weight on public good θ_i plays a crucial role in the ways adult children allocate their time differently. As for the marginal rates of substitution in Equations 9 and 11, the ratio between consumption c_i and time spent on activities other than family care l_i depends positively on wage $w_i(\alpha_i)$ but negatively on γ. Again, wage is an important parameter to explain this ratio. As higher wage reflects higher opportunity cost to take time off to provide care or enjoy leisure (substitution effect) but it also increases consumption due to higher earnings (income effect). Consequently, the number of own children can interact with leisure and consumption differently, as number of own children can either increase wages or decreases wages.

3.3 Cournot-Nash Equilibrium

To define the equilibrium decisions of the siblings, I define a strategy profile $\delta = \{\delta_1, \delta_2\}$ where each sibling either provides family care (C) or does not provide family care (N). This gives us four possible outcomes and pay-off functions as follows:
Both provide care (C,C):

$$U_1^{CC} = u_1(c_1, \bar{L} - h_1 - q_1) + \theta_1 \cdot Q(q_1, q_2)$$
$$U_2^{CC} = u_2(c_2, \bar{L} - h_1 - q_1) + \theta_2 \cdot Q(q_1, q_2)$$

Sibling 1 only provides care (C,N):

$$U_1^{CN} = u_1(c_1, \bar{L} - h_1 - q_1) + \theta_1 \cdot Q(q_1)$$
$$U_2^{CN} = u_2(c_2, \bar{L} - h_1) + \theta_2 \cdot Q(q_1)$$

Sibling 2 only provides care (N,C):

$$U_1^{NC} = u_1(c_1, \bar{L} - h_1) + \theta_1 \cdot Q(q_2)$$
$$U_2^{NC} = u_2(c_2, \bar{L} - h_1 - q_1) + \theta_2 \cdot Q(q_2)$$

None provides care (N,N):

$$U_1^{NN} = u_1(c_1, \bar{L} - h_1)$$
$$U_2^{NN} = u_2(c_2, \bar{L} - h_1)$$

where each of the pay-off function is subject to the budget and time constraints in Equations (3) - (5). Note the Cournot-Nash approach allows for an interdependency between adult children's decision making. Each child decides their consumption, employment and family care not only based on their own wages, wealth and preferences but also based on their sibling's since family care time of your sibling q_2 also enters your utility function U_1 through public good Q.

The interdependency allows for two main features regarding the interaction between adult children: risk-sharing and crowding-out. A wealthier child may insure their sibling with low wages by offering more family care and help them to increase their market hours to smooth family consumption since the wealthy child can potentially take care of their private family consumption without working as much and still spending their time on other activities. However, public good benefits a child as long as their sibling provides care even though they themselves may not have provided care, in the cases of U_i^{CN} and U_i^{NC}. In this case, a child with low opportunity cost may end up providing all the care despite a wealthier sibling, depending on which channel dominates.

Adult children also can be at the intensive margin where they both provide care U_i^{CC}, which is a pattern found in the HRS data and described in Section **??** and the model allows us to examine the distribution of care hours between them. In the case two children have too low wealth and substitution of wages dominate, the children may end up at the outcome where none of them provides care U_i^{NN}. This can vastly depend on how severe the parent's health status is and how wealthy the parents themselves are. Elderly individuals at the high end of the wealth distribution can rely on self-insurance rather than other than family care or those at the bottom quintile can rely on Medicaid (Braun, Kopecky, and Koreshkova 2019; J. Brown and Finkelstein 2007). Since my model does not include the parent's decision-making, it does not capture these dimensions of why any adult child would not provide care to their parent. However, family care is prevalent across all wealth distribution of the elderly, making

it the important source families rely on despite other sources of long-term care (Ko 2021; Mommaerts 2021). Table 1 shows the pay-off matrix for the four possible outcomes.

Table 1: Pay-offs from Strategic Family Care Decisions of Two Adult Children

		Sibling 2	
		C	N
Sibling 1	C	(U_1^{CC}, U_2^{CC})	(U_1^{CN}, U_2^{CN})
	N	(U_1^{NC}, U_2^{NC})	(U_1^{NN}, U_2^{NN})

A strategy profile $\delta^* = (\delta_1^*, \delta_2^*)$ is the Cournot-Nash equilibrium if all of the following conditions are satisfied[11].

Optimality of the Child 1's decision problem:

$$\delta_1^* = \underset{c_1^*, l_1^*, q_1^*}{\arg\max}\, U_1(c_1^*, l_1^*, q_1^* | w_1(\alpha_1), \theta_1, \delta^*) \tag{11}$$

Optimality of the Child 2's decision problem:

$$\delta_2^* = \underset{c_2^*, l_2^*, q_2^*}{\arg\max}\, U_2(c_2^*, l_2^*, q_2^* | w_2(\alpha_2), \theta_2, \delta^*) \tag{12}$$

where consumption c_i^*, market work h_i^*, family care q_i^* are chosen given wage w_i, number of own children α_i, preference for family care θ_i and the strategy profile of the other sibling $\delta^* = (\delta_1^*, \delta_2^*)$.

3.4 Model Mechanisms

I focus on three main channels on how the model captures the distribution of family care time between adult children. First, I illustrate the role of wages in child's family care decision. Second, I describe how number of own children can interact with wages. Third, I show how heterogeneous preferences for family care among adult children can lessen or pronounce the effects of the previous two channels.

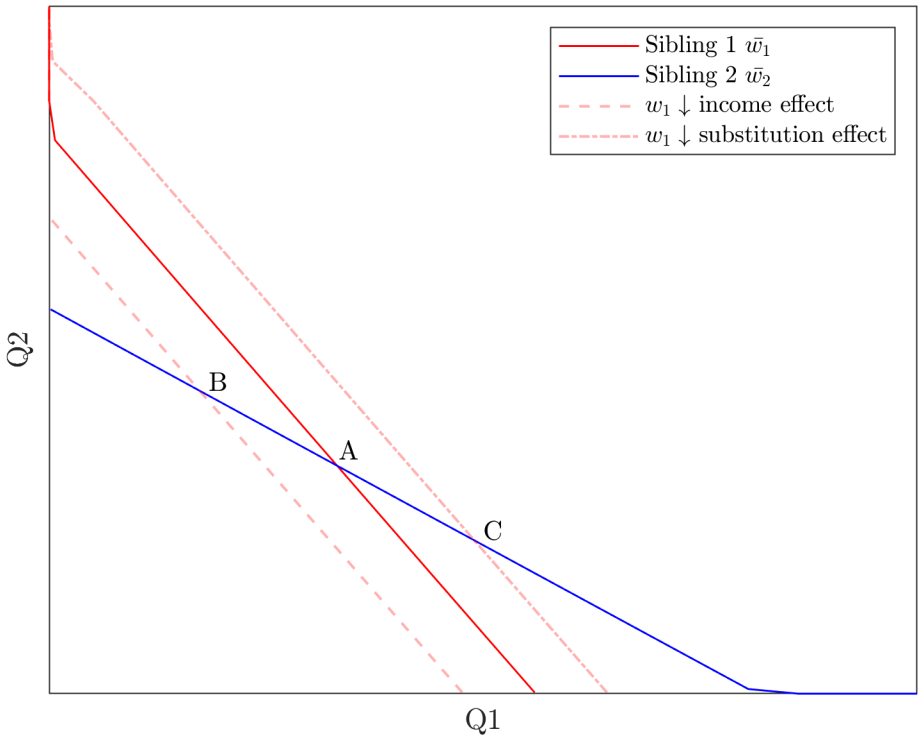
3.4.1 Wages

The effect of wages on family care time is ambigious. Figure 1 illustrates the effect of wages on the equilibrium of family care hours between two siblings. We start again at Point A where both children are homogeneous in terms of wages and preferences, and thus contribute

[11] See Bergstrom, Blume, and Varian (1986) where he provides extensive proof and discussions on the Nash Equilibrium of a model with private contributions to public good.

to the public good in equal amounts. Now we consider two cases of a negative wage shock. The dashed red line represents the leftward shift of response function when Child 1 faces lower income compared to their sibling. The new equilibrium is at Point B, lowering family care hours of Child 1 but increasing family care hours of their sibling due to income effect. Since working the same amount does not provide as much income as it used to, Child 1 may increase their market hours in response, which takes away from their time spent on leisure, with family or providing family care to their parent. In response, Child 2 now increases their family care hours. However, the effect of wages on family care time can be positive such that the new equilibrium resulting from a negative wage shock could result in Point C. In this case, the substitution effect dominates. When Child 1 has lower wage, they can choose to provide more family care compared to their sibling since they face lower opportunity cost in doing so.

