Elderly Care across Europe: The Role of Informal and Formal Care*

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Abstract

This paper studies the relationship between time allocation decisions and the provision of elderly care. Using a sample assembled from European survey data, first I document the existence of a substantial degree of heterogeneity in the use of formal and informal care across Europe, giving place to different patterns in time allocation and care provision. In order to rationalize these findings, I develop and estimate a structural model which features working-age individuals and their parents making decisions on consumption, market work, and care in a static, discrete choice game of complete information.

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I. Introduction

Population aging is an important demographic trend in most advanced economies. As a consequence of the large baby-boomer cohorts reaching retirement age, the continued rise in life expectancy, and the low fertility rate over the last four decades, the ratio of people aged 65 or above to those aged 15 to 64 is growing significantly. Having increased from 25% to 29.6% between 2010 and 2016 in the European Union, this ratio is projected to rise up to 51.2% by 2070. It will thus move from four working-age individuals per person older than 65 in 2010 to around two working-age individuals in 2070. During the same period, the share of people who need help to carry out their daily activities is set to increase by 21%, and that of individuals with strong limitations due to health problems by 25% (European Commission, 2018, 2019). As a result of this demographic shift, the demand for elderly care is very high and will likely increase in the future.

Elderly care can be defined as the set of activities which aim to improve the quality of life of older adults who are not fully able to look after themselves because of terminal illness or permanent physical and cognitive decline. This can include assistance with activities of daily living (ADL) such as dressing, bathing, grooming, using the toilet, eating, and getting in and out of bed; and support to perform instrumental activities of daily living (IADL) such as shopping, cooking, managing medications, doing housework, and settling financial or legal matters (Clancy, Fisher, Daigle, Henle, McCarthy and Fruhauf, 2019).

Elderly care arrangements have important implications for care recipients and their families. On the one hand, the use of institutional care alternatives such as nursing homes or hospices can place a burden on household finances, and often involve social and psychological costs for the care recipients (Macken, 1986). On the other hand, care provided by family members can impose substantial opportunity costs in terms of time and foregone labor earnings on caregivers (Skira, 2015; Korfhage, 2019), apart from being psychologically demanding (Ory, Hoffman, Yee, Tennstedt and Schulz, 1999; Cannuscio, Jones, Kawachi, Colditz, Berkman and Rimm, 2002; Pinquart and Sörensen, 2003). It is well-known that the children of the care recipients represent one of the most important sources of help. These are usually middle-aged individuals for whom the willingness to provide care to their parents is in conflict with the aforementioned costs, which plays a role in their time allocation decisions. In this context, understanding how elderly care arrangements are made and their consequences is relevant for the design of optimal long-term care systems.

In this paper, I study the factors which determine the arrangements made by

families to care for the elderly in Europe. Although the rising demand for elderly care is a matter of concern in many countries, its analysis is of particular interest for European economies. One reason for this is the existence of a substantial degree of heterogeneity with respect to the availability of public long-term care services across the continent that has been documented in the literature (Attias-Donfut, Ogg and Wolff, 2005; Crespo and Mira, 2014; Barczyk and Kredler, 2019). While Northern European countries exhibit the highest shares of public expenditure on long-term care over GDP (3.2% in Sweden; 2.5% in Denmark), Southern European countries devote less resources to it (1.7% in Italy; 0.9% in Spain), with Central European countries falling in the middle (European Commission, 2019). On top of that, family ties have been found to be weaker in Northern and Central European countries than in Southern countries (Reher, 1998; Kohli, Kunemund and Ludicke, 2005). As a consequence, the use of *informal care* provided by relatives of the care recipient as the only means of help is more prevalent in the south of Europe than in the north. The opposite happens with the *formal care* provided by means of professional services in the house of the care recipient or in institutional facilities.

In order to understand how time allocation decisions and socioeconomic characteristics lead to these differences, I propose to model the interactions among family members at the time of making these choices as a static game of complete information. In this setup, working-age individuals make simultaneous decisions on their employment status (to be employed or non-employed) and care given to their parents (to give informal care or not), while the parents decide whether to buy formal care. When making these choices, agents are constrained by the available amount of time, labor earnings and parental wealth. I fit this model to data from the Survey of Health, Ageing and Retirement in Europe (SHARE) for the period 2013-2015. SHARE is particularly suitable for this study, since it collects detailed information about the living conditions of a representative sample of people aged 50 and older in Europe. Using a set of eight countries, I take advantage of the cross-country variation offered by these data and estimate the parameters of the model separately for three groups (Northern, Central and Southern Europe) by maximum simulated likelihood.

This paper contributes to the literature in several ways. First, it intends to clarify the role of the factors which shape elderly care arrangements in Europe. Economists have long been interested in the determination of elderly care arrangements and their relationship with the time allocation decisions made by families. In particular, there is an extensive literature that studies the labor market outcomes of caring for old parents (e.g. Wolf and Soldo (1994), Ettner (1996), Johnson and Lo

Sasso (2000), Van Houtven, Coe and Skira (2013) for the United States; Carmichael and Charles (1998), Spiess and Schneider (2003), Heitmueller (2007), Bolin, Lindgren and Lundborg (2008), Casado-Marín, García-Gómez and López-Nicolás (2010), Michaud, Heitmueller and Nazarov (2010), Crespo and Mira (2014), Schmitz and Westphal (2017) for Europe). Much of this work aims to estimate the effect of taking care of parents on labor supply by relying on reduced-form specifications and different approaches to correct for reverse causality and endogeneity bias. The estimates obtained by these studies range from being negligible to negative and statistically significant, depending on the sample and the empirical strategy used. In my model, the parameters to be estimated describe the preferences of the agents and the constraints they face at the time of making their labor and care choices, which allows me to analyze the role that institutions, cultural traits and other factors play in determining them.

With the aim of disentangling the elements which drive these decisions, some authors have proposed structural models which endogeneize the outcome of the relationship between elderly care and the allocation of time to other tasks. These models vary along several dimensions. In the first place, some of them involve only one decision-maker, usually an adult child whose parent is in need of help, as in Skira (2015) and Korfhage (2019). Although this assumption simplifies modeling and estimation considerably, it dismisses some important mechanisms. Other authors have addressed this concern by modeling the interaction between the child and her parent, as in Dobrescu and Iskhakov (2013), Barczyk and Kredler (2018), Canta, Cremer and Gahvari (2020), Ko (2020), Mommaerts (2020), and Barczyk, Fahle and Kredler (2022). In these settings, the child is allowed to provide informal care out of altruism or in order to prevent depletion of her inheritance on formal care. Nevertheless, in practice several family members may participate in the family's care decision, and these may disagree on what needs to be done to meet the needs of the care recipient. Moreover, the decision to give care to parents may depend on the amount of care given by other relatives, generating free-riding incentives. Alternatively, if parents decide to allocate a larger bequest to the children who spend more time taking care of them, siblings might compete to obtain a greater share of inheritance. The possibility of such strategic interplay suggests that a non-cooperative game may be the appropriate framework to analyze elderly care arrangements. In this regard, my paper would be most closely related to Byrne, Goeree, Hiedemann and Stern (2009) who estimate a game-theoretic model of elderly care and family decision making using data from the United States. To the best of my knowledge, my paper is the first to apply a game-theoretic model to study the

provision of elderly care in Europe.

Among other relevant dimensions, some authors argue that both care and living arrangements (whether children and parents live together or separately) should be modeled, as in Hoerger, Sloan and Picone (1996) and Pezzin and Schone (1999). Others also underscore the forward-looking nature of care and time allocation decisions, making emphasis on the opportunity costs of caregiving in terms of labor force participation and human capital accumulation (Skira, 2015; Korfhage, 2019), and the decisions to save and buy insurance (Ko, 2020; Mommaerts, 2020). In this paper, I will overlook these aspects, taking living arrangements as given and opting for a static setting that focus on the interactions among family members.

Finally, I exploit the cross-country variation offered by the data to compare different markets. With a few exceptions such as Dobrescu and Iskhakov (2013) and Dobrescu (2015), most of the work in the elderly care literature focus on the study of a single market. The comparison of three different country pools in this paper allows me to learn about the ways in which the forces driving elderly care arrangements manifest in different contexts.

The remainder of the paper is organized as follows. I present some descriptive evidence on elderly care provision across Europe in Section II. I develop the model in Section III. I discuss identification and estimation in Section IV.

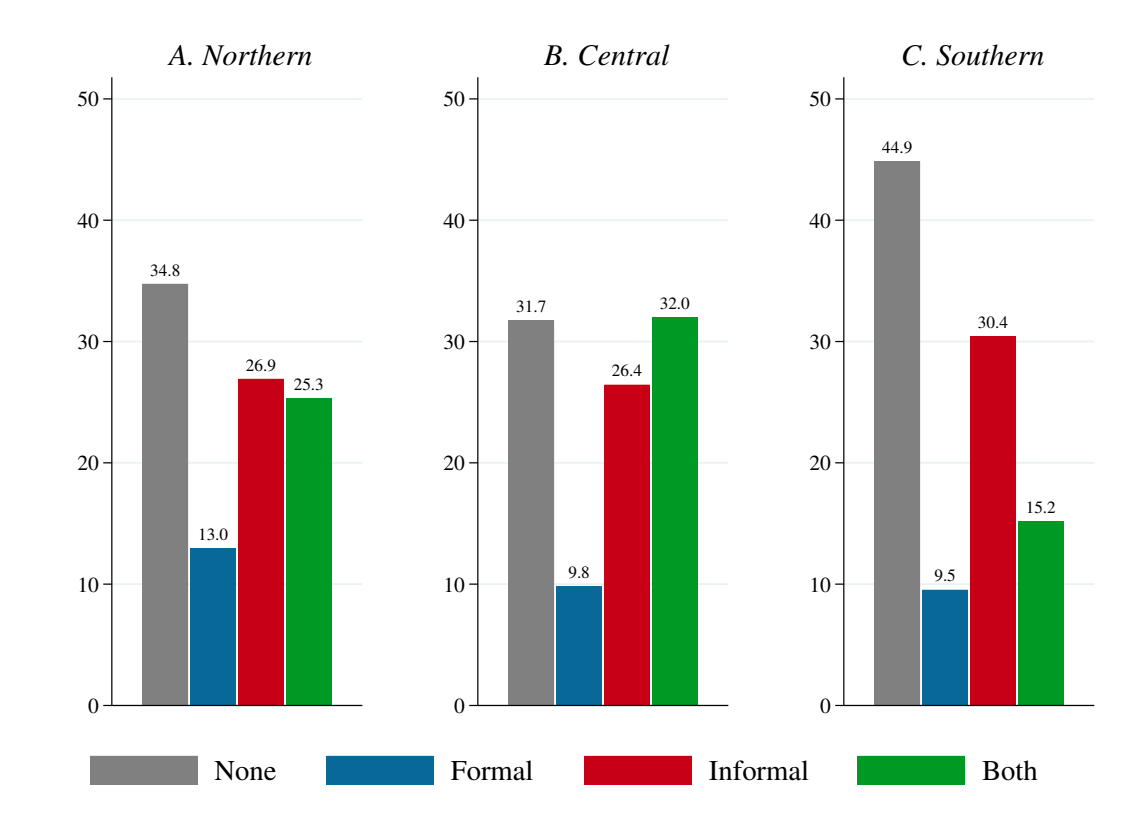
II. Data and Facts

This section provides descriptive statistics which offer a general picture about the provision of elderly care across Europe, based on data from the Survey of Health, Ageing and Retirement in Europe (SHARE). I focus on eight countries, which I group in three areas according to differences in the availability of public care services (Bolin, Lindgren and Lundborg, 2008; Crespo and Mira, 2014; Dobrescu, 2015): Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). This partition is also meant to capture differences in family ties across Europe that could be relevant in shaping the preferences for the provision of care (Reher, 1998; Kohli, Kunemund and Ludicke, 2005).

Figure 1 illustrates the existent degree of heterogeneity in the use of informal and formal care across Europe. The figure shows the share of people aged 70 or older with difficulties to perform activities of daily living who receive only formal care, only informal care, both types of care, or no care at all in Northern, Central and Southern Europe. In Southern countries, the use of informal care as the only means of help for the elderly is more prevalent (30.4% of cases) than in Northern

European (26.9%) and Central European countries (26.4%). In turn, the share of individuals who receive both types of care in these two regions is larger (25.3% and 32%) than in the South (15.2%), while the shares of individuals who receive only formal care are similar (13% in Northern Europe, 9.8% in Central Europe, and 9.5% in Southern Europe).

