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

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Abstract

This paper studies the factors that determine families' decisions to provide formal and informal care across Europe. To explain the observed patterns of care provision and labor force participation of children of care recipients, I develop a structural model that represents the interactions among old parents and adult children as a static, non-cooperative game of complete information. I estimate this model using data of Northern, Central and Southern European countries from the Survey of Health, Aging and Retirement in Europe. The model is able to replicate the choices made by families in the three regions considered well. Equipped with the estimated model, I carry out a decomposition analysis of the forces behind differences in formal and informal care use across Europe. The results of this exercise indicate that the variability in care arrangements across regions can be largely explained by model parameters that capture the influence of care prices and social norms, and by wage levels. Next, I use the estimated model to assess various types of subsidies to support care recipients and caregivers. I find that subsidies for family caregivers are more effective than subsidies for care recipients to meet elderly care needs in Southern Europe.

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

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I. Introduction

The rising demand for elderly care resulting from population aging is one of the most concerning challenges that countries all over the world will face in the coming years. In the European Union, the ratio of people aged 65 or above to those aged 15 to 64 increased from 25% to 29.6% between 2010 and 2016, and is projected to rise up to 51.2% by 2070. During the same period, the share of people over 65 years old who have difficulties carrying out their daily activities due to health problems, currently set at 48.7%, is expected to increase by 21% (European Commission, 2018, 2019).

Elderly care can be defined as the set of activities that aim to improve the quality of life of older adults who are not fully able to look after themselves because of physical or cognitive decline. This includes assistance with daily activities such as dressing, bathing, getting in and out of bed, or doing housework (Clancy, Fisher, Daigle, Henle, McCarthy and Fruhauf, 2019). Elderly care is said to be *formal* when is provided by paid, professional services in the home of the care recipient or in residential care facilities. By contrast, it is *informal* when help is given by relatives or friends.

The children of the care recipients represent one of the main sources of this type of care. These are usually middle-aged individuals who consider the cost of caregiving in terms of foregone labor earnings when making care and labor supply decisions. At the same time, these decisions are influenced by the behavior of other family members. On the one hand, a child's provision of informal care for an old parent may depend on the amount of care given by their siblings. On the other hand, some families may prefer to resort to formal care when the informal help that their members can provide is not enough to meet the parents' needs. In this context, understanding how families make these choices is relevant for the design of care policies.

This paper asks the following questions: what drives families' decisions to provide formal and informal care? Why do different families make different choices? What are the implications of these for labor supply? What policies can support care recipients and caregivers? To address these questions, I model the behavior of family members when making care provision and labor force participation decisions by means of a static, non-cooperative game of complete information. In this setup, a family is composed of an old parent and their adult children. Each child makes a decision concerning labor force participation (to be employed or not) and informal care (to give care to their parent or not). If a child chooses to be employed, they earn a wage that is enjoyed as consumption. Meanwhile, the parent decides whether to receive formal care. All these choices are discrete, mutually exclusive, and are made simultaneously by players to maximize their respective payoffs, which depend on observable family characteristics, the choices of the other players, and unobservables in the form of choice-specific preference shocks. The outcome is a Nash equilibrium in which the parent may receive formal care, and/or informal care from one or several children.

I use this model to analyze the provision of elderly care in Europe, where there are significant differences across countries. In Northern European countries, 46% of older adults with help needs receive some formal care. This percentage is much lower in Southern European countries, where these needs are often met by the relatives of care recipients informally, and the share of unattended individuals is higher than in the North. In principle, this fact can be related to

several factors. First, countries differ substantially with respect to the availability and generosity of public formal care services. While public spending on formal care is around 3% of the GDP in Northern Europe, it does not reach 1% of the GDP in Southern Europe. Second, social norms and family structure are different across countries, which might influence care arrangements as well. In this regard, Southern European countries are often contrasted with Northern and Central European countries, where contact between generations is less frequent and rates of co-residence are lower. In Southern Europe, the percentage of people aged 60 or older who live with at least one of their children in the household is around 30%, whereas in Northern Europe this nudges 2.5%. These circumstances may favor a greater potential for informal support in the South. On top of that, the decision to give care is connected with labor supply. Indeed, in Southern Europe, there is a big gap between the employment rate of children who provide care to their parents and those who do not.

I fit the model to data from the Survey of Health, Ageing and Retirement in Europe (SHARE), where I observe the care and employment decisions and the characteristics of old parents and their children. I take advantage of the cross-country variation offered by these data, and estimate the parameters of the model separately for three country groups: Northern, Central, and Southern Europe. The estimated model replicates the choices made by families in the three regions considered well.

The model enables me to carry out a decomposition analysis of the factors driving the differences in care provision and labor force participation of adult children across Europe. In the first part of this exercise, I compare the decisions simulated by the model in the baseline scenario with the ones of a counterfactual where I set the parameter values for Central and Southern European families equal to the ones estimated for Northern Europe. These parameters capture the influence of care prices, institutions, and social norms over the preferences of the agents. Then, I shut down other sources of differences across regions, namely wage levels, and parental health and wealth. The results indicate that the variability of care arrangements across Europe can be largely explained by the model parameters, followed by wages, while parental health and wealth are less relevant. By simulating the decisions of Southern European families under the same parameter values as Northern Europe, the percentage of elderly people who receive care becomes almost 20 points higher than in the baseline scenario. Employment rates of adult children would also be higher for caregivers and non-caregivers, reaching similar levels to those observed in Northern countries. Employment rates would also increase for caregivers and non-caregivers if wage levels, instead of parameters, were equal across regions, narrowing the gap between these two groups by 7.2 percentage points. Differences in parental health and wealth are less relevant mechanisms.

Next, I assess the effects of five care subsidies aimed at reducing the high percentage of older adults who do not receive any care in Southern Europe and the big gap in terms of employment rates between the children who do not give any care to parents and those who do in this region. The first of these policies consists of a non-means-tested subsidy that is given to parents conditional on receiving formal care. The amount of money granted corresponds to the transfer that would be necessary to make the share of total elderly care costs covered by public social protection systems in Southern Europe equal to the corresponding share in

Northern Europe. This subsidy gives place to a 9.9-point growth in the share of older adults who receive some care in Southern Europe. This is achieved by increasing the use of formal care by 18.3 points. The policy also seems to alleviate the pressure put on families, with an 8.5-point decline in the percentage of individuals who receive only informal care. Associated with it, the employment rate of the children who provide care becomes 3.9 points bigger than in the baseline scenario, contributing to closing the gap with those who do not give any care. By contrast, the second policy, which extends the subsidy to all parents, regardless of their formal care choices, has a small influence on families' decisions.

In the third policy experiment, I split the same amount of money offered to parents in the two previous exercises equally between the children who are employed and provide informal care. The effect of this transfer on the share of parents who receive some care in Southern Europe is larger than that of the subsidy for formal care recipients, increasing this proportion by 11.3 points. In this case, the subsidy encourages children who would not provide any care in the baseline scenario to step in as caregivers. In terms of labor force participation, making the combination of care and employment more attractive gives place to a 19.7-point increase in the employment rate of children who choose this alternative, closing the employment gap with respect to non-caregivers, which goes from 14.9 to -1.1 points. The fourth policy, which distributes the same amount of money between the children who do not work, has the opposite consequences on employment and a weaker effect on care provision. The fifth experiment, which offers the subsidy to all the children, regardless of their employment choice, has stronger effects on care provision, whereas its impact on employment rates is in the middle of the other two subsidies for caregivers.

This paper marries two strands of the literature. In the first place, there is an applied microeconomic literature that studies the provision of elderly care by means of structural models. Most of these papers are based on the United States and analyze relatively stylized households in different settings. Some of them consider only one decision-maker (Skira, 2015; Korfhage, 2019), while others incorporate the interplay between one parent and one child (Pezzin and Schone, 1999; Dobrescu and Iskhakov, 2013; Mommaerts, 2020; Ko, 2021) or two siblings (Fontaine, Gramain and Wittwer, 2009). Some papers assume that families have a limited set of care alternatives, disregarding the possibility to combine formal and informal care, or abstracting from the labor supply decisions of children (Hiedemann and Stern, 1999; Engers and Stern, 2002; Checkovich and Stern, 2002). Byrne, Goeree, Hiedemann and Stern (2009) examine the decisions to provide elderly care in the family and evaluate various care policies in a richer environment. They develop a static, non-cooperative game where family members from two generations make care and labor supply decisions, and care is an input for parental health quality. However, they estimate a low effect of care on health quality, and as a result, they predict low rates of formal care use and null policy effects. I contribute to this group of studies by providing a different model that takes very seriously the heterogeneity in household structure in the data. In my model, multiple children and their parent make elderly care and labor supply decisions. My model allows for the combination of formal and informal care, which enter directly into the utility functions of the agents. It also incorporates strategic interactions in the family by allowing for free-riding, as well as the possibility that the incentives for providing care differ

across siblings.

In the second place, there is a literature that investigates how elderly care arrangements differ across countries in Europe. Studies in this group document the existence of different rates of use of formal and informal care (Attias-Donfut, Ogg and Wolff, 2005; Barczyk and Kredler, 2019). Some provide evidence of varying degrees of substitutability between the two forms of care (Bonsang, 2007, 2009; Bolin, Lindgren and Lundborg, 2008a) and of a negative association between giving informal care to parents and labor supply (Spiess and Schneider, 2003; Viitanen, 2005; Bolin, Lindgren and Lundborg, 2008b; Crespo and Mira, 2014). Bakx, de Meijer, Schut and van Doorslaer (2015) highlight the role of institutions, social norms, and family cohesion to understand these patterns, in line with other studies that stress the importance of culture to explain patterns in domestic production, female labor force participation (Alesina, Algan, Cahuc and Giuliano, 2015), living arrangements (Giuliano, 2007) and other economic outcomes (Guiso, Sapienza and Zingales, 2006), including take-up of long-term care insurance (Costa-Font, 2010). Nevertheless, most of these papers overlook the role of the interactions among family members in the decision-making process that determines care provision. Fontaine, Gramain and Wittwer (2009) allows for the interaction between two siblings who decide how to supply care to their parent. Dobrescu and Iskhakov (2013) examine the saving behavior of elderly individuals in Europe through a dynamic discrete choice game of incomplete information between one parent and one child. Instead, my model features multiple children taking part in the decision-making process with their parent in a static, non-cooperative framework with complete information.

In a wider sense, this paper also relates to a macroeconomic literature on old-age risks and long-term care insurance policies (De Nardi, French and Jones, 2010; Attanasio, Kitao and Violante, 2011; Braun, Kopecky and Koreshkova, 2017; Koreshkova and Lee, 2021). Barczyk and Kredler (2018) argue that these papers miss a key margin by neglecting the role of the family. They incorporate this aspect in a dynamic, heterogeneous-agents model with overlapping generations calibrated to the US economy. My paper also emphasizes the importance of taking the presence of the family into account for the evaluation of elderly care policies.

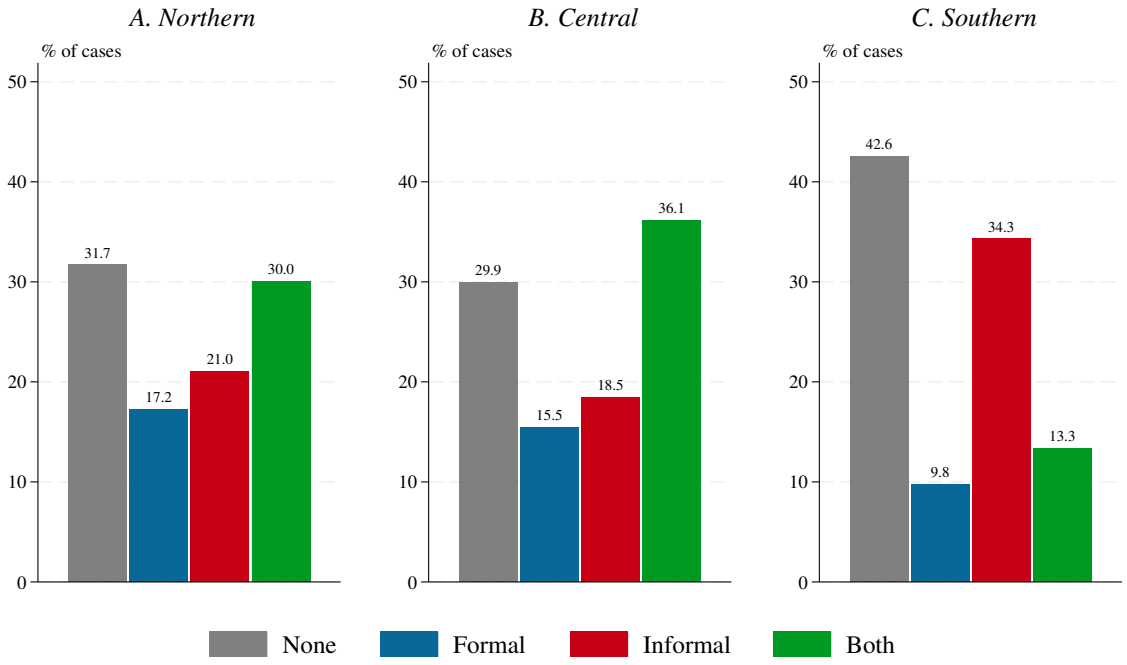
The rest of the paper is organized as follows. I present some motivating evidence on elderly care provision across Europe in Section II. I develop the model in Section III. I discuss the estimation of the model in Section IV. I examine the estimation results and the model fit in Section V. I show the results of the decomposition analysis in Section VI. Finally, I analyze the outcomes of the policy experiments before concluding in Section VIII.