Figure 1: Effects of Wages on Family Care



Notes: Simple numerical solutions of the Cournot-Nash model presented in Sections 3.1-3.3. The red lines refer to the response functions of Child 1 in family care time Q_1 while the blue lines refer to the response functions of Child 2 in family care time Q_2. Point A represents the equilibrium of the model where both adult children are the same in terms of wages $w_1 = w_2$, wealth $A_1 = A_2$ and preferences for public good $\theta_1 = \theta_2$. Point B shows the income effect on equilibrium from a negative wage shock due to a leftward shift in the response function of Child 1, represented by red dashed line. Point B shows the substitution effect on equilibrium from a negative wage shock due to a rightward shift in the response function of Child 1, represented by red dash-dotted line.

3.4.2 Number of Own Children

The number of own children have two effects in the model. Since having more children increase your demand for time spent on activities such as childcare and time with family, it can lower adult child's contribution to public good due to time constraint channel. On the other hand, wage is a function of number of own children. That is, having more children can either lower or increase your wages.

If number of children lowers one's wages, those with more children can also provide more family care through the opportunity cost channel. Since providing childcare is strongly correlated with wages, this can be a likely outcome. Conversely, if number of children increases one's wages, those with more children can also provide more family care through the opportunity cost channel.

As for the income effect, lower wages due to having more children can also lead to working more since now you have to earn more to sustain your family consumption. Higher wages due to having more children can also lead to reducing labor supply so that you can enjoy more time with your children. The former has negative effect on family care and the latter has positive effect on family care.

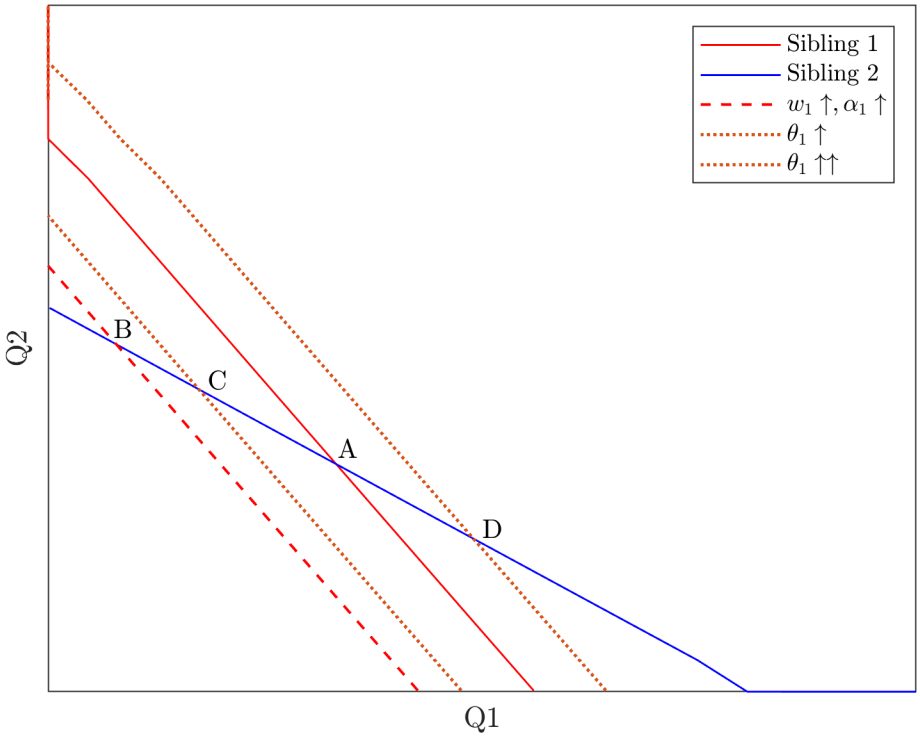
3.4.3 Heterogenenous Preferences Channel

Lastly, I describe how heterogeneous preferences among adult children and how they interact with the effects of income and number of own chldren. Holding all else equal, lower preference for public good reduces family care time and higher preference increases family care time. These can be reflected by a shift in the response function of the child: a leftward shift in the case of lower preference $\theta \downarrow$ and a rightward shift in the case of higher preference $\theta \uparrow$. This feature can interact with the effects of wage and number of own children. Figure 2 shows a scenario where two children start at initial Point A where they provide the equal amounts of family time. Then high wages due to higher number of children (case where $w_1'(\alpha_1) > 0$) occur and the opportunity cost channel shifts Child 1's response function to the left, shown in red dashed line, and creates a new equilibrium at Point B. Due to the substitution effect of high wages, Child 1 lowers their family care time q_1 from Point A to Point B so that they increase their time in the labor market. In response, their sibling increases their family care time q_2 from Point A to Point B.

To see the effects of preference parameter θ_1, I illustrate two more scenarios in Figure 1. In the first scenario, Child 1 who provides family care time at Point B due to higher opportunity cost of high wage, induced by number of own children, now prefers public good in the family a little bit higher than their sibling does, represented by a dotted line with

$\theta_1 \uparrow$. As predicted, this shifts the response function of Child 1 to the left resulting in a new equilibrium from Point B to Point C. However, the positive effect of higher preference for public good does not completely erase the negative effects of higher opportunity cost. In the end, despite having higher preference for public good compared to their sibling, Child 1 provides less family care than their sibling at Point C compared to the baseline at Point A with equal distribution. This entails that the opportunity cost channel dominates the heterogeneous preference channel in the case of shift to Point B due to higher wages.

Figure 2: Heterogeneous Preferences for Public Good



Notes: Simple numerical solutions of the Cournot-Nash model presented in Sections 3.1-3.3. The red lines refer to the response functions of Child 1 in family care time Q_1 while the blue lines refer to the response functions of Child 2 in family care time Q_2. Point A represents the equilibrium of the model where both adult children are the same in terms of wages $w_1 = w_2$, wealth $A_1 = A_2$ and preferences for public good $\theta_1 = \theta_2$. Point B shows the income effect on equilibrium from a negative wage shock due to a leftward shift in the response function of Child 1, represented by red dashed line. Point B shows the substitution effect on equilibrium from a negative wage shock due to a rightward shift in the response function of Child 1, represented by red dash-dotted line.

Now, what happens if the preference for public good is higher in magnitude for Child 1 compared to the above case? The second scenario includes a much higher preference for public good for Child 1 compared to their sibling, represented by a red dotted line with $\theta_1 \uparrow\uparrow$. This change shifts the equilibrium from Point B to Point D, entirely erasing the negative effects of high opportunity cost on family care time. If the preference is high enough for

public good, we can see a distribution of family care between adult children that is widely divided along their preferences for public good.

So far, I have not commented on the underlying sources of this heterogeneity in preferences among adult children in the model. I assume this preference parameter as endogenous rather than fixed or exogeneous. Specifically, this feature of the model can incorporate the role of social and cultural norms such that one of the siblings may feel more of the 'responsibility' to take care of their elderly parent.

4 Data

This section introduces the data used, sample construction and provide descriptive evidence on multiple children caregivers and their characteristics. I use the Health and Retirement Study (HRS) conducted between 1998 and2014. Beginning in 1992, HRS collected survey on a nationally representative individuals over 50 years old. The survey provides information about elderly individuals regarding their health, asset, income and long-term caregiving arrangements such as nursing home and paid home care uses. In addition, HRS collects information on demographic characteristics, family care hours and employment of adult children of the elderly. I use the sample of all children aged 21 and over of single elderly individuals aged 65 and over to construct my dataset. In addition, in order to have a dataset with full set of information, I restrict the sample to elderly individuals who consecutively interviewed between 1998 and 2014 or the exit interview if the individual dies during the sample period[12]. More specifically, I construct the final sample for the general analysis in the following sequence.