FIGURE 1: TYPE OF CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER WITH CARE NEEDS (%, 2015)

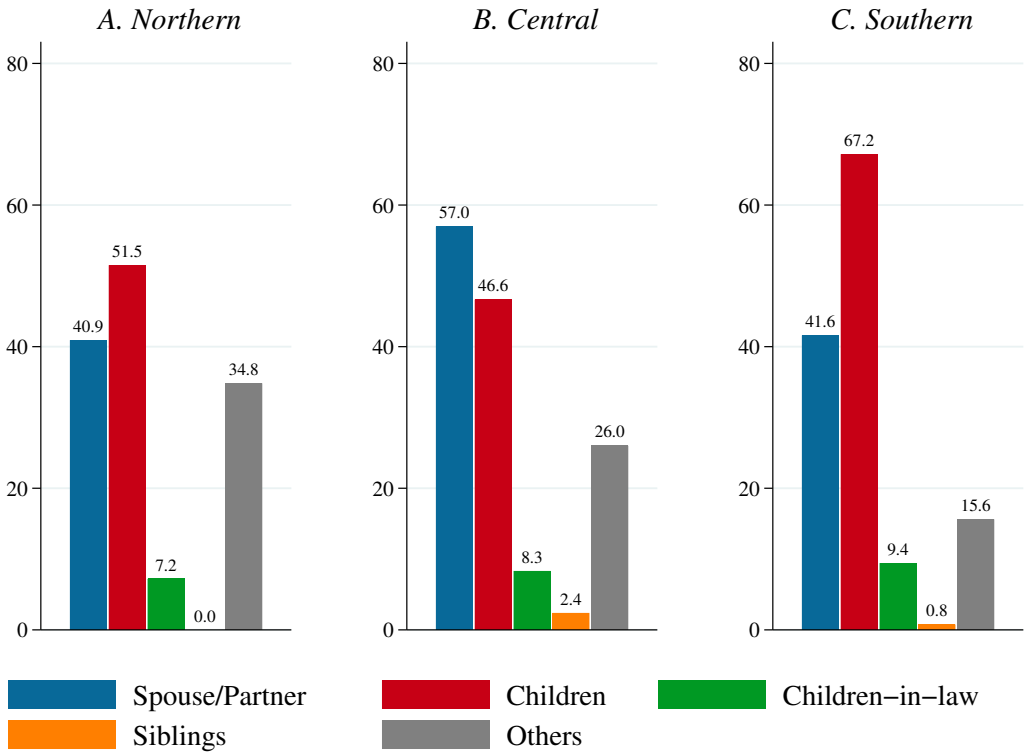


Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive each type of care in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 6.

These discrepancies in the combination of care types across regions suggest that there might be differences in the burden which elderly care represents for the children of the care recipients, who are, with spouses, the most common source of informal care, as Figure 2 points out. In fact, as Figure 3 implies, the three regions under study also differ in this aspect. The figure shows that the share of individuals aged 70 or older who receive care from their children on a daily basis in Southern Europe is more than ten and two times higher than in Northern Europe and Central Europe, respectively. In contrast, families in these two regions rely more heavily on formal

home care and nursing home services (58.7% in Northern Europe and 61.3% in Central Europe) than in Southern countries (44.8%).

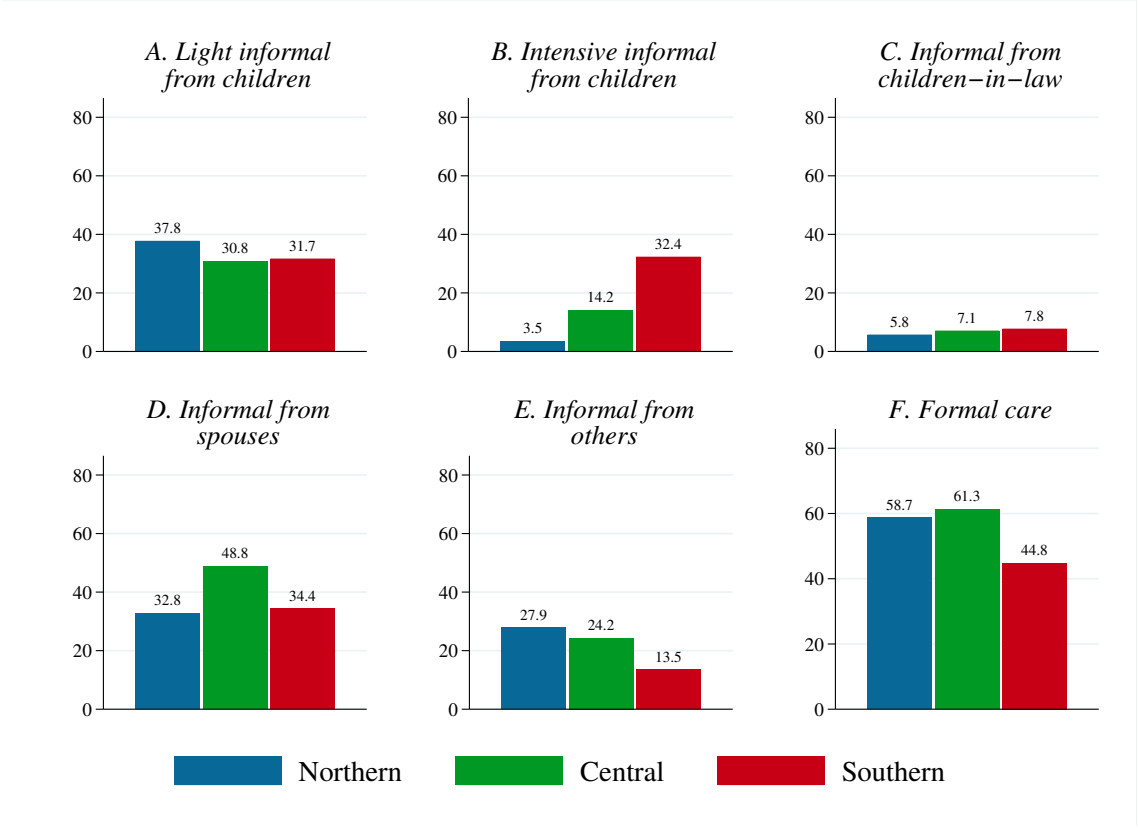
FIGURE 2: SOURCES OF INFORMAL CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER WITH CARE NEEDS (%, 2015)



Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive informal care from each source, conditional on receiving some informal care, in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). The alternatives are not mutually exclusive. *Source:* SHARE Wave 6.

Figures 4 and 5 provide insight into the relationship between elderly care and the labor supply decisions made by the children of the potential care recipients, and how these might be affected by the aforementioned patterns in caregiving across the continent. First, in Central and Southern Europe, individuals who give informal care to their parents are less likely to be employed than those who are not giving any care. Second, there are differences in the intensive margin. In the three regions, individuals who take care of their parents on a daily basis are less likely to be full-time employed than people who are not daily caregivers. While the share of full-time employment among individuals who do not give any care to their parents is 86.4% in Northern Europe, 79.1% in Central Europe, and 67.8% in Southern Europe, these shares fall

FIGURE 3: TYPE OF CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER WITH CARE NEEDS (SIX OPTIONS, %, 2015)

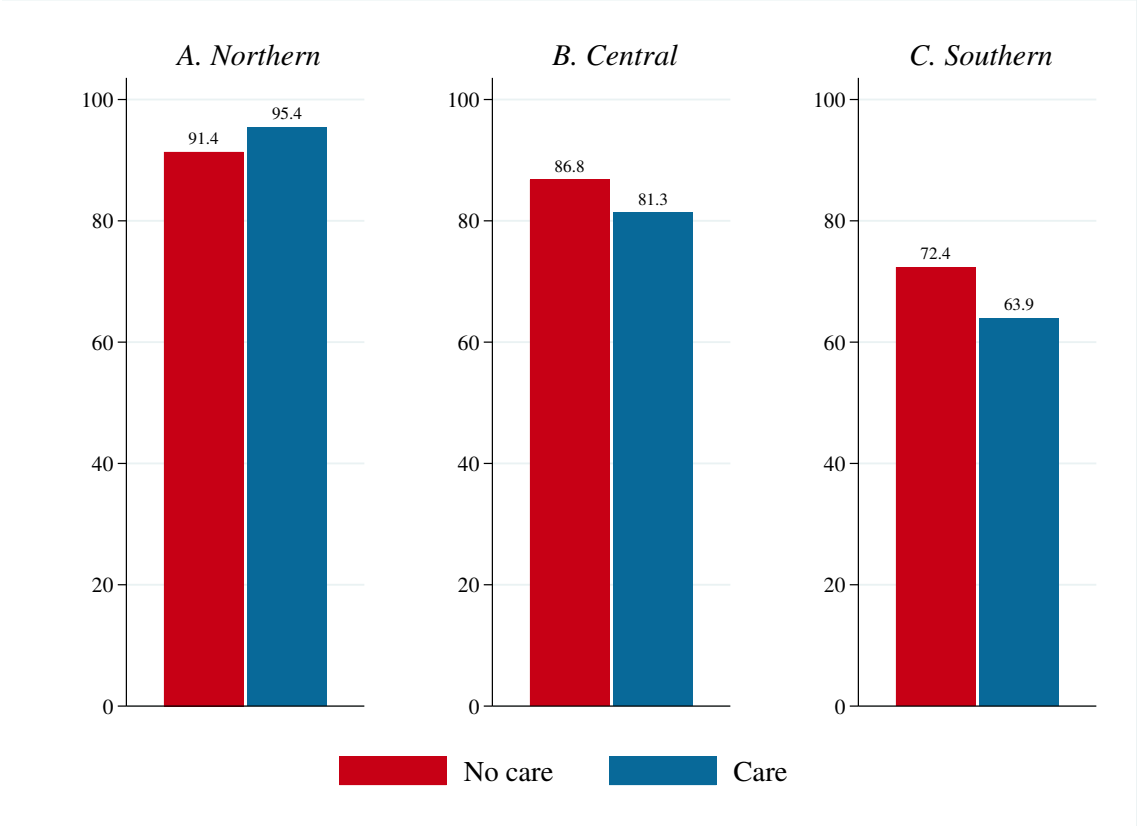


Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive each type of care, conditional on receiving some care, in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). Care alternatives are not mutually exclusive. Informal care is defined as *intensive* when is provided on a daily basis, and as *light* when is provided on a less than daily basis. *Source*: SHARE Wave 6.

down to 67.4%, 60.3% and 53%, respectively, among daily caregivers. Nonetheless, in Northern and Central European countries, informal caregivers seem to be able to substitute full-time employment by part-time employment, a tendency that is not observed in Southern Europe, where there is a high prevalence of full-time jobs over part-time jobs. In Southern countries, the share of individuals who are part-time employed is higher among daily caregivers (7.3%) than among non-caregivers (4.6%) and less-than-daily caregivers (0.4%). As for the share of non-employed people, it is higher in Southern Europe, where the gap between the share of non-employed caregivers and the share of non-employed, non-caregivers is the largest among the three groups of countries.

On top of the geographical differences outlined previously, it is possible to find

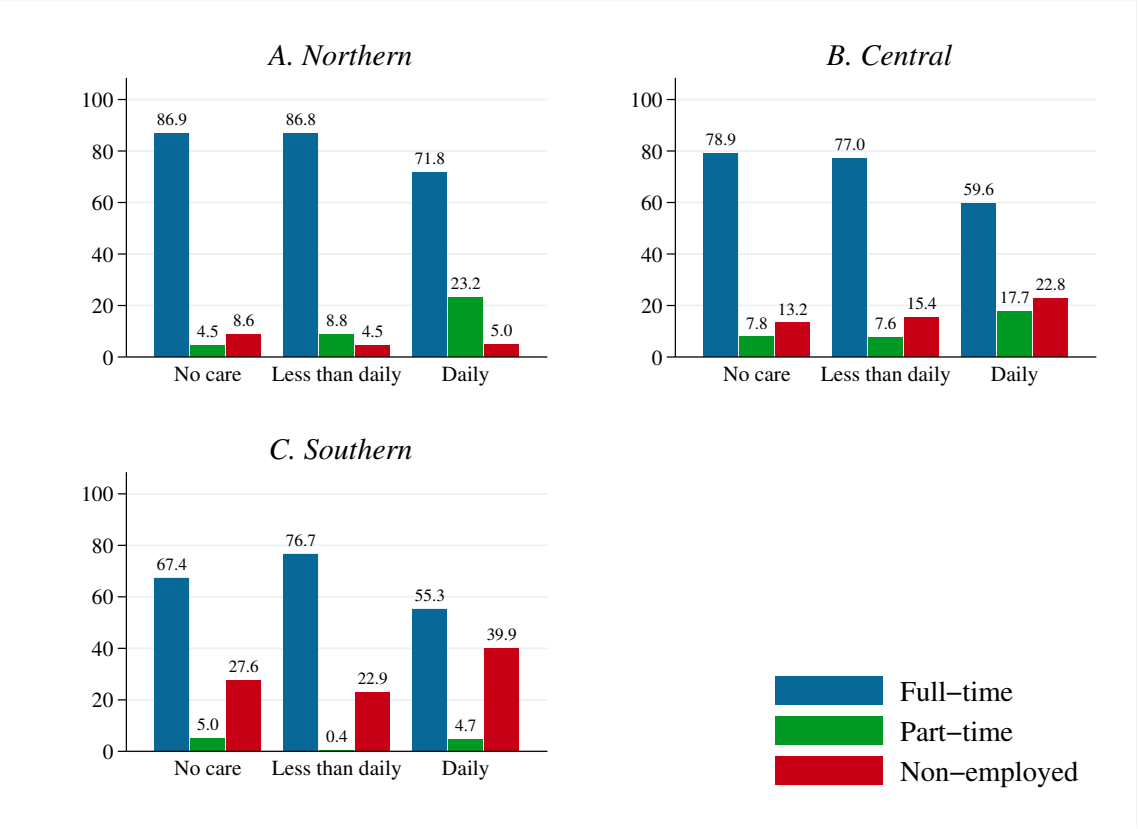
FIGURE 4: EMPLOYMENT STATUS OF CHILDREN AND INFORMAL CARE RECEIVED BY RESPONDENTS WITH CARE NEEDS (%, 2015)



Note: The figure plots the shares of individuals who are between 30 and 60 years-old, have at least one parent with care needs who is aged 70 or older, and are employed, or non-employed while giving informal care or no care at all. The data corresponds to Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 6.

disparities between men and women. First, as pointed out by Table B1, women are more likely to need care than men, and among those who do, as shown in Figure B1, women also have a higher probability of receiving care in the three country pools considered. Second, as suggested by Figure B2 and Figure **??**, conditional on receiving care, women have a higher chance of receiving informal care from their children than men, whereas men rely on informal care given by their partners more heavily than women. Third, as can be seen in Figure B5, when the children of potential care recipients are considered, daughters are less likely to be full-time employed than sons, and the employment choices of the former present a larger variability across caregiving choices than those of the latter. In any case, these differences between men and women are robust after controlling for individual characteristics that may be relevant in this context (see Tables B2-B5).

