Elderly Care Across Europe: The Role of Formal and Informal Care in Family Decision Making*

Manuel V. Montesinos†

Universitat Autònoma de Barcelona
Barcelona School of Economics

September 22, 2022
Download the latest version here

Abstract

This paper studies the determinants of elderly care arrangements in Europe, where there is a substantial degree of heterogeneity in the use of formal and informal care. In order to explain this fact, I develop and estimate a structural model representing working-age individuals and their parents making decisions on care and labor supply in a static, non-cooperative game of complete information. Using the estimated model to simulate families' choices in several counterfactual scenarios, I find that preferences are largely responsible for the different outcomes across countries, followed by wages. Parental health, geographical proximity to children, and access to informal care from spouses and other sources are less influential.

Keywords: elderly care, non-cooperative game, discrete choice, SHARE.
JEL Codes: D64, J14, J22.

*I am indebted to Joan Llull for his continuous encouragement and advice. I am also grateful to Eric French for his wonderful sponsorship and feedback during my visit at the University of Cambridge. I would also like to thank Noriko Amano-Patiño, J. Ignacio Conde-Ruiz, Luis Corchón, Joan Costa-i-Font, Lidia Cruces, Ines Lee, Inés Macho-Stadler, Lourdes Moreno, Pau Olivella, Áureo de Paula, Christopher Rauh, Ana Rute Cardoso, Katherina Thomas, Hanna Wang, Weilong Zhang, seminar participants at Universitat Autònoma de Barcelona, University of Cambridge, and Universidad Complutense de Madrid, and conference participants at the ENTER Jamboree, and the BSE PhD Jamboree for many helpful comments and discussions. This paper uses data from SHARE release 7.0.0 as of April 3, 2019 (see Börsch-Supan et al. (2013) for methodological details and www.share-project.org). This paper is also based on data from Eurostat, European Union Statistics on Income and Living Conditions (EU-SILC). The responsibility for all conclusions drawn from the data lies entirely with me. I acknowledge financial support from the Barcelona GSE-UAB IDEA PhD Track Fellowship, the Spanish Ministry of Economy and Competitiveness through grant ECO2015-63679-P, the Secretaria d'Universitats i Recerca de la Generalitat de Catalunya and the European Social Fund through the FI-AGAUR Predoctoral Fellowship, and the European Research Council (ERC) through Starting Grant n. 804989.

†Departament d'Economia i d'Història Econòmica. Universitat Autònoma de Barcelona. Campus de Bellaterra – Edifici B, 08193, Bellaterra, Cerdanyola del Vallès, Barcelona (Spain). E-mail: manuel.montesinos@barcelonagse.eu.

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.[1]

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

[1]The aforementioned projections are in line with several other forecasts. For instance, Kotschy and Bloom (2022) estimate that the proportion of individuals older than 65 in advanced economies will jump from 19.6% in 2020 to 26.7% in 2040, while that of people over 80 will rise from 5.2% to 8.8%. As a consequence, the share of individuals who depend on long-term care will grow from 2.9% to 4.2%.

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 and income. 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 a large body of 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 (2008b), 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 (2021), 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, Picone and Sloan (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, 2021; 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. I examine the estimates of the model and its goodness of fit in Section V. Finally, I show the results of the counterfactual simulations in Section VI before concluding in Section VII.

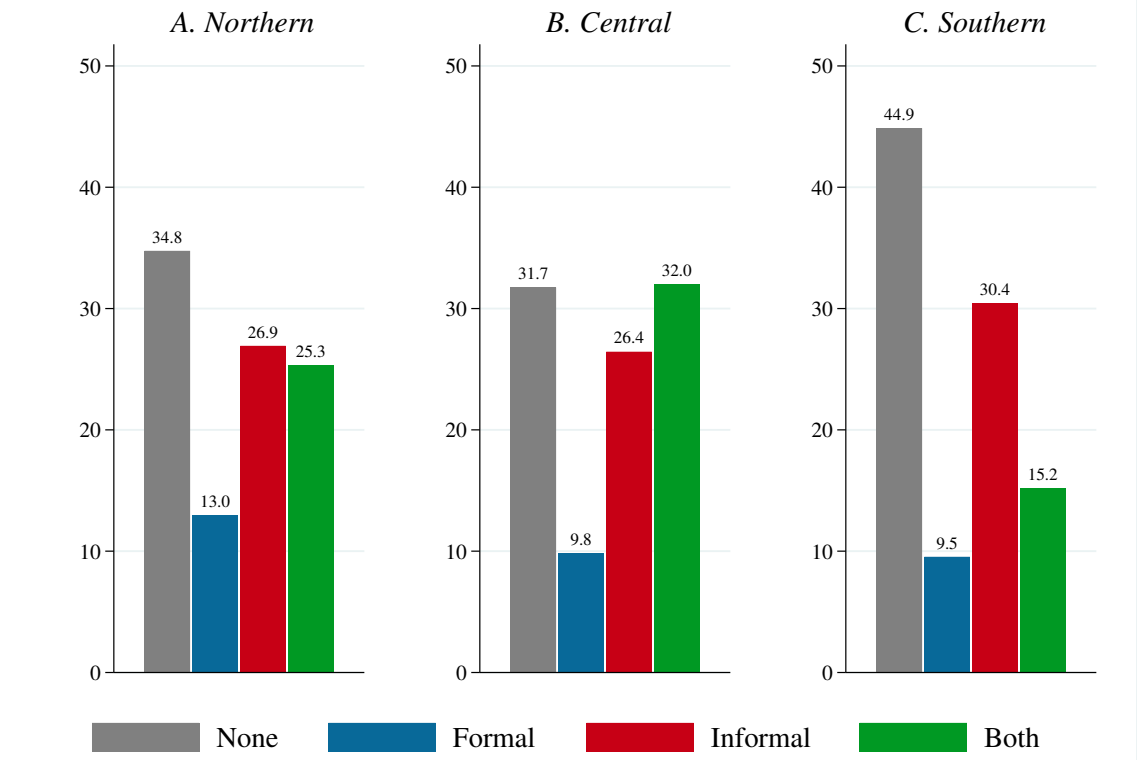
II. Data and Motivating Evidence

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, 2008b; 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)

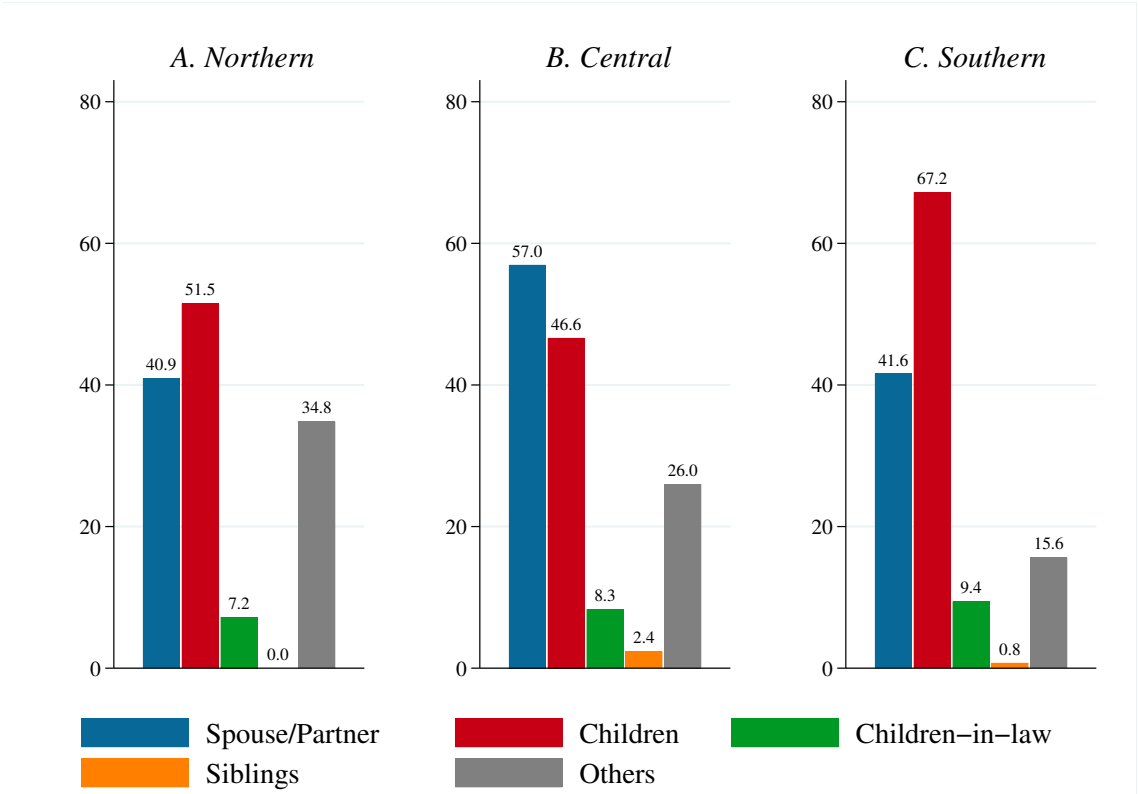


Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive each type of care in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: 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, Figure 3 implies that 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%).

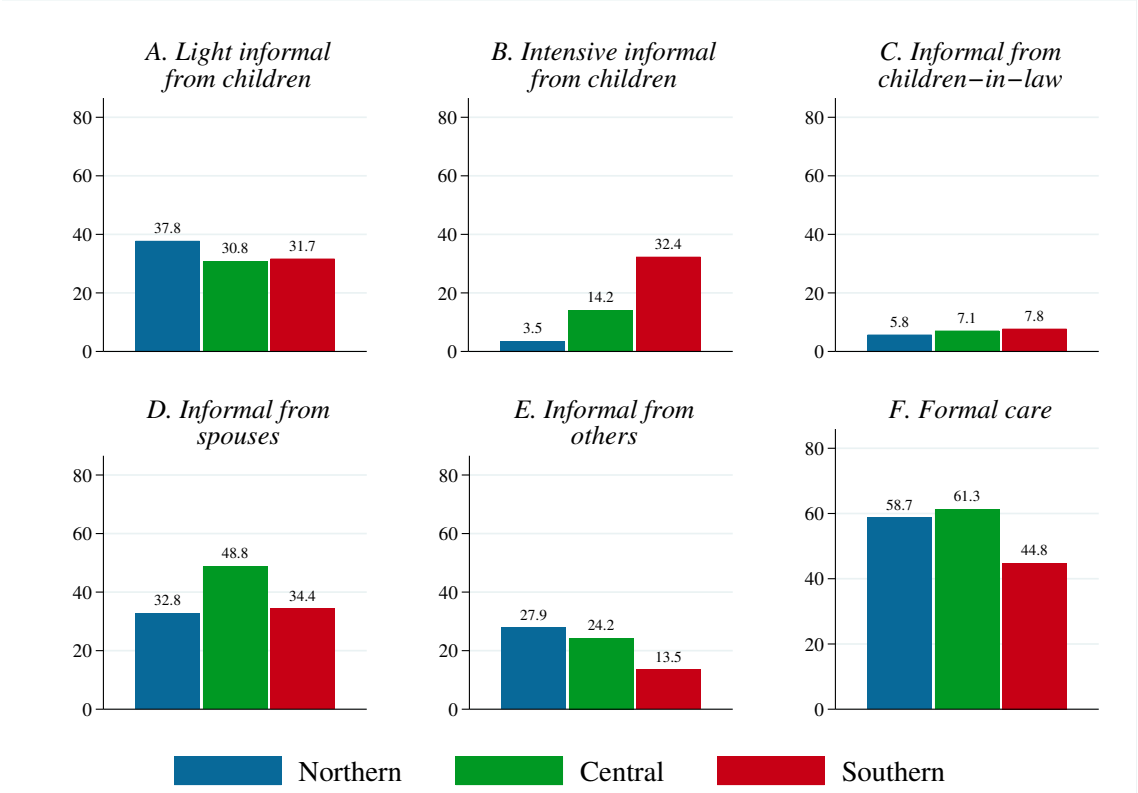
FIGURE 2: SOURCES OF INFORMAL CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER WITH CARE NEEDS (%, 2015)



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 shed light on the relationship between elderly care and labor supply decisions, 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 (81.4% and 64.5%, respectively) than those who do not giving any help (86.9% and 72%). Second, there are differences in the number of hours worked by children who provide care and those who do not. In the three country groups, individuals who take care

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



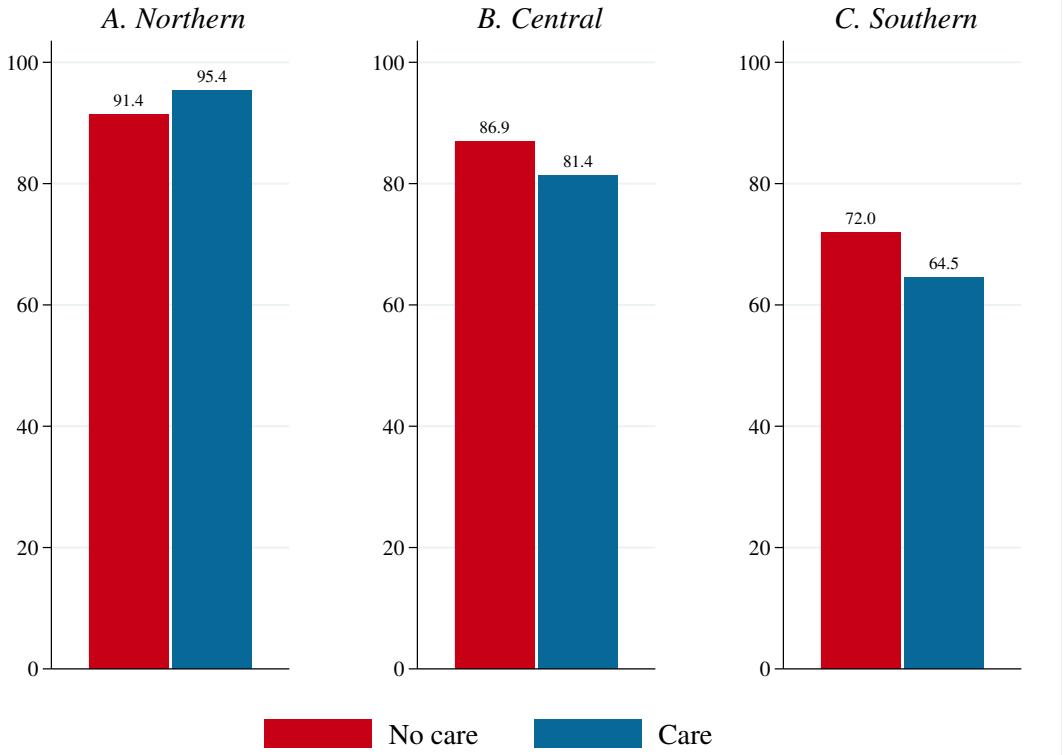
Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive each type of care, conditional on receiving some care, in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and 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.