Parents Sample. I choose single individuals aged 65 and over in 1998, who are followed till death (if applicable) without missing any interview between 1998 and 2014, stayed single throughout the sample period (N=3,685; n=16,773)[13]. Sample of parents with at least one adult child aged 21 and over that are alive while the individual is alive consists of 3,110 elderly parents and sample with two or more children consists of 2,587 elderly parents.

Children Sample. After constructin the sample of elderly parents with children, I now turn to constructing the sample of adult children of these elderly individuals. Adult children of the 3,110 individuals with at least one adult child aged 21 and over consist of 9,653 adult children and 45,958 child-wave observations. Moving onto individuals with two or more children, I construct the final sample of adult siblings consisting of 9,128 adult children (who has at least one sibling) with 43,896 child-wave observations.

[12]See Lockwood (2018) for a similar approach.

[13]N refers to number of individuals and n refers to individual-wave observations

Long-Term Care Needs

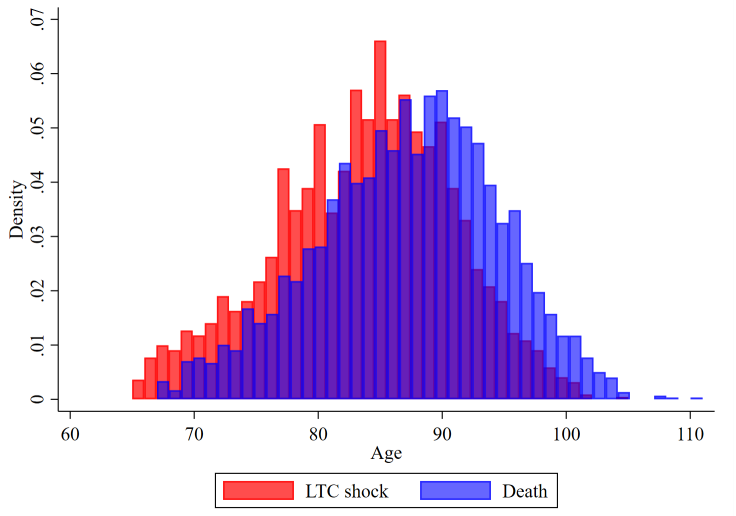
Long-term care needs[14] is defined in terms of needing assistance with physical limitations to perform activities of daily living (ADL) or instrumental activities of daily living (IADL). In the HRS, ADLs refer to activities of walking across a room, dressing, bathing, eating, getting in and out of bed, and using the toilet and IADLs include activities such as using a telephone, managing money, taking medications, shopping for groceries, and preparing hot meals. I construct the shock as identity if the individuals has at least one limitation with ADLs or IADLs. As shown in Table 2, 83% of the 3,685 individuals died during the 1998-2014 sample period at an average age of 87.2. 61% of individuals experienced physical limitation with at least one ADL or IADL at an average age of 83.7. The age distributions of the two events are shown in Figure 3.

Table 2: Long-Term Care Shock and Death

	% of individuals	Average age
Experienced LTC shock	61.4	83.7
Died during 1998-2014	82.8	87.2
Total # of individuals	3,685	

Notes: The sample single individuals aged 65 and over in the pooled 1998-2014 Health and Retirement Study. The additional selection criterion requires that individuals do not miss an interview during the sample period, including when the individual dies, a proxy answers questions about the prior state of the individual before death in an exit interview.

Figure 3: Age Distribution at LTC Shock and Death



[14]Long-term care shock or long-term care needs is interchangeably used throughout the paper.

Number of Children and Family Care

To illustrate the importance of sibling interaction in family caregiving, I provide descriptive statistics on how many adult children elderly parents receive care from over the sample period and how many hours of care children provide. Table 3 disaggregates the full sample by number of children and records the family care rate for each group. Elderly individuals, who experience long-term care shock during the sample period, are more likely to receive informal care when they have multiple children. About 83% of the sample has two or more children, demonstrating the importance of not neglecting interaction between siblings. 70.1% of individuals with one child receive informal care from their child at least once over the 1998-2014 sample period. However, the share of individuals increases to 79.6% and 79.3% for individuals with two and three children, respectively, and is highest at 89.9% for individuals with six or more children. Overall, 81% of the sample with long-term care needs receive informal care from their children. This is significant given that most elderly individuals in the sample experience long-term care shock at some point during the sample period, shown in Table 2.

Table 3: Number of Adult Children and Informal Caregiving

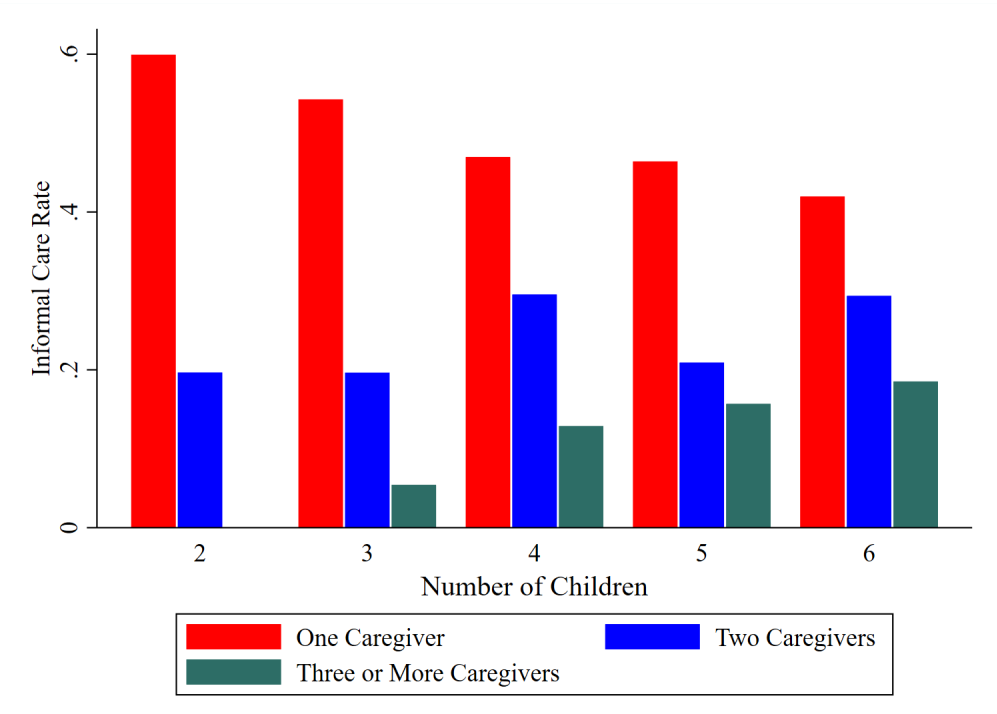
	Number of children						
	1	2	3	4	5	6+	Total
% of sample	17.1	26.8	19.9	13.6	7.9	14.7	100
% of sample receive informal care	70.1	79.6	79.3	89.4	83.0	89.9	81.0

Notes: The sample includes 1,940 65+ single individuals who has at least one child and experience long-term care needs at some point in the pooled 1998-2014 Health and Retirement Study. The second rows show the percent of those who receive informal care from any child over the 1998-2014 sample period, split by number of children.

To explore whether having more children lead to one child providing care more often or multiple children coordinating to provide care to their parent, I decompose the individuals with multiple children in terms of how many caregivers they have throughout the 1998-2014 sample period in Figure 4.

Across number of children, getting help from only one child is the most common arrangement for individuals. However, share of families with one caregiver (red bars) decreases with number of children. For example, 60% of individuals with two children get informal care from one child but this share lowers to 42% when it comes to families with six or more children. Interestingly, for families with more children, multiple caregiver arrangements become more pervasive with around 20% of families with three children receiving informal care from two children, and the rate increases to 30% for families with four children. Receiving informal care from three or more children also increase with number of children, which essentially

Figure 4: Number of Adult Children Caregivers



Notes: The sample includes single individuals aged 65 and over with at least two adult children in the pooled 1998-2014 Health and Retirement Study. Red bars refer to share of individuals who receive informal care from one adult child, blue bars refer to share of individuals who receive informal care from two children and green bars refer to individuals who receive care from three or more adult children over the sample period. Number of children equals to six when an individual has six or more adult children.

makes up more than 45% of families with three or more children. This suggests that, children may coordinate their efforts or work together to care for their sick parent. In fact, for families with multiple caregivers, two types of care arrangements are observed: multiple caregivers take turns (one child providing care in some periods and another child providing care in other periods but never simultaneously) or they care for the parent simultaneously in the same period (over two years), as demonstrated in Appendix A.