FIGURE 5: EMPLOYMENT STATUS OF CHILDREN AND FREQUENCY OF INFORMAL CARE RECEIVED BY RESPONDENTS WITH CARE NEEDS (%, 2015)



Note: The figure plots the shares of individuals who are between 30 and 60 years-old, have at least one parent with care needs who is aged 70 or older, and are full-time employed, part-time employed or non-employed while giving informal care on a daily basis, informal care less frequently or no care at all. The data corresponds to Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 6.

III. Model

The model is a static, simultaneous-move game of complete information which features family members from two generations making decisions. The decision makers include an old parent (or a couple of parents as a decision unit) and their working-age children.[1] The younger generation can allocate time to informal care and market work, and can spend their labor earnings on consumption. Meanwhile, the parents can spend their wealth on consumption and formal care. Subject to these constraints, each family member makes her choices to maximize utility, taking the behavior of the other agents in the family as given. As a result, the outcome of

[1]The use of female pronouns from now on does not mean that only mothers receive care or that only daughters provide care. Instead, I use female pronouns as generic pronouns.

this game is a Nash equilibrium where the parents can receive care from multiple sources. Therefore, agents in this model face a number of trade-offs. On the one hand, if a child increases her labor supply, she will able to enjoy from a higher consumption level. On the other hand, an increase in her labor supply implies a reduction in the amount of time available for informal care. This conflict can be avoided if the parents buy formal care services, which in turn implies a reduction in their consumption level. Moreover, the decision to provide informal care or buy formal care of each agent depends on the choices made by the other family members. The result of this interaction will be influenced by several factors. First, caregiving may be more burdensome for some children than for others, while the opportunity costs in terms of forgone labor earnings may vary across them, creating free-riding incentives in the provision of informal care. Second, the parents, who have preferences over informal and formal care, might perceive differences in the quality of the care provided by each family member.

A. Choices

In my model, a family is composed of a parent or a couple of parents, and their children, who are indexed by $i = 1, 2, ..., N$. The children make simultaneous decisions that concern their employment status and the provision of informal care for their parents. Let a_i denote the choice (or action) of child i. Each child can choose among four mutually exclusive alternatives: to be non-employed and give her parent no informal care, $a_i = \text{NENC}$; to be employed and give her parent no informal care, $a_i = \text{ENC}$; to be non-employed and give informal care, $a_i = \text{NEIC}$; and to be employed and give informal care, $a_i = \text{EIC}$. Therefore, a child's set of choice alternatives is $\mathcal{A}_i \equiv \{\text{NENC}, \text{ENC}, \text{NEIC}, \text{EIC}\}$. The actions of all the children in the family are collected by vector $\boldsymbol{a} \equiv (a_1, ..., a_N)$, which is an element of $\mathcal{A} \equiv \mathcal{A}_1 \times ... \times \mathcal{A}_N$.

At the same time, the parents make consumption and formal care decisions. Let b denote their choice concerning formal care, which can be either to buy formal care, $b = \text{FC}$; or not, $b = \text{NFC}$. Thus, the parents' action set is $\mathcal{B} \equiv \{\text{NFC, FC}\}$. The actions of all the family members are collected by vector $\boldsymbol{d} \equiv (\boldsymbol{a}, b)$, which takes values in set $\mathcal{D} \equiv \mathcal{A} \times \mathcal{B}$.

B. Preferences

Each child draws utility from consumption and the chosen combination of employment status and informal care. I assume that child i's utility is linear and additively separable between an observable and an unobservable component. In particular, her

utility of choosing action a is

$$U_{ia} = \boldsymbol{\alpha}_a(\boldsymbol{x}) + \beta C_i(\boldsymbol{d}, \boldsymbol{x}) + \epsilon_{ia}. \tag{1}$$

where $\boldsymbol{\alpha}_a(\boldsymbol{x})$ is meant to capture her preferences over combinations of elderly care and employment status, given the set $\boldsymbol{x} \in \mathcal{X}$ of observable characteristics in the family; $C_i(\boldsymbol{d}, \boldsymbol{x})$ denotes the consumption level of child i when the family is playing outcome $\boldsymbol{d}$, and ϵ_{ia} is a choice-specific, random preference shock which is common knowledge to all the family members, but unobserved for the econometrician. I assume that this preference shock is independent and identically distributed (i.i.d.) with probability density function g_{ϵ_i}.

The parents have linear and additively separable preferences over consumption and care. Their choice-specific utility is

$$V_b = \gamma C(\boldsymbol{d}, \boldsymbol{x}) + \delta_{1b} F(\boldsymbol{d}, \boldsymbol{x}) + \delta_{2b}\text{spouse} + \delta_{3b} \sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x}) + \delta_{4b}\text{others} + \zeta_b, \tag{2}$$

where $C(\boldsymbol{d}, \boldsymbol{x})$ is the consumption level that she enjoys when the family plays outcome $\boldsymbol{d}$, $F(\boldsymbol{d}, \boldsymbol{x})$ is the number of hours of formal care that she decides to buy, and $\sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x})$ is the number of hours of informal care provided by the children. Utility also depends on other sources of informal care, through dummies for care given by one of the couple members and other sources. While the number of hours of informal care given by the children depends on the decisions that these make in the model, the number of hours of informal care given by spouses and other potential caregivers are exogenous. I assume that formal care and the three types of informal care considered are perfect substitutes, which is in line with empirical evidence on the relation between different types of care (Van Houtven and Norton, 2004; Charles and Sevak, 2005; Coe, Houtven and Goda, 2020). In the same way as the children, ζ_b is an i.i.d., choice-specific preference shock that is common knowledge to all the family members, but unobserved for the econometrician. The preference shocks of the parents are jointly distributed with the shocks of their children with density $g_{\boldsymbol{\epsilon},\zeta}(\boldsymbol{\epsilon}, \zeta) = \prod_{i=1}^{N} g_{\epsilon_i} g_{\zeta}$.

C. Constraints

At the time of making her choices, child i must comply with the budget constraint

$$C_i(\boldsymbol{d}, \boldsymbol{x}) \leq w(\boldsymbol{z}_i) N_i(\boldsymbol{d}, \boldsymbol{x}), \tag{3}$$

which states that her consumption level is limited by her labor earnings. These are determined by the number of hours worked N_i, which depends on the action that she takes, and the hourly wage w, which is a function of a set of observable, individual characteristics collected in $\boldsymbol{z}_i$, a subset of $\boldsymbol{x}_i$.

The parents can spend her wealth W on consumption $C(\boldsymbol{d}, \boldsymbol{x})$ and hours of formal care by paying an hourly price q, as implied by

$$0 \leq C\left(\boldsymbol{d}, \boldsymbol{x}\right) + qF\left(\boldsymbol{d}, \boldsymbol{x}\right) \leq W. \tag{4}$$

D. Equilibrium

Let $\boldsymbol{U}_i = \left(U_i\left(\boldsymbol{d}, \boldsymbol{x}, \epsilon_i\right)\right)_{\boldsymbol{d}\in\mathcal{D}}$ and $\boldsymbol{V} = \left(V\left(\boldsymbol{d}, \boldsymbol{x}, \zeta\right)\right)_{\boldsymbol{d}\in\mathcal{D}}$ be vectors collecting the payoffs of child i and the parents, respectively, for each possible outcome $\boldsymbol{d} \in \mathcal{D}$ of the game played by their family. By gathering the payoff vectors of the N children in the family and the parents, it is possible to write matrix $\boldsymbol{U} = (\boldsymbol{U}_1, ..., \boldsymbol{U}_N, \boldsymbol{V})$. Given their knowledge about the observable characteristics in $\boldsymbol{x}$ and the preference shocks $(\boldsymbol{\epsilon}, \zeta)$, the parents and their children take a discrete action simultaneously in order to maximize their respective payoffs. Let σ_i and π be a strategy of child i and the parents, respectively. Then, a strategy vector $(\sigma_1^*, ..., \sigma_N^*, \pi^*) \equiv (\boldsymbol{\sigma}^*, \pi^*)$ is a Nash equilibrium of the game played by the family members if and only if each player's strategy is a best response, that is, if for every $i \in N$ and every possible strategy,

$$\begin{aligned} U_i\left(\boldsymbol{\sigma}^*, \pi^*, \boldsymbol{x}, \epsilon_i\right) &\geq U_i\left(\sigma_i, \boldsymbol{\sigma}_{-i}^*, \pi^*, \boldsymbol{x}, \epsilon_i\right) \\ V\left(\boldsymbol{\sigma}^*, \pi^*, \boldsymbol{x}, \zeta\right) &\geq V\left(\boldsymbol{\sigma}^*, \pi, \boldsymbol{x}, \zeta\right), \end{aligned} \tag{5}$$

where $\boldsymbol{\sigma}_{-i}^*$ collects the best response of all the children in the family except for i.

IV. Identification and Estimation

This section provides a brief description of the data construction and variable definitions, which is expanded in Appendix C. It also presents the main identification arguments and gives an overview of the procedure to estimate the parameters of the model.

A. Sample selection and variable definitions

I estimate the model using individual data from Waves 5 and 6 of SHARE, spanning eight countries (Austria, Belgium, Denmark, France, Germany, Italy, Spain, and Sweden) in years 2013 and 2015. I target families where at least one of the parents is

retired, older than 70, has one or more limitations with activities of daily living, and whose children are between 30 and 60 years-old.[2] I obtain this information from the sample of age-eligible respondents of the survey who are potential care recipients and provide information about their children. I use this sample for estimation because it contains richer information about the use of different types of care than the sample of working-age respondents who may take care of their old parents. Besides, the sample of parents also contains some relevant characteristics of the children, such as age, gender, education, marital and employment status, elderly care decisions, and living arrangements.

Each observation in my sample is a child-parents dyad when the survey interview was conducted. All of the dyads which share the same parents constitute a family f playing the game described by my model. For each dyad, I observe the employment and elderly care decisions made by the child and her parents, represented by a_{if} and b_f, respectively, as well as the vector of observable characteristics $\boldsymbol{x}_{if}$, which contains child i's age and dummies for gender, education, distance to the parents' residence, marital status, and whether she has children, her parent is not widowed, and parental health.

I measure parental health status following Ko (2020), using information about limitations with activities of daily living (ADL) and cognitive impairment in SHARE.[3] Survey respondents take word recall, orientation and numeracy tests to measure their cognitive abilities. I categorize a respondent as cognitively impaired if she is in the bottom 10% of the cognitive score distribution of the sample. I classify an individual as having light care needs if she has difficulties with three or less ADLs and is not cognitively impaired, and as having severe care needs if she has more than three ADLs or cognitive impairment. Parental wealth W_f, also included in $\boldsymbol{x}_{if}$, is measured by the value of all financial and real assets of the respondent, net of any debts and liabilities, and adjusted for constant PPP exchange rates to allow for comparison across countries and over time.

In my model, the choice set concerning a child's employment status comprises two alternatives: to be employed, and to be non-employed, with a fixed number of hours of work assigned. The information collected by SHARE allows me to categorize the children of survey respondents according to their employment status, but there is no specific information on the number of hours worked by them. In order to overcome this problem, I assign each child in my sample the average number of hours worked

[2] I exclude children who are older than 60 to lessen the concerns over simultaneous retirement and caregiving decisions.

[3] Activities of daily living include dressing, bathing/showering, eating/cutting up food, walking across a room, and getting in/out of bed.

in the region to which her country belongs (Northern, Central or Southern Europe), taking the sample of survey respondents below 60 years-old as reference. Table 1 shows the value of this average for each country and region.

Table 1: Average Weekly Hours of Work and Care, Hourly Wages, and Hourly Prices of Formal Care

	Hours worked	Hours of informal care	Hours of formal care	Wage (euros/hour)	Price of formal care (euros/hour)
Denmark	37.08	3.01	27.15	30.36	3.02
Sweden	37.81	3.26	20.45	19.99	4.33
Northern Europe	37.56	3.14	23.16	23.66	4.16
Austria	34.12	6.28	32.04	19.77	4.27
Belgium	34.45	5.45	24.17	22.44	4.70
France	36.23	6.39	18.90	16.13	7.40
Germany	34.08	5.49	25.16	16.82	2.25
Central Europe	34.53	5.63	24.02	17.02	3.75
Italy	35.39	10.57	20.53	13.87	4.10
Spain	35.36	10.87	18.89	10.76	3.10
Southern Europe	35.38	10.64	19.98	12.92	3.65

Note: The table shows the hours worked, hours of informal care given to parents, hours of formal care received by parents, hourly wages and hourly prices imputed to individuals in the estimation sample. Further details about these computations can be found in Appendix C.1 and Appendix C.2.

The choice set concerning the child's informal care decision contains two alternatives: to give informal care, and not to give informal care. In my dataset, the child of a survey respondent is considered to give informal care to their parents if in the twelve months before the interview she helped her with personal care (dressing, bathing or showering, eating, getting in or out of bed, using the toilet), practical household help (home repairs, gardening, transportation, shopping, household chores), or help with paperwork (filling out forms, settling financial or legal matters). An analogous definition applies to the informal care given by the spouse of the care recipient and other sources such as siblings or children-in-law.