II. Motivating Evidence

This section offers a general overview of the provision of elderly care across Europe, based on data from the Survey of Health, Ageing and Retirement in Europe (SHARE). My analysis focuses on eight countries that can be grouped in three regions: Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain).

Figure 1 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 the three country groups considered. This figure represents how countries differ in the use of

FIGURE 1: TYPE OF CARE RECEIVED BY INDIVIDUALS AGED 70 OR OLDER WITH CARE NEEDS



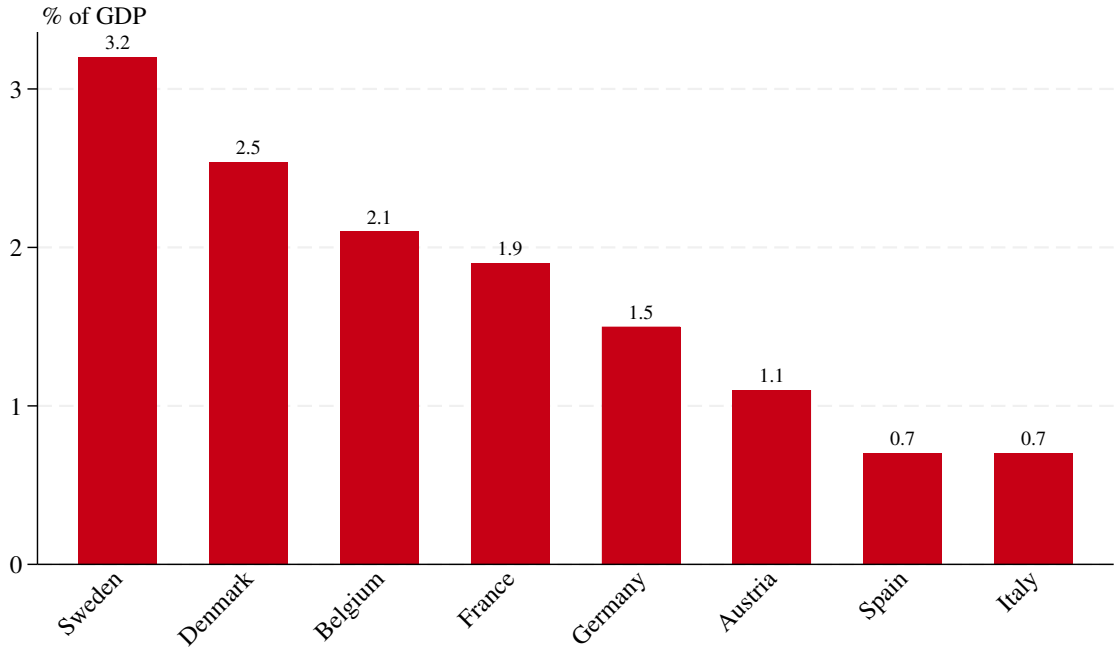
Note: The figure plots the percentage of individuals aged 70 or older with care needs and at least one child aged 60 or younger who receive no care, only formal care, only informal care, or both types of care in Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

informal and formal care. In line with previous studies (Barczyk and Kredler, 2019), there is a North-South gradient in the use of formal care. The percentage of individuals who receive some formal care, alone or in combination with informal care, is 46.3% in Northern Europe, 50.8% in Central Europe, and 22.7% in Southern Europe. This fact can be first related to a significant degree of variety in terms of the availability and generosity of public elderly care services across the continent. As can be seen in Figure 2, governments in Northern European countries devote more resources to these services (3.2% of the GDP in Sweden, 2.5% in Denmark) than countries in the South (0.7% of the GDP in Italy and Spain), and Central European countries are in between (from 2.1% in Belgium to 1.1% in Austria). The resulting underprovision of formal care in the South may induce families in these countries to meet the needs of their parents informally, although this might be difficult for some. In the South, the use of informal care as the only means of help for the elderly is more prevalent (34% of cases) than in Northern and Central European countries (20.8% and 18.3%), where the percentage of individuals who do not receive any help is lower (32.8% and 30.8%) than in Southern countries (43.3%).

Secondly, there are differences in family structure and social norms across Europe that might also influence care arrangements. In this regard, Southern European countries are often categorized as "familistic" or "strong family" countries, contrasted with the countries in the North and the Center of Europe, with a less traditional family structure.[1] This gradient is

[1] Reher (1998) claims that the strength of family ties in Europe "refers to cultural patterns of family loyalties, allegiances, and authorities which are reflected in demographic patterns of coresidence with adult children and older family members".

Figure 2: Public long-term care spending as a share of GDP (2017 or nearest year)



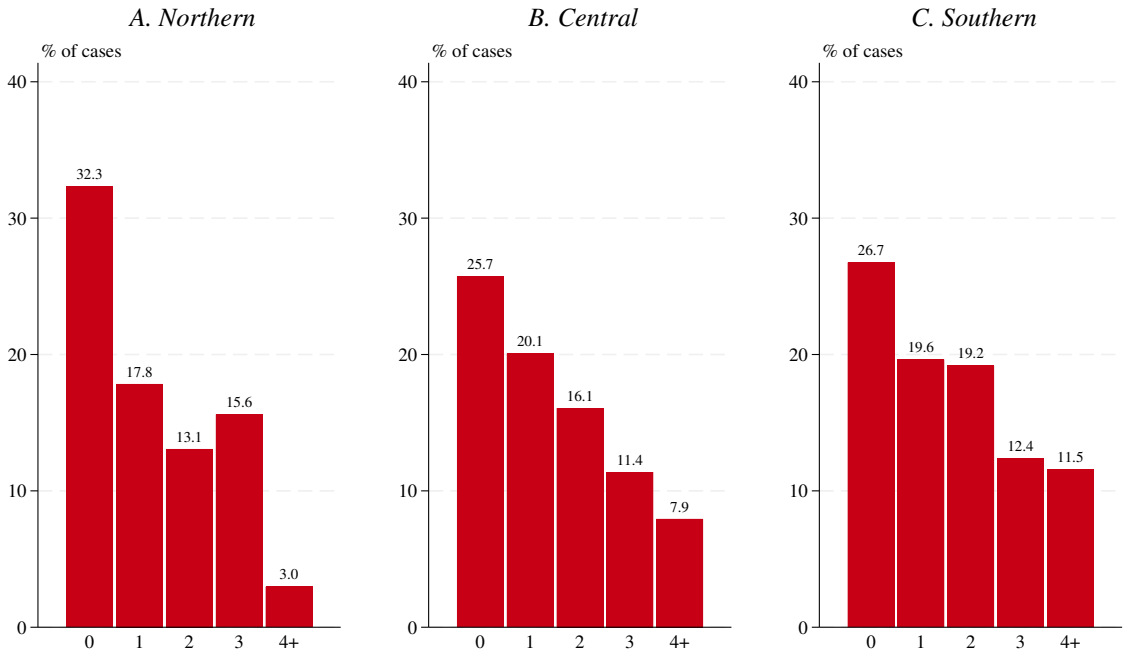
Note: Long-term care expenditure (health and social components) made by the government and compulsory insurance schemes. *Source*: OECD (2019).

noticeable with respect to rates of co-residence and frequency of contact between generations. In Southern Europe, the percentage of parents aged 60 and older who live with at least one child in the household is around 30%, while in Northern Europe this only nudges 2.5% (Kohli et al., 2005).

The aforementioned circumstances favor a greater potential for support from children to parents in the South, where the share of old parents who receive care from their children is higher than in the North and the Center (see Figure A1). Children are indeed the most common source of informal care (see Figure A3), and their role as caregivers in influenced by the structure of their families and the interactions among their members. In this sense, Figure 3 illustrates one of the aspects in which the decision to care for parents varies across families. According to this figure, the probability of engaging in care provision decreases in family size. It is highest in Northern Europe for children without siblings (31.3%) and lowest for children with four or more siblings (3.7%). This pattern of specialization is common across regions, but is somewhat less pronounced in Southern Europe, where the likelihood of giving care is 15.3 points higher for an only child than for a person with four or more siblings.

The decision to give care to parents is also connected with labor supply. Figure 4 sheds light on how this relationship differs across countries. In Central and Southern European countries, individuals who give informal care to their parents are less likely to be employed than those who do not give any help. This gap is bigger in the South, and contrast with the situation in Northern Europe, where the employment rate of caregivers even surpasses the one of non-caregivers. It is possible to find differences in the intensive margin as well, as shown in Figure

FIGURE 3: PROBABILITY OF GIVING INFORMAL CARE TO PARENTS BY NUMBER OF SIBLINGS



Note: The figure plots the percentage of individuals who are aged 60 or younger, have at least one parent with care needs aged 70 or older, and give informal care to them, by number of siblings (from zero to four or more). The country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

A8.

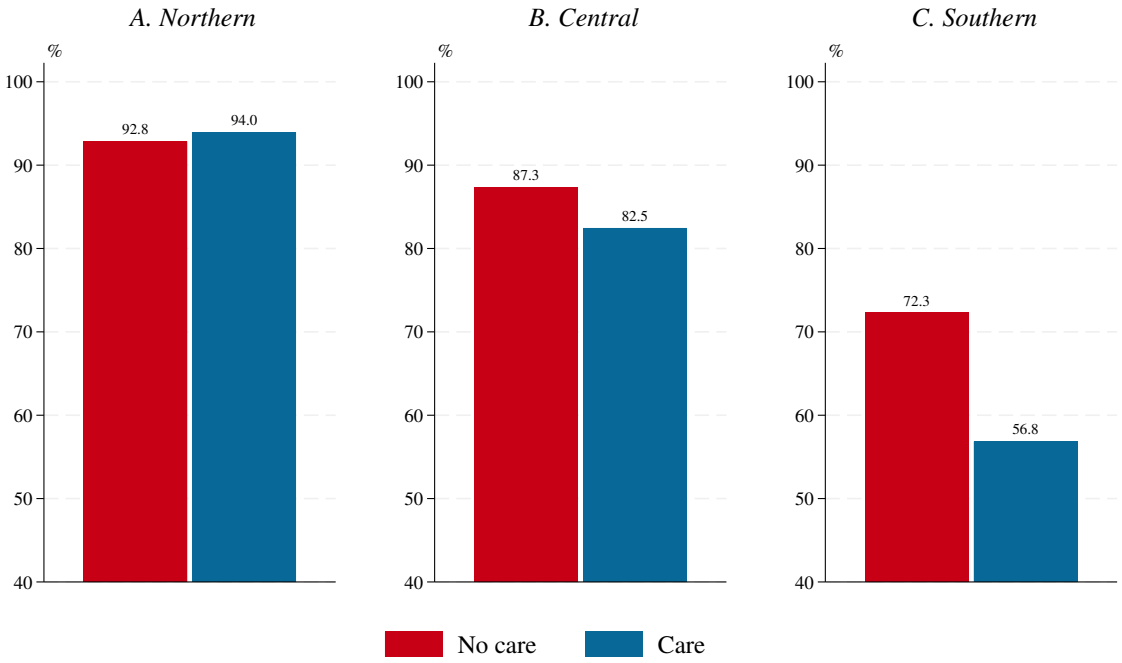
Appendix A presents further evidence on the existing disparities in care arrangements across Europe, and how they manifest separately for men and women.

III. Model

The model is a static, non-cooperative game of complete information which features family members making simultaneous decisions. The decision makers are an old parent and their working-age children. Each child decides whether to be employed and whether to give informal care to their parent. If she chooses to be employed, she earns a wage that is enjoyed as consumption. Meanwhile, the parent decides whether to receive formal care. All these choices are discrete, mutually exclusive, and are made by players to maximize their respective payoffs. These payoffs depend on a set of observables representing family characteristics and the outcomes of the behavior of the other players. They also depend on unobservables in the form of choice-specific preference shocks that are known by all the players. They make their decisions simultaneously, reaching a Nash equilibrium in which the parent may receive formal care, and/or informal care from one or several children.

Agents in this model face a number of trade-offs. On the one hand, the employment and informal care decision of each child maps into a number of hours worked and a number of hours of care. The number of hours worked, together with wages, determine the labor earnings of

FIGURE 4: EMPLOYMENT RATE OF CHILDREN BY INFORMAL CARE GIVEN TO PARENTS



Note: The figure plots the percentage of individuals who are aged 60 or younger, have at least one parent with care needs aged 70 or older, and are employed or non-employed while giving informal care or no care at all. The country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

this child, which she consumes. By giving informal care, this child will not be able to work as many hours as if she does not give care, so their labor earnings will be lower. Moreover, their decision will consider the behavior of their parent and siblings with respect to caregiving. This interactions will be influenced by several factors. For instance, caregiving may be more burdensome for some children than for others, while the opportunity cost in terms of forgone labor earnings may vary across them. On the other hand, the parent can choose to receive formal care, which can be combined with the help received from children, although they may prefer to be assisted only by their children.