Now, we move on to the intensive margin of caregiving across how many caregivers an elderly parent has. In this way, we not only show whether multiple children participate in caregiving but also the distribution of care provided between them. Table 4 presents the distribution of informal care hours between multiple caregivers compared with the hours provided by 'solo' caregivers (where one child is the only caregiver among their siblings over the sample period). For elderly parents with one caregiver, the caregiver child spends 24.2 hours of informal care per week on average. However, the mean is highly driven by those

providing intensive care on the right tail as the median hour is only 7.5 hours. In fact, 29% of the time the caregivers (that are the only providing care among their siblings) spent more than 20 hours per week providing care.

Table 4: Caregiving Patterns

	One caregiver	Multiple Caregivers
Informal care hours (mean/median)	24.2/7.5	18.2/6
Informal care hours | primary caregiver		26.1/7.75
Provides $\geqslant$ 20 hrs/wk	0.29	0.23
Provides $\geqslant$ 20 hrs/wk | primary caregiver		0.33
% of hours by primary caregiver	100.0	0.73

Notes: The sample includes 24,973 person-wave observations of 4,967 adult children of 65+ single individuals who has multiple children and received family care from at least once child in the pooled 1998-2014 Health and Retirement Study. The table reports the characteristics of children based on whether they provide care to their parent during the sample period, and on how many hours they provide care. Main caregiver is defined as the child that provides the most total hours of informal care to their parent over the sample period.

For multiple caregivers, I first define a primary caregiver among the multiple caregivers for each family by choosing the caregiver child that provide the most total hours of informal care hours to their parent over the sample 1998-2014 period. For all caregivers in families with multiple caregivers, they spend 18.2 hours of informal care on average with a median of 6 hours. However, when I only focus on the primary caregivers, the mean rises to 26.1 hours and the median rises to 7.75 hours. Additionally, only 23% of the time all caregivers, who share caregiving among them, spend more than 20 hours per week. This is contrast to the 33% of the time the primary caregiver spending more than 20 hours of care per week on family care. This suggests that even though multiple caregivers are common, the bulk of the care is still done by one caregiver (i.e., primary careigiver) among the multiple caregivers. Interestingly, the caregiving patterns of rate and intensity of care by the primary caregiver is very similar to the caregiving patters by a 'solo-caregiver' who did not have any other sibling helping with care over the sample period. In fact, 73% of the total informal care hours are done by the primary caregiver in families with multiple caregivers[15].

Characteristics of Caregivers

Table 5 presents the characteristics of adult children based on the intensity of their family care hours. Non-caregiver siblings are more likely to be male (66%). On the other hand, siblings who provide provide care are more likely to be female. Specifically, 59% of caregivers who provided 20 or more hours and 70% of caregivers who provided less than 20 hours per

[15]This finding is consistent with those found in Mommaerts (2021) though she uses slightly different sample selection and focuses on 1998-2010 sample period.

week are female. Siblings who provide care are more likely to live closer to their parent, which is predictable given care decision or the prospect of caregiving in the future is often made together with co-residency or moving close to elderly parent (L. E. Pezzin, Pollak, and Schone 2007; Stern 2021). Despite living closer to a parent, being a daughter appears to be an important indicator of providing care to a parent[16].

Table 5: Characteristics of Adult Children by Caregiving Patterns

	Provide Care		Not Provide Care
	$\geqslant$ 20 hrs/wk	<20 hrs/wk	
Age	53.5	53.5	53.6
Female	0.70	0.59	0.44
Married	0.49	0.69	0.69
Home ownership	0.51	0.74	0.66
College	0.21	0.32	0.24
Working full-time	0.48	0.63	0.62
Working part-time	0.10	0.09	0.07
Not working	0.42	0.27	0.31
Earns >$35,000	0.37	0.64	0.60
Earns >$70,000	0.05	0.12	0.12
Lives within 10 miles	0.75	0.61	0.31
Informal care (hrs/wk)	45/28	5/3	-
Observations	3,271	7,176	14,526

Notes: The sample includes 24,973 person-wave observations of 4,967 adult children of 65+ single individuals who has two or more children and receive informal care from at least once child in the pooled 1998-2014 Health and Retirement Study. The table reports the characteristics of children based on whether they provide care to their parent during the sample period, and on whether they provide more than 20 hours of care during the sample period. For informal care hours, the mean/median hours are reported.

Siblings who provide less than 20 hours of informal care per week have quite similar characteristics to those who do not provide care in terms of marital status, home ownership, working status and earnings. For example, light caregivers (those providing less than 20 hours per week) are equally likely to be married as non-caregiver siblings, and owns home at a higher rate than non-caregivers at 74%. In terms of working, light caregivers work full-time at 63% close to non-caregivers who work full-time at 62%, and light caregivers also work part-time more than non-caregivers. Light caregivers and non-caregivers earn more than $70,000 at the same rate though light caregivers are more likely to earn more than $35,000 than non-caregivers. This implies that there is a big difference in the characteristics of caregivers by caregiving intensity. Those who provide the intensive care and significantly different from

[16]In fact, Ko (2021) finds similar patterns and proposes using these two characteristics to price the premium of private Long-Term Care Insurance.

those who provide few or couple of hours per week. These descriptions, however, do not demonstrate the causal direction between family caregiving and the sibling's characteristics such as geographical proximity to parent, marriage, home ownership, working and earning.

5 Gender Role and Heterogeneity in Caregiving

In this section, I focus on one of the sources of heterogeneity in caregiving among adult children. Given the strongest predictor of family caregiving is gender of the adult child, this is an important factor that shapes family decision making in care arrangements. By focusing on elder parents aged 70 to 85 pooled across two waves of the HRS in 1995 and 2000, Grigoryeva (2017) finds that the share of care hours by sons lowers with the number of sisters but the share of care hours by daughters increase with the number of brothers. Gender norms about caregiving is extensively found in childcare between married spouses (Andresen and Nix 2019; Bittman et al. 2003; Cortés and Pan 2020; Kleven, Landais, and Søgaard 2020). Though the literature on the role of gender norm in family caregiving to elderly parents is more scant, the results of Grigoryeva (2017) suggests that gender norm may shape preferences of adult children: daughters are likely to assume the role of caregiving over their brothers due to social expectations to be the main caregiver or their internalization that the responsibility falls on them. I expand on the work of Grigoryeva (2017) to test my model hypothesis that children have heterogeneous preferences for family caregiving and this can be shaped by social and cultural norms, and the social norm I consider here is the gender of the child and the gender composition of their siblings. I further complement the analysis of Grigoryeva (2017) by including a longitudinal analysis of caregiving rather than focusing on one wave, and specifically looks at how the caregiving patterns change dynamically around the event of parent's shock to their long-term care needs.

To do so, I categorize sibling groups into three groups based on their gender composition: sibling groups that have at least one son and at least one daughter (Mixed-Gender), sibling groups that have only daughters (Daughters-Only) and sibling groups that have only sons (Sons-Only). Table 6 shows the number of adult children caregivers across three sibling groups for elderly parents who experience long-term care shock at some point during the sample period. Most elderly parents (52%) receive care from one child despite having multiple children while a significant share (39%) still receives family care from more than one child. Across all sibling groups, elderly parents with only sons have the highest incidences of not receiving any family care from their children at 27.7%. On the other hand, the share of elderly parents not receiving care in mixed-gender group and the group with only daughters is much lower at 14.8% 15.7%, respectively. For the parents who received care from their

children, getting care from only one child is more common for families with only daughters or only sons, which is expected given that adult children in single-gender groups with only daughters or only sons have lower number of total children[17]. However, shared caregiving appears to happen more in sibling groups with more sisters rather than sons. That is, sibling groups with only sons provide less care to their parent and if they provide care, the caregiving burden falls on one sibling rather than shared between siblings, compared to the groups with daughters only or groups with mixed-gender composition.