Parents in my model are allowed to choose between two alternatives: to buy formal care or not. In my dataset, respondents are considered to receive formal care if in the twelve months before the interview she stayed in a nursing home or residential care facility, or received professional care, help with domestic tasks or meals-on-wheels at home. Further details about the computation of the number of hours of care corresponding to each alternative can be found in Appendix C.1. The results of these computations are shown in Table 1. The proportions of combined

employment status and elderly care choices in my sample are reported in Table 2.

Table 2: Employment Status and Elderly Care Choices (%)

	NE, NC	E, NC	NE, IC	E, IC	NFC	FC
Denmark	9.32	75.52	1.65	13.50	75.96	24.04
Sweden	6.56	84.02	0.21	9.21	82.09	17.91
Northern Europe	7.54	81.01	0.72	10.73	80.04	19.96
Austria	7.16	75.87	0.94	16.04	70.73	29.27
Belgium	11.52	78.21	1.15	9.13	60.32	39.68
France	11.61	78.70	1.60	8.09	70.55	29.45
Germany	10.64	73.96	2.86	12.54	72.30	27.70
Central Europe	10.82	75.17	2.49	11.53	71.40	28.60
Italy	17.90	68.14	4.81	9.15	85.23	14.77
Spain	25.88	63.62	3.27	7.23	80.69	19.31
Southern Europe	20.34	66.76	4.34	8.56	83.97	16.03

Note: The table shows the shares of children and respondents who choose each combination of employment status and elderly care in the sample used for estimation of the model. The child's choice alternatives are *non-employment and no care* (NE, NC), *employment and no care* (E, NC), *non-employment and informal care* (NE, IC), and *employment and informal care* (E, IC). The parents' choice alternatives are *no formal care* (NFC), and *formal care* (FC).

Wage data comes from information on gross earnings for employees and number of hours usually worked per week in the main job, provided by the European Union Statistics on Income and Living Conditions (EU-SILC) for the set of countries and years under study.

Using the information in SHARE, I identify the hourly price of formal care services non-parametrically as the average price per hour of formal care in each region (see Appendix C.2 for further details). I assume that the unobservables $\epsilon_i(a)$ for $i = 1, ..., N$ and $\zeta(b)$ are independent and identically distributed as standard normal. Therefore, wages $w(\boldsymbol{z}_{if})$ and preference parameters $\alpha(\boldsymbol{d}, \boldsymbol{x})$, β, γ, δ_S, δ_K, and δ_O are left to be identified.

B. Wages

I assume that wage offers depend on a set $\boldsymbol{z}_{if}$ of observable characteristics of child i in family f, and are measured with error ξ_{if}, such that

$$\ln w_{if} = \boldsymbol{z}_{if}'\boldsymbol{\lambda} + \xi_{if}, \tag{6}$$

similar to Mincer (1974), with ξ_{if} being i.i.d. normal. Since I can only observe workers' wages in EU-SILC, I follow standard arguments in the self-selection literature (Heckman, 1974, 1979) to estimate $\boldsymbol{\lambda}$. In particular, $\boldsymbol{z}_{if}$ consists of a quadratic in child i's age, and dummies for gender, college education, and country of residence. The marital status of the child and whether she has children act as the exclusion restrictions required for identification in the presence of self-selection bias, since these characteristics affect the utility associated with employment and care choices, but do not affect wages. I estimate the coefficients using data of individuals aged 60 or younger in years 2013 and 2015. Table E1 presents the resulting estimates.

C. Preferences

To estimate child i's preferences over employment and care alternatives, I parameterize $\alpha(\boldsymbol{d}, \boldsymbol{x})$ as a linear function of an intercept, the sum of the number of hours of informal care given by the siblings and the hours of formal care bought by the parents, a dummy for the parents having severe care needs, an interaction term between these two, the number of siblings who decide not to give informal care to their parents, and dummies for the parent not being widowed, child i living more than 25 km away from her parents, gender, having children, and being married.

I estimate these parameters together with β, γ, δ_S, δ_K, and δ_O within the model. Let $\boldsymbol{\theta} \in \mathbb{R}^{35}$ be the vector that collects these parameters. To control for the simultaneity of actions by the players in the family, I estimate $\boldsymbol{\theta}$ by maximum simulated likelihood (MSL), using the probability distribution of the possible outcomes $\boldsymbol{d} \in \mathcal{D}$ of the game, conditional on the observables $\boldsymbol{x}_f$. Since these probabilities do not have a closed form, I approximate them numerically by making R independent draws of the unobservables, denoted by $\left(\boldsymbol{\epsilon}_f^{(r)}, \zeta_f^{(r)}\right)$, for $r = 1, ..., R$. With these draws, I simulate the game played by each family in the data, and observe the resulting Nash equilibrium of each game.[4] Let $\Pr\left(\boldsymbol{d}|\boldsymbol{x}_f; \boldsymbol{\theta}, \boldsymbol{\epsilon}_f^{(r)}, \zeta_f^{(r)}\right)$ be the probability that family f plays outcome $\boldsymbol{d}$ in equilibrium, given a value of $\boldsymbol{\theta}$, and the error draws $\boldsymbol{\epsilon}_f^{(r)}$ and $\zeta_f^{(r)}$. I obtain an estimate $\widetilde{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f; \boldsymbol{\theta}, \boldsymbol{\epsilon}_f^{(r)}, \zeta_f^{(r)}\right)$ of this probability by means of a flexibly specified logit model where the outcome of the game is assumed to depend on a polynomial of characteristics of the family.[5] Averaging over draws, the

[4] I simulate the game played by each family in the data by means of the Python interface of the Gambit library (McKelvey, McLennan and Turocy, 2014). Using this software, I obtain the Nash equilibrium of each game as the solution of a system of polynomial equations and inequalities. For the details of the algorithm, see McKelvey and McLennan (1996). Gambit is free, open source software that can be downloaded from http://www.gambit-project.org.

[5] The polynomial of family characteristics contains quadratics in the ages of the children and the parent and in parental wealth; dummies for the parents having severe care needs, not being widowed, gender of the parent and the children, and the children living far from the parents, having

simulated probability that family f plays outcome $\boldsymbol{d}$ is

$$\widehat{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f;\boldsymbol{\theta}\right) = \frac{1}{R}\sum_{r=1}^{R}\widetilde{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f;\boldsymbol{\theta},\boldsymbol{\epsilon}_f^{(r)},\zeta_f^{(r)}\right). \tag{7}$$

Thus, the MSL estimator $\hat{\boldsymbol{\theta}}_{\text{MSL}}$ maximizes the log-likelihood

$$\widehat{\mathcal{L}}\left(\boldsymbol{\theta}\right) = \sum_{f=1}^{F}\hat{\ell}_f(\boldsymbol{\theta}) = \sum_{f=1}^{F}\sum_{\forall \boldsymbol{d}\in\mathcal{D}_f}\mathbb{1}\{\boldsymbol{d}_f=\boldsymbol{d}\}\ln\widehat{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f;\boldsymbol{\theta}\right), \tag{8}$$

where $\hat{\ell}_f(\boldsymbol{\theta})$ is the likelihood contribution of family f.[6] Under standard regularity conditions, this estimator is asymptotically equivalent to the corresponding maximum likelihood estimator (**?**), and a simulated estimate of its asymptotic variance can be obtained as

$$\widehat{\text{Var}}\left(\hat{\boldsymbol{\theta}}_{\text{MSL}}\right) = -\left[\frac{\partial^2\widehat{\mathcal{L}}\left(\hat{\boldsymbol{\theta}}\right)}{\partial\boldsymbol{\theta}\partial\boldsymbol{\theta}'}\right]^{-1} = \left[\frac{\partial\widehat{\mathcal{L}}\left(\hat{\boldsymbol{\theta}}\right)}{\partial\boldsymbol{\theta}}\frac{\partial\widehat{\mathcal{L}}\left(\hat{\boldsymbol{\theta}}\right)}{\partial\boldsymbol{\theta}'}\right]^{-1}. \tag{9}$$

I apply the above estimation algorithm separately to the samples of families with three or fewer children in Northern, Central, and Southern Europe, which consist of 629, 1,430 and 1,882 families, respectively, using 50 draws of the unobservables, and the estimates of $\boldsymbol{\theta}$ from the incomplete information version of the model as initial guess for the optimization algorithm (see Appendix D for more details).[7]

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children and being married, plus an intercept.

[6] Theoretically, the game could exhibit multiple equilibria and equilibria in mixed strategies at some realizations of $\boldsymbol{\theta}$, $\boldsymbol{\epsilon}$ and ζ, what could cast doubt on the estimation strategy. After simulating 10,000 games in each region under study, I only find two cases of multiple equilibria and equilibria in mixed strategies. Then, although I cannot rule out these types of equilibria formally, they do not seem to be empirically important.

[7] Families with three or fewer children constitute 74% of my initial sample in Northern Europe, 72.92% in Central Europe, and 68.14% in Southern Europe.

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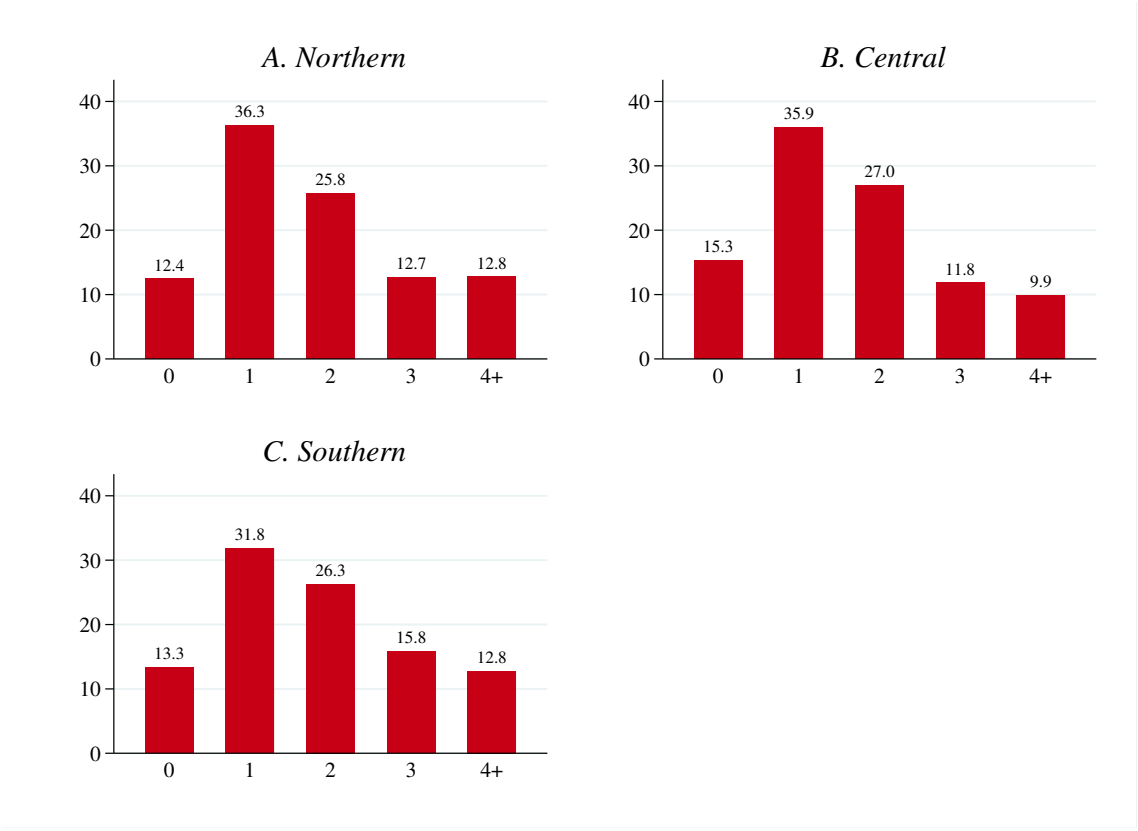
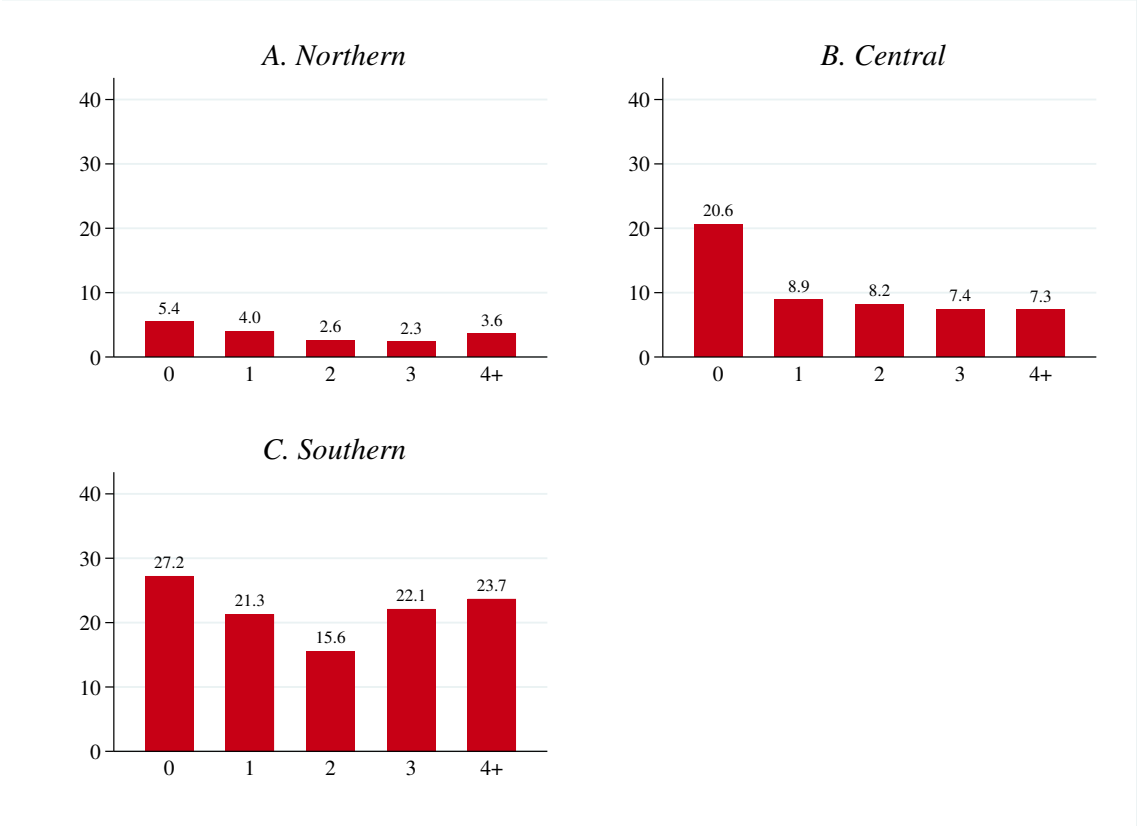
Appendix A: Elderly Care Arrangements by Family Size

Figure A1: Number of Siblings and Informal Care Given to Parents (%, 2015)



Note: The figure plots the shares of individuals who are between 30 and 60 years-old, have at least one parent with care needs who is aged 70 or older, and give informal care to her, by number of siblings (from 0 to 4 or more). The data corresponds to Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 6.