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 86.9% in Northern Europe, 79.1% in Central Europe, and 67.3% in Southern Europe, these shares fall down to 71.8%, 60.2% and 54.4%, 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.[2] In Southern countries, the share of individuals who are part-time employed is higher among daily caregivers (6.2%) than among non-caregivers (4.7%)

[2]In Southern Europe, 85.5% of workers were employed full-time in 2015, compared to 79.9% and 77% in Northern and Central Europe, respectively (Eurostat, 2022).

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.

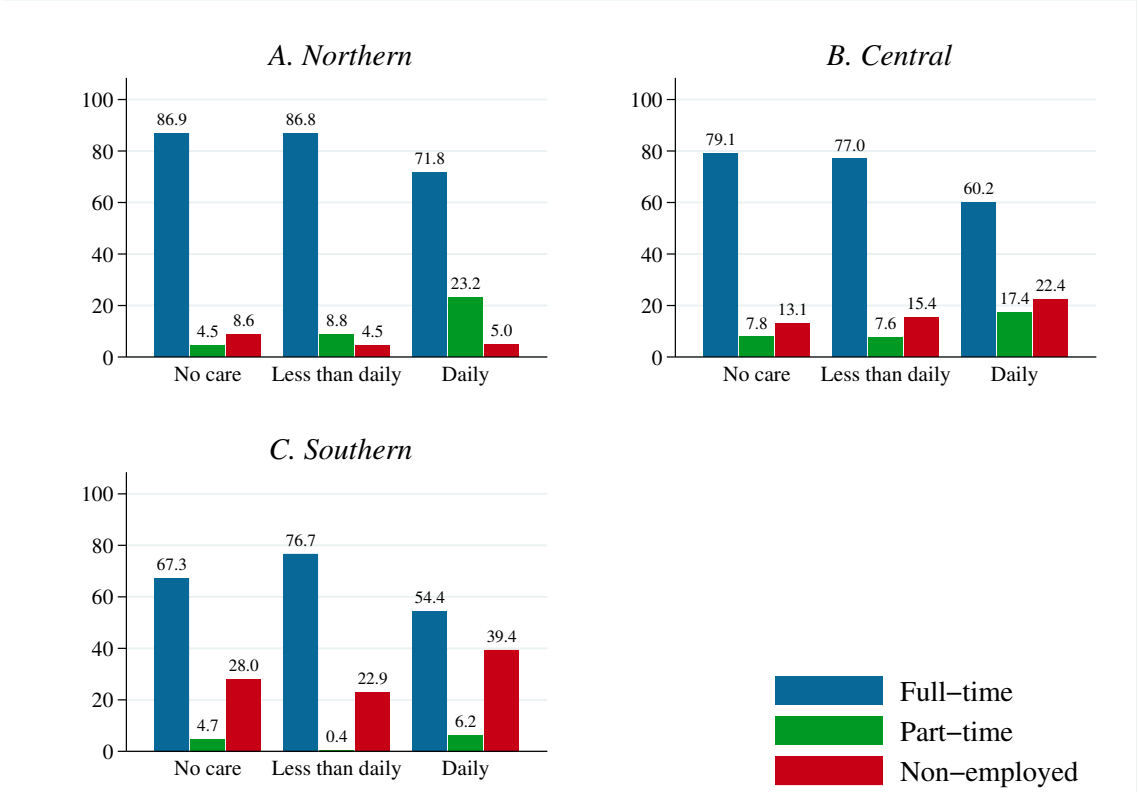
FIGURE 4: EMPLOYMENT STATUS OF CHILDREN AND INFORMAL CARE RECEIVED BY RESPONDENTS WITH CARE NEEDS (%, 2015)



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.

Figure 6 illustrates how care arrangements vary in family size. According to it, children with one sibling are more likely to give informal care to their parents than children without siblings. This could be attributed to feelings of guilt, opportunities to share caregiving responsibilities among family members, or bequest motives that push siblings to compete with one another for a larger inheritance. However, this effect vanishes for larger families, where the probability that a child provides informal care declines as family size increases. The hypothesis that this is caused by free-riding among family members would be supported for Central Europe by data on the number of hours of care, as shown in Figure 7. In this country group, children in

Figure 5: Employment Status of Children and Frequency of Informal Care Received by Respondents with Care Needs (%, 2015)

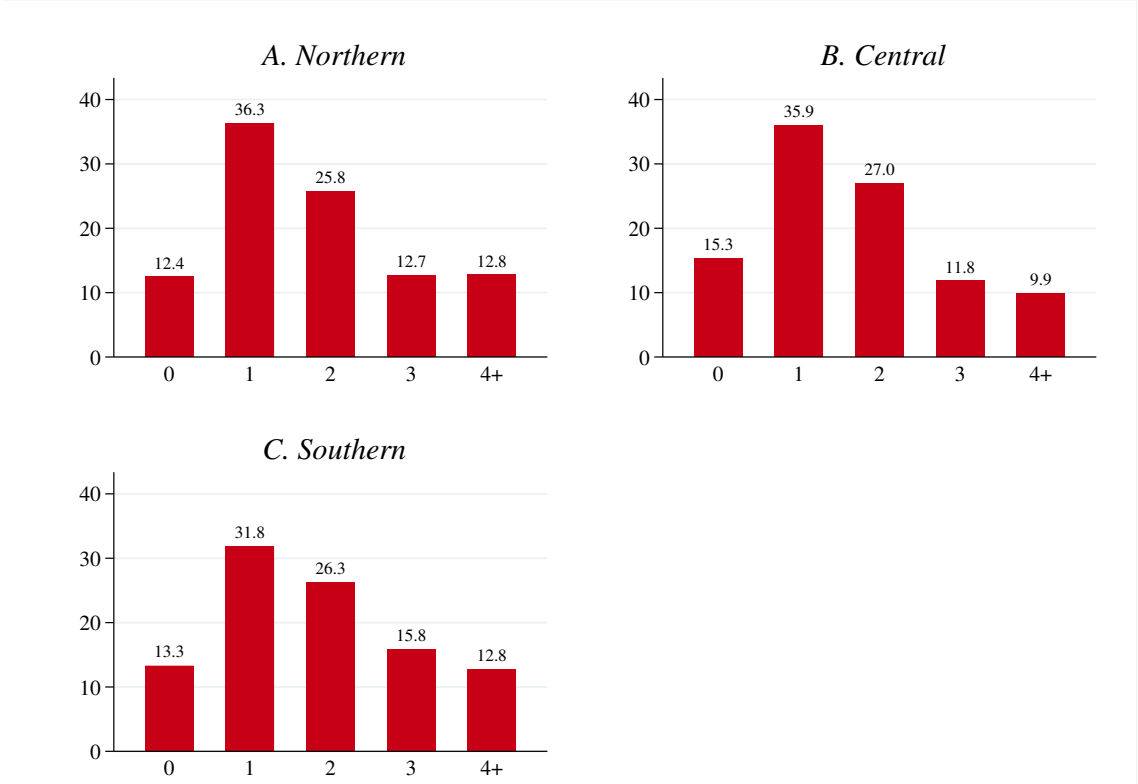


Note: The figure plots the shares of individuals who are between 30 and 60 years-old, have at least one parent with care needs who is aged 70 or older, and are full-time employed, part-time employed or non-employed while giving informal care on a daily basis, informal care less frequently or no care 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.

larger families spend fewer hours on caregiving than children in smaller families. In Northern and Southern Europe, by contrast, the relationship between the amount of care provided and the number of siblings is u-shaped, with children with one sibling giving nearly the same number of hours of care than children with four or more siblings.

On top of the geographical differences outlined previously, it is possible to find disparities between men and women. First, as pointed out by Table A1, women are more likely to need care than men, and among those who do, women also have a higher probability of receiving care in the three country pools considered, as shown in Figure A1. Second, as Figure A2 and Figure A3 suggest, 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

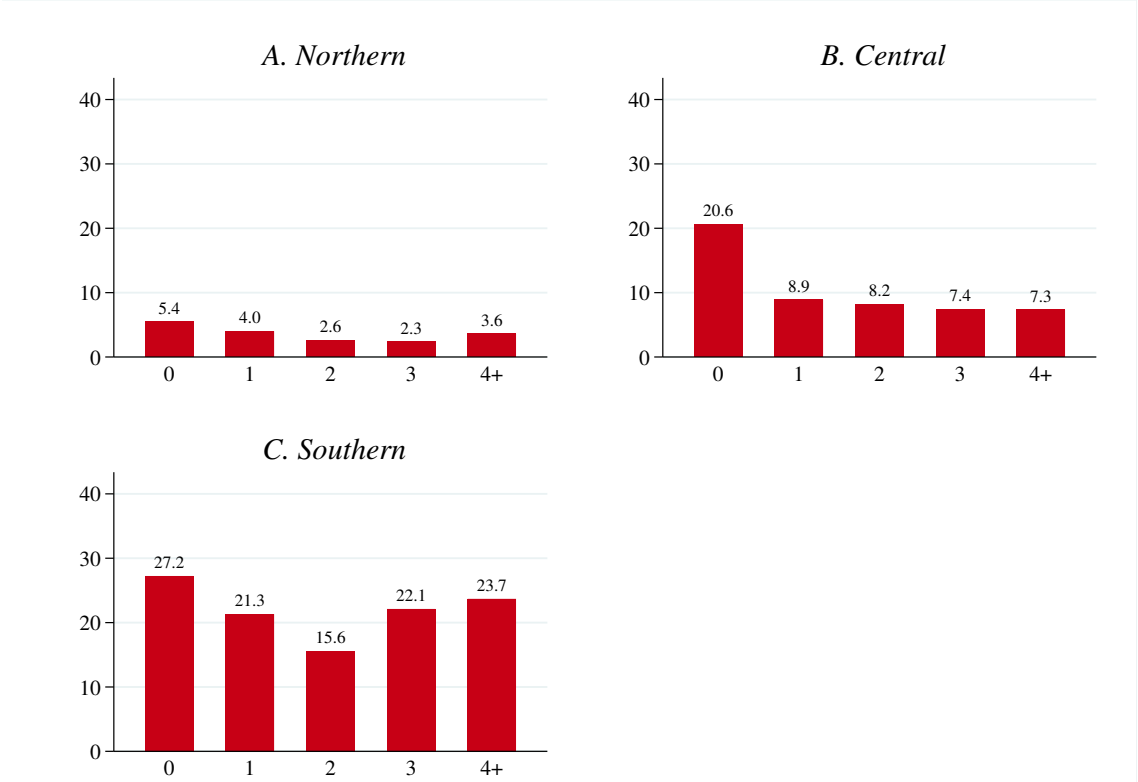
FIGURE 6: NUMBER OF SIBLINGS AND INFORMAL CARE GIVEN TO PARENTS (%, 2015)



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.

than women. Third, as can be seen in Figure A5, 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. Fourth, in Figures A6 and A7 it is possible to observe that the aforementioned relation between the likelihood of providing informal care, the amount of help given, and family size holds for sons and daughters, with the latter giving more hours of care than the former. These differences between men and women are robust after controlling for individual characteristics that may be relevant in this context (see Tables A2-A5).

FIGURE 7: 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.

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.[3] The younger generation can allocate time to informal care and market work, and can spend their labor earnings on consumption. Meanwhile, the parents can buy formal care. Each family member makes her choices to maximize utility, taking the behavior of the other agents in the family as given. The outcome of 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

[3]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.

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, although they may prefer to be assisted by their children rather than hired outsiders. 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 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, the set of choice alternatives of a child 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 $\mathcal{A} \equiv \mathcal{A}_1 \times ... \times \mathcal{A}_N$.

Simultaneously, 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 several sources of care. Their choice-specific utility is

$$\begin{aligned} V_b =& \delta_{0b} + \delta_{1b} \sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x}) + \delta_{2b} \mathbb{1}\left\{ \sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x}) > 0 \right\} + \delta_{3b}\text{spouse} + \delta_{4b}\text{others} \\ &+ \delta_{5b}\text{widow} \times \text{male} + \delta_{6b}\text{widow} \times \text{female} + \delta_{7b} W + \zeta_b, \end{aligned} \tag{2}$$

where $\sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x})$ is the number of hours of informal care provided by the children, followed by an indicator function that takes value one if this number is larger than zero. 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. This specification also allows preferences over formal care to differ between married and widowed parents, with gender-specific shifters. W represents the amount of wealth available to the parents. This is to consider, in a simplified way, the fact that wealthier parents may afford to pay for formal care and leave larger bequests to their children, who might feel compelled to supply informal care to safeguard their inheritances from the cost of formal care. As in the child's utility function, 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.[4] The preference shocks of the parents are jointly distributed with the shocks

[4] An alternative formulation of the problem might consider that parents derive utility from consumption and hours of formal care, and determine how to distribute their assets between these two by making their choice on whether to buy formal care. In this case, their choice-specific utility could be written as $V_b = \gamma C(\boldsymbol{d}, \boldsymbol{x}) + \eta F(\boldsymbol{d}, \boldsymbol{x}) + \delta_{1b} \sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x}) + \delta_{2b} \mathbb{1}\left\{ \sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x}) > 0 \right\} + \delta_{3b}\text{spouse} + \delta_{4b}\text{others} + \delta_{5b}\text{widow} \times \text{male} + \delta_{6b}\text{widow} \times \text{female} + \zeta_b$, and their budget constraint by $C(\boldsymbol{d}, \boldsymbol{x}) + qF(\boldsymbol{d}, \boldsymbol{x}) = W$, with $\delta_{1b}, ..., \delta_{6b}$ normalized to zero for $b = \text{NFC}$, and $C(\boldsymbol{d}, \boldsymbol{x})$ being the consumption level that they enjoy when the family plays outcome $\boldsymbol{d}$, $F(\boldsymbol{d}, \boldsymbol{x})$ the number of hours of formal care that they decide to buy, and q the price of formal care. Wealth would not play any role in the choice on whether to buy formal care, though: $V_{\text{FC}} - V_{\text{NFC}} = (\eta - \gamma q) F(\boldsymbol{d}, \boldsymbol{x}) + \delta_1 \sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x}) + \delta_2 \mathbb{1}\left\{ \sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x}) > 0 \right\} + \delta_3\text{spouse} + \delta_4\text{others} + \delta_5\text{widow} \times \text{male} + \delta_6\text{widow} \times \text{female} + \zeta_{\text{FC}} - \zeta_{\text{NFC}}$.