Table 6: Number of Children Caregivers by Family Types

	Mixed-Gender	Daughters-Only	Sons-Only	Total
% with no caregiver	14.8	15.7	27.7	16.7
% with one caregiver	49.7	58.4	55.9	52.0
% with multiple caregivers	35.5	25.9	16.4	31.3
Total	100.0	100.0	100.0	100.0

Notes: The sample includes 1,609 65+ single individuals who have two or more children and experience LTC needs at some point in the pooled 1998-2014 Health and Retirement Study. The rows represent the percent of families by number of children caregivers over the sample period, split by three family types. "Mixed-Gender" refers to the set of families that have both sons and daughters, "Daughters-Only" refers to the set of families that only have daughters, and "Sons-Only" refers to the set of families that have only sons.

In Table 7, I show the charactersitics of adult children across sibling groups. Column(1) refers to daughters in each group and Column(2) refers to sons in each group. Percents of children providing care to their parent are highest for families with only daughters and only sons. Despite parents in these families receiving less informal care from their children overall, as shown in Table 6, note that they have less children on average compared to mixed-gender groups. Almost 60% of the children in single-gender families provide care to their parent. In contrast, 49% of daughters and 30% of sons provide care in mixed-gender groups. Interestingly, the difference in caregiving patterns between sons in mixed-gender group and sons in single-gender group are starkest when it comes to caregiving for more intensive hours. 16% of sons with no sister provide more than 20 hours per week care to parent. This is comparable to daughters in mixed-gender and single-gender groups, which are 17% and 19%, respectively. In contrast, only 7% of the sons in mixed-gender group provide intensive care of more than 20 hours per week. This again suggest the pattern of 'crowding-out' of sons by daughters in mixed-gender groups due to the role of gender norm in their (heterogeneous) preferences in caregiving.

A basic descriptive analysis reveals the differences in caregiving by sons across mixed and single-gender groups. However, I do not find big differences in care intensity and care

[17]See Appendix **??** for the distribution of number of children across family types.

Table 7: Characteristics and Gender Composition of Children

	Mixed-Gender		Daughter-Only	Sons-Only
	(1)	(2)	(1)	(2)
Age	52.9	53.5	54.8	55.5
Married	0.63	0.68	0.65	.77
College	23.7	24.02	0.32	0.40
Working Full-Time	0.56	0.66	0.51	0.67
Working Part-time	0.10	0.07	0.11	0.06
Earns $\geqslant \$35,000$	0.53	0.59	0.63	0.70
Lives within 10 miles	0.50	0.42	0.49	0.52
Provides care	0.49	0.30	0.58	0.58
Provides $\geqslant$ 20 hrs/wk	0.17	0.07	0.19	0.16
Informal care (hrs/wk)	23.7	15.0	24.1	14.25
Observations	10,454	10,315	2,442	1,762

Notes: The sample includes adult children of 65+ single individuals with long-term care needs who has two or more children and experience long-term care needs in the pooled 1998-2014 Health and Retirement Study. Column (1) refers to the sample of daughters and Column (2) refers to the sample of sons. "Mixed-Gender" refers to the set of families that have both sons and daughters, "Daughters-Only" refers to the set of families that only have daughters, and "Sons-Only" refers to the set of families that have only sons.

hours performed by daughters in each of the group. Though insightful, the unconditional means reported in this section does not say anything about the sources of these differences. I explore the sources in the following section.

5.1 Empirical Strategy

In this section, I turn to an empirical analysis of caregiving patterns around the long-term care shock to a parent. Based on the model in Section XX, my hypotheses are the following: 1) if the preferences of daughters are shaped by gender roles, daughters should behave similar regardless of whether they have a brother, and 2) if heterogeneity in preferences for family care is shaped by gender roles, son's caregiving is expected to be 'crowded out' by their sisters in mixed-gender groups, and 3) sons with only brothers are expected to provide higher family care than their counterparts in mixed-gender group but still provide less care than daughters in either of the group.

To test these hypotheses, I employ an event-study analysis of caregiving, at the extensive and the intensive margin, around an event that parent needs family care due to a health condition. In this way, I can capture the dynamic effects of long-term care shock to a parent on adult children's caregiving patterns after the parent experiences shock, which allows me

to quantify persistence in caregiving for the same children over time[18]. For an adult child of an elderly parent, event time t is indexed relative to the event that parent experiences a long-term care shock. I run the following regression for sons and daughters of each sibling group:

$$Y_{ist}^{g} = \alpha^{g} D_{ist}^{Event} + \beta^{g} D_{ist}^{Age} + \gamma^{g} D_{ist}^{Year} + \nu_{ist}^{g} \tag{13}$$

where Y_{ist}^{g} denotes the outcome variables of child i of sibling group $g = \{$mixed-gender, daughters-only and sons-only$\}$ in year s and at event time t. The outcome variables of interest are: whether child provides care to their parent and how many weekly hours of care child provides. Since the waves are biannual in the HRS, $t = \{-2, 0, 2, 4\}$ with event of parent needing assistance with performaing daily activities at $t = 0$. The first term includes event-time dummies D_{ist}^{Event} with the reference group is $t = -2$, which means the event-time coefficients α^{g} measure the impact of parent's long-term care shock relative to two years before the shock (when parent was healthy). Next, similar to (Kleven, Landais, and Søgaard 2019), I include age dummies D_{ist}^{Age} to control for life-cycle effects of caregiving as children are of difference ages and younger adult children may be more likely to have other caregiving burdens such as caring for young children and older adult children tend to have more time in terms of other care responsibilities but could be more attached to the labor force in their late 40s and 50s (Fahle and McGarry 2017). I also control for year dummies D_{ist}^{Year} as these can account for changes in caregiving activities due to time trends such as evolving changes in social and cultural norms, public investment in long-term care facilities by state and federal agencies or more generally, business cycles. Conditional on age and year, this identifies variation in event time driven by variation in age at which child experiences long-term care assistance from their parent(Cortés and Pan 2020; Kleven, Landais, and Søgaard 2019, 2020).

5.2 Results

Using a standard event-study specification, I estimate the effect of long-term care shock to a parent on the propensity of caregiving and how many hours of care by adult children. The estimation is run separately for sons and daughters across three sibling groups: mixed-gender group and groups consisting of only daughters and of only sons. Panel A of Table 8 presents the estimates of the event time dummies compared to the reference point, which is two years before the long-term care shock. The probability of providing care increases by 26% for daughters in mixed-gender groups as opposed to 27% increase for daughters in single-gender groups. For all daughters, caregiving propensity drops after first year but the

[18]This is in contrast to the pooled cross-sectional analysis of Grigoryeva (2017)

same effect persists from year 2 to year 4. This shows the importance of capturing persistence in caregiving over time, as duration and not necessarily an incidence in providing care can have large effects on employment, earnings and physical well-being of caregivers (Do et al. 2013; Van Houtven, Coe, and Skira 2013). The results here support the first hypothesis that daughters should behave similarly regardless of whether they have a brother or not if their preferences are shaped by gender role such that they are socially expected to provide care or that they themselves assume that care responsibility falls on them.