A. Choices

In this model, a family is composed of a parent and their children. The children, indexed by $i = 1, 2, ..., N$, make simultaneous decisions that concern their employment status and the provision of informal care for their parent. 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 their parent no informal care, $a_i = \text{NENC}$; to be employed and give their 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 $\mathcal{A} \equiv \mathcal{A}_1 \times ... \times \mathcal{A}_N$.

At the same time, the parent makes a formal care decision. Let b denote their choice concerning formal care, which can be either to receive formal care, $b = \text{FC}$; or not, $b = \text{NFC}$. Thus, the parent's 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, the utility of choosing action a is

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

where $\boldsymbol{\alpha}_a\left(\boldsymbol{x}\right)$ is meant to capture the preferences of the child over combinations of elderly care and employment status, given the set $\boldsymbol{x} \in \mathcal{X}$ of observable characteristics in the family. I model this as

$$\begin{aligned}\boldsymbol{\alpha}_a(\boldsymbol{x}) =& \alpha_{0a} + \alpha_{1a} \sum_{\ell \neq i} I_\ell\left(\boldsymbol{d}, \boldsymbol{x}\right) + \alpha_{2a} \sum_{\ell \neq i} \mathbb{1}\left\{I_\ell\left(\boldsymbol{d}, \boldsymbol{x}\right) = 0\right\} + \alpha_{3a} F\left(\boldsymbol{d}, \boldsymbol{x}\right) + \alpha_{4a} H \\ &+ \alpha_{5a}\text{widow} + \alpha_{6a}\text{near}_i + \alpha_{7a}\text{female}_i + \alpha_{8a}\text{children}_i + \alpha_{9a}\text{married}_i,\end{aligned} \tag{2}$$

a choice-specific linear index which depends on the number of hours $\sum_{\ell \neq i} I_\ell\left(\boldsymbol{d}, \boldsymbol{x}\right)$ of informal care given by the siblings, the number of siblings $\sum_{\ell \neq i} \mathbb{1}\left\{I_\ell\left(\boldsymbol{d}, \boldsymbol{x}\right) = 0\right\}$ who do not give care to the parent, the number of hours $F\left(\boldsymbol{d}, \boldsymbol{x}\right)$ of formal care that the parent receives, the parent's health status H, and dummies for the parent being widowed, and child i living less than 25 kilometers away from them, gender, having children, and being married. I assume that all these elements, except for the hours of care and the number of siblings who do not give care, are exogenous.[2]

$C_i(\boldsymbol{d}, \boldsymbol{x})$ denotes the consumption level of child i when the family is playing outcome $\boldsymbol{d}$. Consumption is given by

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

where $w\left(\boldsymbol{z}_i\right)$ is the hourly wage offer for child i. This is a function of the observable, individual characteristics collected in $\boldsymbol{z}_i$, a subset of $\boldsymbol{x}_i$. $N_i\left(\boldsymbol{d}, \boldsymbol{x}\right)$ is the number of hours worked by i, which is determined by their choice a_i as part of $\boldsymbol{d}$. ϵ_{ia} is a choice-specific, random preference shock that 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 parent has linear and additively separable preferences over several sources of care. Their

[2] I consider that parental health is exogenous and independent of whether or not the parents receive care. I make this assumption because, in contrast to other forms of care, 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 improving their health. 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 determination of the health stock (Finkelstein and McKnight, 2008).

choice-specific utility is

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

where $\sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x})$ is the number of hours of informal care given by the children, followed by an indicator function that takes value one if this number is larger than zero. Utility depends on other sources of informal care as well, through dummies for care given by a spouse and other sources. While the informal care given by the children depends on the decisions that these make in the model, the informal care given by partners and other potential caregivers is exogenous.

I also allow preferences over formal care to differ between married and widowed parents, with gender-specific shifters. W represents the value of wealth owned by the parent. This is to consider, in a simplified way, how the parent enjoys their wealth, and so the fact that wealthier parents may be able to obtain more formal care and leave larger bequests to their children. ζ_b is an i.i.d., choice-specific preference shock that is common knowledge to all the family members, but unobserved for the econometrician.[3] It is jointly distributed with the shocks of the children with density $g_{\boldsymbol{\epsilon},\zeta}(\boldsymbol{\epsilon}, \zeta) = \prod_{i=1}^{N} g_{\epsilon_i} g_{\zeta}$.

C. 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 parent, respectively, for each possible outcome $\boldsymbol{d} \in \mathcal{D}$ of the game. Matrix $\boldsymbol{U} = (\boldsymbol{U}_1, ..., \boldsymbol{U}_N, \boldsymbol{V})$ gathers these vectors. Given their knowledge about the observable characteristics in $\boldsymbol{x}$ and the preference shocks $(\boldsymbol{\epsilon}, \zeta)$, the parent 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 parent. Then, a strategy vector $(\sigma_1^*, ..., \sigma_N^*, \pi^*) \equiv (\boldsymbol{\sigma}^*, \pi^*)$ is a Nash equilibrium if and only if each player's strategy is a best response, that is, if for every $i \in N$ and every possible strategy,

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

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

[3] An alternative formulation of the problem might consider that the parent derives utility from consumption and hours of formal care, and decides 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 as $C(\boldsymbol{d}, \boldsymbol{x}) + qF(\boldsymbol{d}, \boldsymbol{x}) = W$, with $\delta_{1b}, ..., \delta_{6b}$ normalized to zero for $b = \text{NFC}$, and $C(\boldsymbol{d}, \boldsymbol{x})$ being the consumption level enjoyed when the family plays outcome $\boldsymbol{d}$, $F(\boldsymbol{d}, \boldsymbol{x})$ the number of hours of formal care that she decides to buy, and q the price of formal care. However, wealth would not play any role in the choice to buy formal care, since $V_{\text{FC}} - V_{\text{NFC}} = (\eta - \gamma q) F(\boldsymbol{d}, \boldsymbol{x}) + \delta_1 \sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x}) + \delta_2 \mathbb{1}\left\{ \sum_{i=1}^{N} I_i(\boldsymbol{d}, \boldsymbol{x}) > 0 \right\} + \delta_3\text{spouse} + \delta_4\text{others} + \delta_5\text{widow} \times \text{male} + \delta_6\text{widow} \times \text{female} + \zeta_{\text{FC}} - \zeta_{\text{NFC}}$.

IV. Estimation

This section provides a brief description of the data and variables used in the model and presents the estimation procedure.

A. Sample selection and variable definitions

I estimate the model using individual-level 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 younger than 60.[4] I obtain this information from the sample of survey respondents who are potential care recipients and provide information about their children.

Each observation in my sample is a child-parent dyad when the survey interview was conducted. All the dyads which share the same parent constitute a family f playing a game. For each dyad, I observe the employment and care decisions made by each child and the parent, represented by a_{if} and b_f, respectively, as well as the vector of family characteristics $\boldsymbol{x}_f$ that are part of the child's and the parent's utility.

I measure the health status of the parent following Ko (2021), using information available in SHARE about limitations with activities of daily living (ADL) and cognitive impairment.[5] 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. Thus, H_f in the child's utility function is a dummy that takes value 1 if the parent has severe care needs.

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 the parent has at the moment, by the number of weeks that she is 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 gives informal care if they helped their parent 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

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

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

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 informal helpers such as siblings, children-in-law or friends.

The parent in the model can choose between two alternatives: to receive 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.

The decision of child i to give informal care, and the one of the parent to receive formal care, map to a number of hours $I_i(\boldsymbol{d}, \boldsymbol{x})$ of informal care given and a number of hours $F(\boldsymbol{d}, \boldsymbol{x})$ of formal care received that depend on individual and family characteristics in $\boldsymbol{x}$. 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 explained in Appendix B.

B. Hours worked and wages

In terms of employment, a child in the model has two options: to be employed or to be non-employed. This choice corresponds to a number of hours worked $N_i(\boldsymbol{d}, \boldsymbol{x})$ that depends on individual characteristics in $\boldsymbol{x}$ and the decision to give informal care. In particular,

$$N_i(\boldsymbol{d}, \boldsymbol{x}) = \begin{cases} \tilde{N}_i(\boldsymbol{d}, \boldsymbol{x}) & \text{if } a_i = \text{ENC}, \\ \tilde{N}_i(\boldsymbol{d}, \boldsymbol{x}) - I_i(\boldsymbol{d}, \boldsymbol{x}) & \text{if } a_i = \text{EIC}, \\ 0 & \text{otherwise}, \end{cases} \tag{6}$$

where $\tilde{N}_i(\boldsymbol{d}, \boldsymbol{x})$ is the potential number of hours that i could work.

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 $\tilde{N}_i(\boldsymbol{d}, \boldsymbol{x})$ 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.

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

$$\ln w_{if} = \boldsymbol{z}_{if}' \boldsymbol{\lambda} + \xi_{if}, \tag{7}$$

similar to Mincer (1974), with ξ_{if} being i.i.d. normal. Since SHARE does not report the wages of the children of survey respondents, I use EU-SILC data on employees' gross earnings from hours usually worked per week in the main job 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 literature to correct for self-selection bias (Heckman, 1974, 1979) in the estimation of $\boldsymbol{\lambda}$. 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 estimated coefficients.

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. All the parameters in $\boldsymbol{\alpha}(\boldsymbol{d}, \boldsymbol{x})$, as defined in Equation 2, are choice-specific, and I normalize to zero the ones corresponding to action $a_i = \text{NENC}$. In the parent's 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 $\boldsymbol{\alpha}(\boldsymbol{d}, \boldsymbol{x})$, together with β, δ_0, δ_1, δ_2, δ_3, δ_4, δ_5, δ_6 and δ_7. I estimate $\boldsymbol{\theta}$ by maximum simulated likelihood (MSL), using the probability distribution of the possible outcomes $\boldsymbol{d} \in \mathcal{D}$ of the game, conditional on the observables $\boldsymbol{x}_f$. Since these probabilities do not have a closed form, I approximate them numerically by making R independent draws of the unobservables, denoted by $\left(\boldsymbol{\epsilon}_f^{(r)}, \zeta_f^{(r)}\right)$, for $r = 1, ..., R$. With these draws, I simulate the game played by each family in the data, and obtain a Nash equilibrium in pure strategies.[6,7] 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.[8] Averaging over draws, the simulated probability that family f plays outcome $\boldsymbol{d}$ is

$$\widehat{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f; \boldsymbol{\theta}\right) = \frac{1}{R} \sum_{r=1}^{R} \widetilde{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f; \boldsymbol{\theta}, \boldsymbol{\epsilon}_f^{(r)}, \zeta_f^{(r)}\right). \tag{8}$$

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

$$\widehat{\mathcal{L}}\left(\boldsymbol{\theta}\right) = \sum_{f=1}^{F} \hat{\ell}_f(\boldsymbol{\theta}) = \sum_{f=1}^{F} \sum_{\forall \boldsymbol{d} \in \mathcal{D}_f} \mathbb{1}\{\boldsymbol{d}_f = \boldsymbol{d}\} \ln \widehat{\Pr}\left(\boldsymbol{d}|\boldsymbol{x}_f; \boldsymbol{\theta}\right), \tag{9}$$

where $\hat{\ell}_f(\boldsymbol{\theta})$ is the likelihood contribution of family f.[9]

I apply the above estimation algorithm separately to the samples of families with three or fewer children in Northern, Central, and Southern Europe, which consist of 708, 2,349 and

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

[7] 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 this happens in less than 1% of the games that I simulate.

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

[9] Theoretically, the game could exhibit multiple equilibria at some realizations of $\boldsymbol{\theta}$, $\boldsymbol{\epsilon}$ and ζ. In case of multiplicity, I assume that all the possible equilibria are equally likely. This approach could be extended by estimating the probability of playing each equilibrium as a function of covariates, as part of the overall likelihood function. Thus, this equilibrium selection mechanism can be seen as a simplified version of the one proposed by Bjorn and Vuong (1984) in the context of labor force participation in the household, further explored by Tamer (2003) and Bajari et al. (2010).

2,393 families, respectively. As Table B4 shows, these families represent 88.6% of the initial sample in Northern Europe, 86.6% in Central Europe, and 83.2% in Southern Europe. 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 use 50 draws of the unobservables in the simulations.