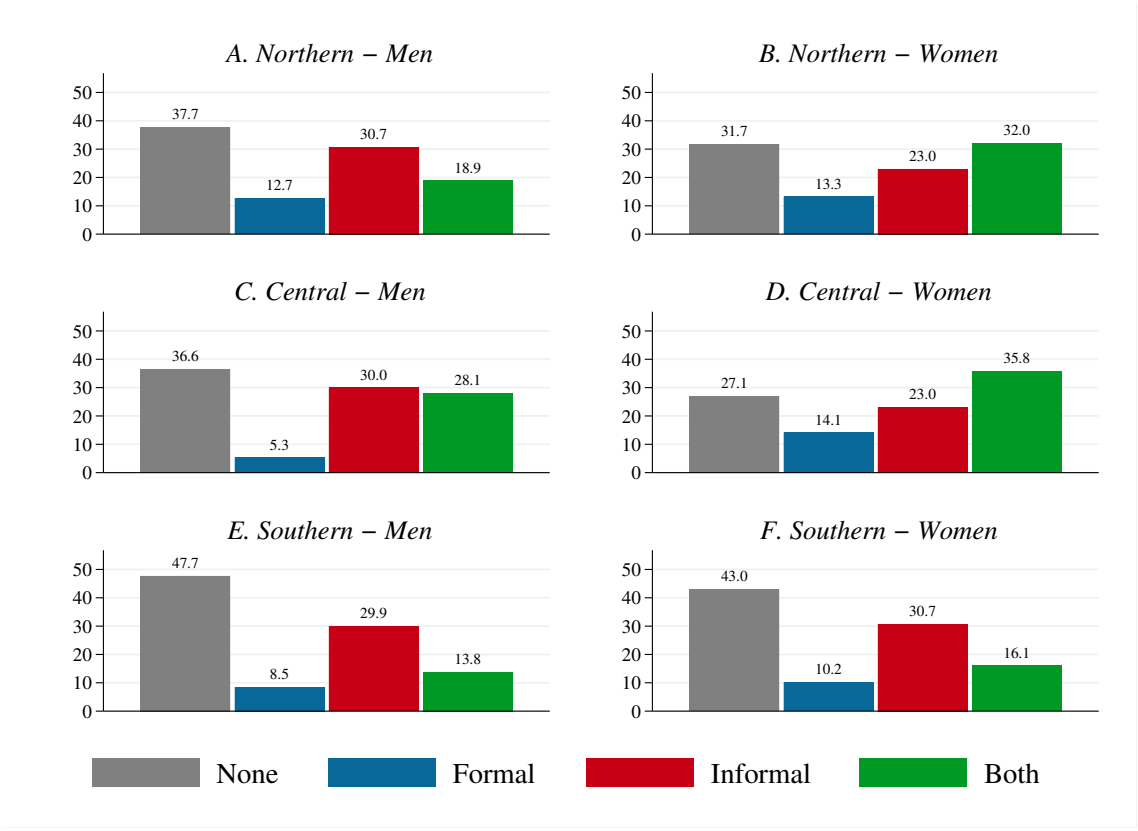
FIGURE A2: NUMBER OF SIBLINGS AND AVERAGE HOURS OF INFORMAL CARE GIVEN TO PARENTS (2007)



Note: The figure plots the average number of hours of informal care that SHARE respondents give to parents, by number of siblings (from 0 to 4 or more). The data corresponds to Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 2.

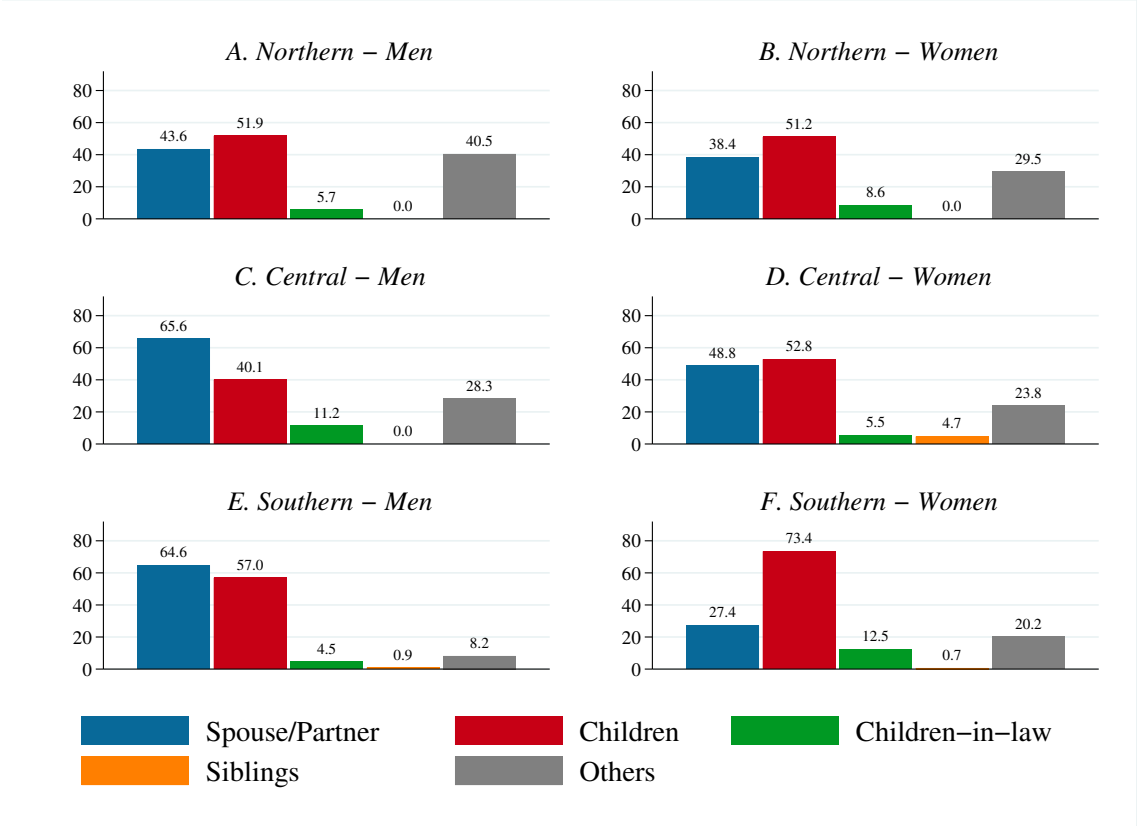
Appendix B: Gender Differences in Elderly Care

Figure B1: Type of Care Received by Individuals Aged 70 or Older with Care Needs - Men and Women (%, 2015)



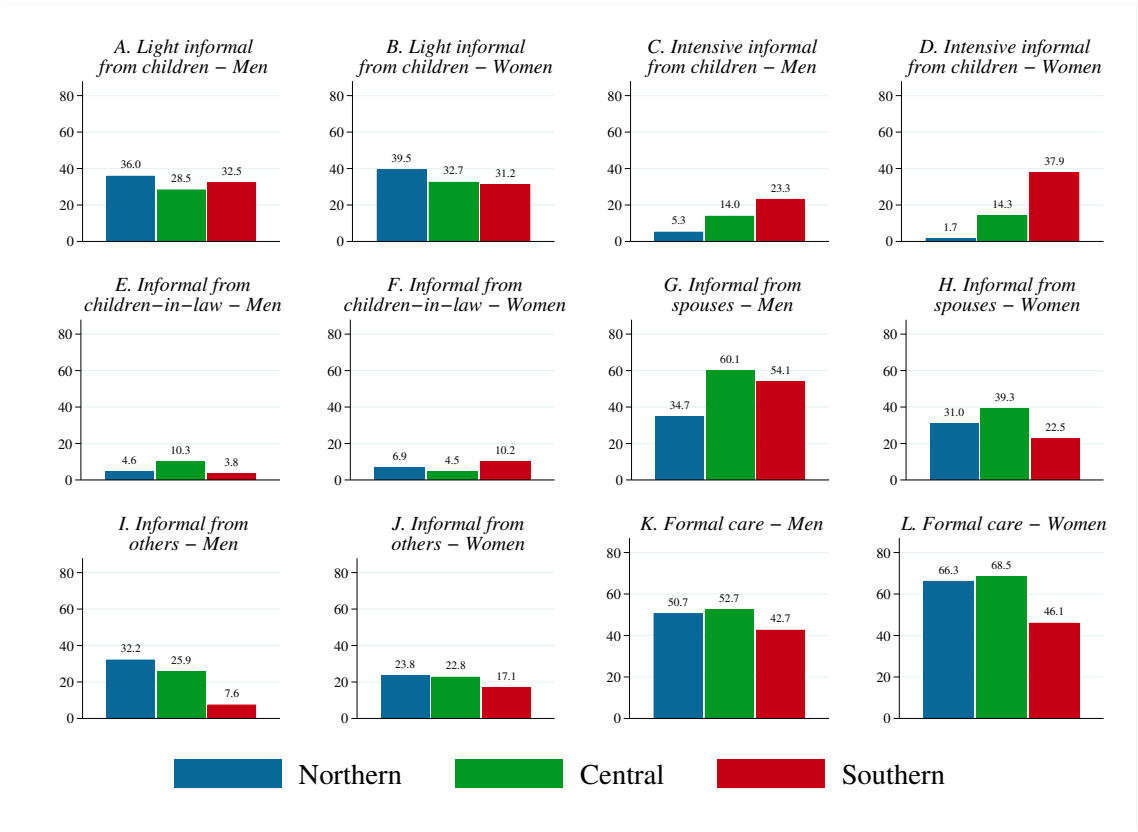
Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive each type of care in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 6.

FIGURE B2: SOURCES OF INFORMAL CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER WITH CARE NEEDS - MEN AND WOMEN (%, 2015)



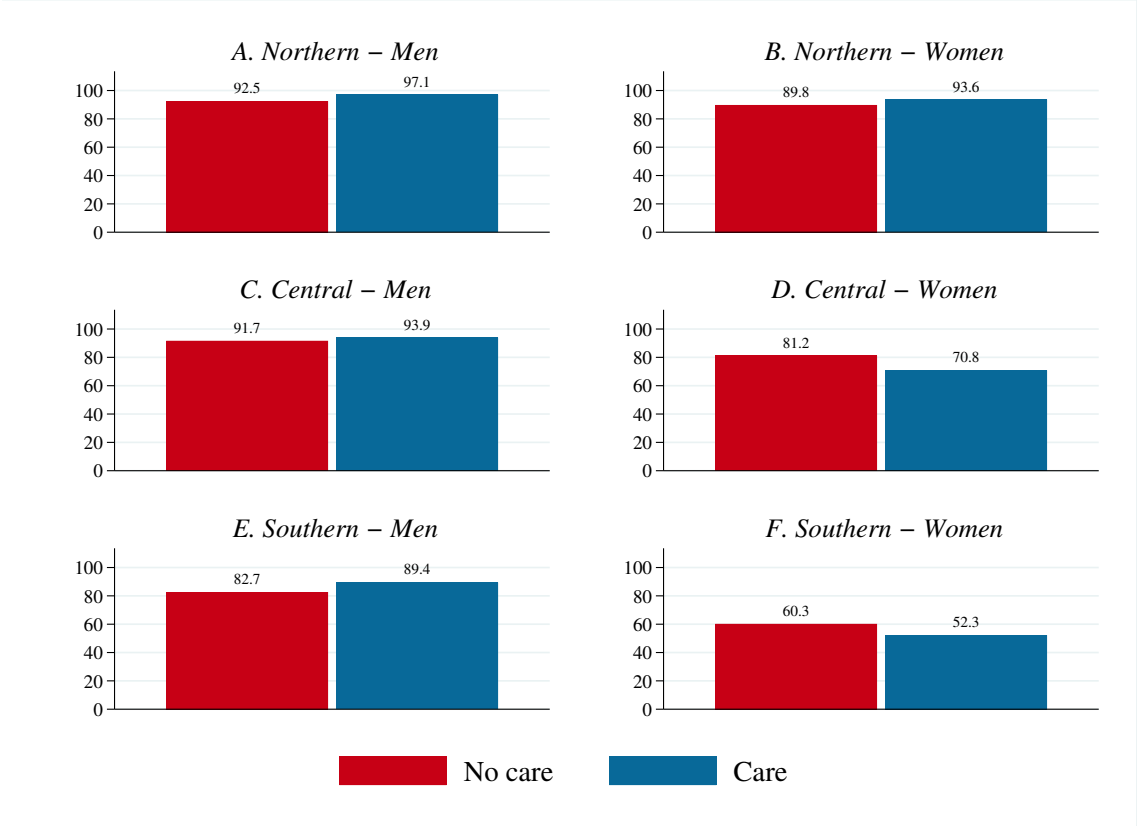
Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive informal care from each source, conditional on receiving some informal care, in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). The alternatives are not mutually exclusive. *Source:* SHARE Wave 6.