Table 8: Probability of Caregiving by Gender Composition of Siblings

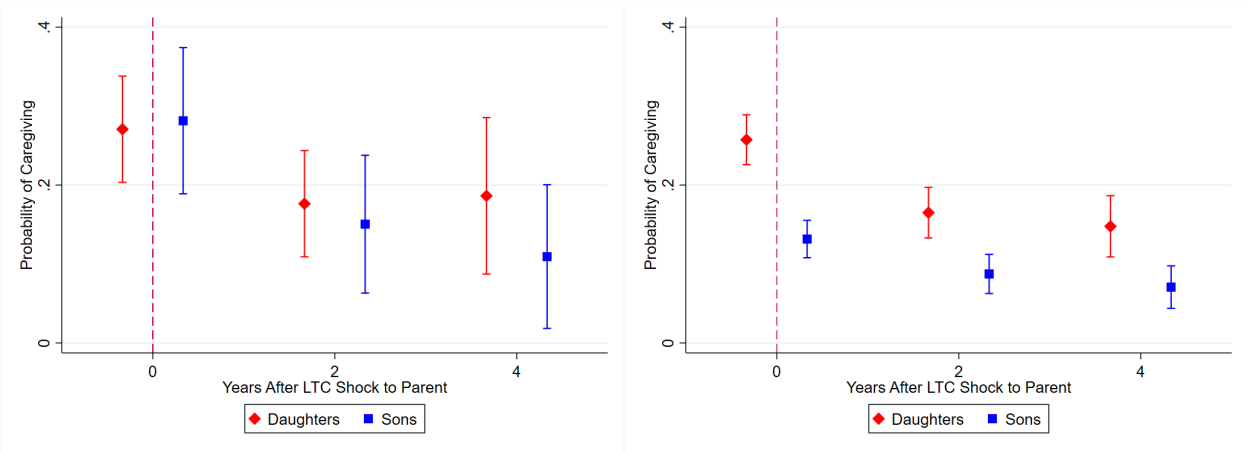
	Mixed-Gender		Daughter-Only	Sons-Only
	(1)	(2)	(1)	(2)
Panel A. Probability of Caregiving				
At event	0.26***	0.13***	0.27***	0.28***
	(0.016)	(0.012)	(0.033)	(0.046)
Two years after	0.16***	0.09***	0.18***	0.15***
	(0.016)	(0.013)	(0.033)	(0.046)
Four year after	0.15***	0.7***	0.19***	0.11***
	(0.019)	(0.014)	(0.049)	(0.045)
Panel B. Weekly Care Hours				
At event	4.14***	1.68***	5.48**	4.43**
	(.607)	(.398)	(2.15)	(1.96)
Two years after	4.24***	0.79***	3.52**	1.4
	(.81)	(0.287)	(1.62)	(1.51)
Four year after	3.75***	0.87**	2.52	-.11
	(0.94)	(0.405)	(1.67)	(1.82)
Observations	3,352	3,352	800	520

Notes: Panel A reports the event-study estimates on the probability of providing informal to a parent when a parent is hit by a long-term care shock. Panel B reports the event-study estimates on weekly care hours to a parent around the event that the parent experiences long-term care shock. Column (1) refers to the sample of daughters and Column (2) refers to the sample of sons. "Mixed-Gender" refers to the set of siblings that have both sons and daughters, "Daughters-Only" refers to the set of sibling groups that only have daughters, and "Sons-Only" refers to the set of sibling groups that have only sons. The reference point is two years before the long-term care shock. Long-term care shock is defined as needing assistance with activities of daily living and instrumental activities of daily living, described in Section 4. Robust standard errors clustered at the family level are in parentheses. * p<0.10, ** p<0.05, ***p<0.01

In the mixed-gender group, sons are 13% more likely to provide care compared to their counterparts in single-gender group where they are 28% more likely to provide care to their parent. This stark difference supports the second hypothesis that son's caregiving is likely to be 'crowded-out' by the presence of a sister or sisters. Caregiving along gender line in

mixed-gender group underlines the importance of considering heterogeneity in preferences of caregiving among adult children and how gender role may play particular importance. Sons in all groups are less likely to continue providing care after year 1 compared to daughters. As their probability of providing care lowers to 9% in year 2 to 7% in year 4 as opposed to 16% in year 2 and 15% in year 4 for daughters in mixed gender group. Though similar decline happens, the probability is at 15% and 11% for year 2 and year 4, respectively, for sons in single-gender groups. This also suggest evidence to the third hypothesis that sons are expected to provide less care to their parent compared to daughters regardless of gender composition of siblings but provide more care compared to their counterparts in mixed-gender groups. The differences in propensity of caregiving between sons and daughters in different sibling groups are graphically illustrated in Figure 5.

Figure 5: Probability of Caregiving by Gender Composition of Children



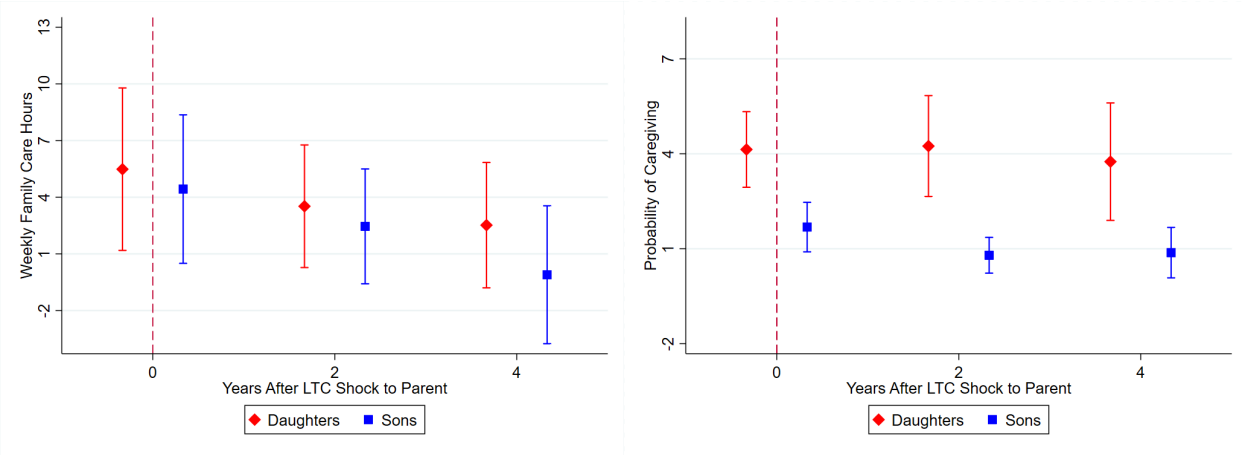
(a) Single-Gender (b) Mixed Gender

Notes: The sample includes adult children of single individuals aged 65 and over with two or more children and at least one onecaregiver in the pooled 1998-2014 Health and Retirement Study. Figure (a) refers to adult children in single-gender sibling groups and Figure (b) refers to adult children in mixed-gender sibling groups.

In Panel B of Table 8 presents the event-study estimation for weekly care hours of sons and daughters, disaggregated by sibling groups. Overall, we see similar patterns as the propensity of caregiving in Panel A. Daughters provide 4.14 to 5.5 weekly hours of care to a parent at year 1 compared to the year before when the parent was healthy. The hours lower as the year goes but not drastically. For sons, we again see the stark differences in caregiving hours. Sons in single-gender group, provide similarly high weekly hours as daughters in both groups although the effect dissipates in significant in year 2 and beyond[19]. Sons in mixed-gender

[19]This could be due to low power of the sample size

Figure 6: Weekly Care Hours by Gender Composition of Children



(a) Single-Gender (b) Mixed Gender

Notes: The sample includes adult children of single individuals aged 65 and over with two or more children and at least one onecaregiver in the pooled 1998-2014 Health and Retirement Study. Figure (a) refers to adult children in single-gender sibling groups and Figure (b) refers to adult children in mixed-gender sibling groups.

groups, however, provide significanly lower hours at 1.68 weekly hours in year 1 but less than 1 hours in year 2 and year 4. The differences are illustrated graphically in Figure 6. These patterns suggest evidence to the hypotheses predicted by the model. That is, there is heterogeneity in preferences in caregiving among adult children and the role of gender norm can be one of the sources of this heterogeneity.