V. Estimation Results and Model Fit

Tables 1 and 2 report the parameter estimates of the preferences of the child and the parent. 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: Parameter estimates of the child's utility

	Northern			Central			Southern		
β	0.002			0.002			0.005		
	ENC	NEIC	EIC	ENC	NEIC	EIC	ENC	NEIC	EIC
α_0: Constant	0.393	-4.016	-1.602	0.513	-3.588	-1.373	0.122	-3.154	-2.774
α_1: Hours of informal care from siblings	-0.052	0.040	0.227	-0.062	0.107	0.101	-0.027	0.062	0.063
α_2: Number of siblings who do not give care	-0.013	-0.325	-0.708	-0.014	-0.337	-0.601	-0.034	-0.445	-0.608
α_3: Hours of formal care	-0.002	-0.007	0.000	-0.000	0.002	0.003	0.002	0.001	0.002
α_4: Severe care needs	0.075	0.453	0.036	0.067	0.333	-0.295	-0.181	0.481	0.046
α_5: Parent is widowed	-0.128	1.206	0.524	-0.590	0.160	0.122	-0.189	0.202	0.368
α_6: Near dummy	0.185	1.792	1.529	0.037	2.256	1.214	-0.271	1.069	0.830
α_7: Female dummy	-0.520	-0.033	-0.256	-0.243	0.802	0.373	-0.722	1.069	0.738
α_8: Children dummy	1.257	2.107	1.241	0.147	-0.088	-0.132	-0.096	0.002	-0.059
α_9: Married dummy	0.355	-1.347	-0.018	0.238	-0.038	-0.056	0.559	0.195	0.222

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. Standard errors to be computed.

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, remaining non-employed and becoming a caregiver is the least preferred option in the three country groups. This is an adult, unmarried male who does not have children. His parent, who is married and has light care needs, does not receive any formal care, lives 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 attenuate the burden of being the only caregiver in the family.

Consistent with previous studies (Ko, 2021) and reduced-form evidence in Table A3, the disutility from providing care is lower for children who live with their parents or nearby. Being married also reduces this cost in Southern 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 house-

hold production of the former might save some time.

The disutility from providing care decreases in the presence of own children as well, except for caregivers in Central Europe and employed caregivers in this region and Southern Europe. For some families, greater contact with parents due to the grandparenting role (Kalmijn and Dykstra, 2006) and the possibility that grandchildren participate in caregiving might outweigh the "sandwich generation" effect (Železná, 2016; Albertini, Tur-Sinai, Lewin-Epstein and Silverstein, 2022), when 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, except in Northern Europe. This is in line with Figures A7 and A9 and previous studies (Engers and Stern, 2002; Checkovich and Stern, 2002; Byrne, Goeree, Hiedemann and Stern, 2009; Ko, 2021) that show that daughters are more likely than sons to give care. Parents with worse health and more difficulties to perform daily activities demand more attention, which reflects in a higher utility for giving care, as pointed out by Table A3 and found in earlier work (Sloan, Picone and Hoerger, 1997; Checkovich and Stern, 2002; Byrne, Goeree, Hiedemann and Stern, 2009; Skira, 2015; Ko, 2021), except for employed caregivers in Central Europe.

The presence of alternative sources of care is another factor that influences the preferences of the child. The values estimated for α_1 and α_2 imply that the participation of siblings in caregiving increases the utility from providing care. 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 impact on the utility of becoming a caregiver, being negative for non-employed caregivers in Northern Europe and positive for employed caregivers in this region and for both groups in Central and Southern Europe. 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 parent's utility from receiving no formal care to zero, the negative estimate of δ_0 in Table 2 indicates that she dislikes 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 may 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_5 in the child's preferences and δ_5 and δ_6 in the parent's imply that there are stronger incentives to give informal care and buy formal care when the parent is widowed. Presumably, widowed parents require more attention than their married counterparts because they are generally older and in worse health. Additionally, these incentives change slightly depending on the gender of the care recipient. With the exception of Southern Europe, widowed mothers benefit more from formal care than widowed fathers do. These findings agree with reduced-form evidence in Tables A2 and A3.

Table 2: Parameter estimates of the parent's utility

	Northern	Central	Southern
δ_0: Constant	-1.094	-1.064	-1.760
δ_1: Hours of informal care from children	0.003	0.024	0.025
δ_2: At least one child gives some care (dummy)	0.639	0.647	-0.034
δ_3: Informal care from the spouse (dummy)	0.719	1.166	0.530
δ_4: Informal care from other sources (dummy)	0.556	0.512	0.596
δ_5: Widowed male	1.070	0.688	0.697
δ_6: Widowed female	1.241	1.243	0.327
δ_7: Wealth	0.00005	0.00005	0.00004

Note: Standard errors to be computed.

The estimates of the marginal utility of wealth are positive, and slightly higher in Northern and Central Europe than in Southern Europe.

To evaluate the goodness of fit of the estimated model, Figures D1 and D2 compare the elderly care arrangements and employment choices of children in the estimation sample with those obtained in model simulations. The model is able to reproduce both the ranking of alternative sources of care and their magnitudes, as well as the probability of giving informal care to parents across family size, and employment rates across caregiving status.

VI. Decomposition Analysis

Differences in institutions, social norms and family characteristics contribute to the variety of care arrangements observed across Europe. To better understand the role of these factors, I use the estimated model to carry out a decomposition analysis based on counterfactual simulations.

The first of these exercises aims at quantifying the importance of differences in the estimated utility parameters. In the model, utility parameters are influenced by institutions and social norms, among other factors. In this exercise, I simulate the decisions made by families in Central and Southern Europe after setting their utility parameters equal to the ones estimated for Northern Europe.

Next, to further explore the relevance of social norms, I run simulations in a scenario where children assign the same value to one hour of informal care by their siblings and one hour of formal care, and do not take the number of siblings who do not give care into account. This way, I intend to reproduce a scenario where children are not driven by feelings of guilt with respect to what their siblings do, views of what constitutes a normal or fair care arrangement, or stigma from not giving informal care to parents.

The model also allows me to assess the effect of other aspects in which European regions are also heterogeneous, such as wages, and levels of parental health and wealth. To remove these differences across country groups, I predict counterfactual values of these variables in Central

and Southern Europe, matching individuals living in these regions with their nearest neighbors from Northern Europe.[10] This approach enables me to set the conditional distribution of each of these elements in Central and Southern Europe equal to the distribution in the North, keeping everything else the same as in the baseline scenario. In the following subsections, I focus on discussing the results of the simulations in Southern Europe. The reactions of Central European families in these counterfactual scenarios are more moderate, but point in the same direction.

A. Model parameters

Figure 5 summarizes the simulation results in terms of the type of care received by parents. Out of the factors analyzed, differences in care arrangements across regions seem to be mainly driven by the utility parameters. By simulating the decisions of Southern European families under the same parameter values as in Northern Europe, the percentage of parents who receive both formal and informal care would rise by 21.7 points. This change, along with a modest increase in the use of formal care as the only means of help, and a reduction in the use of informal care only, would result in a 19.5 point growth in the share of individuals who receive some care.

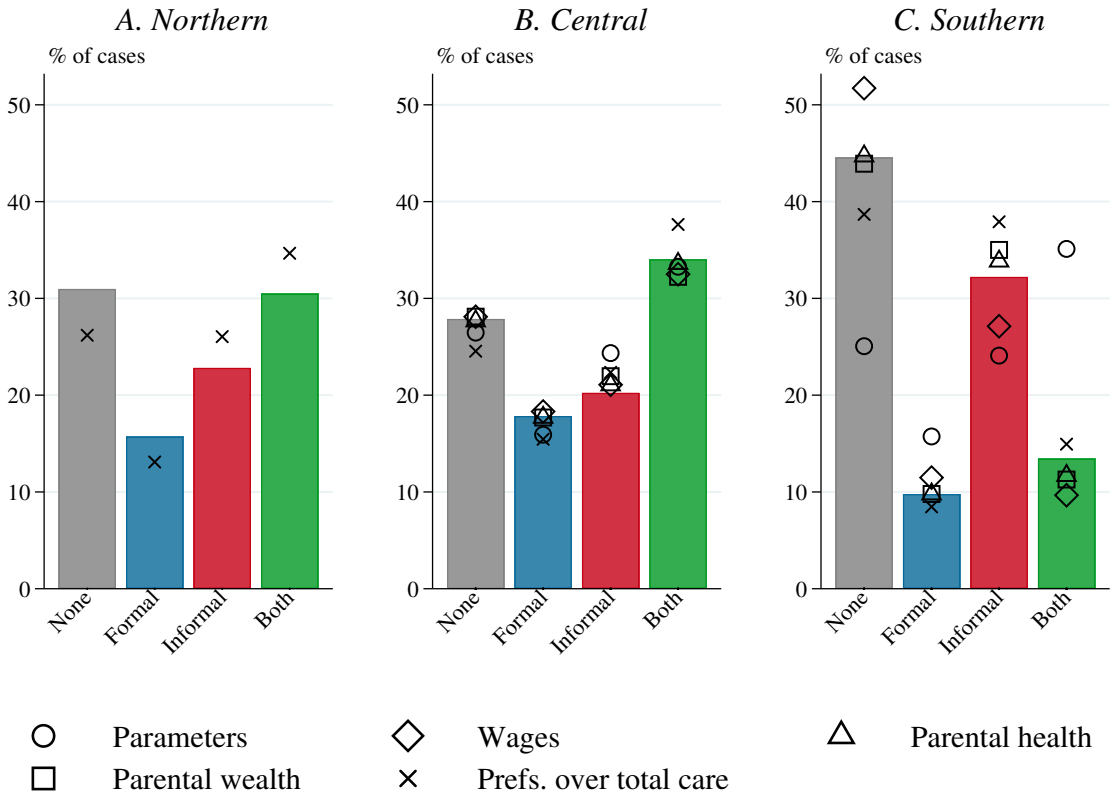
Figure 6 displays the employment rate among children who give informal care and among those who do not. Under the same model parameters as Northern Europe, caregivers in the South would have a higher employment rate than non-caregivers, replicating the pattern observed in the North. This would bring the two regions closer, especially with respect to caregivers, whose employment rate would become 0.8 points higher than in Northern Europe.

The effect of this experiment in the differences in care arrangements across countries is illustrated in Table E2. As the second row of Panel B shows, the gap between Northern and Southern Europe in the percentage of parents who receive only one of the types of care almost disappears, and the gap in the share of those who receive both types narrows substantially. As a result, the percentage of parents receiving some care in Southern Europe goes from being 13.6 points lower than in the North in the baseline scenario to being 5.9 points higher.

In another counterfactual exercise, I try to isolate part of the influence of social norms in the utility parameters. I focus on the influence of siblings on the behavior of a child and the views she might have about formal and informal care. A child might have incentives to give informal care to her parents if the social norms in place encourage this type of care over formal care, especially in countries with strong family ties. Moreover, she might have an opinion with regards to what constitute a normal or fair care arrangement, and feel compelled to take part in care provision if her siblings are involved. Thus, I simulate the decisions of families in a scenario where I shut down these mechanisms by setting $\alpha_{1a} = \alpha_{3a}$ and $\alpha_{2a} = 0$ for all $a \in \mathcal{A}_i$.

[10] I apply nearest-neighbor matching based on the Mahalanobis distance. In case an individual in Central and Southern Europe is matched with more than one Northern European individual, I take the average of the variable of interest —wage, health or wealth— as counterfactual value.

FIGURE 5: TYPE OF CARE RECEIVED BY PARENTS – BASELINE AND COUNTERFACTUAL SIMULATIONS



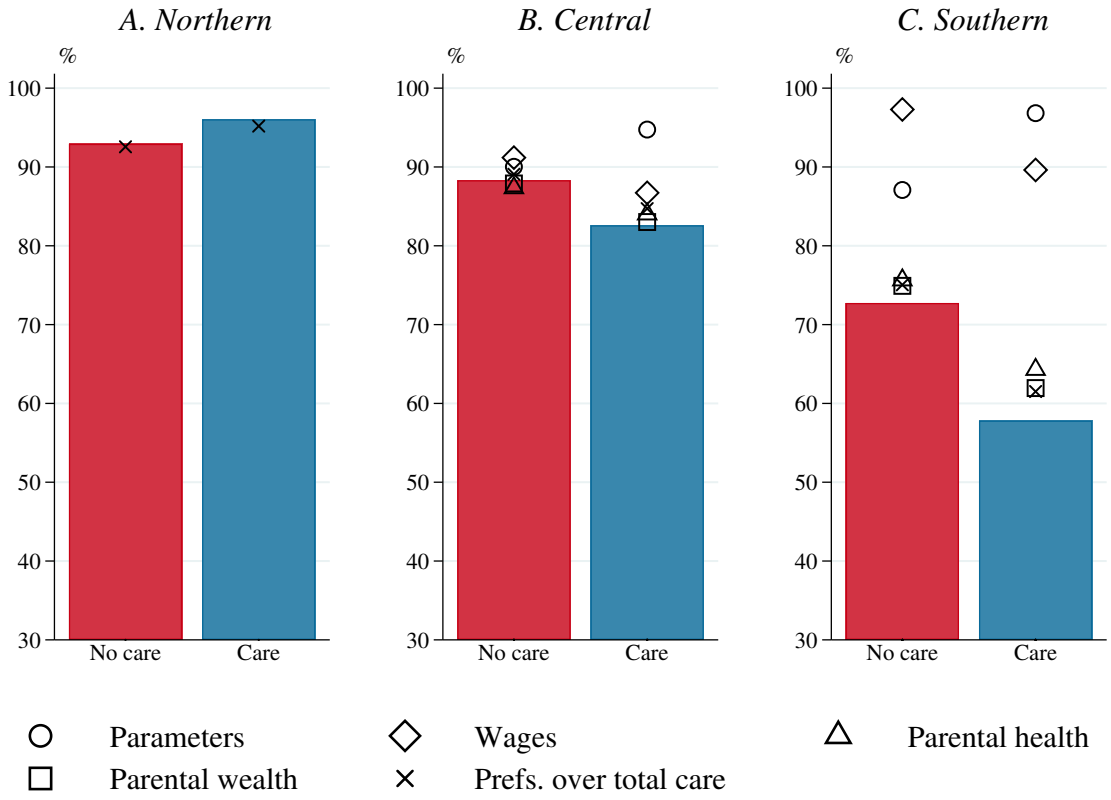
Note: The figure plots the percentage of parents aged 70 or older with care needs who receive no care, only formal care, only informal care, or both types of care in baseline (bars) and counterfactual (markers) simulations. In the counterfactual scenarios, differences in model parameters (dots), wage levels (diamonds), parental health (triangles) and parental wealth (squares) are removed. In the last counterfactual (crosses), I assume that children have preferences over the total amount of care received by their parent. 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 shares are also reported in Table E1.