FIGURE B3: TYPE OF CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER WITH CARE NEEDS - MEN AND WOMEN (SIX OPTIONS, %, 2015)



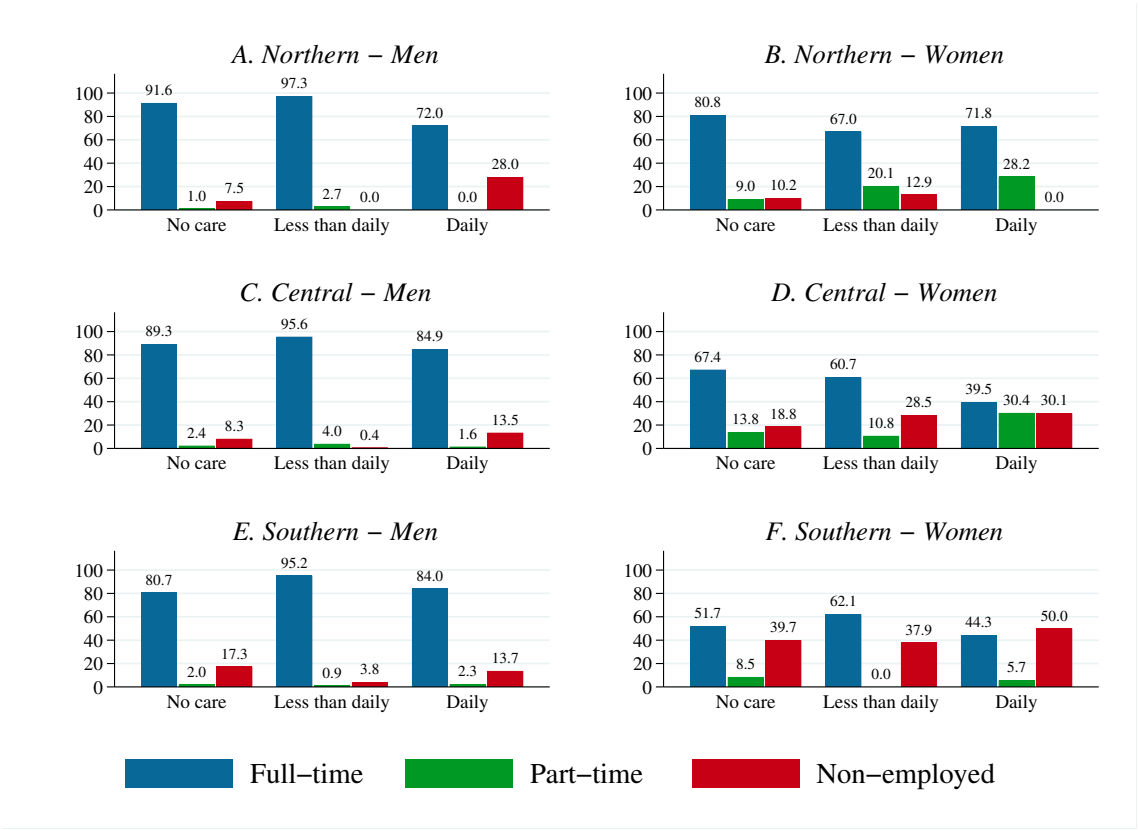
Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive each type of care, conditional on receiving some care, in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). Care alternatives are not mutually exclusive. Informal care is defined as *intensive* when is provided on a daily basis, and as *light* when is provided on a less than daily basis. *Source*: SHARE Wave 6.

Figure B4: Employment Status of Children and Informal Care Received by Respondents with Care Needs - Men and Women (%, 2015)



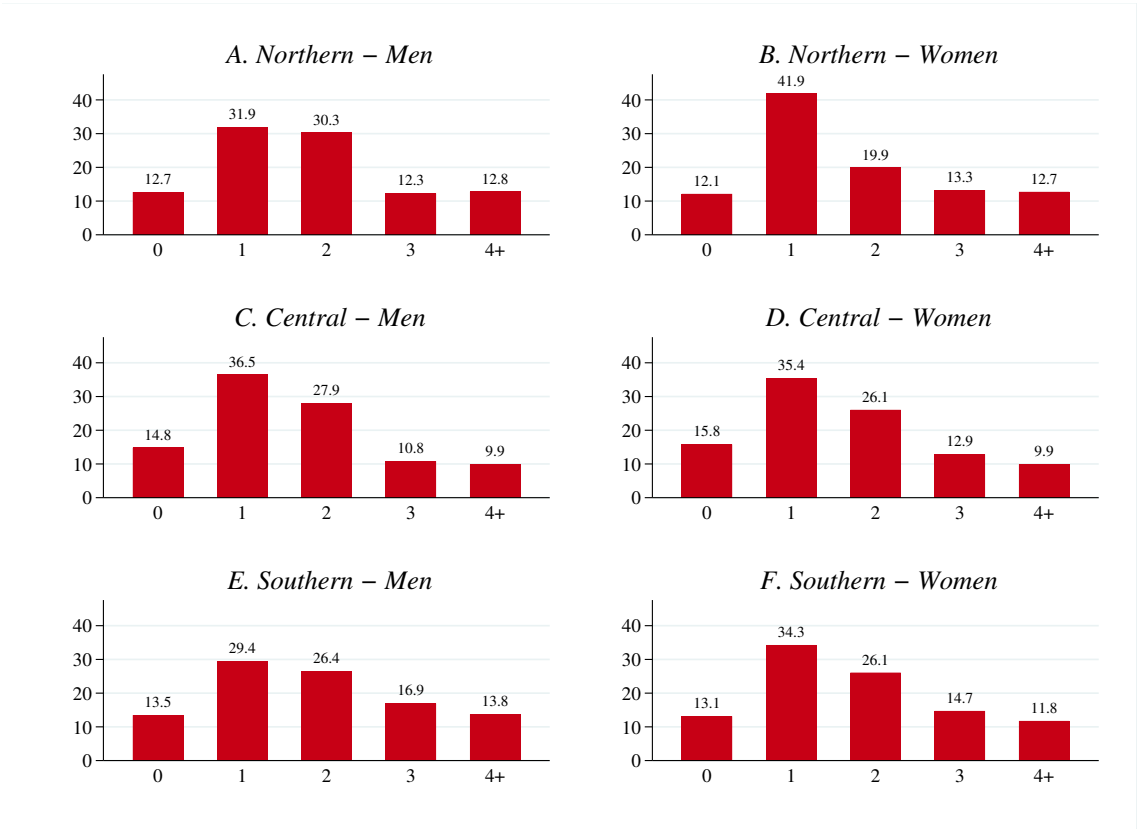
Note: The figure plots the shares of individuals who are between 30 and 60 years-old, have at least one parent with care needs who is aged 70 or older, and are employed, or non-employed while giving informal care or no care at all. The data corresponds to Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 6.

FIGURE B5: EMPLOYMENT STATUS OF CHILDREN AND FREQUENCY OF INFORMAL CARE RECEIVED BY RESPONDENTS WITH CARE NEEDS - MEN AND WOMEN (%, 2015)



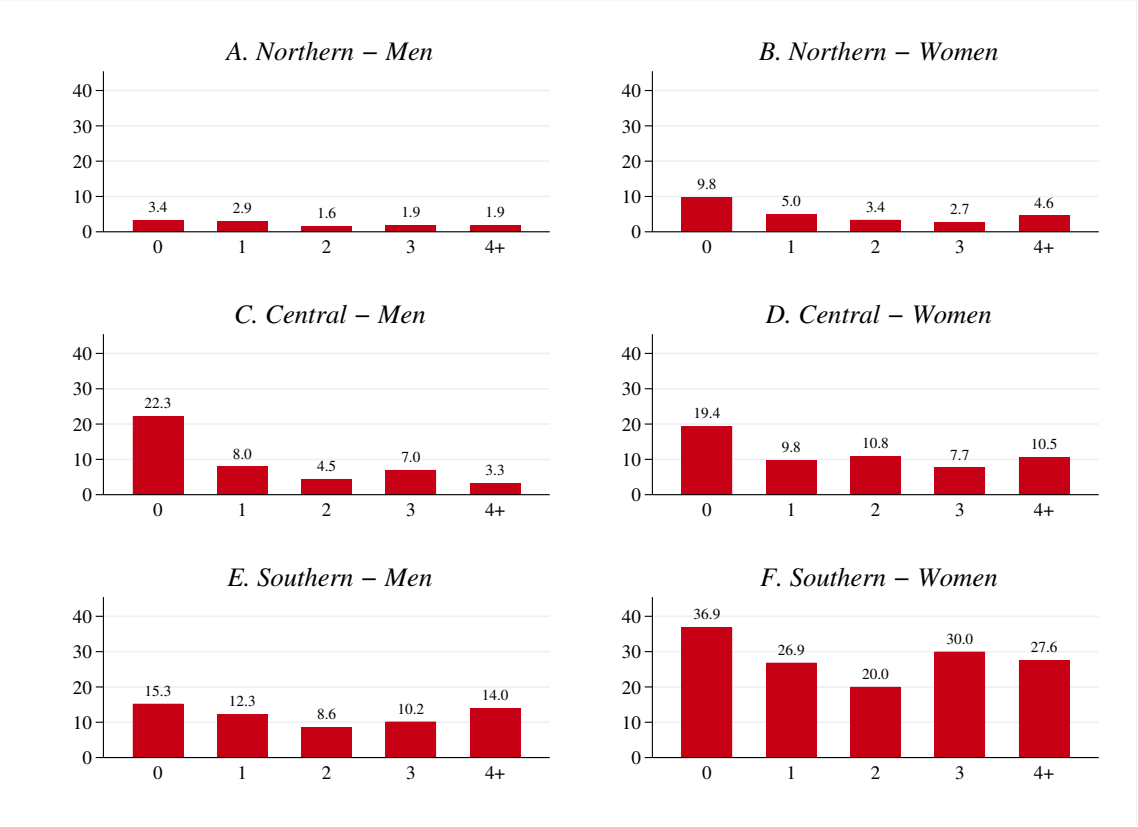
Note: The figure plots the shares of individuals who are between 30 and 60 years-old, have at least one parent with care needs who is 70 or older, and are full-time employed, part-time employed or non-employed while giving informal care on a daily basis, informal care less frequently, or no care at all. The data corresponds to Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 6.

FIGURE B6: NUMBER OF SIBLINGS AND INFORMAL CARE GIVEN TO PARENTS - MEN AND WOMEN (%, 2015)



Note: The figure plots the shares of individuals who are between 30 and 60 years-old, have at least one parent with care needs who is aged 70 or older, and give informal care to her, by number of siblings (from 0 to 4 or more). The data corresponds to Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 6.

FIGURE B7: NUMBER OF SIBLINGS AND AVERAGE HOURS OF INFORMAL CARE GIVEN TO PARENTS - MEN AND WOMEN (2007)



Note: The figure plots the average number of hours of informal care that SHARE respondents give to parents, by number of siblings (from 0 to 4 or more). The data corresponds to Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Wave 2.