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 when the family plays outcome $\boldsymbol{d}$, and the hourly wage w, which is a function of the observable, individual characteristics collected in $\boldsymbol{z}_i$, a subset of $\boldsymbol{x}_i$.

D. Equilibrium

Let $\boldsymbol{U}_i = (U_i(\boldsymbol{d},\boldsymbol{x},\epsilon_i))_{\boldsymbol{d}\in\mathcal{D}}$ and $\boldsymbol{V} = (V(\boldsymbol{d},\boldsymbol{x},\zeta))_{\boldsymbol{d}\in\mathcal{D}}$ 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 each child take a discrete action simultaneously in order to maximize their respective payoffs. Let σ_i be a strategy of child i, and π a strategy of the parents. 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,

$$\begin{aligned} U_i(\boldsymbol{\sigma}^*, \pi^*, \boldsymbol{x}, \epsilon_i) &\geq U_i\left(\sigma_i, \boldsymbol{\sigma}_{-i}^*, \pi^*, \boldsymbol{x}, \epsilon_i\right) \\ V(\boldsymbol{\sigma}^*, \pi^*, \boldsymbol{x}, \zeta) &\geq V(\boldsymbol{\sigma}^*, \pi, \boldsymbol{x}, \zeta), \end{aligned} \tag{4}$$

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. 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 to perform activities of daily living, and whose children are between 30 and 60 years-old.[5] 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 care than the sample of working-age respondents who may take care of their parents. This sample also offers details on some characteristics of the children, such as age, gender, education, marital and employment status, and living arrangements.

Each observation in my sample is a child-parents dyad when the survey interview was conducted. All the dyads which share the same parents constitute a family f playing a game. For each dyad, I observe the employment and elderly care decisions made by each child and her parents, represented by a_{if} and b_f, respectively, as well as the vector of observable characteristics $\boldsymbol{x}_{if}$. This contains child i's age and dummies for gender, college education, distance to the parental residence being less than 25 kilometers, being married, having children, the parent being widowed, and parental health.

I measure parental health status following Ko (2021), using the information available in SHARE about limitations with activities of daily living (ADL) and cognitive impairment in SHARE.[6] Survey respondents take word recall, orientation, and numeracy tests to assess their cognitive abilities. Using the scores from these tests, I categorize a respondent as cognitively impaired if she is in the bottom 10% of the cognitive score distribution of the sample. Next, 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.[7]

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

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

[7] I consider that parental health is exogenous and independent to whether or not the parents receive care. I make this assumption because, in contrast to other forms of healthcare, elderly care is concerned with the ability to carry out basic, daily activities. Thus, children may benefit from this form of care because it enhances the well-being of their parents, rather than having more negative effects on their health outcomes. Earlier research has shown that receiving care has no effect on mortality (Applebaum, Christianson, Harrigan and Schore, 1988), and it has only a small impact on health overall, suggesting that earlier investments are much more relevant for the

My measure of parental wealth W_f, also included in $\boldsymbol{x}_{if}$, comes from the value of all financial and real assets of the respondent, net of debts and liabilities, and adjusted for constant PPP exchange rates to allow for comparison across countries and over time. I divide this amount, which represents the total stock of wealth that parents have at the moment, by the number of weeks that they are expected to live according to national life expectancy at age 65. I use these "weekly assets" in the model as a way to incorporate consumption smoothing and account for the possibility that older or wealthier parents may run down their assets at a different rate than younger or poorer ones.

In the model, the choice set concerning the child's informal care decision contains two alternatives: to give informal care, and not to give informal care. In the data, I consider that a child of a survey respondent gives informal care if she helped 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) in the twelve months before the interview. An analogous definition applies to the informal care supplied by the spouse of the care recipient and other sources such as siblings, children-in-law or friends.

Parents in the model can choose between two alternatives: to buy formal care or not. In the data, I consider that a respondent receives formal care if she stayed in a nursing home or a residential care facility, or received professional care, help with domestic tasks or meals-on-wheels at home in the twelve months before the interview. Since there is no information about hours of care in Waves 5 and 6 of SHARE, I impute these using data from Waves 1 and 2, as detailed in Appendix B.

B. Hours worked and wages

In terms of employment status, a child in the model has two options: to be employed, and to be non-employed. The data gathered by SHARE allows me to categorize the children of survey respondents as employed or non-employed, but there is no information on the number of hours worked by them. To overcome this limitation, I impute this number using data on hours worked from the European Union Statistics on Income and Living Conditions (EU-SILC). Targeting individuals aged between 30 and 60 in the countries and years studied, I regress the logarithm of hours worked on a second order polynomial of age and dummies for gender and having college education. Table C1 shows the estimated coefficients. In case a child decides to be employed and give care to her parents, I subtract from the resulting number the

determination of the health stock (Finkelstein and McKnight, 2008).

imputed hours of informal care given. If a child decides not to be employed, the imputed number is zero.

I assume that wage offers w_{if} 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

$$\ln w_{if} = \boldsymbol{z}_{if}'\boldsymbol{\lambda} + \xi_{if}, \tag{5}$$

similar to Mincer (1974), with ξ_{if} being independent and identically distributed as normal. Since SHARE does not report the wages of the children of survey respondents, I use data on employees' gross earnings from hours usually worked per week in the main job from EU-SILC for the set of countries and years studied. Since I can only observe the wages of employed individuals in this dataset, 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, and college education. The marital status of the child and whether she has children act as exclusion restrictions for identification, since these aspects affect the utility associated with employment and care choices, but not wages. Table C2 displays the coefficient estimates.

C. Preferences

To estimate child i's preferences over employment and care alternatives, I assume that the unobservables $\epsilon_i(a)$ for $i = 1, \ldots, N$ and $\zeta(b)$ are independent and identically distributed as type-I extreme value. I parameterize $\boldsymbol{\alpha}(\boldsymbol{d}, \boldsymbol{x})$ as a linear function of an intercept, the sum of the number of hours of informal care given by the siblings, the hours of formal care bought by the parents, the number of siblings who do not give any care, and dummies for the parent being widowed, the parents having severe care needs, living less than 25 kilometers away from them, child i's gender, having children, and being married. All these parameters are choice-specific, and I normalize to zero the ones corresponding to action $a_i = \text{NENC}$. In the parents' utility function, I also normalize to zero the parameters associated to $b = \text{NFC}$.

Let $\boldsymbol{\theta} \in \mathbb{R}^{39}$ be the vector that collects the parameters in $\boldsymbol{\alpha}(\boldsymbol{d}, \boldsymbol{x})$, and β, δ_0, δ_1, δ_2, δ_3, δ_4, δ_5, δ_6 and δ_7. 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 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 obtain a Nash equilibrium in pure strategies.[8] 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.[9] Averaging over draws, the simulated probability that family f plays outcome $\boldsymbol{d}$ is

$$\widehat{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f;\boldsymbol{\theta}\right)=\frac{1}{R}\sum_{r=1}^{R}\widetilde{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f;\boldsymbol{\theta},\boldsymbol{\epsilon}_f^{(r)},\zeta_f^{(r)}\right). \tag{6}$$

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

$$\widehat{\mathcal{L}}\left(\boldsymbol{\theta}\right)=\sum_{f=1}^{F}\hat{\ell}_f(\boldsymbol{\theta})=\sum_{f=1}^{F}\sum_{\forall\boldsymbol{d}\in\mathcal{D}_f}\mathbb{1}\{\boldsymbol{d}_f=\boldsymbol{d}\}\ln\widehat{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f;\boldsymbol{\theta}\right), \tag{7}$$

where $\hat{\ell}_f(\boldsymbol{\theta})$ is the likelihood contribution of family f.[10]

I apply the above estimation algorithm separately to the samples of families with four or fewer children in Northern, Central, and Southern Europe, which consist of 1,141, 1,638 and 1,458 families, respectively.[11] I feed the optimization algorithm with the estimates of $\boldsymbol{\theta}$ from a version of the model with no interactions among family members as initial guess, and I use 50 draws of the unobservables in the simulations.

[8] I simulate the game played by each family in the data by means of the Python interface of Gambit library (McKelvey, McLennan and Turocy, 2014). This software computes the Nash equilibria of any finite, non-cooperative game using algorithms based on McKelvey and McLennan (1996).

[9] The polynomial of family characteristics contains the value of weekly assets of the parents, quadratics in the ages of the children, dummies for the parents having severe care needs, being widowed, interactions between assets and the other variables, and an intercept.

[10] Theoretically, the game could exhibit multiple equilibria and equilibria in mixed strategies at some realizations of $\boldsymbol{\theta}$, $\boldsymbol{\epsilon}$ and ζ. To select one equilibrium in the simulations and treat the model in standard ways for identification and inference, I let families pick one of the possible equilibria in pure strategies they can play at random. An application of a similar equilibrium selection mechanism in the context of labor force participation decisions in the household can be found in Bjorn and Vuong (1984). I focus on equilibria in pure strategies because mixed strategies lack empirical support in the situation described by my model. One could then be concerned about the possibility that some families may not have any equilibrium in pure strategies, but after running simulations, this does not seem to be relevant in this model.

[11] As Table B5 shows, families with four or fewer children represent 89.03% of the initial sample in Northern Europe, 85.20% in Central Europe, and 83.49% in Southern Europe.

V. Estimation Results and Model Fit

Tables 1 and 2 report the parameter estimates of the preferences of the child and the parents. The three sets of coefficient values aim to capture the influence of different family characteristics, institutions and social norms in the provision of elderly care across Europe.

Table 1: Child's Parameters – Complete Information Game

	Northern			Central			Southern		
β	0.003			0.003			0.006		
	ENC	NEIC	EIC	ENC	NEIC	EIC	ENC	NEIC	EIC
α_0: Constant	-1.428	-5.491	-3.768	-0.345	-3.165	-2.608	-0.068	-5.331	-3.406
α_1: Hours of informal care from siblings	-0.074	0.445	0.340	-0.081	0.123	0.125	-0.023	0.119	0.092
α_2: Hours of formal care	-0.000	-0.011	0.002	0.005	0.008	0.004	0.005	0.012	0.007
α_3: Severe care needs	0.094	0.942	0.650	-0.502	-0.018	0.067	-0.550	0.389	-0.017
α_4: Number of siblings who do not give care	-0.027	0.318	-0.888	0.048	-0.597	-0.689	-0.034	-0.503	-0.740
α_5: Parent is widowed	-0.154	1.235	0.221	-0.186	0.234	0.204	-0.172	0.167	0.232
α_6: Near dummy	-0.131	0.580	0.966	-0.326	1.440	0.979	-0.195	2.151	1.550
α_7: Female dummy	0.185	-0.025	0.164	0.120	0.444	0.308	-0.443	1.403	0.487
α_8: Children dummy	0.802	1.826	0.895	0.463	0.649	0.354	0.177	-0.123	-0.159
α_9: Married dummy	0.898	-0.678	0.807	0.063	-0.018	-0.121	0.601	0.740	0.371

Note: The choice alternatives are *non-employment and no care* (NENC; base category), *employment and no care* (ENC), *non-employment and informal care* (NEIC), and *employment and informal care* (EIC). Columns 2-4 report the choice-specific parameters estimated for Northern Europe, columns 5-7 the ones for Central Europe, and columns 8-10 the ones for Southern Europe.

In the upper panel of Table 1, the child's marginal utility of consumption is positive, as expected, and slightly higher in Southern Europe than in Northern and Central Europe. In the lower panel, the estimates associated to the choice alternatives of the children illustrate how they respond to the needs of their parents. According to the values estimated for α_0, becoming a caregiver and remaining non-employed is the least preferred option in the three country groups considered for the reference individual. This is an adult, unmarried male who does not have children. His parents, with light care needs, live more than 25 kilometers away, and there are not siblings involved in caregiving. This individual would be better off in case he was employed, and there is a number of circumstances that can also attenuate the burden of being the only caregiver in the family.

Consistent with previous studies (Ko, 2021) and reduced-form evidence in Table A4, the disutility of providing care is lower for children who live with their parents or nearby. Being married also reduces this cost, except for nonemployed adults in

Northern Europe and employed ones in Central Europe. Although married children might provide fewer hours of help (Sloan, Picone and Hoerger, 1997) and less effective care (Byrne, Goeree, Hiedemann and Stern, 2009) than their unmarried counterparts, the efficiency gains from household production of the former might save time.

The disutility from providing care decreases in the presence of own children as well. In this case, greater contact with parents due to the grandparenting role (Kalmijn and Dykstra, 2006) and the possibility that grandchildren participate in caregiving in some families might outweigh the opposite effect in "sandwich generation" families (Železná, 2016; Albertini, Tur-Sinai, Lewin-Epstein and Silverstein, 2022) where childcare competes with elderly care.

Preferences over employment and care vary across child's gender and parental health, too. The utility of providing care is higher for women than for men. This in line with other estimates in the literature (Byrne, Goeree, Hiedemann and Stern, 2009; Ko, 2021), as well as Figures A4 and A5 and previous studies (Engers and Stern, 2002; Checkovich and Stern, 2002) which show that daughters are more likely than sons to give care. Table A4 and the existing literature (Sloan, Picone and Hoerger, 1997; Checkovich and Stern, 2002) point out that parents facing worse health and more difficulties to perform daily activities demand more attention, which reflects in a higher utility for giving care, as found in earlier work (Byrne, Goeree, Hiedemann and Stern, 2009; Skira, 2015; Ko, 2021).

The presence of alternative sources of care is another factor that influences the preferences of the child. The values estimated for α_2 and α_4 imply that a higher participation of siblings in caregiving increases the utility of providing care. Bequest motives, the possibility of distributing the care burden over family members, or the will to stay away from guilt may work against children's incentives to free-ride on one another and in favor of shared caregiving. Meanwhile, formal care seems to have a small, mostly positive impact on the utility of becoming a caregiver. Earlier literature has found that informal care is a substitute of formal care (Pezzin and Schone, 1999; Van Houtven and Norton, 2004, 2008; Bolin, Lindgren and Lundborg, 2008a), but this substitution effect tends to diminish as the needs of the elderly rise and the level of skill required to meet these demands advances (Bonsang, 2009).