Under this assumption, child i's choice-specific utility is defined as

$$U_{ia} = \alpha_{0a} + \alpha_{1a}\left[\sum_{\ell \neq i} I_\ell\left(\boldsymbol{d}, \boldsymbol{x}\right) + F\left(\boldsymbol{d}, \boldsymbol{x}\right)\right] + \alpha_{4a}H + \alpha_{5a}\text{widow}_i + \alpha_{6a}\text{near}_i$$
$$+ \alpha_{7a}\text{female}_i + \alpha_{8a}\text{children}_i + \alpha_{9a}\text{married}_i + \beta C_i(\boldsymbol{d}, \boldsymbol{x}) + \epsilon_{ia}. \quad (10)$$

The results of the simulations produced by these preferences for the total amount of care are also shown in Figures 5 and 6 and in Table E2. In this scenario, there is a 5.7 point increase in the use of informal care as the only means of help. This, joint with small changes in the use of formal care only and both types of care, results in a 5.9 point growth in the percentage of parents who receive some care. The employment rates of children also vary moderately, as well as the gaps with Northern Europe.

Figure 6: Employment rate of children by informal care given to parents – Baseline and counterfactual simulations



Note: The figure plots the percentage of individuals who are aged 60 or younger, have at least one parent with care needs aged 70 or older, and are employed, or non-employed while giving informal care or no care in baseline (bars) and counterfactual (markers) simulations. In the counterfactual scenarios, differences in model parameters (dots), wage levels (diamonds), parental health (triangles) and parental wealth (squares) are removed. In the last counterfactual (crosses), I assume that children have preferences over the total amount of care received by their parent. 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 percentages are also reported in Table E1.

B. Wages, health and wealth

Setting wage levels equal across regions has sizable effects in Southern Europe, where wages are lower than in Northern and Central Europe. If Southern European children had the same wages as their Northern European counterparts, the employment rate would grow by 24.6 and 31.8 points for non-caregiving and caregiving children, respectively, closing the gap between these two groups by 7.2 points. The increase in labor supply to obtain higher earnings is accompanied by a reduction in the percentage of parents who receive some care, becoming 7.1 points lower than in the baseline scenario and widening the gap with Northern Europe.

In two additional counterfactual exercises, I shut down the differences across country groups in parental health and wealth. For the first of these, I set the conditional distribution of parents with severe care needs in Central and Southern Europe equal to Northern Europe. For the second, I do the same with the value of assets owned by parents. The responses of families in both experiments are small. By making Southern European parents as healthy as their

Northern European counterparts, the employment rate of children increases by 3 points for non-caregivers and 6.5 points for caregivers, reducing the gap between the two groups. The percentage of parents who receive some care barely changes. By making Southern European parents as rich as those in Northern Europe, employment rates increase by 2.2 points for non-caregivers and 4.1 points for caregivers, narrowing the gap between the two, as well. The share of parents who receive some care increases by 0.7 points.

VII. Policy Experiments

As explained in Section II, two of the most salient outcomes of care provision in Southern Europe are the high percentage of old parents who do not receive any help, and the big gap in terms of employment between the children who do not give care and those who do. In this context, the policymaker might be interested in easing access to formal care services or compensating informal caregivers for the cost of providing care. In this section, I use the estimated model to evaluate five policies that serve these purposes.[11] The first of these policies consists of a non-means-tested subsidy that is given to parents conditional on receiving formal care. Next, I assess the effects of an alternative implementation of this subsidy, where the transfer is extended to all the parents with care needs. In the remaining three policy experiments, I simulate the decisions of families when the transfer is instead split equally among the children who give informal care, conditionally or unconditionally on their labor force participation decisions.

To gauge the impact of these policy alternatives in different regions, I carry out the policy simulations in the sample of Central Europe as well as Southern Europe. The amount of money granted to families in the five experiments depends on the level of care needs (moderate or severe) and is between 6,846 and 10,681 euros per year in Central Europe, and 7,208 and 10,192 euros in Southern Europe. These values correspond to the transfer that would be necessary to make the share of total elderly care costs covered by public social protection systems in Central and Southern Europe equal to the corresponding share in Northern Europe. I use the same quantities to simulate the subsidy for all the parents with care needs. In the case of the three subsidies for informal caregivers, I recalculate the amount granted to each family so the total cost of each policy equals that of the formal care subsidy.[12] In the following subsections, I will focus on Southern Europe to discuss the effects of the subsidies. In Central Europe, the effects of the policies are similar, but of smaller magnitude.

A. Subsidies for care recipients

To simulate the subsidy for parents who receive formal care, I increase the value of the estimated δ_0 in the parent's utility. In the parent's utility function, the role of wealth is captured by $\delta_{7b}W$. Parents may derive utility from wealth for two reasons: first, wealth could be used to pay for formal care; and second, it could be enjoyed as consumption or as bequest left to children. An

[11] Cash benefits are one of the many alternatives that countries have implemented to help meet elderly care needs (Colombo et al., 2011).

[12] In the simulations for Central Europe, the cost of these policies amounts to 0.8% of the sum of Austria, Belgium, France and Germany's GDP. In Southern Europe, the cost is equal to 1.3% of the sum of Italy and Spain's GDP.

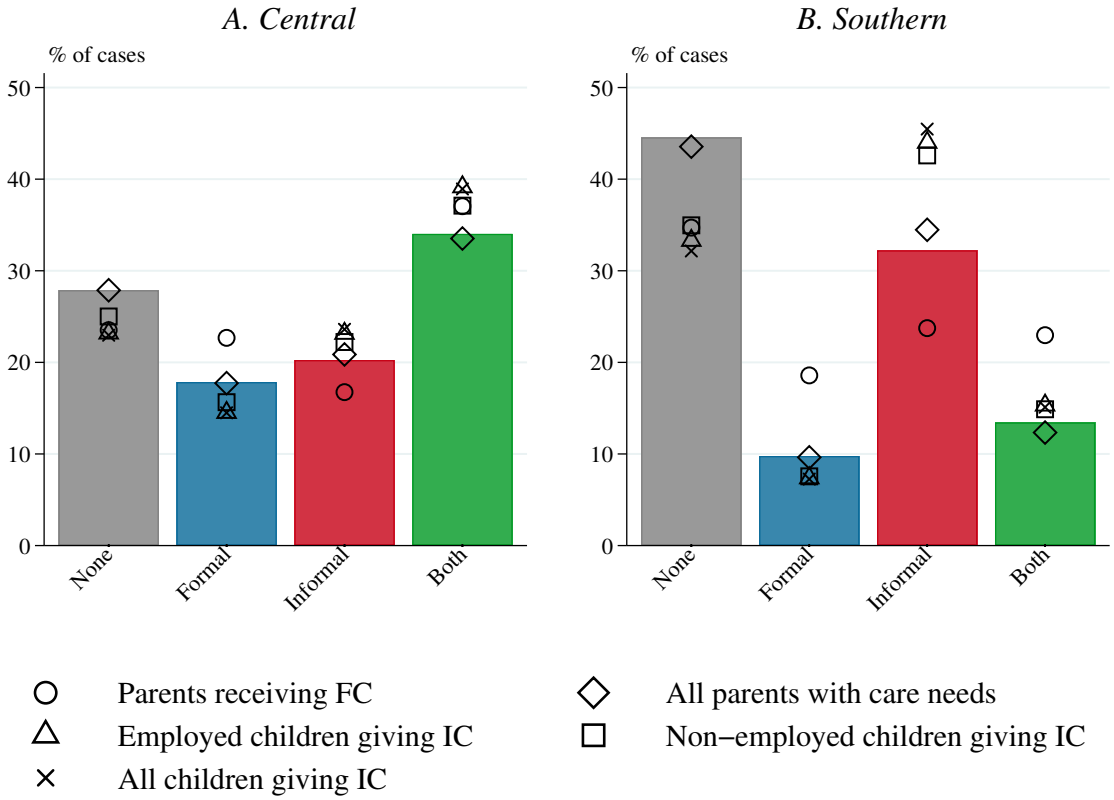
alternative specification of the parent's utility makes these two roles more explicit, replacing $\delta_{7b}W$ by $\gamma\widetilde{W} + \eta_b W$, with

$$\widetilde{W} = \begin{cases} W - p & \text{if } b = \text{FC}, \\ W & \text{otherwise}, \end{cases} \tag{11}$$

and p being the price of formal care. For $b = \text{FC}$, this would be $(\gamma + \eta_b)W - \gamma p$, and the subsidy could be implemented by reducing the value of p. In my specification of the parent's utility, this is equivalent to increasing the value of δ_0 by $\gamma \times \textit{subsidy}$. I use the value estimated for the child's marginal utility of consumption β in each region as an approximation to γ.

Next, I implement the second version of the policy, which extends the transfer to all the parents with care needs, regardless of their formal care decision, by increasing the value of parental wealth W. Figures 7 and 8 summarize the results of these policies in terms of care provision and employment rates.

FIGURE 7: TYPE OF CARE RECEIVED BY PARENTS – BASELINE AND POLICY SIMULATIONS

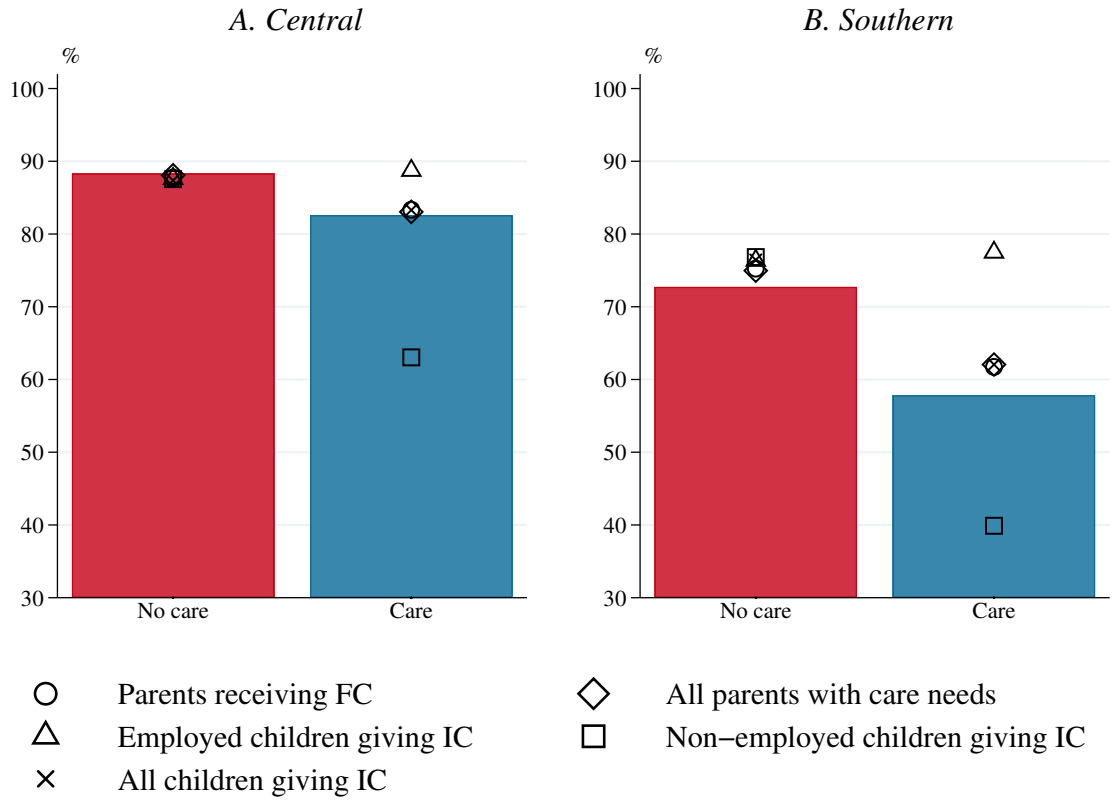


Note: The figure plots the percentage of parents aged 70 or older with care needs who receive no care, only formal care, only informal care, or both types of care in baseline (bars) and policy (markers) simulations. The evaluated policies are a subsidy for parents, conditional on formal care (dots); a subsidy for parents, unconditional on formal care (diamonds); a subsidy for caregiving children, conditional on employment (triangles); a subsidy for caregiving children, conditional on non-employment (squares); and a subsidy for caregiving children, unconditional on employment (crosses). The two country groups represented are Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). The shares are also reported in Tables F1 and F2.