Table B1: Having Care Needs - Respondents Aged 70 or Older (2015) – Logit Estimates

Dependent variable	Having care needs (dummy)
Female (dummy)	1.392***
	(0.125)
Age	0.957
	(0.203)
Age squared	1.001
	(0.001)
Widowed (dummy)	1.289*
	(0.180)
Log net assets	0.895***
	(0.018)
North (dummy)	0.592***
	(0.064)
South (dummy)	1.668***
	(0.154)
Constant	0.071
	(0.595)
Number of observations	6,673

Note: Sample of respondents aged 70 or older with at least one child between 30 and 60 years-old in SHARE Wave 6. Exponentiated coefficients (odds ratios). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B2: Care Received by Respondents Aged 70 or Older with Care Needs (2015) – Logit Estimates

Dependent variable	Care received (dummy)
Female (dummy)	1.376**
	(0.219)
Age	0.815
	(0.313)
Age squared	1.002
	(0.002)
Widowed (dummy)	1.046
	(0.245)
Severe LTC needs (dummy)	0.971
	(0.173)
Number of children	0.946
	(0.049)
At least one child lives less	0.865
than 1km away (dummy)	(0.139)
Log net assets	0.882***
	(0.031)
North (dummy)	0.892
	(0.185)
South (dummy)	0.514***
	(0.092)
Constant	614.814
	(9344.205)
Number of observations	1,426

Note: Sample of respondents aged 70 or older, with care needs, and at least one child between 30 and 60 years-old in SHARE Wave 6. Exponentiated coefficients (odds ratios). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B3: Type of Care Received by Respondents Aged 70 or Older with Care Needs (2015) – Multinomial Logit Estimates

	Formal	Informal	Both
Female (dummy)	2.175***	1.045	1.760***
	(0.647)	(0.197)	(0.383)
Age	0.878	1.431	0.554
	(0.495)	(0.682)	(0.276)
Age squared	1.002	0.998	1.005
	(0.004)	(0.003)	(0.003)
Widowed (dummy)	1.294	1.229	0.716
	(0.451)	(0.342)	(0.234)
Severe LTC needs (dummy)	0.641	0.872	1.382
	(0.204)	(0.179)	(0.347)
Number of children	0.929	0.956	0.939
	(0.074)	(0.059)	(0.065)
At least one child lives less	0.591*	0.991	0.817
than 1km away (dummy)	(0.173)	(0.184)	(0.179)
Log net assets	0.835***	0.905**	0.869***
	(0.044)	(0.037)	(0.040)
North (dummy)	1.251	0.966	0.713
	(0.409)	(0.240)	(0.192)
South (dummy)	0.663	0.789	0.233***
	(0.221)	(0.165)	(0.060)
Constant	1.309	0.000	1.901e+08
	(29.415)	(0.000)	(3.781e+09)
Number of observations		1,426	

Note: Sample of respondents aged 70 or older, with care needs, and at least one child between 30 and 60 years-old in SHARE Wave 6. Exponentiated coefficients (relative-risk ratios). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B4: Type of Care Received by Respondents Aged 70 or Older with Care Needs (2015) – Logit Estimates

	(1) Light from children	(2) Daily from children	(3) Spouse
Female (dummy)	0.946	1.443	0.464***
	(0.201)	(0.395)	(0.105)
Age	1.857	0.598	1.300
	(0.971)	(0.370)	(0.592)
Age squared	0.996	1.004	0.998
	(0.003)	(0.004)	(0.003)
Widowed (dummy)	1.625	2.369***	
	(0.489)	(0.761)	
Severe LTC needs (dummy)	1.641**	2.392***	1.360
	(0.390)	(0.679)	(0.338)
Number of children	1.148*	1.144*	0.897
	(0.084)	(0.086)	(0.065)
At least one child lives less	1.006	4.693***	0.748
than 1km away (dummy)	(0.223)	(1.427)	(0.171)
Log net assets	1.192***	0.925	1.049
	(0.053)	(0.052)	(0.041)
North (dummy)	1.329	0.284**	0.362***
	(0.341)	(0.167)	(0.097)
South (dummy)	0.784	1.917**	0.509***
	(0.188)	(0.536)	(0.124)
Constant	0.000	2058018.879	0.001
	(0.000)	(51255385.834)	(0.014)
Number of observations	864	864	700

Note: Sample of respondents aged 70 or older, with care needs, and at least one child between 30 and 60 years-old in SHARE Wave 6. Exponentiated coefficients (odds ratios). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B5: Employment Status of Children of Respondents Aged 70 or Older with Care Needs (2015) – Multinomial Logit Estimates

	Part-time	Full-time
Female (dummy)	1.758**	0.241***
	(0.498)	(0.033)
Age	1.403*	1.170
	(0.288)	(0.140)
Age squared	0.996	0.999
	(0.002)	(0.001)
College (dummy)	2.874***	4.292***
	(0.979)	(1.057)
Lives more than 25km	0.817	1.234
away from parents (dummy)	(0.236)	(0.208)
Children (dummy)	2.071**	1.207
	(0.677)	(0.218)
Married (dummy)	0.878	1.467**
	(0.240)	(0.238)
Siblings (dummy)	0.746	0.855
	(0.355)	(0.258)
Severe LTC needs (dummy)	0.829	0.872
	(0.220)	(0.135)
Light informal care (dummy)	0.817	1.070
	(0.412)	(0.329)
Intensive informal care (dummy)	1.262	0.671*
	(0.454)	(0.154)
North (dummy)	1.257	1.757**
	(0.405)	(0.411)
South (dummy)	0.334***	0.556***
	(0.095)	(0.094)
Constant	0.000*	0.108
	(0.000)	(0.297)
Number of observations	3,136	

Note: Sample of respondents aged 70 or older, with care needs, and at least one child between 30 and 60 years-old in SHARE Wave 6. Exponentiated coefficients (relative-risk ratios). Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix C: Sample Selection and Variable Definitions

C1. Hours of elderly care

In Waves 5 and 6, SHARE does not provide any information about the number of hours of informal care which survey respondents receive from their children or any other caregiver after they report having received informal care in the twelve months prior to the interview. For each care alternative in the model to correspond with a number of hours, first I use the information on whether the respondents received care from each of their children. In Wave 5, I obtain this information from the *social support* module of the survey, while in Wave 6 I use the *gvchildren* module, which is only available for this wave and Wave 7, and makes information on the respondents' children more easily accessible. In any case, I mark a child, spouse or any other person as informal caregiver if the respondent reports having received personal care, practical household help, or help with paperwork from this person in the twelve months before the survey. It should be noted, though, that the question aimed at collecting this information has a slightly different formulation when it refers to care received from people who live outside the respondent's household in Wave 5. In this case, SHARE asked about care received by the respondent and her partner together, instead of care only received by the respondent.

After finding the children who gave care to their parents, I assign each child the average weekly number of hours of care given to parents living outside the household, using the sample of respondents below 60 years-old who were interviewed in the same region as that child in Wave 1 or Wave 2. I use data from these two waves to compute this average because the information about the number of hours of informal care given or received by SHARE respondents stopped being available after the second wave of the survey. In these two waves, SHARE only collected the number of hours of care in the case the care recipient and the caregiver were not living in the same household. Therefore, I assume that the number of hours of informal care for parents living outside the child's household is the same as if they lived together.

I proceed similarly with the number of hours of formal care. First, I distinguish between the respondents who received formal care during the twelve months before the interview and those who did not. I assign those who did the average weekly number of hours of formal care in the region to which her country belongs, based on the sample of respondents above 70 years-old who stayed in nursing homes or residential care facilities, or received professional nursing care, help from paid professionals or meals-on-wheels at home, and were interviewed in Waves 1 or 2. After Wave 2, SHARE stopped providing information about the number of hours of nurs-

ing care and help from paid professionals received by survey respondents, and this was not collected again until Wave 7. I use data from Waves 1 and 2 instead of Wave 7 to compute these averages because the number of observations in the first two waves is higher, and I also use these waves to deal with the analogous problem in the case of informal care. As for the respondents who received meals-on-wheels services, I impute 14.84 hours of care a week to them (Barczyk and Kredler, 2019), and to those who stayed in nursing homes, 168 hours a week (24 hours a day).

Table C1 shows how the aforementioned types of informal care (outside the household/inside the household) and formal care (home care/nursing home care) are distributed in my sample.

Table C1: Type of Care Received by Survey Respondents Aged 70 or Older

Type of care	2004/05	2006/07	2010/11	2013	2015	2017	Total
A: Informal care (%)							
Outside the household	88.7	88.5	84.7	86.8	91.0	91.6	88.5
Inside the household	9.0	8.2	9.9	8.5	6.4	7.2	8.1
Both	2.3	3.3	5.5	4.7	2.5	1.3	3.4
B: Formal care (%)							
Formal home care	88.4	88.1	68.8	88.6	87.6	86.1	86.2
Nursing home care	11.6	11.9	26.1	5.8	12.4	13.9	11.7
Both	0.0	0.0	5.1	5.6	0.0	0.0	2.1

Note: The table shows the percentages of SHARE respondents who report having received each type of care during the twelve months prior to the wave interview, conditional on having received informal care (top panel) or formal care (bottom panel).

C2. Price of formal care

In Waves 5 and 6, SHARE did not collect information about the price of formal care in each country. To overcome this limitation, I construct a proxy for this price using data from the first two waves of the survey. In these waves, respondents were asked about how much they paid out-of-pocket for all the care they received in nursing homes and daycare centers, and for all home care services in the last twelve months, not counting health insurance premia. Taking the survey respondents of these two waves, I divide the reported expenses by the number of hours of formal care received during the same period, computed as explained in Appendix C.1. Finally, I take the average of these hourly prices for each region and assign each individual interviewed

in Waves 5 and 6 the resulting average price in the region where she lives. These, together with country averages, are reported in Table 1.

Appendix D: Estimation of the Incomplete Information Game

In order to obtain an initial guess of the vector of preference parameters for the maximum simulated likelihood estimator defined in Section IV.C, I estimate a version of the model in which the error terms $(\epsilon_{1f}, ..., \epsilon_{Nf}, \zeta_f)$ of any given family f are private information instead of common knowledge to all the players. In particular, I assume that $\{\epsilon_{if}(a_{if})\}_{i=1}^{N}$ and $\zeta_f(b_f)$ are i.i.d. type-I extreme value across actions a_{if} and b_f, respectively.

The model parameters of this game can be estimated by the two-step method proposed by Bajari, Hong, Krainer and Nekipelov (2010). To do that, I denote by $\sigma_{if}(a_{if}|\boldsymbol{x}_f)$ the probability that child i in family f chooses action a_{if} conditional on the vector of payoff-relevant variables $\boldsymbol{x}_f$. Similarly, I denote by $\pi_f(b_f|\boldsymbol{x}_f)$ the probability that the parents in family f chooses action b_f conditional on $\boldsymbol{x}_f$. Under the assumptions that each family member has consistent beliefs about the actions of the rest of players, and only one equilibrium is played out in the data, I can estimate these conditional choice probabilities in a first step by using flexibly specified logit models. In particular, I let child i's decision concerning employment and informal care to be explained by a quadratic in age, and dummies for gender, having college education, living more than 25 kilometers away from her parents, having children, being married, having siblings, and her parent having severe care needs. Meanwhile, I let the parents' choice to buy formal care to be explained by a quadratic in age, number of children, the value of net assets, and dummies for gender, marital status, having severe care needs, and having children who live more than 25 kilometers away.

In a second step, I use the estimates of the conditional choice probabilities to construct a pseudo-likelihood function and recover the preference parameters. Since the children's payoffs do not depend directly on the parameters that govern the parents' preferences, and vice versa, I can estimate the parameters $\boldsymbol{\theta}_K$ of the children and the parameters $\boldsymbol{\theta}_P$ of the parents separately. Thus, the contribution of family

f to the log pseudo-likelihood to estimate $\boldsymbol{\theta}_K$ is

$$\ell_f(\boldsymbol{\theta}_K) = \sum_{i=1}^{N} \sum_{\forall a \in \mathcal{A}_i} \mathbb{1}\{a_{if} = a\} \tag{D1}$$
$$\times \ln \frac{\exp\left\{ \sum_{b_f} \sum_{\boldsymbol{a}_{-if}} \hat{\boldsymbol{\sigma}}_{-if}(\boldsymbol{a}_{-if}|\boldsymbol{x}_f)\, \hat{\pi}_f(b_f|\boldsymbol{x}_f)\, u_{ifa}(\boldsymbol{a}_{-if}, b_f, \boldsymbol{x}_f; \boldsymbol{\theta}_K) \right\}}{\sum_{\forall a \in \mathcal{A}_i} \exp\left\{ \sum_{b_f} \sum_{\boldsymbol{a}_{-if}} \hat{\boldsymbol{\sigma}}_{-if}(\boldsymbol{a}_{-if}|\boldsymbol{x}_f)\, \hat{\pi}_f(b_f|\boldsymbol{x}_f) u_{ifa}(\boldsymbol{a}_{-if}, b_f, \boldsymbol{x}_f; \boldsymbol{\theta}_K) \right\}},$$

where $\mathbb{1}\{a_{if} = a\}$ is an indicator that equals 1 if child i takes action a, $\hat{\sigma}_{-if}(\boldsymbol{a}_{-if}|\boldsymbol{x}_f)$ is the estimate of the probability that child i's siblings choose action profile $\boldsymbol{a}_{-if}$ conditional on the value of $\boldsymbol{x}_f$, $\hat{\pi}_f(b_f|\boldsymbol{x}_f)$ is the estimate of the probability that the parents choose action b_f conditional on the value of $\boldsymbol{x}_f$, and $u_{ifa}(\boldsymbol{a}_{-if}, b_f, \boldsymbol{x}_f; \boldsymbol{\theta}_K)$ is child i's action-specific payoff given the actions of her siblings and her parents. Similarly, the contribution of family f to the log pseudo-likelihood to estimate $\boldsymbol{\theta}_P$ is

$$\ell_f(\boldsymbol{\theta}_P) = \sum_{\forall b \in \mathcal{B}} \mathbb{1}\{b_f = b\} \ln \frac{\exp\left\{ \sum_{\boldsymbol{a}_f} \hat{\boldsymbol{\sigma}}_f(\boldsymbol{a}_f|\boldsymbol{x}_f)\, v_{fb}(\boldsymbol{a}_f, \boldsymbol{x}_f; \boldsymbol{\theta}_P) \right\}}{\sum_{\forall b \in \mathcal{B}} \exp\left\{ \sum_{\boldsymbol{a}_f} \hat{\boldsymbol{\sigma}}_f(\boldsymbol{a}_f|\boldsymbol{x}_f)\, v_{fb}(\boldsymbol{a}_f, \boldsymbol{x}_f; \boldsymbol{\theta}_P) \right\}}, \tag{D2}$$

where $\mathbb{1}\{b_f = b\}$ equals 1 if the parents take action b, $\hat{\sigma}_f(\boldsymbol{a}_f|\boldsymbol{x}_f)$ is the estimate of the probability that her children choose action profile $\boldsymbol{a}_f$ conditional on the value of $\boldsymbol{x}_f$, and $v_{fb}(\boldsymbol{a}_f, \boldsymbol{x}_f; \boldsymbol{\theta}_P)$ is the parents' action-specific payoff given the actions of her children.