Given that I normalize the utility of not receiving formal care to zero, the negative estimate of δ_0 in Table 2 indicates that parents dislike formal care, which is consistent with findings in earlier studies (Barczyk and Kredler, 2018; Mommaerts, 2020; Ko, 2021). Informal care can mitigate this negative effect, though. Care recipients might not only prefer their children, spouses, and other relatives as caregivers, but these

Table 2: Parents' Parameters – Complete Information Game

	Northern	Central	Southern
δ_0: Constant	-2.103	-2.053	-2.185
δ_1: Hours of informal care from children	0.142	0.092	0.037
δ_2: At least one child gives some care (dummy)	0.424	0.358	0.246
δ_3: Informal care from the spouse (dummy)	1.691	2.063	0.955
δ_4: Informal care from other sources (dummy)	0.604	0.372	0.268
δ_5: Male widow	0.550	0.865	0.769
δ_6: Female widow	0.471	0.914	0.293
δ_7: Assets	0.00004	0.00011	0.00009

might also be better informed about their care needs. This is especially true for highly handicapped individuals, for whom informal care often acts as a complement rather than a substitute of formal care (Bonsang, 2009).

The choice-specific estimates of α_6 in the child's preferences and δ_5 and δ_6 in the parents' imply that there are stronger incentives to give informal care and buy formal care when the parent is widowed. Presumably, widow parents require more attention than their married counterparts because they are generally older and in worse health. Additionally, these incentives change slightly across male and female parents. With the exception of Northern Europe, widowed fathers benefit more from formal care than widowed mothers do. This finding agrees with previous research pointing out that informal care provided to mothers is less effective, yet less burdensome than care given to fathers (Byrne, Goeree, Hiedemann and Stern, 2009), encouraging families to turn to formal care providers.

The estimates of the marginal utility of assets, which parents may use for consumption, buying formal care or leaving bequests to their relatives, are positive, and slightly higher in Central Europe than in Southern and Northern Europe.

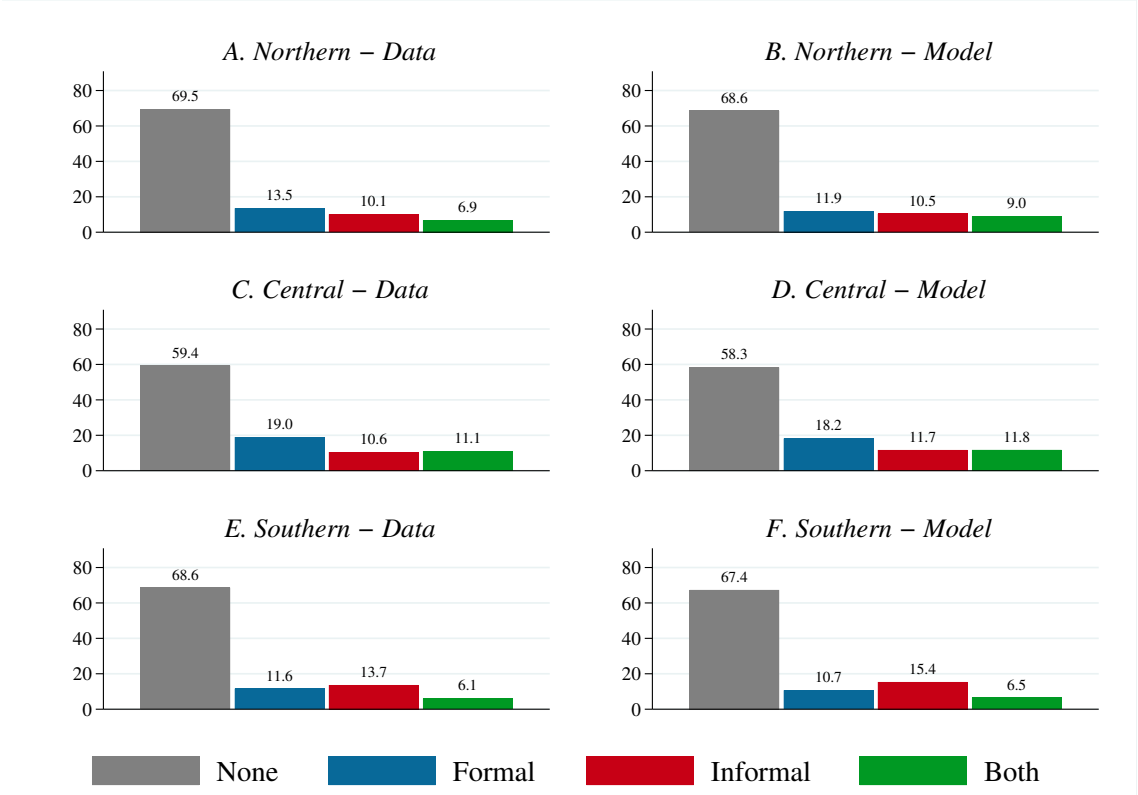
To evaluate the goodness of fit of the estimated model, Table 3 compares the shares of children and respondents choosing each combination of employment status and care in the estimation sample with those obtained in model simulations. The model matches well the distributions of choices by children and parents in the countries under study. As a result, the model is able to reproduce both the ranking of alternative sources of care and their magnitudes in Figure 8, as well as the employment rates by caregiving status of the children in Figure 9.

Table 3: Employment Status and Elderly Care Choices (%) – Complete Information Estimates

	NENC		ENC		NEIC		EIC		NFC		FC	
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Denmark	9.92	7.12	74.85	74.91	1.66	1.09	13.56	16.88	74.70	75.16	25.30	24.84
Sweden	6.59	8.63	84.43	75.54	0.17	0.43	8.80	15.40	82.15	81.60	17.85	18.40
Northern Europe	7.79	8.09	80.99	75.31	0.71	0.67	10.51	15.93	79.63	79.42	20.37	20.58
Austria	7.09	13.50	76.47	68.30	0.68	4.19	15.77	14.00	68.61	68.50	31.39	31.50
Belgium	11.03	8.17	78.12	69.85	1.40	3.96	9.44	18.03	59.91	72.31	40.09	27.69
France	10.52	9.49	78.58	75.43	2.03	3.22	8.87	11.85	70.00	69.02	30.00	30.98
Germany	10.81	10.31	73.65	68.89	3.04	4.31	12.50	16.48	70.47	70.46	29.53	29.54
Central Europe	10.70	10.12	74.82	70.13	2.74	4.09	11.75	15.65	69.88	70.25	30.12	29.75
Italy	16.83	16.63	69.36	65.62	4.46	5.05	9.35	12.71	83.28	83.52	16.72	16.48
Spain	23.37	17.42	65.92	61.40	3.41	7.21	7.30	13.97	79.44	82.31	20.56	17.69
Southern Europe	18.65	16.85	68.40	64.44	4.17	5.65	8.78	13.06	82.29	83.21	17.71	16.79

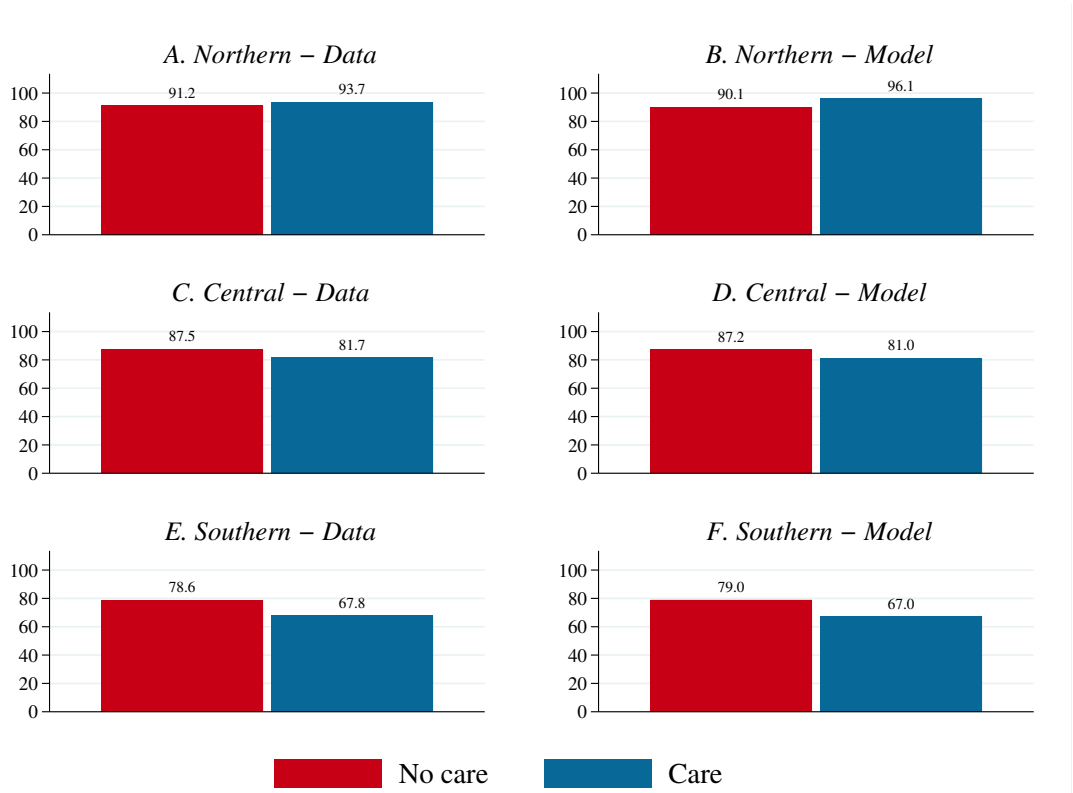
Note: The table shows the shares of children and respondents who choose each combination of employment status and elderly care in the estimation sample and the model simulations according to the parameter estimates. The child's choice alternatives are *non-employment and no care* (NENC), *employment and no care* (ENC), *non-employment and informal care* (NEIC), and *employment and informal care* (EIC). The parents' choice alternatives are *no formal care* (NFC), and *formal care* (FC).

FIGURE 8: TYPE OF CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER (%) – MODEL FIT WITH COMPLETE INFORMATION ESTIMATES



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) in the estimation sample and the model simulations according to the parameter estimates.

Figure 9: Employment Status of Children and Informal Care Received by Respondents with Care Needs (%) – Model Fit with Complete Information Estimates



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 in the estimation sample and the model simulations according to the parameter estimates. The three country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain).

VI. Counterfactual Simulations

Differences in opportunity costs, institutions and social norms contribute to the variety of care arrangements observed across European countries. To better understand the role of these factors, represented by the model components, I examine their effects on care and employment decisions in baseline and counterfactual scenarios produced by the estimated model.

The first counterfactual exercise aims to quantify the role of social norms and the availability of formal care in the country groups considered. To do so, I simulate the decisions made by families in Central and Southern Europe after setting their preference parameters equal to the ones estimated for Northern Europe.

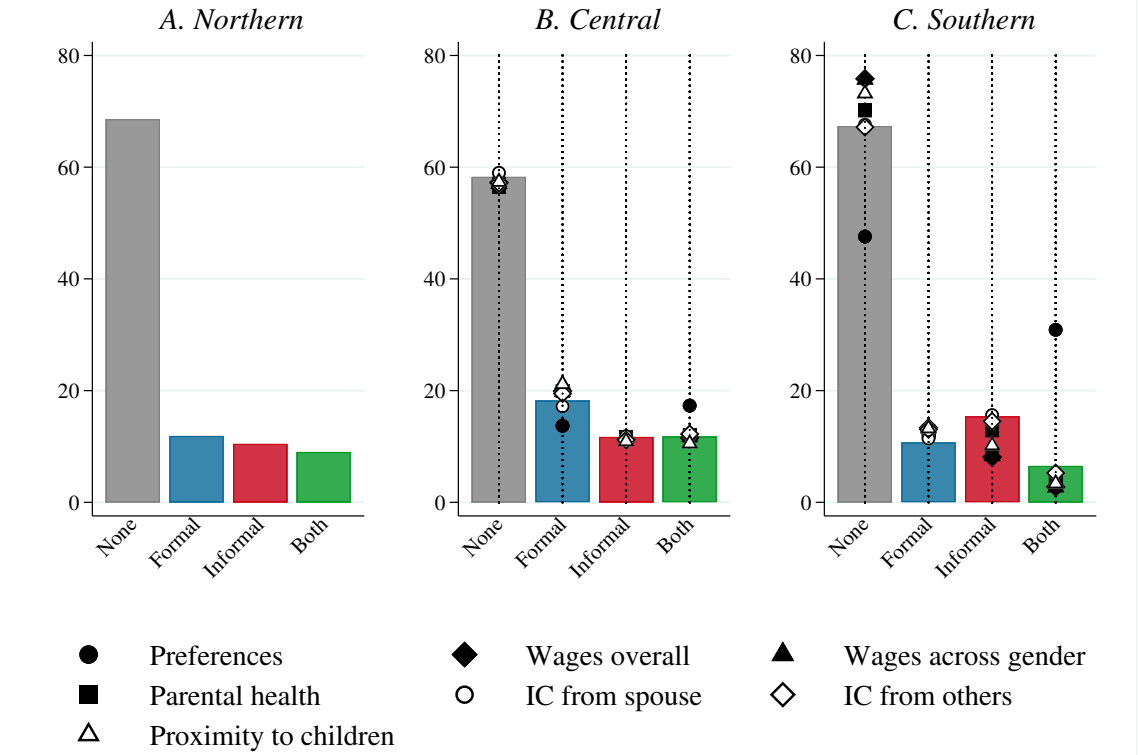
In addition to culture and institutions, countries are also heterogeneous in other

economic and demographic dimensions that could be relevant to explain the patterns in care and time allocation observed across Europe. The estimated model also allows to evaluate the importance of wage rates, parental health, availability of informal care from sources different from children, and living arrangements. In order to do that, in additional counterfactual exercises I set the conditional distribution of each of these factors in Central and Southern Europe equal to the corresponding conditional distribution in Northern Europe, keeping everything else the same as in the baseline scenario. I accomplish that by mathing each individual in the samples of Central and Southern Europe with her nearest neighbor in Northern Europe. Thus, in the second counterfactual exercise, I assess the role of wages by replacing those of children in Central and Southern Europe with the wages of their Northern European counterparts, and simulate the game played by them and their relatives. In subsequent exercises, ignoring the wage gaps between men and women, and offsetting regional differences in parental care needs, access to informal care from spouses and other sources, and geographical proximity of parents to children.

Figure 10 summarizes the results of the simulations in terms of the type of care received by parents. Out of all the factors investigated, preferences have the greatest impact on care arrangements. If families in Southern Europe had the same preferences as those in Northern Europe, the percentage of parents who receive the two types of care would rise from 6.5% to 30.9%. Such a change would result in a significant decrease in the share of people who do not receive any care, moving from 67.4% to 47.6%, along with a modest increase in the share of parents who receive only formal care and a decrease in the percentage of those who receive only informal care. As shown in Panel B of Table 4, the gap with Northern Europe in the share of parents receiving only one of the types of care would nearly disappear, while the gap in percentage of parents receiving both types would widen significantly. Figure 11 and Panel B of Table 5 display the associated changes in the employment shares of children. The employment share of Southern European children who do not provide care would decrease from 79% to 64.4%, widening the gap with Northern Europe, whereas the employment rate of children who do give care would slightly increase. Therefore, facing the same institutions and social norms as in Northern Europe would encourage families to take advantage of easier access to formal care services, rather than motivating children to participate in caregiving. The reaction of Central European families in the same scenario would be more moderate.