Granting parents a subsidy conditional on receiving formal care gives place to a 9.9-point

growth in the share of older adults who receive some care in Southern Europe. This result is achieved by increasing the use of formal care —alone or in combination with informal care— by 18.3 points, while the overall use of informal care rises by 1 point. The policy seems to alleviate the pressure put on families, with an 8.5-point decline in the percentage of individuals who receive only informal care. Associated with it, the employment rate of children becomes 2.7 points higher than in the baseline scenario, 2.5 points larger for non-caregivers, and 3.9 points bigger for caregivers, contributing to closing the gap between these two groups.

FIGURE 8: EMPLOYMENT RATE OF CHILDREN BY INFORMAL CARE GIVEN TO PARENTS – BASELINE AND POLICY SIMULATIONS



Note: The figure plots the percentage of individuals who are younger than 60 years-old, have at least one parent with care needs aged 70 or older, and are employed, or non-employed while giving informal care or no care in baseline (bars) and policy (markers) simulations. The evaluated policies are a subsidy for parents, conditional on formal care (dots); a subsidy for parents, unconditional on formal care (diamonds); a subsidy for caregiving children, conditional on employment (triangles); a subsidy for caregiving children, conditional on non-employment (squares); and a subsidy for caregiving children, unconditional on employment (crosses). The two country groups represented are Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). The percentages are also reported in Tables F1 and F2.

By contrast, extending the subsidy to all parents, regardless of their formal care choices, has a small effect on families' decisions. This experiment makes parents richer, but this does not translate into a broader use of formal care. In fact, the rate of formal care users is 1.2 lower than in the baseline scenario, whereas the rate of informal care users becomes 1.2 points higher. As a result, there is a 1 point increase in the percentage of individuals receiving some care. The impact of this measure on employment is comparable to the first version of the subsidy: the

overall employment rate is raised by 2.5 points, 2.2 points for non-caregivers, and 4.2 points for caregivers.

B. Subsidies for caregivers

In the third policy experiment, I split the subsidy equally within each family between the children who are employed and provide informal care. The effect of this transfer on the share of parents who receive some care in Southern Europe is larger than that of the subsidy for formal care recipients, increasing this share by 11.3 points. In terms of the type of care provided, the policy makes families more likely to use informal care as the only means of help (+11.8), and less likely to choose formal care as the only source of help (-2.4), but overall, the percentage of formal care recipients does not change much: it decreases by 0.5 points, whereas the share of informal care recipients grows by 13.7 points. Thus, the subsidy encourages children who would not provide any care in the baseline scenario to step in as caregivers.

This policy also has remarkable effects on employment. Making the combination of care and employment more attractive gives place to a 19.7-point increase in the employment rate of children who choose this alternative, closing the employment gap with respect to non-caregivers, which goes from 14.9 to -1.1 points.

The fourth policy, which distributes the same amount of money between the children who do not work, has the opposite consequences on employment and a weaker effect on care provision. This transfer reduces the employment rate of informal caregivers by 17.9 points, and increases the percentage of care recipients by 9.6 points. Finally, the fifth experiment, which offers the subsidy to all children, regardless of their employment choice, has the strongest effects on care provision: a 14.9-point increase in the share of informal care recipients and a 0.8-point reduction in the share of formal care users, contributing to a 12.4-point growth in the percentage of parents who receive some care. The impact of this last subsidy on employment rates is in the middle of the other two subsidies for children, and close to the effects of the subsidies for care recipients.

VIII. 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 outcomes of these decisions across Europe. The literature has studied the nature of such disparities, but it has done so without considering the implications of family interactions among multiple children and their parents. To close this gap, I build and estimate a structural model that represents old parents and their working-age children making care provision and labor force participation decisions in a static, non-cooperative game of complete information. I show that this model does a good job in fitting the observed patterns in care received by older adults and employment rates of their children 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 regions. Results show that differences in the estimated model parameters, capturing the influence of care

prices, social norms and institutions, can largely explain the disparities found across regions, followed by wages. Differences in parental health and parental wealth are less relevant. Lastly, I use the model to conduct five policy experiments with the aim of reducing the high percentage of old parents who do not receive any care, and the big gap in terms of employment between the children who do not give care and those who do in Southern Europe. I find that subsidies for informal caregivers are more effective than subsidies for care recipients to achieve these goals.

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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.

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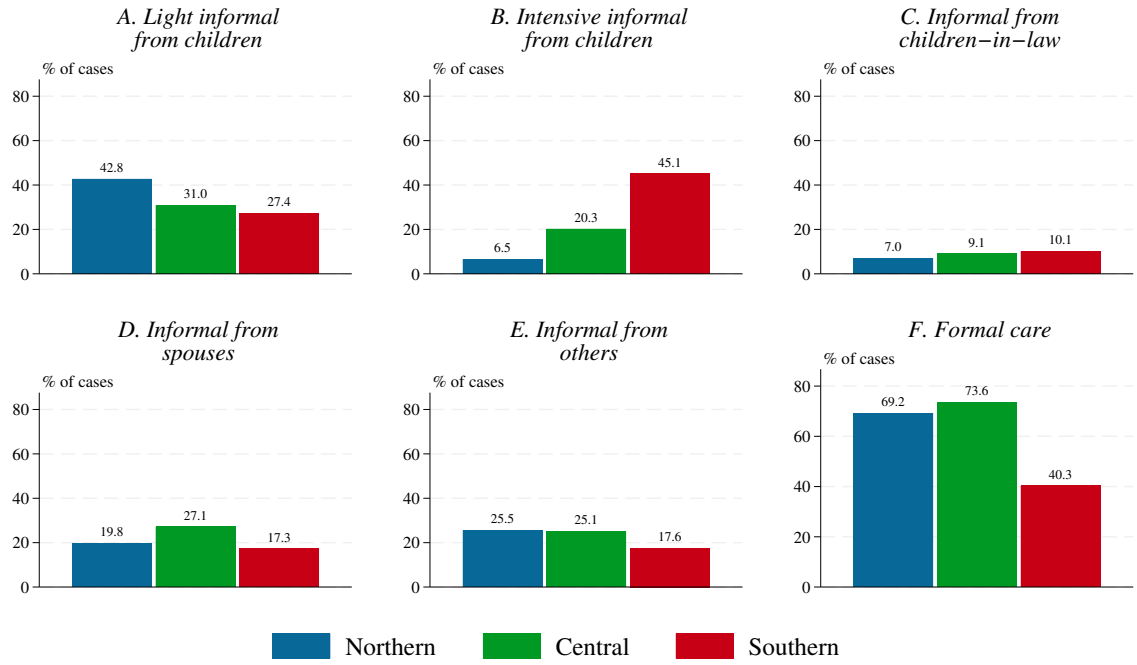
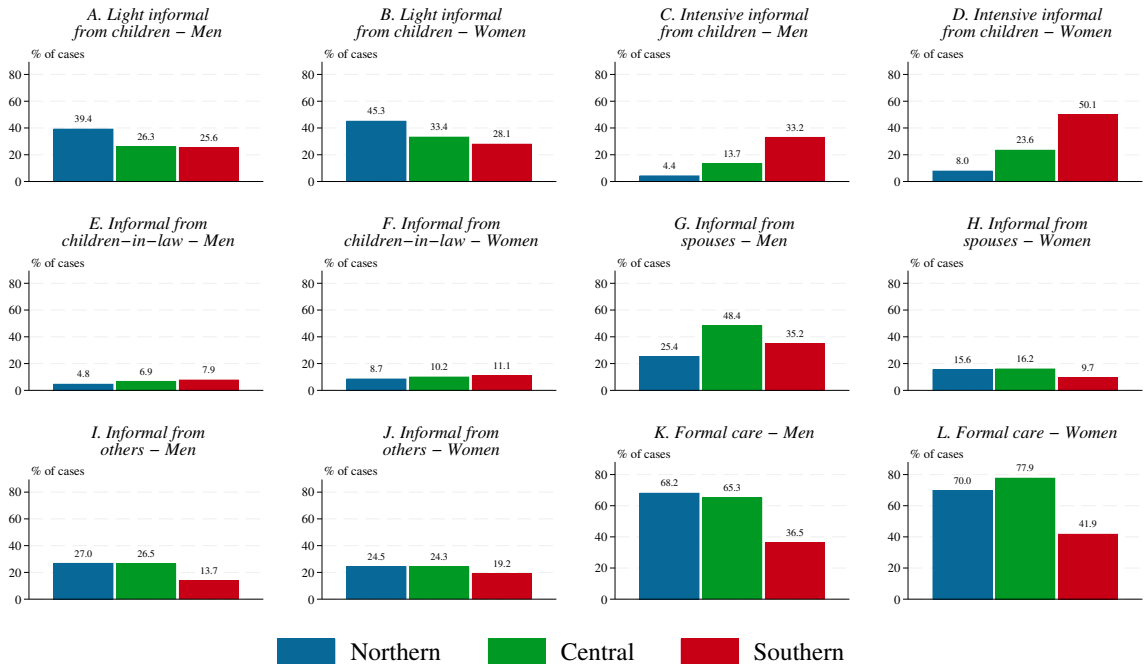
Appendix A: Motivating Evidence

Figure A1: Type of care received (six options, conditional on receiving care)



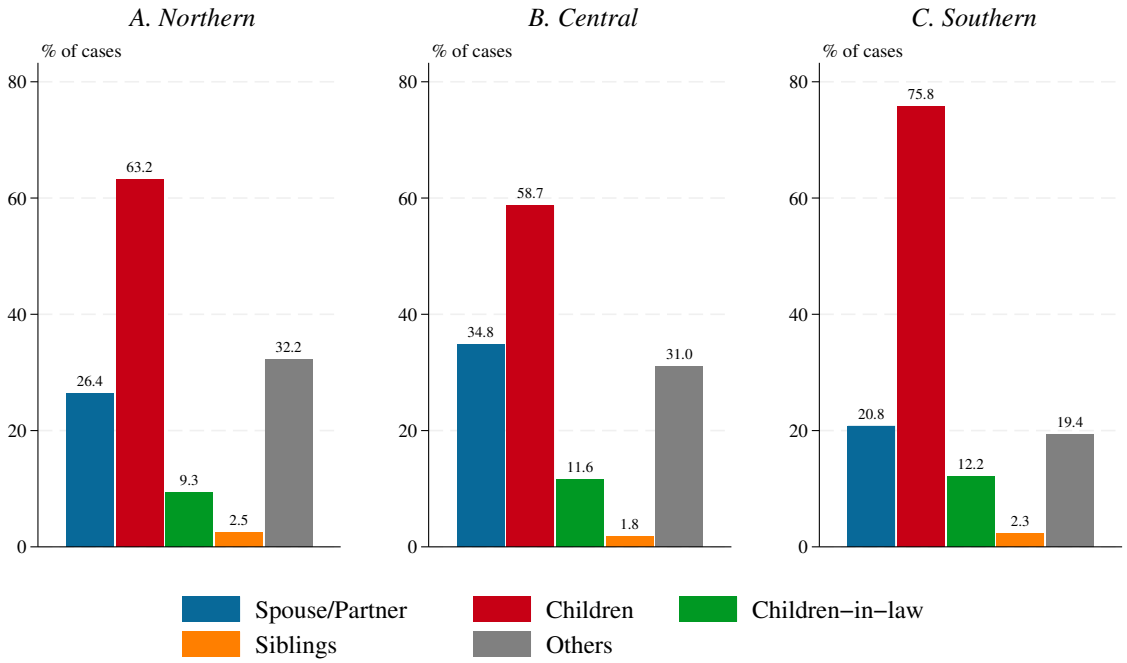
Note: The figure plots the percentages of individuals aged 70 or older with care needs and at least one child aged 60 or younger who receive light informal care from children, intensive informal care from children, informal care from children-in-law, informal care from a spouse, informal care from other sources, or formal care, conditional on receiving some care. 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. Care alternatives are not mutually exclusive. The country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