6 Family Caregiving and Own Children

According to Spillman and Pezzin (2000), around 5% of women with children under the age 15 also provide care to their elderly parent. In fact, adult children who are providing both childcare for their own children and family care to their infirm parent are referred to as the 'sandwich generation' (Miller 1981). The popularity in double caregiving burden for adult children in the United States is likely to have increased due to longer life expectancy and a larger age gap between baby boomers and their adult children (Reinhard et al. 2019). My modep predictions can help us understand the interaction of number of own children with the adult child's care decision to provide care to their aging parent[20] Specifically, I look at two channels of the model: time constraint and opportunity cost. According to the time

[20]I distinguish the children of adult children, or the grand children of the elderly parent, by putting 'own' in front of children. 'Children' itself refers to the adult children of the elderly parents, however.

constraint channel, adult child may prefer to provide less time in family care due to their other caregiving responsibilities such as childcare to their own children. There is an extensive literature on the association between double caregiving burden is highly associated with lower satisfaction in life and higher rates of depression (Buffardi et al. 1999; Hammer and Neal 2008; Ingersoll-Dayton, Neal, and Hammer 2001; Voydanoff and Donnelly 1999). In this case, you expect that providing care to own children is expected to lower family care time through the time constraint channel. On the other hand, rearing and raising children have big effects on adult children's employment and wages. Studies have found number of children have strong negative effect on women's employment but no effect or positive effect on men's employment (Cools, Markussen, and Strøm 2017; Killewald 2013; Weinshenker 2015). Similarly, number of children increases men's wages whereas it lowers women's wages (Cortés and Pan 2020; Kleven, Landais, and Søgaard 2019, 2020; Kleven and Landais 2017). That is, according to the model, the effect of number of children is expected to increase daughter's family care hours but is expected to lower son's family care hours, both due to opportunity cost channel. Since daughters are likely to be the caregiver for their own child compared to sons, the effect of number of own children on daughter's family care hours is ambiguous.

Table 9 reports the percentage of adult children who earns more than $35,000 across number of own children. It shows a clear difference in wage gap in sons and daughters, which is interacted non-linearly with number of children making a hump-shape. However, contrary to the literature, I see a positive correlation between wages and number of own children for men and women[21]. Interestingly, the wage gap between daughters and sons increases with number of own children with the exception of 5 children. This suggest a positive correlation between number of children and wages.

Table 9: Wage Rate by Number of Own Chilren

	0	1	2	3	4	5
Daughters	.51	.56	.67	.61	.55	.58
Sons	.51	.59	.75	.74	.68	.54

Notes: Percent of adult daughters and adult sons earning more than $\$35,000$ across number of own children in the pooled 1998-2014 Health and Retirement Study. The sample includes all adult children of single elderly individuals aged 65 and over that had full information on income bracket.

[21]Note these are unconditional means.

6.1 Empirical Strategy

To test the channels of time constraint and opportunity cost, I run pooled cross-section probit regression[22]:

$$Pr(y_{it} = 1) = \Omega(\beta_0 + \beta_1 K_{it} + \beta_2 K_{it} \times F_i + \beta_3 F_i + \gamma \cdot X_{it} + \delta Z_{it} + \lambda_t + \epsilon_{it}) \tag{14}$$

where y_{it} equals to 1 if adult child i provides care in time t. K_{it} refers to number of own children an adult child i has in time t and F_i equals to 1 when adult child i is female. X_{it} includes demographic characteristics of adult i such as age, age squared, education, marital status and home ownership. Z_{it} refers to the demographic characteristics of their elderly parent such as age, education, gender, region and permanent income quintile. λ_t is time fixed effects. The coefficient of interest is β_2 where number of own children is interacted with the gender of the adult child.

6.2 Results

The results from the probit estimates are reported in Table 10. Column (1) refers to the probit estimates without any control variables, Column (2) refers to the probit estimates with child characteristics, and Column (3) refers to the probit estimates with child and parent characteristics. The interaction terms between number of own children and the gender of the adult child are reported. Unconditional probit estimates show that having 4 or 5 children increases the likelihood of caregiving by daughters by 2.5% and 2.8%, respectively. However, these effects dissipate as we control for demographic characteristics. This suggests that time constraint channel and the opportunity cost channels are possibly both at play. The predictive margins in Figure 7 presents the daughter's probability of providing care is already higher than sons even when neither adult child has their own child. However, additional number of own children does not change the probability that daughters provide care to their parent. Regardless of number of own children, daughters have higher propensity to care. The effect of gender norm channel may also dominate against the opportunicy cost channel as well.

As for sons, number of own children statistically significantly decreases the likelihood that sons provide care. For instance, having one own child lowers probability to provide care to their elderly parent by 2.3% compared to the base case when sons do not have any own child. This percent increases to 4% when adult son has 5 or more own children. As we control for

[22]Given the panel set up of my analysis, running fixed effect probit model is possible. However, Greene (2002) finds that fixed effects and random effects probit is biased and substantially so when N gets larger. I thus opt for pooled cross-section in this analysis and control for time fixed effects, instead.

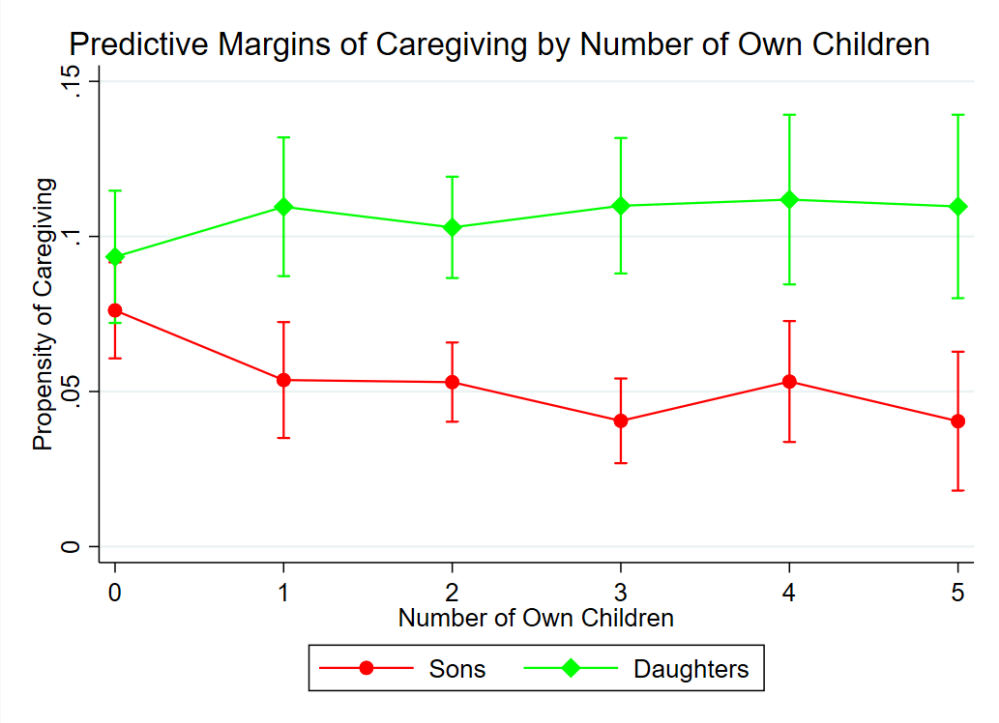
Table 10: Marginal Probability of Caregiving on Own Children

	(1)	(2)	(3)
Daughter × (own child=1)	.007	.0189	.005
	(.012)	(0.017)	(.012)
Daughter × (own child=2)	.013	.021	-.002
	.011	(0.015)	(.010)
Daughter × (own child=3)	.015	.019	-.000
	.012	(.016)	(.011)
Daughter × (own child=4)	.025*	.030	-.000
	.014	(.020)	(.012)
Daughter × (own child=5)	.028*	.024	-.014
	(.015)	(.022)	(.013)
Son × (own child=1)	-.02**	-.019	-.023***
	(0.008)	(0.013)	(0.008)
Son × (own child=2)	-.013	-.026**	-.018**
	(.008)	(0.011)	(0.033)
Son × (own child=3)	-.019**	-.024**	-.033***
	(.008)	(0.012)	(0.008)
Son × (own child=4)	-.015	-.023*	-.028***
	(.01)	(0.014)	(0.009)
Son × (own child=5)	-.027***	-.044***	-.040***
	(.81)	(0.013)	(0.008)
Child Controls	no	yes	yes
Parent Controls	no	no	yes
Observations	33,578	13,113	12,077

Notes: The average marginal effects are from probit model of caregiving on number of own children using adult children of single elderly individuals aged 65 and over in the pooled 1998-2014 Health and Retirement Study. Column (1) represents an unconditional probit estimate of caregiving on number of own children interacted with gender of the adult children. Column (2) includes adult child characteristics such as age, age squared, education, marital status and home ownership. Column (3) includes controls on adult child characteristics and elderly parent's characteristics such as age, education, gender, region and permanent income quintile. Time and parent's cohort fixed effects are included. Robust standard errors clustered at the family level are in parentheses. * p<0.10, ** p<0.05, ***p<0.01

demographic characteristics of adult child and their parents, the marginal effects gain more statistical significant. Given the positive correlation between number of children and wages, this implies that the opportunity cost channel is dominant for adult sons.