The effects of shutting down differences in labor markets, represented by wage levels, in the second counterfactual exercise would be sizable as well, especially in Southern Europe, where wages are lower than in Northern and Central Europe in

FIGURE 10: TYPE OF CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER (%) – BASELINE AND COUNTERFACTUAL SIMULATIONS



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 baseline (bars) and counterfactual (markers) simulations according to the parameter estimates. The three country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain).

the baseline scenario. If Southern European children had the same wages as their Northern European counterparts, the employment rate would increase for caregiving and non-caregiving children, going from 67.1% and 79% to 92.6% and 98%, respectively. This would close the gap with Northern European caregivers by 3.5 points and put Southern European caregivers ahead of those who live in Northern Europe. While increasing their labor supply to obtain higher earnings, some families would replace the informal care given in the baseline scenario with formal care. In spite of this shift, the share of parents receiving both types of care would end up being almost 4 points lower than in the baseline, and that of parents receiving no care would become more than 8 points higher. All the gaps with Northern Europe in terms of care received, but the one in informal care as the only means of help, would widen slightly. The results from the third counterfactual exercise, which removes wage differences across gender, would be similar. The outcomes of these two exercises in

Table 4: Type of care received by individuals aged 70 or older in baseline and counterfactual scenarios – Differences between Northern, Central and Southern Europe (%)

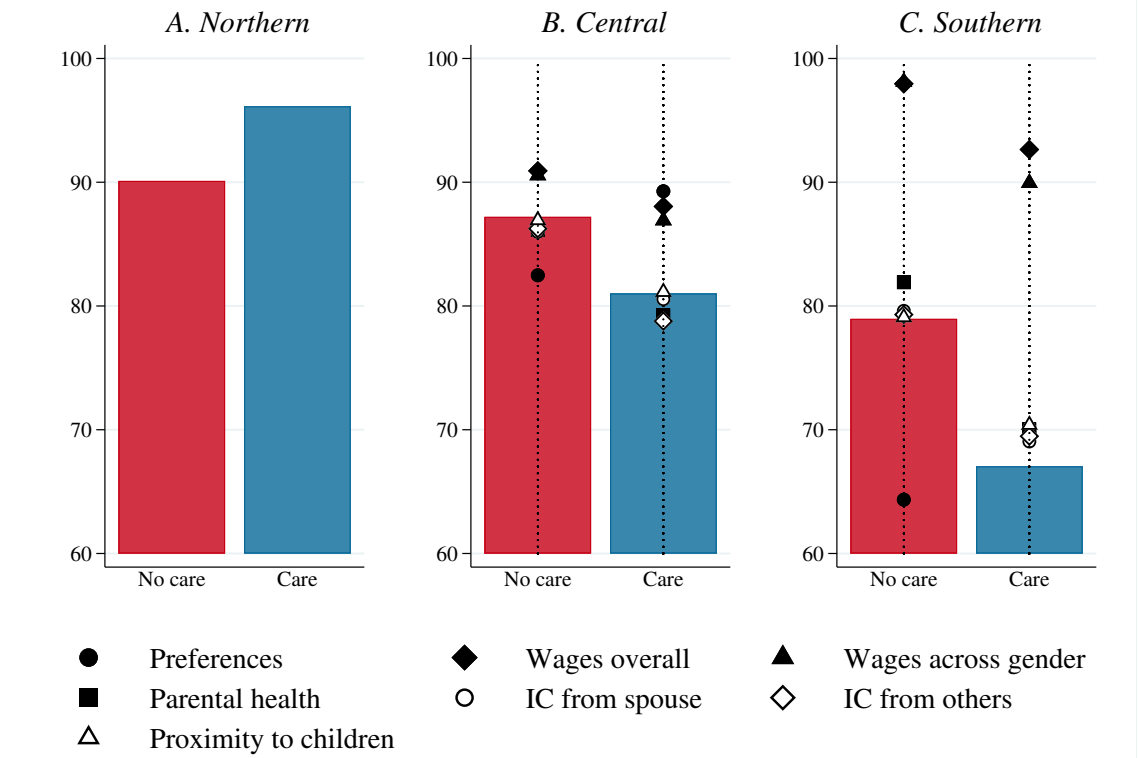
	No care		Formal care		Informal care		Both types of care	
	A. Northern vs Central Europe							
	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	10.31		-6.32		-1.24		-2.75	
Preferences	10.83		-1.80		-0.74		-8.28	
Wages overall	11.32	9.04	-8.04	-2.07	-0.77	-0.36	-2.51	-6.61
Wages across gender	11.63	9.03	-7.84	-2.98	-1.14	0.12	-2.64	-6.17
Parental health	12.14	8.41	-8.03	-2.19	-1.15	-0.03	-2.96	-6.18
Informal care from spouse	9.61	6.52	-5.30	-0.66	-1.36	0.03	-2.95	-5.90
Informal care from others	11.47	6.49	-7.59	-0.61	-0.69	-0.29	-3.20	-5.59
Proximity to children	11.22	6.38	-9.27	-0.82	-0.44	0.65	-1.51	-6.21
	B. Northern vs Southern Europe							
	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	1.23		1.18		-4.91		2.49	
Preferences	21.02		-0.54		1.38		-21.86	
Wages overall	-7.23	22.66	-1.44	-1.73	2.38	-0.35	6.28	-20.57
Wages across gender	-7.07	21.44	-1.49	-1.78	2.21	0.73	6.35	-20.39
Parental health	-1.55	20.10	-0.78	-0.81	-2.40	1.87	4.74	-21.16
Informal care from spouse	1.00	16.11	0.47	0.09	-5.14	1.44	3.66	-17.64
Informal care from others	1.44	18.90	-1.19	-0.82	-4.02	2.27	3.78	-20.35
Proximity to children	-4.59	15.05	-1.34	-0.78	0.28	3.11	5.65	-17.37

Note: The table shows the differences between Northern and Central Europe (Panel A) and Northern and Southern Europe (Panel B) in the share of respondents who receive no care, only formal care, only informal care, or both types of care in baseline and counterfactual scenarios. Columns *Indiv.* display the results of each counterfactual separately, and columns *Cumul.* the results of combining them (e.g., the first entry of these columns is computed in a scenario where preference parameters and wages are equal across country groups; the second adds the effect of removing gender differences in wages, and so on).

the simulations for Central Europe would point in the same direction.

In the fourth counterfactual exercise, I set the conditional distribution of parents with severe care needs in Central and Southern Europe equal to the corresponding distribution in Northern Europe, and in the fifth exercise I do the same with the conditional distribution of parents living less than 25 kilometers away. Families' responses in both situations are more modest than in the previous scenarios, and again stronger in Southern Europe than in Central Europe. In the baseline case, 65.2% of families in Southern Europe have parents with severe care needs, compared to 26.2% in Central Europe and 20.2% in Northern Europe. With regard to proximity to children, 80.3% of Southern European children live near their parents, whereas 64.8% of children in Central Europe and 54% in Northern Europe do. By endowing Southern European parents with better health, the share of those receiving no care

Figure 11: Employment Share of Children by Informal Care Given to Parents (%) – Baseline and Counterfactual Simulations



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 in baseline (bars) and counterfactual (markers) simulations according to the parameter estimates. The three country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain).

would rise by 2.8 points, and the gap with Northern Europe in the proportion of parents receiving only formal or informal care would narrow. Meanwhile, children's employment rate would rise by 2.9 points. By making children live farther away from their parents, the share of individuals receiving only formal care would rise by 2.5 points, the percentage of those receiving only informal care would fall by 5.2 points, and there would be 3.2% fewer parents receiving both types of care than in the baseline.

In the sixth and seventh counterfactuals, I offset regional differences in the availability of informal care from spouses and other sources by applying the same matching procedure as before to the corresponding conditional distributions. Families react mildly to these changes in both cases.

Table 5: Employment share of caregiving and non-caregiving children in baseline and counterfactual scenarios – Difference between Northern and Central Europe (%)

	Employed non-caregivers		Employed caregivers	
	A. Northern vs Central Europe			
	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	2.90		15.13	
Preferences	7.63		6.86	
Wages overall	-0.81	2.79	8.09	4.67
Wages across gender	-0.44	2.81	9.22	4.24
Parental health	3.97	2.48	16.89	4.05
Informal care from spouse	4.13	2.74	15.59	4.84
Informal care from others	3.87	2.62	17.36	4.54
Proximity to children	3.18	2.81	15.00	4.33
	B. Northern vs Southern Europe			
	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	11.14		29.09	
Preferences	25.76		26.32	
Wages overall	-7.84	2.89	3.50	9.01
Wages across gender	-8.00	1.72	6.20	9.76
Parental health	8.20	3.28	26.11	9.02
Informal care from spouse	10.51	2.35	27.09	8.52
Informal care from others	10.81	1.85	26.66	10.04
Proximity to children	11.02	1.79	25.75	10.52

Note: The table shows the differences between Northern and Central Europe (Panel A) and Northern and Southern Europe (Panel B) in the employment shares of children who give informal care and who do not give informal care in baseline and counterfactual scenarios. Columns *Indiv.* display the results of each counterfactual separately, and columns *Cumul.* the results of combining them (e.g., the first entry of these columns is computed in a scenario where preference parameters and wages are equal across country groups; the second adds the effect of removing gender differences in wages, and so on).

VII. Conclusion

In this paper, I analyze the choices made by European families to provide care for the elderly when they require assistance to carry out their daily activities. Earlier research has documented the existence of remarkable differences in the outcome of these decisions across Europe. The literature has studied the nature of such disparities, but it has done so without considering the strategic implication of family interactions. To close this gap, I construct and estimate a structural model that represents old parents and their working-age children making care provision and labor supply decisions in a static, non-cooperative game of complete information. I show that the proposed model does a good job in fitting the observed patterns in care

received by the elderly and employment rates of their relatives in Northern, Central and Southern Europe. Equipped with this model, I simulate families' decisions in several counterfactual scenarios to quantify the role of the factors driving the differences in care arrangements across the three country groups. Results show that preferences, capturing the influence of social norms and access to publicly provided care, are largely responsible for these disparities, followed by wage rates. Differences in parental health, geographical proximity to children, and access to informal care from spouses and other sources are less influential.

References

Albertini, Marco, Aviad Tur-Sinai, Noah Lewin-Epstein, and Merril Silverstein, "The Older Sandwich Generation Across European Welfare Regimes: Demographic and Social Considerations," *European Journal of Population*, May 2022, *38* (2), 273–300.

Applebaum, R. A., J. B. Christianson, M. Harrigan, and J. Schore, "The evaluation of the National Long Term Care Demonstration. 9. The effect of channeling on mortality, functioning, and well-being," *Health Services Research*, April 1988, *23* (1), 143–159.

Attias-Donfut, Claudine, Jim Ogg, and François-Charles Wolff, "Family Support," in "Health, Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe," Mannheim Research Institute for the Economics of Aging, 2005, pp. 171–178.

Barczyk, Daniel and Matthias Kredler, "Evaluating Long-Term-Care Policy Options, Taking the Family Seriously," *The Review of Economic Studies*, 2018, *85* (2), 766–809.

_ **and** _ , "Long-Term Care Across Europe and the United States: The Role of Informal and Formal Care," *Fiscal Studies*, 2019, *40* (3), 329–373.

_ **, Sean Fahle, and Matthias Kredler**, "Save, Spend or Give? A Model of Housing, Family Insurance, and Savings in Old Age," Working Paper 2022.

Bjorn, Paul A. and Quang H. Vuong, "Simultaneous Equations Models for Dummy Endogenous Variables: A Game Theoretic Formulation with an Application to Labor Force Participation," Social Science Working Papers 537, California Institute of Technology 1984.

Bolin, K., B. Lindgren, and P. Lundborg, "Informal and Formal Care among Single-Living Elderly in Europe," *Health Economics*, 2008, *17* (3), 393–409.

Bolin, Kristian, Bjorn Lindgren, and Petter Lundborg, "Your Next of Kin or Your Own Career? Caring and Working Among the 50+ of Europe," *Journal of Health Economics*, 2008, *27* (3), 718–738.

Bonsang, Eric, "Does Informal Care from Children to Their Elderly Parents Substitute for Formal Care in Europe?," *Journal of Health Economics*, 2009, *28* (1), 143–154.

Byrne, David, Michelle S. Goeree, Bridget Hiedemann, and Steven Stern, "Formal Home Health Care, Informal Care, and Familiy Decision Making," *International Economic Review*, 2009, *50* (4), 1205–1242.

Börsch-Supan, Axel, Martina Brandt, Christian Hunkler, Thorsten Kneip, Julie Korbmacher, Frederic Malter, Barbara Schaan, Stephanie Stuck, and Sabrina Zuber, "Data Resource Profile: The Survey of Health, Ageing and Retirement in Europe (SHARE)," *International Journal of Epidemiology*, 2013, *42* (4), 992–1001.

Cannuscio, Carolyn C., Camara Jones, Ichiro Kawachi, Graham A. Colditz, Lisa Berkman, and Eric Rimm, "Reverberations of Family Illness: A Longitudinal Assessment of Informal Caregiving and Mental Health Status in the Nurses' Health Study," *American Journal of Public Health*, 2002, *92* (8), 1305–1311.

Canta, Chiara, Helmuth Cremer, and Firouz Gahvari, ""Honor thy father and thy mother" or not: uncertain family aid and the design of social long term care insurance," *Social Choice and Welfare*, 2020.

Carmichael, Fiona and Susan Charles, "The Labour Market Costs of Community Care," *Journal of Health Economics*, 1998, *17*, 747–765.

Casado-Marín, David, Pilar García-Gómez, and Ángel López-Nicolás, "Informal Care and Labour Force Participation Among Middle-Aged Women in Spain," *SERIEs*, 2010, *2* (1), 1–29.

Checkovich, Tennille J. and Steven Stern, "Shared Caregiving Responsibilities of Adult Siblings with Elderly Parents," *The Journal of Human Resources*, 2002, *37* (3), 441–478.