FIGURE A2: TYPE OF CARE RECEIVED (SIX OPTIONS, CONDITIONAL ON RECEIVING CARE) – MEN AND WOMEN



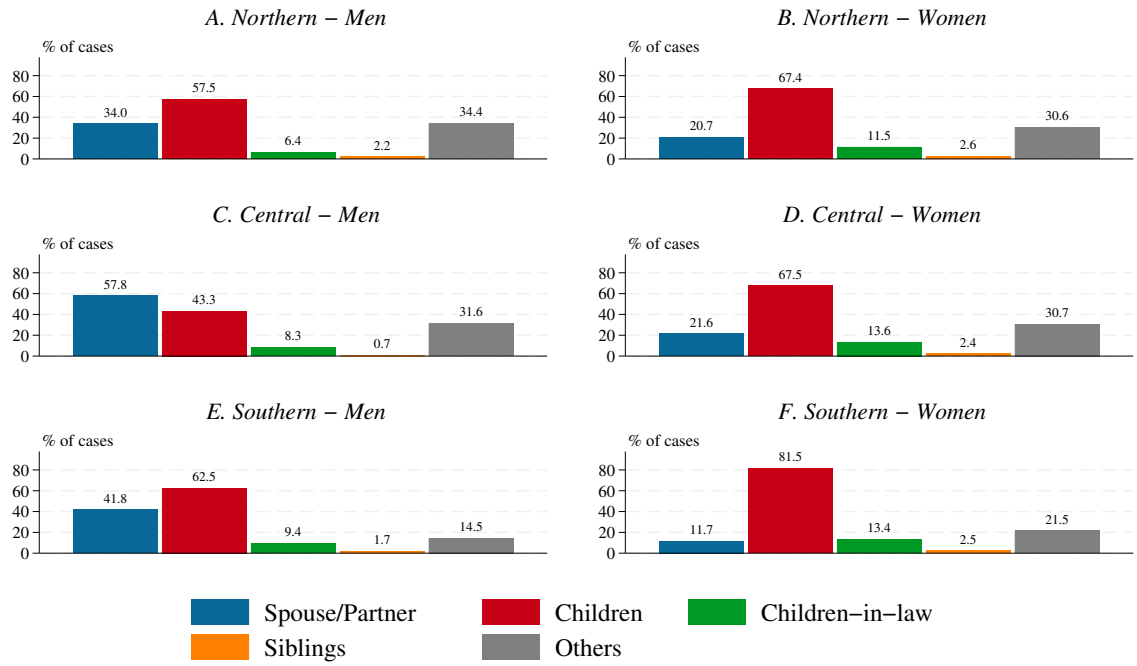
Note: The figure plots the percentages of individuals aged 70 or older with care needs who receive light informal care from children, intensive informal care from children, informal care from children-in-law, informal care from a spouse, informal care from other sources, or formal care, conditional on receiving some care. 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. Care alternatives are not mutually exclusive. The country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

FIGURE A3: SOURCES OF INFORMAL CARE RECEIVED



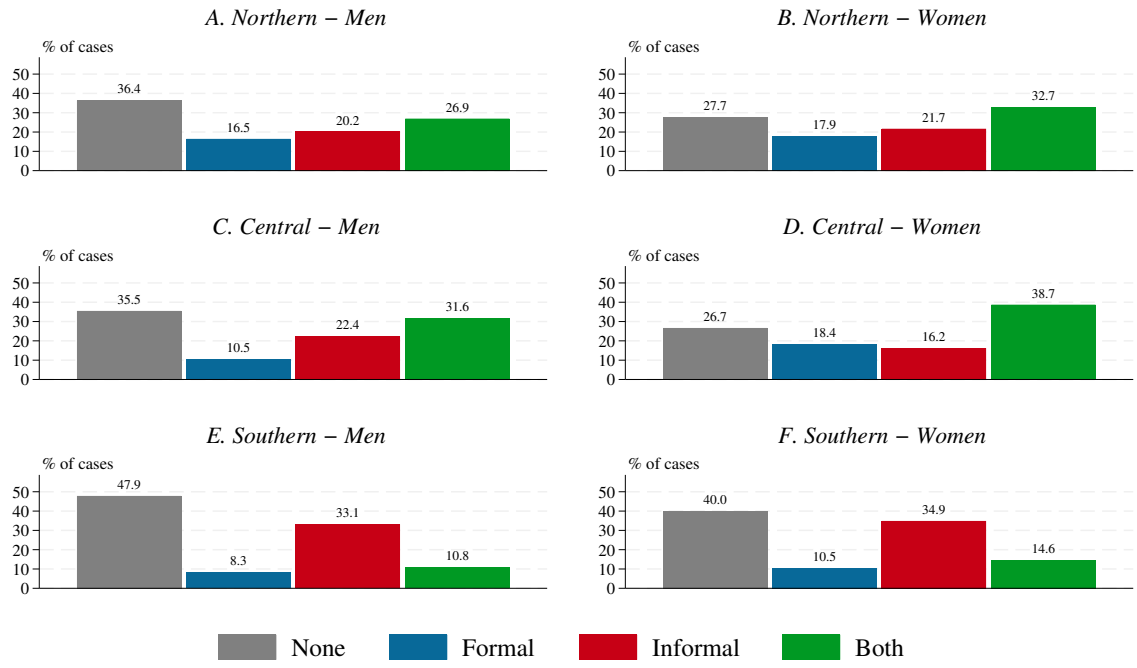
Note: The figure plots the percentage of individuals aged 70 or older with care needs and at least one child aged 60 or younger who receive informal care from a spouse or partner, child, child-in-law, siblings, or other sources, conditional on receiving some informal care. The country groups represented are 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 Waves 5 and 6.

FIGURE A4: SOURCES OF INFORMAL CARE RECEIVED – MEN AND WOMEN



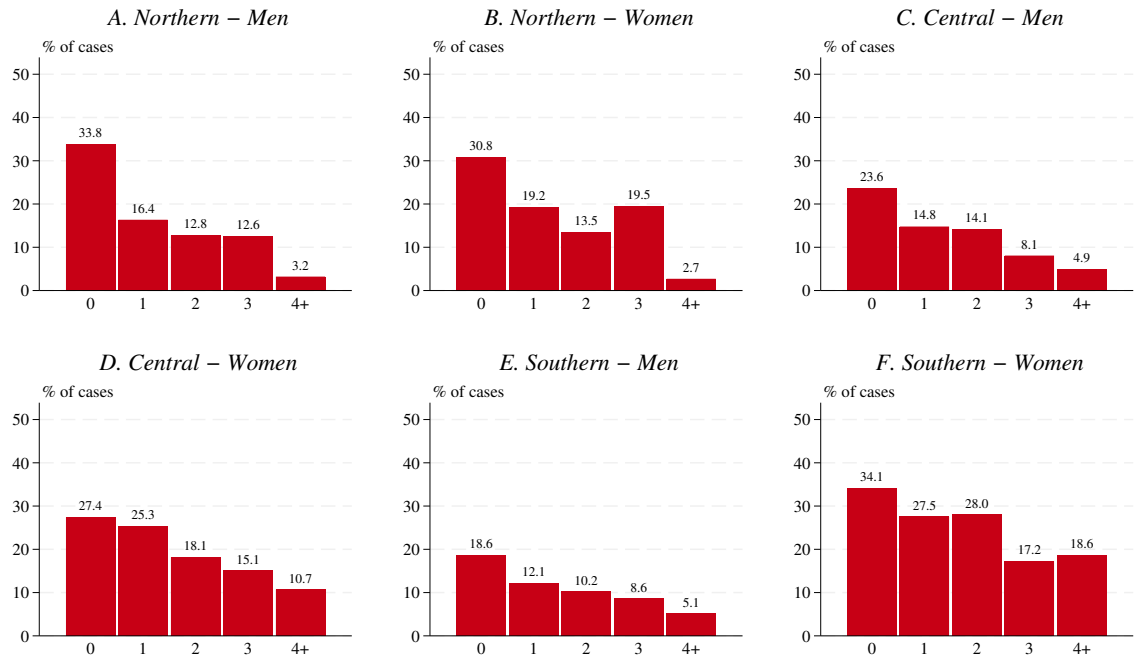
Note: The figure plots the percentage of individuals aged 70 or older with care needs who receive informal care from a spouse or partner, child, child-in-law, sibling, or other sources, conditional on receiving some informal care. The country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). The alternatives are not mutually exclusive. *Source:* SHARE Waves 5 and 6.

FIGURE A5: TYPE OF CARE RECEIVED – MEN AND WOMEN



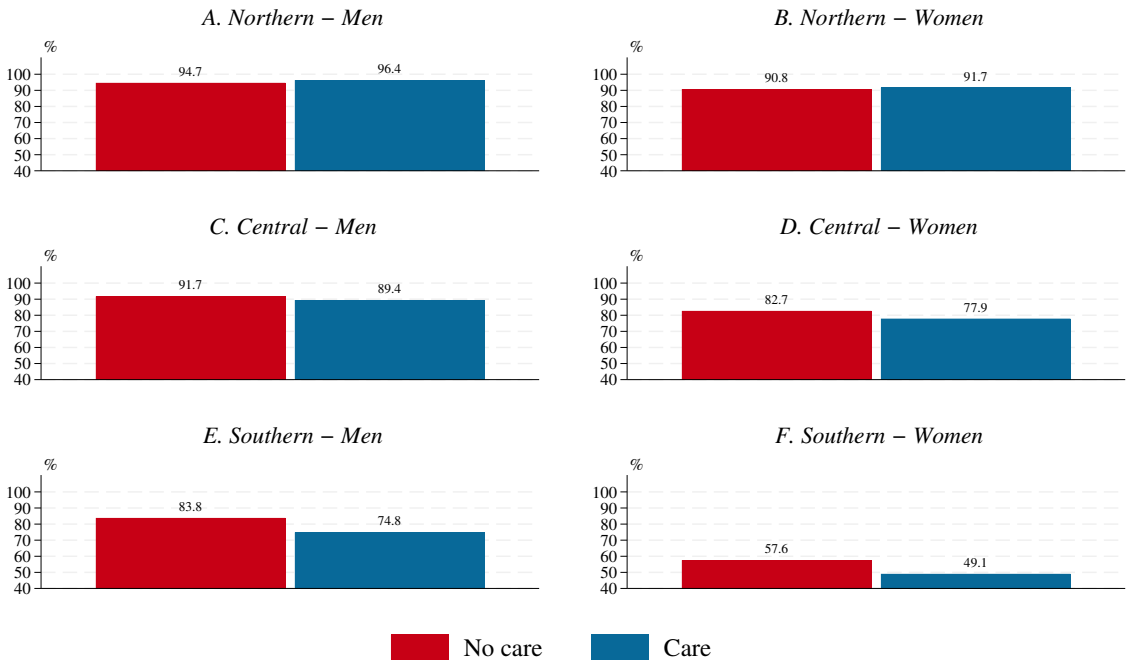
Note: The figure plots the percentage of individuals aged 70 or older with care needs who receive no care, only formal care, only informal care, or both types of care. The country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

FIGURE A6: PROBABILITY OF GIVING INFORMAL CARE TO PARENTS BY NUMBER OF SIBLINGS – MEN AND WOMEN



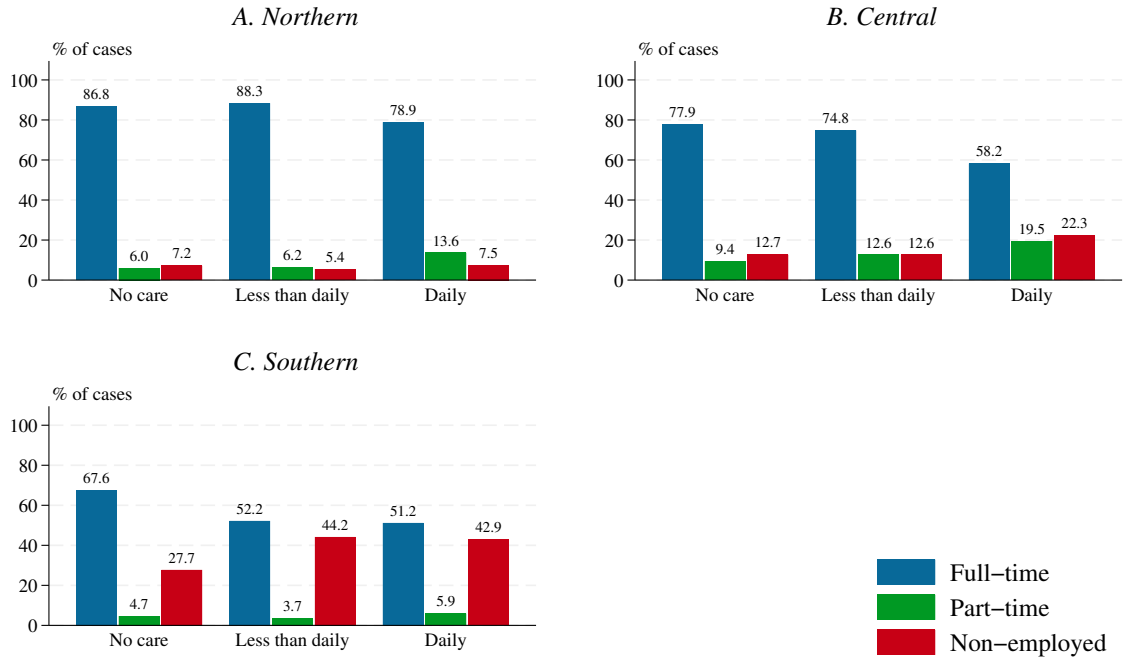
Note: The figure plots the percentage of individuals who are aged 60 or younger, have at least one parent with care needs aged 70 or older, and give informal care to them, by number of siblings (from zero to four or more). The country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