Appendix E: Wage, Hours and Utility Estimates

Table E1: Wage Estimates

	Log wage
Female dummy	-0.166***
	(0.006)
Age	0.055***
	(0.004)
Age squared	-0.000***
	(0.000)
College dummy	0.320***
	(0.007)
Austria	0.183***
	(0.007)
Belgium	0.251***
	(0.007)
Denmark	0.549***
	(0.007)
Spain	-0.368***
	(0.012)
France	-0.051***
	(0.006)
Italy	-0.107***
	(0.009)
Sweden	0.164***
	(0.007)
Constant	1.253***
	(0.092)
σ_ξ	0.549
Number of observations	177,834

Note: Heckman two-step estimates of logarithmic wages using EU-SILC data for years 2013 and 2015. Germany is used as base category. Standard errors in parenthesis. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table E2: Estimates of Hours Worked

	Log hours worked
Female dummy	-0.250***
	(0.003)
Age	0.496
	(0.140)
Age^2	-0.018***
	(0.005)
Age^3	0.000***
	(0.000)
Age^4	-0.000***
	(0.000)
College dummy	0.102***
	(0.003)
Austria	0.023***
	(0.006)
Belgium	-0.005
	(0.005)
Denmark	0.059***
	(0.005)
Spain	0.044***
	(0.005)
France	0.044***
	(0.005)
Italy	0.057***
	(0.004)
Sweden	0.091***
	(0.005)
Constant	-1.354
	(1.504)
Number of observations	100,243
R^2	0.144

Note: OLS estimates of logarithmic hours worked from the sample of employees in EU-SILC, years 2013 and 2015. Germany is used as base category. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table E3: Conditional Choice Probability Parameters of the Child – Northern Europe – Multinomial Logit Estimates

	E, NC	NE, IC	E, IC
Age	-0.069	-0.771	-0.035
	(0.179)	(0.351)	(0.227)
Age squared	0.001	0.008	0.001
	(0.002)	(0.004)	(0.002)
Female (dummy)	-0.842	-0.216	-0.691
	(0.209)	(0.448)	(0.242)
College (dummy)	0.689	0.303	0.855
	(0.237)	(0.529)	(0.271)
Far (dummy)	-0.157	-1.329	-1.330
	(0.211)	(0.499)	(0.252)
Children (dummy)	1.219	1.645	1.291
	(0.249)	(0.528)	(0.302)
Married (dummy)	0.295	-0.626	0.207
	(0.226)	(0.477)	(0.255)
Siblings (dummy)	-0.320	-0.669	-1.401
	(0.556)	(0.977)	(0.587)
Severe LTC needs (dummy)	0.233	0.569	0.365
	(0.203)	(0.449)	(0.235)
Constant	3.728	16.430	1.375
	(4.282)	(8.082)	(5.484)

Note: Standard errors in parentheses. The choice alternatives are *non-employment and no care* (NE, NC; base category), *employment and no care* (E, NC), *non-employment and informal care* (NE, IC), and *employment and informal care* (E, IC).

Table E4: Conditional Choice Probability Parameters of the Child – Central Europe – Multinomial Logit Estimates

	E, NC	NE, IC	E, IC
Age	0.299	-0.159	0.029
	(0.103)	(0.200)	(0.137)
Age squared	-0.003	0.002	-0.000
	(0.001)	(0.002)	(0.001)
Female (dummy)	-0.743	0.823	-0.366
	(0.112)	(0.277)	(0.147)
College (dummy)	1.094	0.443	1.168
	(0.152)	(0.321)	(0.182)
Far (dummy)	0.024	-1.985	-1.118
	(0.121)	(0.333)	(0.162)
Children (dummy)	0.321	0.158	0.055
	(0.137)	(0.284)	(0.178)
Married (dummy)	0.446	0.346	0.292
	(0.119)	(0.244)	(0.157)
Siblings (dummy)	-0.167	0.243	-0.347
	(0.235)	(0.452)	(0.275)
Severe LTC needs (dummy)	0.021	0.349	-0.300
	(0.117)	(0.244)	(0.151)
Constant	-4.870	1.459	-0.001
	(2.436)	(4.721)	(3.267)

Note: Standard errors in parentheses. The choice alternatives are *non-employment and no care* (NE, NC; base category), *employment and no care* (E, NC), *non-employment and informal care* (NE, IC), and *employment and informal care* (E, IC).

Table E5: Conditional Choice Probability Parameters of the Child – Southern Europe – Multinomial Logit Estimates

	E, NC	NE, IC	E, IC
Age	0.143	0.104	0.214
	(0.070)	(0.116)	(0.116)
Age squared	-0.001	-0.001	-0.002
	(0.001)	(0.001)	(0.001)
Female (dummy)	-1.376	0.881	-0.263
	(0.077)	(0.161)	(0.121)
College (dummy)	1.107	0.011	0.877
	(0.126)	(0.230)	(0.176)
Far (dummy)	0.225	-1.257	-0.736
	(0.095)	(0.225)	(0.181)
Children (dummy)	-0.049	-0.098	0.031
	(0.113)	(0.181)	(0.176)
Married (dummy)	0.445	0.101	0.270
	(0.108)	(0.163)	(0.172)
Siblings (dummy)	-0.113	-0.379	-0.742
	(0.184)	(0.292)	(0.236)
Severe LTC needs (dummy)	-0.227	0.484	0.090
	(0.106)	(0.205)	(0.167)
Constant	-1.882	-5.535	-6.739
	(1.626)	(2.721)	(2.768)

Note: Standard errors in parentheses. The choice alternatives are *non-employment and no care* (NE, NC; base category), *employment and no care* (E, NC), *non-employment and informal care* (NE, IC), and *employment and informal care* (E, IC).

Table E6: Conditional Choice Probability Parameters of the Parent – Logit Estimates

	Northern	Central	Southern
Parental age	0.553	-0.510	0.332
	(0.380)	(0.265)	(0.265)
Parental age squared	-0.003	0.004	-0.001
	(0.002)	(0.002)	(0.002)
Parental female (dummy)	0.230	0.432	0.373
	(0.167)	(0.125)	(0.136)
Parental married (dummy)	-0.550	-0.440	0.001
	(0.173)	(0.131)	(0.135)
Severe LTC needs (dummy)	0.056	0.021	-0.194
	(0.167)	(0.116)	(0.162)
Log parental assets	0.062	0.063	0.060
	(0.029)	(0.021)	(0.025)
Number of children	0.059	-0.014	0.031
	(0.063)	(0.038)	(0.038)
At least one child lives	-0.003	0.113	0.130
more than 25 km away (dummy)	(0.176)	(0.119)	(0.134)
Constant	-27.362	15.146	-19.895
	(15.269)	(10.561)	(10.720)

Note: Standard errors in parentheses. The choice alternatives are *no formal care; base category* (NFC) and *formal care* (FC).

Table E7: Children's Parameters – Incomplete Information Game – Northern Europe

A: Consumption			
β		1.686e-01	
		(2.522e-04)	
B: Employment and care	E, NC	NE, IC	E, IC
α_0: Constant	1.384e-04	1.215e+01	3.128e-05
	(2.363e-06)	(3.335e+00)	(2.319e-06)
α_1: Number of siblings who give care	2.865e-05	2.206e+00	6.396e-06
	(1.004e-06)	(7.555e-01)	(6.949e-07)
α_2: Formal care dummy	5.068e-05	5.516e+00	1.387e-05
	(1.218e-06)	(1.521e+00)	(1.117e-06)
α_3: Severe care needs	6.405e-05	7.522e+00	1.584e-05
	(3.308e-06)	(2.234e+00)	(1.746e-06)
α_4: Number of siblings who give care	1.460e-05	1.230e+00	3.708e-06
$\times$ Severe care needs	(1.067e-06)	(4.749e-01)	(5.907e-07)
α_5: Parent is not widowed	1.108e-04	5.786e+00	1.893e-05
	(3.069e-06)	(1.994e+00)	(1.821e-06)
α_6: Far dummy	6.512e-05	4.051e+00	7.385e-06
	(2.677e-06)	(1.611e+00)	(1.052e-06)
α_7: Female dummy	6.243e-05	7.522e+00	1.611e-05
	(2.569e-06)	(2.240e+00)	(1.580e-06)
α_8: Children dummy	1.139e-04	9.837e+00	2.645e-05
	(2.574e-06)	(2.661e+00)	(2.124e-06)
α_9: Married dummy	8.231e-05	6.365e+00	1.786e-05
	(2.709e-06)	(1.897e+00)	(1.780e-06)

Note: Bootstrapped standard errors in parentheses. The choice alternatives are *non-employment and no care* (NE, NC; base category), *employment and no care* (E, NC), *non-employment and informal care* (NE, IC), and *employment and informal care* (E, IC).

Table E8: Children's Parameters – Incomplete Information Game – Central Europe

A: Consumption			
β		1.708e-01	
		(5.177e-04)	
B: Employment and care	E, NC	NE, IC	E, IC
α_0: Constant	1.878e-04	1.536e+01	3.904e-05
	(1.846e-06)	(2.674e+00)	(1.681e-06)
α_1: Number of siblings who give care	4.044e-05	2.934e+00	7.716e-06
	(8.590e-07)	(5.411e-01)	(4.928e-07)
α_2: Formal care dummy	8.253e-05	7.821e+00	1.960e-05
	(1.069e-06)	(1.359e+00)	(8.703e-07)
α_3: Severe care needs	9.157e-05	8.461e+00	1.786e-05
	(2.438e-06)	(1.624e+00)	(1.207e-06)
α_4: Number of siblings who give care	1.807e-05	1.374e+00	2.971e-06
$\times$ Severe care needs	(7.172e-07)	(2.994e-01)	(3.031e-07)
α_5: Parent is not widowed	1.331e-04	6.903e+00	1.868e-05
	(2.412e-06)	(1.432e+00)	(1.228e-06)
α_6: Far dummy	7.196e-05	2.004e+00	8.112e-06
	(1.849e-06)	(5.385e-01)	(7.391e-07)
α_7: Female dummy	8.749e-05	1.136e+01	2.154e-05
	(1.928e-06)	(2.008e+00)	(1.187e-06)
α_8: Children dummy	1.482e-04	1.236e+01	3.017e-05
	(2.084e-06)	(2.147e+00)	(1.487e-06)
α_9: Married dummy	1.199e-04	9.575e+00	2.492e-05
	(1.996e-06)	(1.755e+00)	(1.330e-06)

Note: Bootstrapped standard errors in parentheses. The choice alternatives are *non-employment and no care* (NE, NC; base category), *employment and no care* (E, NC), *non-employment and informal care* (NE, IC), and *employment and informal care* (E, IC).

Table E9: Children's Parameters – Incomplete Information Game – Southern Europe

A: Consumption			
β		3.490e-01	
		(2.262e-03)	
B: Employment and care	E, NC	NE, IC	E, IC
α_0: Constant	8.790e-04	9.808e+00	1.666e-04
	(1.005e-05)	(1.802e+00)	(7.757e-06)
α_1: Number of siblings who give care	1.849e-04	2.160e+00	3.759e-05
	(4.420e-06)	(4.146e-01)	(2.527e-06)
α_2: Formal care dummy	1.680e-04	2.217e+00	3.597e-05
	(2.691e-06)	(4.174e-01)	(1.793e-06)
α_3: Severe care needs	7.228e-04	8.514e+00	1.454e-04
	(1.201e-05)	(1.567e+00)	(7.249e-06)
α_4: Number of siblings who give care	1.620e-04	1.960e+00	3.459e-05
$\times$ Severe care needs	(4.581e-06)	(3.833e-01)	(2.455e-06)
α_5: Parent is not widowed	6.332e-04	5.609e+00	9.415e-05
	(1.276e-05)	(1.063e+00)	(6.288e-06)
α_6: Far dummy	1.967e-04	8.053e-01	1.490e-05
	(7.588e-06)	(2.155e-01)	(2.144e-06)
α_7: Female dummy	3.283e-04	8.139e+00	1.022e-04
	(9.637e-06)	(1.511e+00)	(5.876e-06)
α_8: Children dummy	6.445e-04	8.053e+00	1.335e-04
	(1.077e-05)	(1.475e+00)	(6.806e-06)
α_9: Married dummy	6.612e-04	7.535e+00	1.314e-04
	(1.095e-05)	(1.390e+00)	(6.884e-06)

Note: Bootstrapped standard errors in parentheses. The choice alternatives are *non-employment and no care* (NE, NC; base category), *employment and no care* (E, NC), *non-employment and informal care* (NE, IC), and *employment and informal care* (E, IC).

Table E10: Parent's Parameters – Incomplete Information Game

	Northern	Central	Southern
γ	2.088e-04	7.957e-05	5.464e-05
	(7.019e-05)	(5.777e-05)	(1.618e-05)
δ_S	1.949e-08	1.312e-08	4.647e-09
	(1.173e-08)	(3.764e-08)	(1.044e-08)
δ_K	2.063e-08	9.969e-09	4.944e-09
	(1.037e-08)	(2.928e-08)	(1.395e-08)
δ_O	1.108e-08	4.916e-09	1.296e-09
	(6.282e-09)	(1.496e-08)	(5.239e-09)

Note: Bootstrapped standard errors in parentheses.