Clancy, Rebecca L., Gwenith G. Fisher, Kelsie L. Daigle, Christine A. Henle, Jean McCarthy, and Christine A. Fruhauf, "Eldercare and Work Among Informal Caregivers: A Multidisciplinary Review and Recommendations for Future Research," *Journal of Business and Psychology*, 2019, *33*, 1–19.

Crespo, Laura and Pedro Mira, "Caregiving to Elderly Parents and Employment Status of European Mature Women," *Review of Economics and Statistics*, 2014, *96* (4), 693–709.

Dobrescu, Loretti I., "To Love or to Pay: Savings and Health Care in Older Age," *Journal of Human Resources*, 2015, *50* (1), 254–299.

_ **and Fedor Iskhakov**, "Bequest Motives in a Life-Cycle Model with Intergenerational Interactions," Working Paper 2013.

Engers, Maxim and Steven Stern, "Long-Term Care and Family Bargaining," *International Economic Review*, 2002, *43* (1), 73–114.

Ettner, Susan L., "The Opportunity Costs of Elder Care," *The Journal of Human Resources*, 1996, *31* (1), 189.

European Commission, "The 2018 Ageing Report: Economic & Budgetary Projections for the 28 EU Member States (2016-2070)," Institutional Paper 079, Directorate-General for Economic and Financial Affairs 2018.

_ , *Joint Report on Health Care and Long-Term Care Systems & Fiscal Sustainability: Country Documents 2019 Update*, Luxembourg: Publications Office of the European Union, 2019.

Eurostat, "Distribution of population aged 18 and over by part-time or full-time employment, income group and sex," 2022. Data retrieved from Eurostat Health and Labour Conditions Indicators, https://ec.europa.eu/eurostat/databrowser/view/ILC_LVHL04__custom_3191245/default/table?lang=en.

Finkelstein, Amy and Robin McKnight, "What did Medicare do? The initial impact of Medicare on mortality and out of pocket medical spending," *Journal of Public Economics*, July 2008, *92* (7), 1644–1668.

Heckman, James J., "Shadow Prices, Market Wages, and Labor Supply," *Econometrica*, 1974, *42* (4), 679.

_ , "Sample Selection Bias as a Specification Error," *Econometrica*, 1979, *47* (1), 153.

Heitmueller, Axel, "The Chicken or the Egg? Endogeneity in Labour Market Participation of Informal Carers in England," *Journal of Health Economics*, 2007, *26* (3), 536–559.

Hoerger, Thomas J., Gabriel A. Picone, and Frank A. Sloan, "Public Subsidies, Private Provision of Care and Living Arrangements of the Elderly," *The Review of Economics and Statistics*, 1996, *78* (3), 428.

Johnson, Richard W. and Anthony T. Lo Sasso, "The Trade-Off between Hours of Paid Employment and Time Assistance to Elderly Parents at Midlife," Working Paper, Urban Institute February 2000.

Kalmijn, Matthijs and Pearl A. Dykstra, "Differentials in face-to-face contact between parents and their grown-up children," in "Family solidarity in the Netherlands," Amsterdam: Dutch University Press, 2006, pp. 63–88.

Ko, Ami, "An Equilibrium Analysis of the Long-Term Care Insurance Market," *The Review of Economic Studies*, 2021.

Kohli, Martin, Harald Kunemund, and Jorg Ludicke, "Family Structure, Proximity and Contact," in "Health, Ageing and Retirement in Europe: First Results from the Survey of Health, Ageing and Retirement in Europe," Mannheim Research Institute for the Economics of Aging, 2005.

Korfhage, Thorben, "Long-Run Consequences of Informal Elderly Care and Implications of Public Long-Term Care Insurance," Working Paper, SOEPpapers 2019.

Kotschy, Rainer and David E. Bloom, "A Comparative Perspective on Long-Term Care Systems," Working Paper 29951, National Bureau of Economic Research, Cambridge, MA April 2022.

Macken, Candace L., "A Profile of Functionally Impaired Elderly Persons Living in the Community," *Health Care Financing Review*, 1986, *7*, 33–49.

McKelvey, Richard D. and Andrew McLennan, "Computation of Equilibria in Finite Games," in Hans M. Amman, David A. Kendrick, and John Rust, eds., *Handbook of Computational Economics*, Vol. 1, Elsevier, 1996, pp. 87–142.

_ , Andrew M. McLennan, and Theodore L. Turocy, "Gambit: Software Tools for Game Theory, Version 16.0.1," 2014. http://www.gambit-project.org.

Michaud, Pierre-Carl, Axel Heitmueller, and Zafar Nazarov, "A Dynamic Analysis of Informal Care and Employment in England," *Labour Economics*, 2010, *17* (3), 455–465.

Mincer, Jacob, *Schooling, Experience, and Earnings*, National Bureau of Economic Research, 1974.

Mommaerts, Corinna, "Long-Term Care Insurance and the Family," Working Paper 2020.

Ory, Marcia G., Richard R. Hoffman, Jennifer L. Yee, Sharon Tennstedt, and Richard Schulz, "Prevalence and Impact of Caregiving: A Detailed Comparison Between Dementia and Nondementia Caregivers," *The Gerontologist*, 1999, *39* (2), 177–186.

Pezzin, Liliana E. and Barbara Steinberg Schone, "Intergenerational Household Formation, Female Labor Supply and Informal Caregiving: A Bargaining Approach," *The Journal of Human Resources*, 1999, *34* (3), 475.

Pinquart, Martin and Silvia Sörensen, "Differences Between Caregivers and Noncaregivers in Psychological Health and Physical Health: A Meta-Analysis," *Psychology and Aging*, 2003, *18* (2), 250–267.

Reher, David Sven, "Family Ties in Western Europe: Persistent Contrasts," *Population and Development Review*, June 1998, *24* (2), 203–234.

Schmitz, Hendrik and Matthias Westphal, "Informal Care and Long-Term Labor Market Outcomes," *Journal of Health Economics*, 2017, *56*, 1–18.

Skira, Meghan M., "Dynamic Wage and Employment Effects of Elder Parent Care," *International Economic Review*, January 2015, *56* (1), 63–93.

Sloan, Frank A., Gabriel A. Picone, and Thomas J. Hoerger, "The Supply of Children's Time to Disabled Elderly Parents," *Economic Inquiry*, 1997, *35* (2), 295–308.

Spiess, C. Katharina and A. Ulrike Schneider, "Interactions Between Caregiving and Paid Work Hours among European Midlife Women, 1994 to 1996," *Ageing and Society*, 2003, *23* (1), 41–68.

Van Houtven, Courtney Harold and Edward C. Norton, "Informal Care and Health Care Use of Older Adults," *Journal of Health Economics*, 2004, *23* (6), 1159–1180.

_ **and** _ , "Informal care and Medicare expenditures: Testing for heterogeneous treatment effects," *Journal of Health Economics*, January 2008, *27* (1), 134–156.

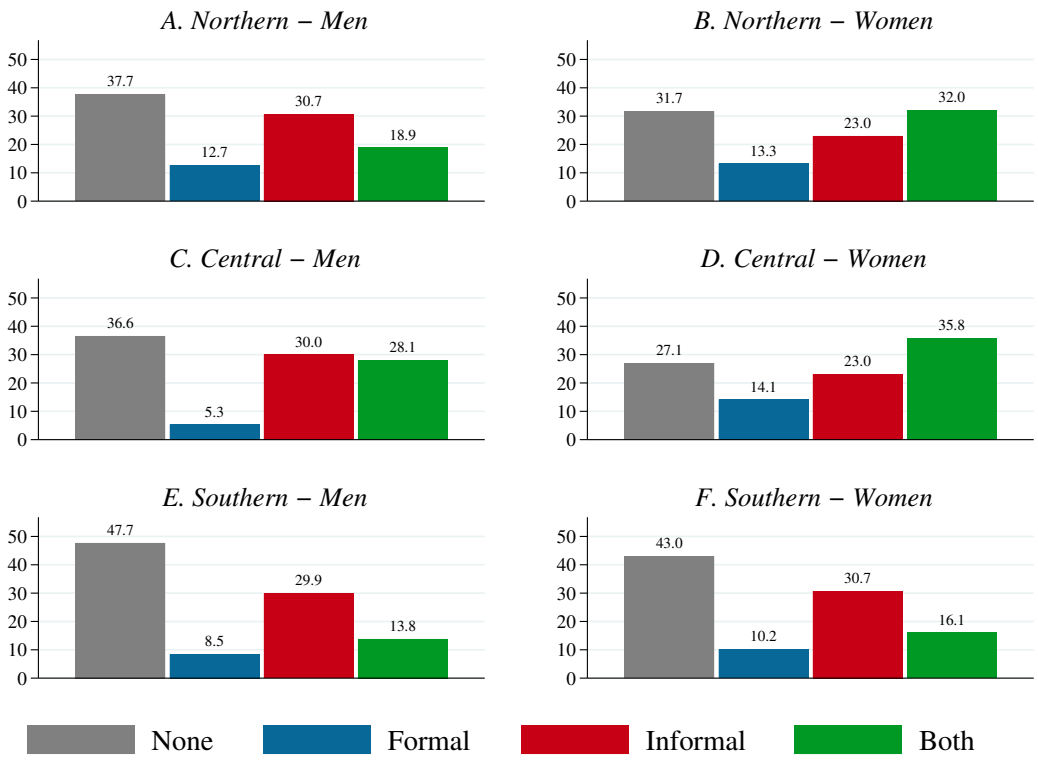
_ **, Norma B. Coe, and Meghan M. Skira**, "The Effect of Informal Care on Work and Wages," *Journal of Health Economics*, 2013, *32* (1), 240–252.

Wolf, Douglas A. and Beth J. Soldo, "Married Women's Allocation of Time to Employment and Care of Elderly Parents," *The Journal of Human Resources*, 1994, *29* (4), 1259.

Železná, Lada, "Care-giving to grandchildren and elderly parents: role conflict or family solidarity?," *Ageing and Society*, dec 2016, *38* (5), 974–994.

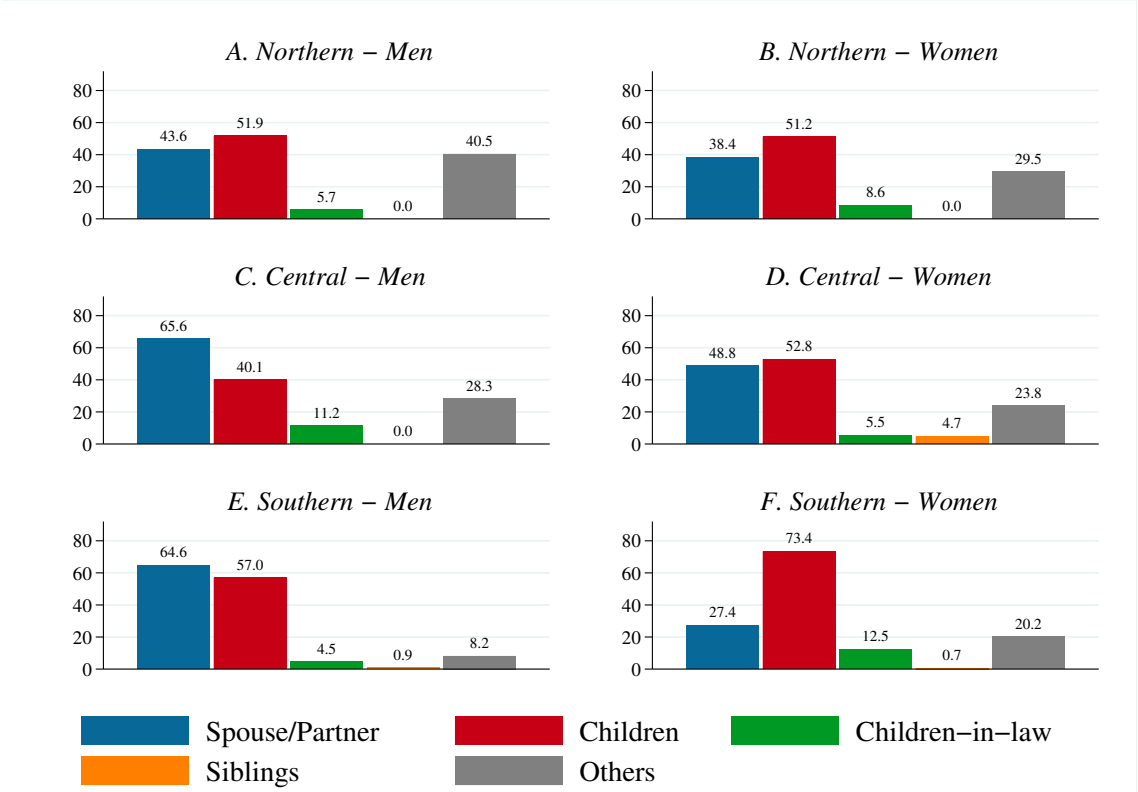
Appendix A: Gender Differences in Elderly Care

Figure A1: Type of Care Received by Individuals Aged 70 or Older with Care Needs - Men and Women (%, 2015)



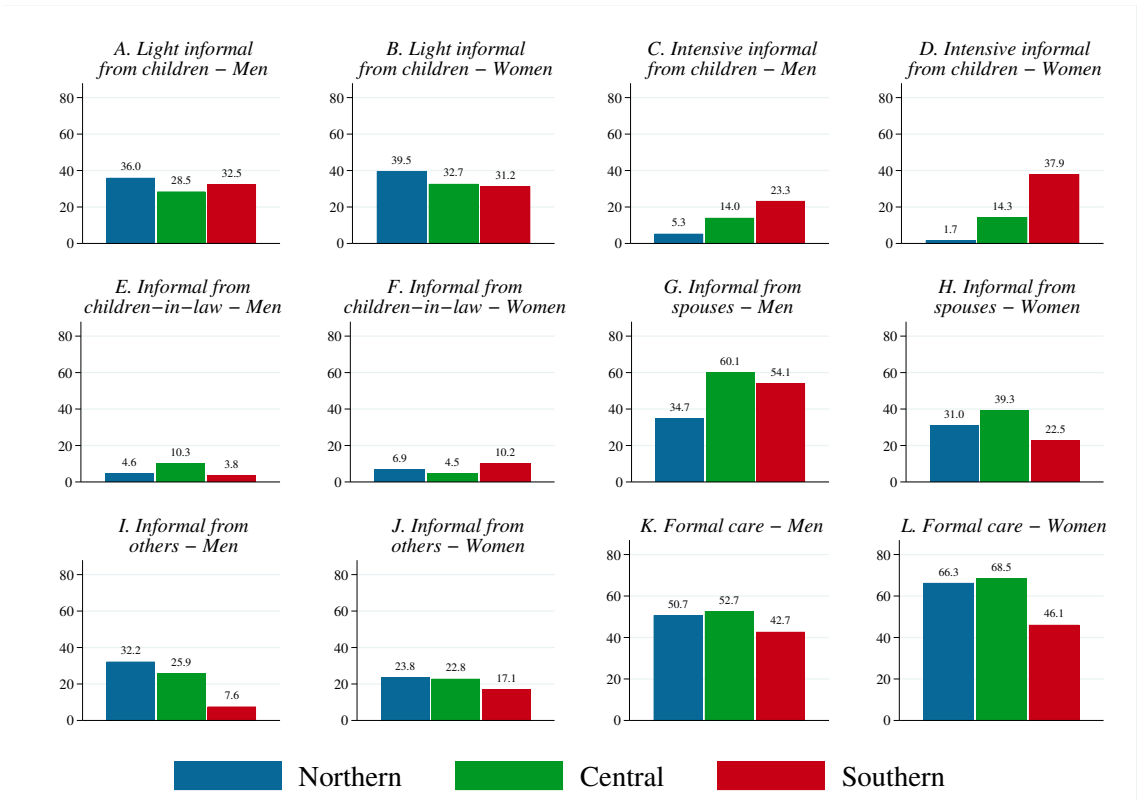
Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive each type of care in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: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