Figure 7: Results from Probit Estimates



Notes: The results are from probit estimates of caregiving in Model 3 in Table 10. The green line refers to the predictive margins of daughters and the red line refers to predictive margins of sons.

7 Conclusion

As demography ages, so is the demand for family care. Due to high price tag of formal care and stringent access to public insurance through Medicaid, families bear the brunt of the caregiving burden. In this paper, I examine the interaction of multiple adult children in a game-theoretic model that treats parent's well-being as public good. Each adult child voluntarily provides care. My model allows for heterogeneity in preferences among adult children in addition to heterogeneity in wages. Additionally, I allow for a range of interaction between number of own children (of the adult child) and family care time the adult child provides to their elderly parent.

I test my model predictions using the Health and Retirement Study. I find that heterogeneity in preferences are, to some extent, shaped by gender norm. Given the strong

concentration of women caregivers in family care provision, especially at levels of intenstive family caregiving, understanding how gender norm plays a role in the observed patterns of caregiving is important as policymakers move forward to tackle the rapidly increasing family care demand in the United States. Lastly, I find that daughters provide family care at a high propensity regardless of number of own children. This could be due to the persistence in gender norm despite the data showed a positive association between number of children and wages for women as well as men. On the contrary, I find that men's propensity to provide care to their parent lowers as they have more children, which is likely dominated by the opportunity cost channel.

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Appendix A More on Multiple Children Caregivers

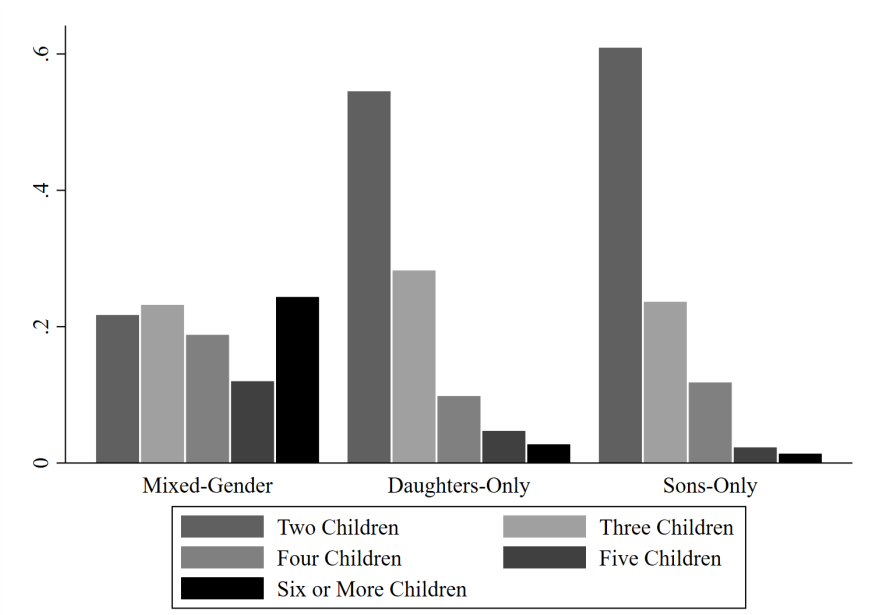
Table 11: Caregiving Arrangement by Number of Caregivers

		Caregiving Arrangement	
	Provide care	Take turns	Simultaneous
One caregiver	82%	-	-
Multiple caregivers	88%	52%	48%

Notes: The sample includes 3,261 observations when a parent is sick, disaggregated by how many caregivers the parent has over the 1998-2014 sample period. The observations are from 1,340 parents aged 65 and over with multiple multiple children and at least one caregiver. Provide care refers to the periods when a caregiver child provides care to the sick parent. For multiple children caregivers, in each period they either take turns (i.e. one providing care in some periods and another providing care in other periods) or provide care simultaneously in the same period (over two years).

Appendix B More on Gender Composition of Children

Figure 8: Distribution of Adult Children By Family Types



Notes: The sample includes single individuals aged 65 and over with at least one adult child in the pooled 1998-2014 Health and Retirement Study. "Mixed-Gender" refers to the set of families that have both sons and daughters, "Daughters-Only" refers to the set of families that only have daughters, and "Sons-Only" refers to the set of families that have only sons.

Table 12: Characteristics and Gender Composition of Children: Families with One Caregiver

	All		Mixed-Gender		Daughters-Only		Sons-Only	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Age	59.2	58.8	58.7	58.4	60.1	60.1	60.7	61.0
Female	0.63	0.44	0.68	0.42				
Married	0.62	0.70	0.59	0.70	0.60	0.68	0.79	0.79
Home ownership	0.66	0.69	0.65	0.68	0.65	0.76	0.70	0.77
College	0.28	0.24	0.26	0.23	0.27	0.27	0.37	0.37
Working full-time	0.56	0.61	0.57	0.62	0.47	0.51	0.63	0.66
Working part-time	0.10	0.07	0.11	0.07	0.12	0.09	0.06	0.06
Earns >$35,000	0.55	0.62	0.53	0.60	0.56	0.71	0.61	0.72
Lives within 10 miles	0.70	0.31	0.72	0.31	0.69	0.28	0.62	0.34
Informal care (hrs/wk)	24.3	-	25.5	-	26.3	-	15.9	-
Provides >20 hrs/wk	0.29	-	0.30	-	0.28	-	0.23	-
Observations	8,784	3,934	2,630	7,270	697	858	607	626
Total	12,718		9,900		1,555		1,233	

Notes: The sample includes adult children of 65+ single individuals with long-term care needs who has two or more children with only one child as caregiver in the pooled 1998-2014 Health and Retirement Study. Column (1) refers to the child who provides informal care to the parent and Column (2) refers to the rest of the children who do not provide informal care. "All" refers to the whole sample, "Mixed-Gender" refers to the set of families that have both sons and daughters, "Daughters-Only" refers to the set of families that only have daughters, and "Sons-Only" refers to the set of families that have only sons.

Table 13: Characteristics and Gender Composition of Children: Families with Multiple Caregivers

	Mixed-Gender			Daughters-Only			Sons-Only		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Age	52.3	52.7	52.9	54.8	53.4	54.4	55.3	54.7	57.0
Female	0.68	0.60	0.41						
Married	0.58	0.65	0.67	0.67	0.68	0.60	0.59	0.77	0.83
Home ownership	0.61	0.72	0.60	0.72	0.78	0.50	0.62	0.73	0.88
College	0.25	0.26	0.20	0.32	0.40	0.34	0.49	0.44	0.22
Working full-time	0.55	0.63	0.63	0.46	0.60	0.53	0.66	0.77	0.72
Working part-time	0.10	0.09	0.08	0.11	0.10	0.13	0.09	0.03	0.05
Earns >$35,000	0.50	0.56	0.57	0.58	0.69	0.51	0.72	0.85	0.87
Lives within 10 miles	0.67	0.60	0.34	0.66	0.49	0.35	0.72	0.65	0.31
Informal care (hrs/wk)	26.5	8.8	-	28.6	13.5	-	16.5	5.2	-
Provides >20 hrs/wk	0.34	0.11	-	0.34	0.19	-	0.18	0.03	-
Observations	2296	3083	5490	335	377	175	200	222	77
Total		10,869			887			499	

Notes: The sample includes adult children of 65+ single individuals with long-term care needs who has two or more children with more than one child as caregivers in the pooled 1998-2014 Health and Retirement Study. Column (1) refers to the child who provides the most informal care hours to the parent over the sample period, Column (2) refers to the children who provide some (but not most) informal care hours over the sample period, and Column (3) refers to the rest of the children who did not provide informal care hours to their parent. "Mixed-Gender" refers to the set of families that have both sons and daughters, "Daughters-Only" refers to the set of families that only have daughters, and "Sons-Only" refers to the set of families that have only sons.