FIGURE A2: SOURCES OF INFORMAL CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER WITH CARE NEEDS - MEN AND WOMEN (%, 2015)



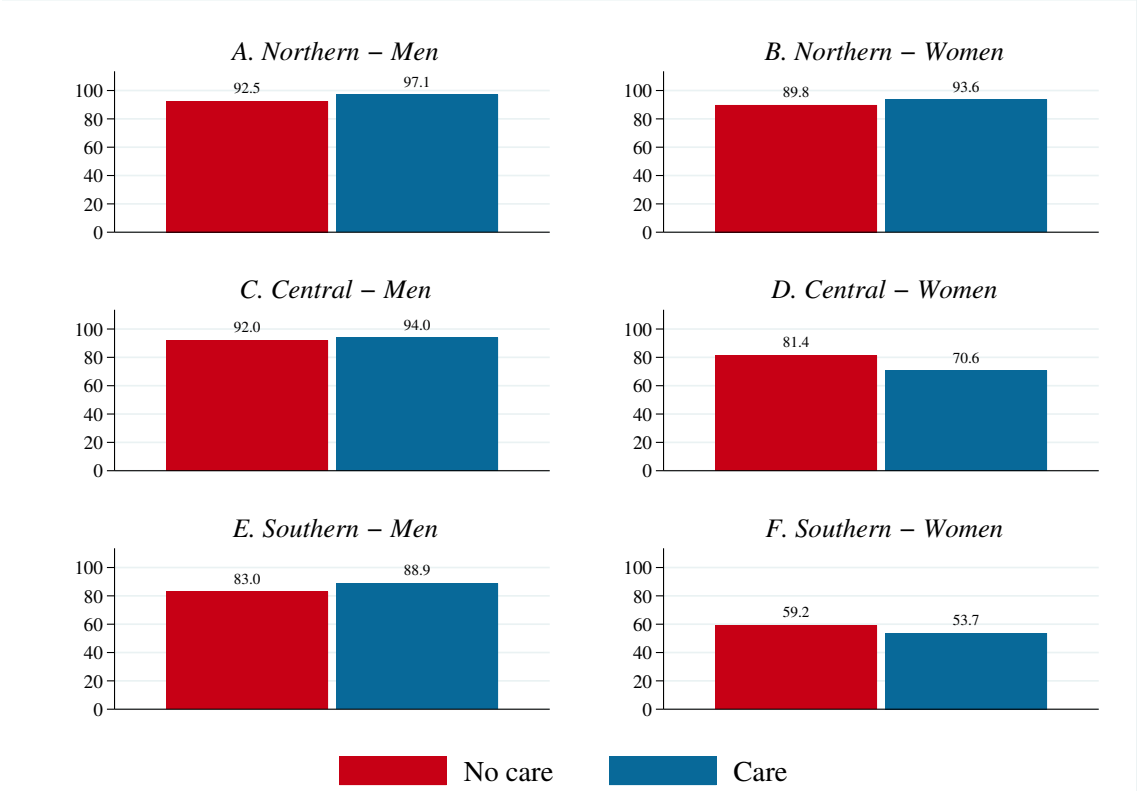
Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive informal care from each source, conditional on receiving some informal care, in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France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

FIGURE A3: TYPE OF CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER WITH CARE NEEDS - MEN AND WOMEN (SIX OPTIONS, %, 2015)



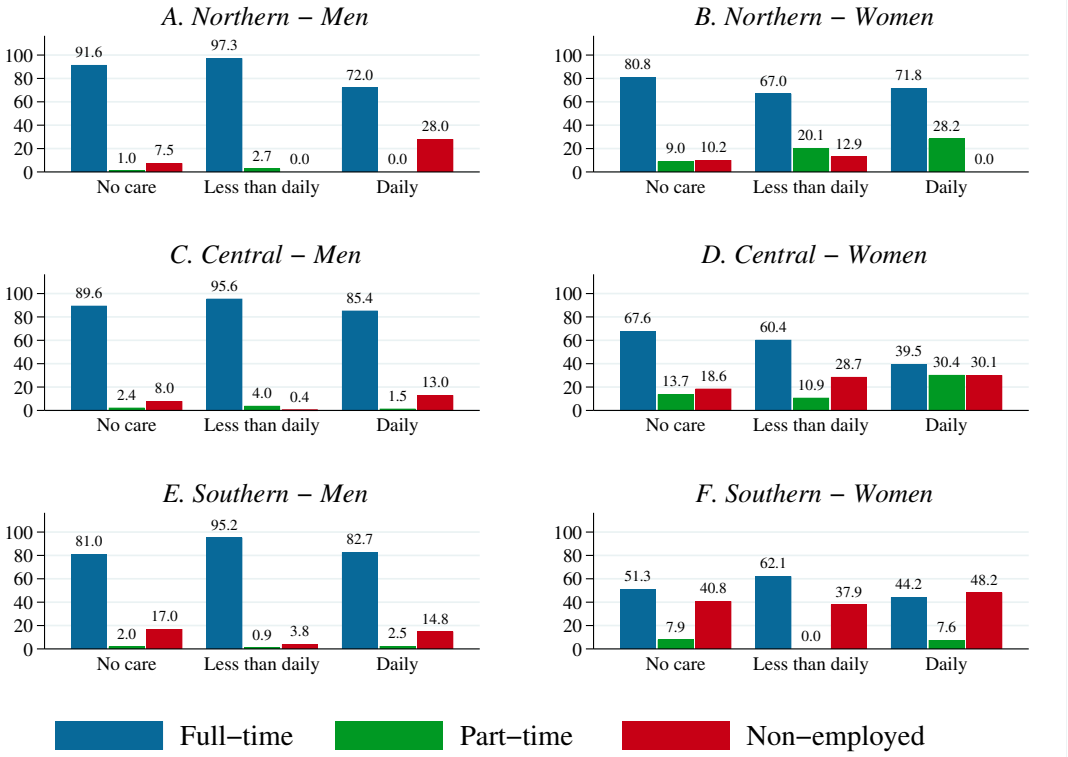
Note: The figure plots the shares of individuals aged 70 or older, with care needs, and at least one child between 30 and 60 years-old, who receive each type of care, conditional on receiving some care, in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and 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 A4: Employment Status of Children and Informal Care Received by Respondents with Care Needs - Men and Women (%, 2015)



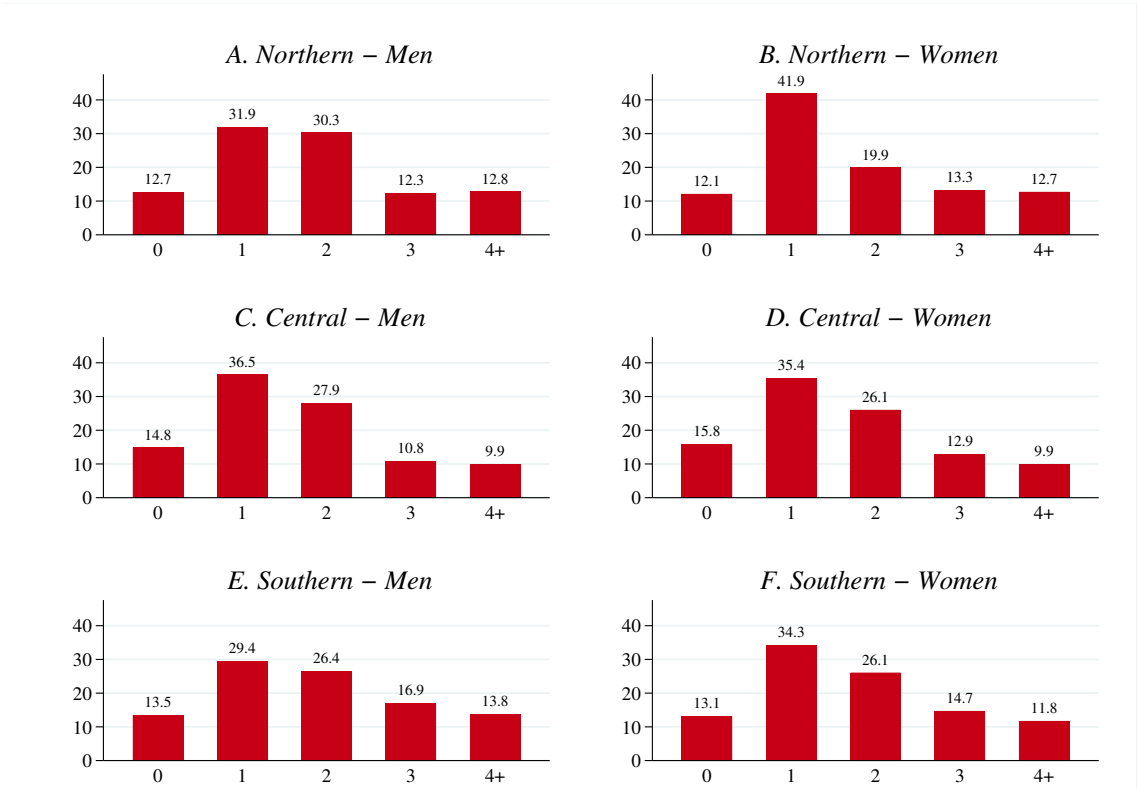
Note: The figure plots the shares of individuals who are between 30 and 60 years-old, have at least one parent with care needs who is aged 70 or older, and are employed, or non-employed while giving informal care or no care at all. The data corresponds to Northern Europe (Denmark and Sweden), Central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

FIGURE A5: EMPLOYMENT STATUS OF CHILDREN AND FREQUENCY OF INFORMAL CARE RECEIVED BY RESPONDENTS WITH CARE NEEDS - MEN AND WOMEN (%, 2015)



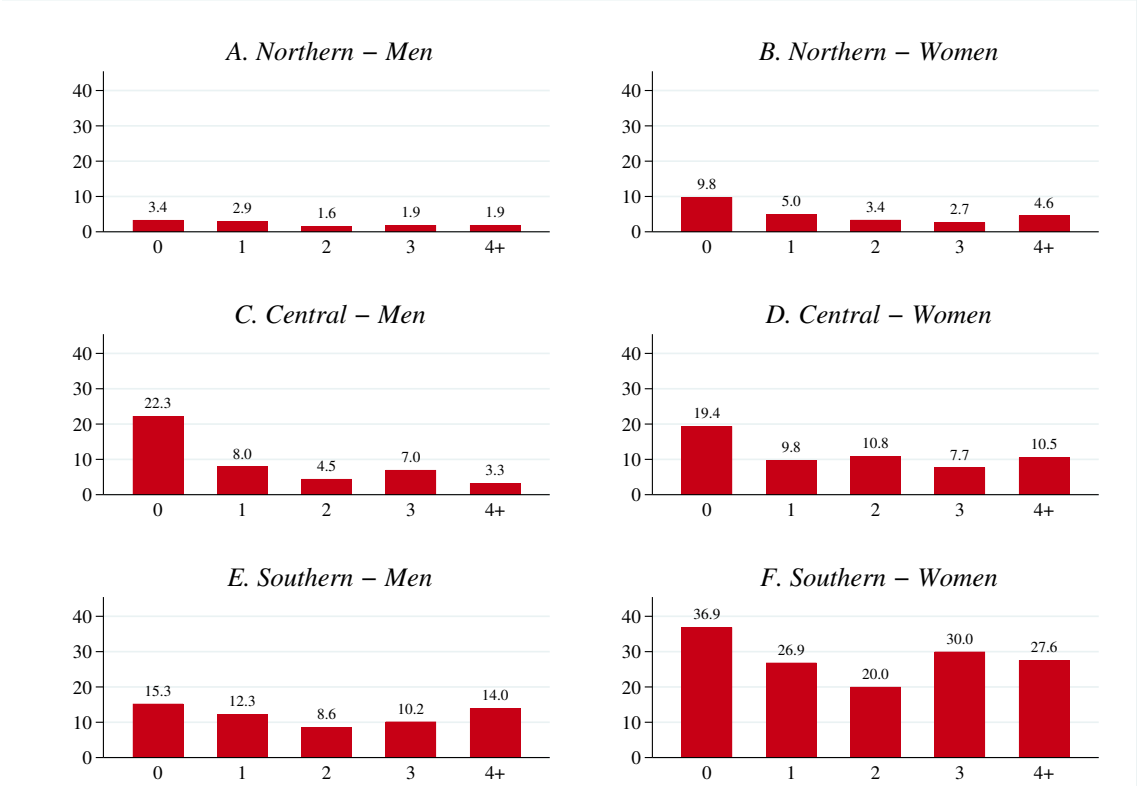
Note: The figure plots the shares of individuals who are between 30 and 60 years-old, have at least one parent with care needs who is 70 or older, and are full-time employed, part-time employed or non-employed while giving informal care on a daily basis, informal care less frequently, or no care at all. 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 A6: 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 A7: 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 A1: Having Care Needs - Respondents Aged 70 or Older (2015) – Logit Estimates

Dependent variable	Having care needs (dummy)
Female (dummy)	1.394***
	(0.125)
Age	0.953
	(0.202)
Age squared	1.001
	(0.001)
Widowed (dummy)	1.295*
	(0.181)
Log net assets	0.895***
	(0.018)
Northern Europe (dummy)	0.591***
	(0.064)
Southern Europe (dummy)	1.665***
	(0.154)
Constant	0.083
	(0.701)
Number of observations	6,672

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 A2: 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 A3: 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 A4: 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 A5: Employment Status of Children of Respondents Aged 70 or Older with Care Needs (2015) – Multinomial Logit Estimates

	Part-time	Full-time
Female (dummy)	1.701*	0.232***
	(0.485)	(0.032)
Age	1.441*	1.152
	(0.302)	(0.139)
Age squared	0.996*	0.999
	(0.002)	(0.001)
College (dummy)	2.917***	4.309***
	(0.997)	(1.066)
Lives more than 25km	0.766	1.232
away from parents (dummy)	(0.223)	(0.208)
Children (dummy)	1.951**	1.221
	(0.646)	(0.223)
Married (dummy)	0.941	1.514**
	(0.261)	(0.247)
Siblings (dummy)	0.724	0.844
	(0.345)	(0.255)
Severe LTC needs (dummy)	0.793	0.855
	(0.210)	(0.133)
Light informal care	0.830	1.075
given (dummy)	(0.417)	(0.333)
Intensive informal care	1.201	0.698
given (dummy)	(0.444)	(0.163)
North (dummy)	1.170	1.752**
	(0.378)	(0.410)
South (dummy)	0.339***	0.548***
	(0.097)	(0.093)
Constant	0.000*	0.163
	(0.000)	(0.454)
Number of observations	3,111	

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 B: Hours of Care

SHARE asks its interviewees about help they may have received from people they know, who can family members living inside or outside the household, friends or neighbors. In Wave 5, I obtain the answers to these questions from the *social support* module, where respondents can name up to three different caregivers living outside the household, among whom their children can be included. In the case of caregivers living inside the household, they can name all the people who gave them help, including a maximum of nine children. Meanwhile, in Wave 6 I use the *gvchildren* module, which is only available in Waves 6 and 7, and makes information on the children of the respondents more easily accessible by collecting answers in several parts of the questionnaire. In this case, respondents can mention up to 20 children.

Table B1: Overview of data on care received in SHARE

	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7
OIC	Hours & frequency (household)	Hours & frequency (household)	–	Frequency (household)	Frequency (household)	Frequency (individual)	Frequency (individual)
IIC	Dummy (individual)	Dummy (individual)	–	Dummy (individual)	Dummy (individual)	Dummy (individual)	Dummy (individual)
FHC	Hours (individual)	Hours (individual)	–	–	Dummy (individual)	Dummy (individual)	Hours (individual)
NHC	Dummy (individual)	Dummy (individual)	Dummy (individual)	Dummy (individual)	Dummy (individual)	Dummy (individual)	Dummy (individual)

Note: The table summarizes the information on care received available in each wave of SHARE. The rows correspond to the types of care distinguished in the survey: *informal care provided by individuals who live outside the household of the respondent* (OIC), *informal care provided by individuals who live with the respondent* (IIC), *formal care received at home* (FHC), and *nursing home care* (NHC). For each form of care and wave, *hours* indicates that there is information about the number of hours of care received; *frequency* denotes that the survey only reports if the respondent received care daily, weekly, monthly, or less often; and *dummy* represents that there is only information on whether the respondent received care. In parenthesis, *individual* and *household* shows if the questions refer to care received only by the respondent, or the two couple members together in case the respondent is married or living with her partner. *Source*: SHARE questionnaires and Barczyk and Kredler (2019).

I consider children, spouses or any other person to be informal caregivers if the respondent reports having received personal care, practical household help, or help with paperwork from this person in the twelve months before the interview. It should be noted, though, that the question collecting this information in Wave 5 is formulated differently when it refers to care received from people who live outside the respondent's household. In this case, SHARE asked about care received by the

respondent and her partner together, instead of care received only by the respondent. Table B1 summarizes the way in which each wave presents the information on the various care options.

Table B2: Estimates of Hours of Informal Care Given to Parents

	Log hours of care
Number of siblings	0.023
	(0.020)
Parental health	-0.256***
	(0.028)
Widowed parent (dummy)	0.034
	(0.074)
Less than 25km away from parents (dummy)	0.182***
	(0.065)
Female (dummy)	0.332***
	(0.061)
Having children (dummy)	-0.185*
	(0.103)
Northern Europe (dummy)	-0.402***
	(0.046)
Southern Europe (dummy)	0.473***
	(0.077)
Constant	1.938***
	(0.134)
Number of observations	2,150
R^2	0.224

Note: OLS estimates of logarithmic hours of informal care given to parents weekly by survey respondents in SHARE Waves 1 and 2. Standard errors in parentheses. P-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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. To assign each child with a number of hours of help given, I rely on data from Waves 1 and 2, where SHARE asked about hours of care given to parents living outside the household of the respondent.[12] I regress the logarithm of this number on a set of characteristics of the potential caregiver, namely, the number of siblings, parental health, and dummies for the parent being widowed, living less than 25 kilometers away from the parents, gender, and living in Northern or Southern Europe. Next, I use these estimates, reported in Table B2, to impute

[12]SHARE stopped collecting this number after the second wave of the survey, and has never asked about hours of help given or received in the case the care recipient and the caregiver were living together.

the number of hours of care given weekly by the children of the respondents in the estimation sample.

Table B3: Estimates of Hours of Formal Home Care Received by Parents

Log hours of care			
ADL dummies			
Dressing	-0.019	Cognitively impaired (dummy)	-0.121***
	(0.055)		(0.044)
Walking across a room	0.349***	Age	7.106
	(0.106)		(22.791)
Bathing/showering	0.103*	Age^2	-0.128
	(0.062)		(0.419)
Eating/Cutting up food	-0.065	Age^3	0.001
	(0.110)		(0.003)
Getting in/out of bed	-0.125	Age^4	-0.000
	(0.094)		(0.000)
Using the toilet	0.154	Number of children	-0.049***
	(0.118)		(0.013)
Preparing a hot meal	0.224***	Widowed (dummy)	0.243***
	(0.077)		(0.046)
Shopping for groceries	0.302***	At least one child	0.073
	(0.053)	lives less than 25km away	(0.056)
Using the phone	-0.465***	Net assets	-0.000
	(0.101)		(0.000)
Taking medications	0.507***	North (dummy)	-0.247***
	(0.094)		(0.048)
Working around the house	0.207***	South (dummy)	-0.146**
	(0.051)		(0.064)
Managing money	0.128*	Constant	-145.108
	(0.072)		(463.622)
Number of observations	3,939		
R^2	0.240		

Note: OLS estimates of logarithmic hours of formal home care received by parents weekly in SHARE Waves 1 and 2. Standard errors in parentheses. P-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

I proceed similarly with the number of hours of formal care. In Waves 5 and 6, SHARE asked its interviewees if they had stayed in a nursing home or residential care facility, or received professional care, help with domestic tasks, or meals-on-wheels at home. However, it did not collect any information on the corresponding number of hours of care received. To approximate the number of hours of formal care that parents receive weekly in my sample, I use data from Waves 1 and 2, where the respondents report the number of hours of nursing care and help from

paid professionals received at home.[13] I add 14.84 hours to this number in case the respondent received meals-on-wheels (Barczyk and Kredler, 2019) and regress the logarithm of it on a fourth polynomial of age, the number of children, the value of net assets, and a list of dummies for difficulties with ADLs, being cognitively impaired, being widowed, having at least one child living less than 25 kilometers away, and living in Northern or Southern Europe. With the resulting estimates, shown in Table B3, I impute the number of hours of care for those respondents in the estimation sample who received formal care at home. For those who stayed in a nursing home or residential care facility, I impute 168 hours (24 hours a day).

Table B4: Type of Care Received by Survey Respondents Aged 70 or Older

Type of care	Wave 1 (2004/05)	Wave 2 (2006/07)	Wave 4 (2010/11)	Wave 5 (2013)	Wave 6 (2015)	Wave 7 (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).

Table B4 summarizes how the types of informal care (outside/inside the household) and formal care (home care/nursing home care) distinguished in SHARE are distributed in the survey waves.

[13]After Wave 2, SHARE stopped providing information about the number of hours of help received at home, and it was not collected again until Wave 7. I use first two waves of the survey and not Wave 7 to make imputations because the number of observations in the former is higher and I also use them to deal with the analogous limitation in the case of informal care.

Table B5: Number of Children in the Family (Estimation Sample)

Number of children	Northern			Central			Southern			Number of outcomes
	Freq.	Percent	Cumul.	Freq.	Percent	Cumul.	Freq.	Percent	Cumul.	
1	96	11.32	11.32	315	16.07	16.07	371	13.43	13.43	8
2	318	37.50	48.82	578	29.49	45.56	830	30.05	43.48	32
3	213	25.12	73.94	537	27.40	72.96	681	24.66	68.14	128
4	128	15.09	89.03	240	12.24	85.20	424	15.35	83.49	512
5	60	7.08	96.11	145	7.40	92.60	185	6.70	90.19	2,048
6	12	1.42	97.52	96	4.90	97.50	138	5.00	95.18	8,192
7	21	2.48	100.00	14	0.71	98.21	98	3.55	98.73	32,768
8	0	0.00	100.00	8	0.41	98.62	8	0.29	99.02	131,072
9	0	0.00	100.00	27	1.38	100.00	27	0.98	100.00	524,288

Note: The table displays the absolute (Freq.), relative (Percent), and cumulative (Cumul.) frecuencies of the number of children in the families included in the estimation sample, as well as the number of possible outcomes in the game for each family size.

Appendix C: Hours Worked and Wages

Table C1: Estimates of Hours Worked by Region

	Northern	Central	Southern
Female dummy	-0.110***	-0.293***	-0.184***
	(0.005)	(0.005)	(0.004)
Age	-0.131	0.470*	0.681***
	(0.219)	(0.204)	(0.172)
Age^2	0.004	-0.018*	-0.024***
	(0.007)	(0.007)	(0.006)
Age^3	-0.00005	0.0003**	0.0004***
	(0.0001)	(0.0001)	(0.00009)
Age^4	0.0000002	-0.000002**	-0.000002***
	(0.0000006)	(0.0000006)	(0.0000005)
College dummy	0.060***	0.125***	0.054***
	(0.005)	(0.005)	(0.004)
Constant	5.155*	-0.893	-3.610
	(2.372)	(2.195)	(1.866)
Number of observations	17,572	47,523	35,148
R^2	0.060	0.160	0.107

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

Table C2: Wage Parameters by Region

	Northern	Central	Southern
Female dummy	-0.168***	-0.119***	-0.340***
	(0.009)	(0.008)	(0.023)
Age	0.058***	0.013**	0.150***
	(0.010)	(0.005)	(0.013)
Age^2	-0.001***	-0.000	-0.001***
	(0.000)	(0.000)	(0.000)
College dummy	0.184***	0.285***	0.495***
	(0.011)	(0.008)	(0.025)
Constant	1.625***	2.429***	-1.575***
	(0.232)	(0.123)	(0.333)
σ_ξ	0.576	0.639	0.747
Number of observations	27,913	77,179	72,742

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

Appendix D: Counterfactual Simulations

Table D1: Type of care received by individuals aged 70 or older in baseline and counterfactual scenarios (%)

	No care		Formal care		Informal care		Both types of care	
	A. Northern Europe							
	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	68.60		11.89		10.48		9.03	
	B. Central Europe							
	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	58.30		18.21		11.72		11.77	
Preferences	57.77		13.70		11.22		17.31	
Wages overall	57.28	59.56	19.93	13.97	11.25	10.83	11.54	15.64
Wages across gender	56.97	59.57	19.74	14.87	11.62	10.36	11.67	15.20
Parental health	56.47	60.19	19.93	14.09	11.63	10.51	11.98	15.21
Informal care from spouse	58.99	62.08	17.19	12.56	11.84	10.44	11.98	14.92
Informal care from others	57.13	62.11	19.48	12.50	11.16	10.77	12.23	14.61
Proximity to children	57.38	62.23	21.17	12.71	10.92	9.82	10.54	15.24
	C. Southern Europe							
	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	67.37		10.71		15.39		6.53	
Preferences	47.59		12.44		9.09		30.89	
Wages overall	75.83	45.95	13.33	13.62	8.10	10.83	2.75	29.60
Wages across gender	75.67	47.16	13.38	13.67	8.27	9.75	2.68	29.42
Parental health	70.15	48.50	12.68	12.70	12.88	8.60	4.29	30.19
Informal care from spouse	67.60	52.49	11.42	11.80	15.62	9.03	5.36	26.67
Informal care from others	67.17	49.70	13.09	12.72	14.50	8.21	5.25	29.38
Proximity to children	73.19	53.55	13.24	12.68	10.20	7.37	3.38	26.40

Note: The table shows the share of respondents aged 70 or older, with care needs, and at least one child between 30 and 60 years-old who receive no care, only formal care, only informal care, or both types of care in baseline and counterfactual scenarios. Columns *Indiv.* display the results of each counterfactual separately, and columns *Cumul.* the results of combining them (e.g., the first entry of these columns is computed in a scenario where preference parameters and wages are equal across country groups; the second adds the effect of removing gender differences in wages, and so on). The three country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany), and Southern Europe (Italy and Spain).

Table D2: Employment share of caregiving and non-caregiving children in baseline and counterfactual scenarios (%)

	Employed non-caregivers		Employed caregivers	
	A. Northern Europe			
	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	90.11		96.14	
	B. Central Europe			
	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	87.22		81.01	
Preferences	82.48		89.27	
Wages overall	90.92	87.32	88.04	91.47
Wages across gender	90.55	87.30	86.91	91.90
Parental health	86.14	87.64	79.24	92.09
Informal care from spouse	85.99	87.37	80.55	91.30
Informal care from others	86.25	87.50	78.77	91.60
Proximity to children	86.93	87.31	81.13	91.81
	C. Southern Europe			
	Indiv.	Cumul.	Indiv.	Cumul.
Baseline	78.97		67.05	
Preferences	64.35		69.82	
Wages overall	97.96	87.22	92.64	87.13
Wages across gender	98.11	88.39	89.94	86.38
Parental health	81.91	86.84	70.03	87.12
Informal care from spouse	79.61	87.76	69.05	87.61
Informal care from others	79.30	88.26	69.48	86.10
Proximity to children	79.09	88.32	70.39	85.61

Note: The table shows the shares of individuals between 30 and 60 years-old, who have at least one parent with care needs, and are employed or non-employed while giving informal care or no care at all in baseline and counterfactual scenarios. Columns *Indiv.* display the results of each counterfactual separately, and columns *Cumul.* the results of combining them (e.g., the first entry of these columns is computed in a scenario where preference parameters and wages are equal across country groups; the second adds the effect of removing gender differences in wages, and so on). The three country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany), and Southern Europe (Italy and Spain).