FIGURE A7: EMPLOYMENT RATE OF CHILDREN BY INFORMAL CARE GIVEN TO PARENTS – MEN AND WOMEN



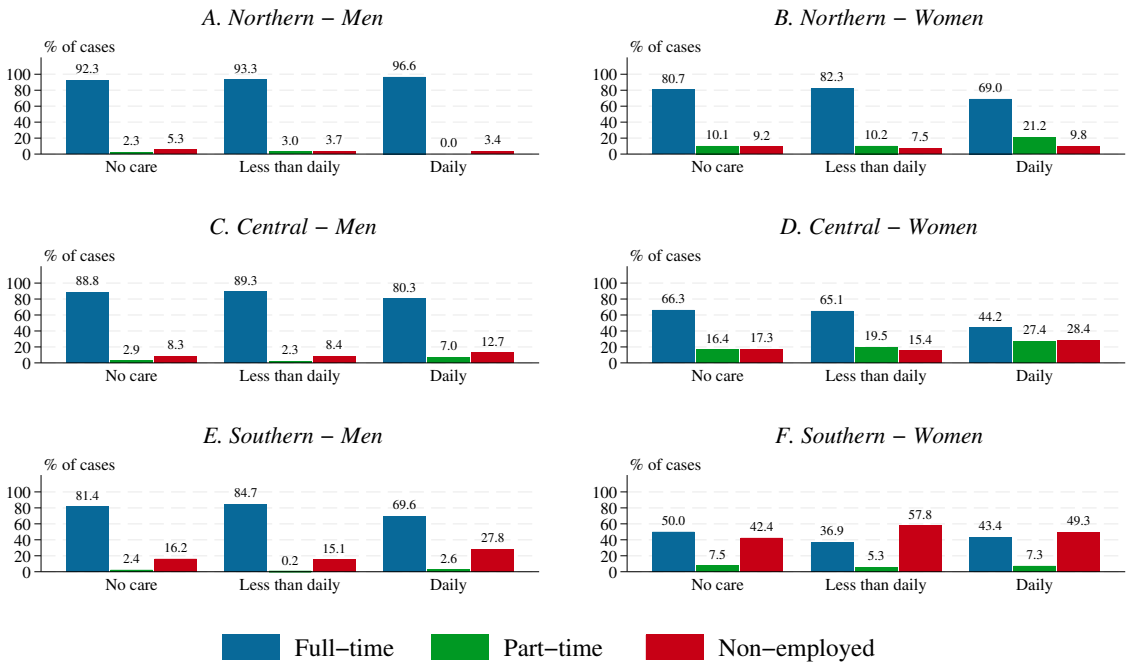
Note: The figure plots the percentage of individuals who are aged 60 or younger, have at least one parent with care needs aged 70 or older, and are employed or non-employed while giving informal care or no care at all. The country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

FIGURE A8: EMPLOYMENT STATUS OF CHILDREN BY FREQUENCY OF INFORMAL CARE GIVEN TO PARENTS



Note: The figure plots the percentage of individuals who are aged 60 or younger, have at least one parent with care needs 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 country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

Figure A9: Employment status of children by frequency of informal care given to parents – Men and women



Note: The figure plots the percentage of individuals who are aged 60 or younger, have at least one parent with care needs 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 country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain). *Source*: SHARE Waves 5 and 6.

Table A1: Having care needs and receiving care – Logit estimates

	Having care needs (dummy)[(a)]	Care received (dummy)[(b)]
Central Europe (dummy)	1.880***	1.050
	(0.122)	(0.116)
Southern Europe (dummy)	4.396***	0.591***
	(0.286)	(0.068)
Female (dummy)	1.411***	1.198**
	(0.071)	(0.099)
Age	1.034	0.816
	(0.122)	(0.157)
Age squared	1.001	1.002
	(0.001)	(0.001)
Widowed (dummy)	1.093	1.401***
	(0.066)	(0.134)
Severe LTC needs (dummy)		0.883
		(0.080)
Number of children		1.021
		(0.030)
At least one child lives less		0.918
than 25 km away from parent (dummy)		(0.119)
Log net assets	0.887***	0.945***
	(0.010)	(0.015)
Constant	0.002	262.504
	(0.008)	(2004.460)
Number of observations	23,496	6,527

Note: (a) Sample of respondents aged 70 or older; (b) sample of respondents aged 70 or older with care needs. Exponentiated coefficients (odds ratios). Standard errors clustered at the household level in parentheses. P-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: SHARE, waves 5 and 6.

Table A2: Type of care received – Multinomial logit estimates

	Only formal care	Only informal care	Both types of care
Central Europe (dummy)	0.917	0.895	1.242
	(0.145)	(0.124)	(0.167)
Southern Europe (dummy)	0.361***	1.160	0.280***
	(0.063)	(0.156)	(0.042)
Female (dummy)	1.460***	1.019	1.361***
	(0.202)	(0.096)	(0.155)
Age	0.812	0.983	0.736
	(0.223)	(0.222)	(0.181)
Age squared	1.002	1.000	1.003*
	(0.002)	(0.001)	(0.002)
Widowed (dummy)	1.641***	1.343***	1.366**
	(0.240)	(0.147)	(0.177)
Severe LTC needs (dummy)	0.938	0.791**	0.963
	(0.138)	(0.085)	(0.113)
Number of children	0.960	1.046	1.019
	(0.044)	(0.034)	(0.038)
At least one child lives less	0.788	1.023	0.907
than 25 km away from parent (dummy)	(0.141)	(0.165)	(0.147)
Log net assets	0.901***	0.962**	0.952**
	(0.020)	(0.017)	(0.019)
Constant	45.303	0.160	1835.695
	(501.649)	(1.434)	(1.8e+04)
Number of observations		6,527	

Note: *No care received* is the base category. Sample of respondents aged 70 or older with care needs. Exponentiated coefficients (relative-risk ratios). Standard errors clustered at the household level in parentheses. P-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *Source*: SHARE, waves 5 and 6.

Table A3: Type of care received (conditional on receiving care) – Logit estimates

	Children (light)	Children (intensive)	Children-in-law	Spouse	Others	Formal care
Central Europe (dummy)	0.588***	3.719***	1.369	1.723***	0.894	1.269*
	(0.075)	(0.876)	(0.345)	(0.266)	(0.127)	(0.172)
Southern Europe (dummy)	0.409***	9.457***	1.510*	0.907	0.648***	0.260***
	(0.057)	(2.203)	(0.375)	(0.150)	(0.102)	(0.037)
Female (dummy)	1.225**	1.549***	1.093	0.210***	0.890	1.394***
	(0.126)	(0.183)	(0.214)	(0.024)	(0.115)	(0.149)
Age	1.261	0.981	1.136	1.441	0.922	0.885
	(0.294)	(0.240)	(0.438)	(0.352)	(0.235)	(0.192)
Age squared	0.999	1.000	0.999	0.997*	1.000	1.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Widowed (dummy)	1.320**	1.720***	1.892***		1.811***	1.036
	(0.161)	(0.229)	(0.383)		(0.257)	(0.124)
Severe LTC needs (dummy)	0.960	1.337**	0.850	1.145	0.833	1.235*
	(0.112)	(0.180)	(0.156)	(0.141)	(0.113)	(0.150)
Number of children	1.136***	1.115***	0.878*	0.943	0.918*	0.960
	(0.039)	(0.044)	(0.064)	(0.037)	(0.045)	(0.034)
At least one child lives less	1.498**	3.141***	1.697	0.807	0.726*	0.839
than 25 km away from parent (dummy)	(0.244)	(0.732)	(0.620)	(0.130)	(0.121)	(0.138)
Log net assets	1.084***	0.960*	0.976	1.147***	1.020	0.973
	(0.019)	(0.021)	(0.026)	(0.029)	(0.021)	(0.019)
Constant	0.000	0.004	0.000	0.000	42.562	24.456
	(0.000)	(0.042)	(0.003)	(0.000)	(435.200)	(213.728)
Number of observations	4,036	4,036	4,036	4,036	4,036	4,036

Note: Sample of respondents aged 70 or older with care needs. Exponentiated coefficients (odds ratios). Standard errors clustered at the household level in parentheses. P-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Care alternatives are not mutually exclusive. *Source*: SHARE, waves 5 and 6.

Table A4: Employment status of children – Multinomial logit estimates

	Part-time	Full-time
Central Europe (dummy)	0.745	0.481***
	(0.162)	(0.091)
Southern Europe (dummy)	0.185***	0.196***
	(0.042)	(0.037)
Central Europe × Light informal care (dummy)	1.133	1.099
	(0.378)	(0.284)
Central Europe × Intensive informal care (dummy)	1.182	0.471***
	(0.346)	(0.103)
Southern Europe × Light informal care (dummy)	0.541	0.742
	(0.275)	(0.144)
Southern Europe × Intensive informal care (dummy)	0.792	0.741**
	(0.188)	(0.101)
Female (dummy)	1.901***	0.246***
	(0.309)	(0.021)
Age	1.154*	1.247***
	(0.086)	(0.068)
Age squared	0.998**	0.998***
	(0.001)	(0.001)
College (dummy)	1.669***	2.633***
	(0.275)	(0.306)
Lives less than 25 km away from parent (dummy)	1.106	0.782***
	(0.166)	(0.072)
Having children (dummy)	1.134	1.025
	(0.181)	(0.109)
Married (dummy)	1.047	1.341***
	(0.149)	(0.126)
Having siblings (dummy)	0.919	0.809
	(0.250)	(0.132)
Severe LTC needs (dummy)	0.765**	0.869
	(0.103)	(0.078)
Constant	0.029**	0.169
	(0.049)	(0.215)
Number of observations	13,951	

Note: Sample of individuals who are aged 60 or younger and have at least one parent with care needs aged 70 or older. Exponentiated coefficients (relative-risk ratios). Standard errors clustered at the household level in parentheses. P-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. 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 Waves 5 and 6.

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.

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 their 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 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 that is 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 reports if the respondent received care daily, weekly, monthly, or less often; and *dummy* represents that there is information on whether the respondent received care. In parentheses, *individual* and *household* indicate 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 their partner. *Source*: SHARE questionnaires and Barczyk and Kredler (2019).

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

Table B2: Estimates of hours of informal care given to parents

	Log hours of informal care
Number of siblings	0.023
	(0.020)
Parental health	-0.256***
	(0.028)
Widowed parent (dummy)	0.034
	(0.074)
Lives less than 25km	0.182***
away from parents (dummy)	(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

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: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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.[14] I add 14.84 hours to this number in case the

[13] 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.

[14] 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

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).

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 B3: Estimates of hours of formal home care received by parents

	Log hours of care		
ADL dummies			
Dressing	-0.063	Cognitively impaired (dummy)	0.099
	(0.085)		(0.118)
Walking across a room	0.480***	Age	27.589
	(0.143)		(22.323)
Bathing/showering	0.038	Age^2	-0.502
	(0.091)		(0.404)
Eating/Cutting up food	0.091	Age^3	0.004
	(0.148)		(0.003)
Getting in/out of bed	-0.061	Age^4	-0.000
	(0.143)		(0.000)
Using the toilet	-0.015	Number of children	-0.040*
	(0.155)		(0.022)
Preparing a hot meal	0.328***	Widowed (dummy)	0.228***
	(0.106)		(0.067)
Shopping for groceries	0.087	At least one child lives less	-0.097
	(0.081)	than 1km away	(0.085)
Using the phone	-0.595***	Net assets	0.000
	(0.151)		(0.000)
Taking medications	0.491***	North (dummy)	-0.277***
	(0.149)		(0.067)
Working around the house	0.210***	South (dummy)	-0.124
	(0.074)		(0.094)
Managing money	0.084	Constant	-564.548
	(0.110)		(460.746)
Number of observations	1,830		

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: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B4: Number of children in the family

Number of children	Northern			Central			Southern			Number of outcomes
	Freq.	Percent	Cumul.	Freq.	Percent	Cumul.	Freq.	Percent	Cumul.	
1	224	28.04	28.04	873	32.19	32.19	763	26.54	26.54	8
2	327	40.93	68.96	927	34.18	66.37	988	34.37	60.90	32
3	157	19.65	88.61	549	20.24	86.62	642	22.33	83.23	128
4	71	8.89	97.50	234	8.63	95.24	320	11.13	94.37	512
5	12	1.50	99.00	69	2.54	97.79	93	3.23	97.60	2,048
6	7	0.88	99.87	37	1.36	99.15	32	1.11	98.71	8,192
7	1	0.13	100.00	12	0.44	99.59	25	0.87	99.58	32,768
8	0	0.00	0.00	5	0.18	99.78	5	0.17	99.76	131,072
9	0	0.00	0.00	5	0.18	99.96	5	0.17	99.93	524,288
10	0	0.00	0.00	1	0.04	100.00	0	0.00	99.93	2,097,152
11	0	0.00	0.00	0	0.00	0.00	1	0.03	99.97	8,388,608
12	0	0.00	0.00	0	0.00	0.00	1	0.03	100.00	33,554,432

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

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: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

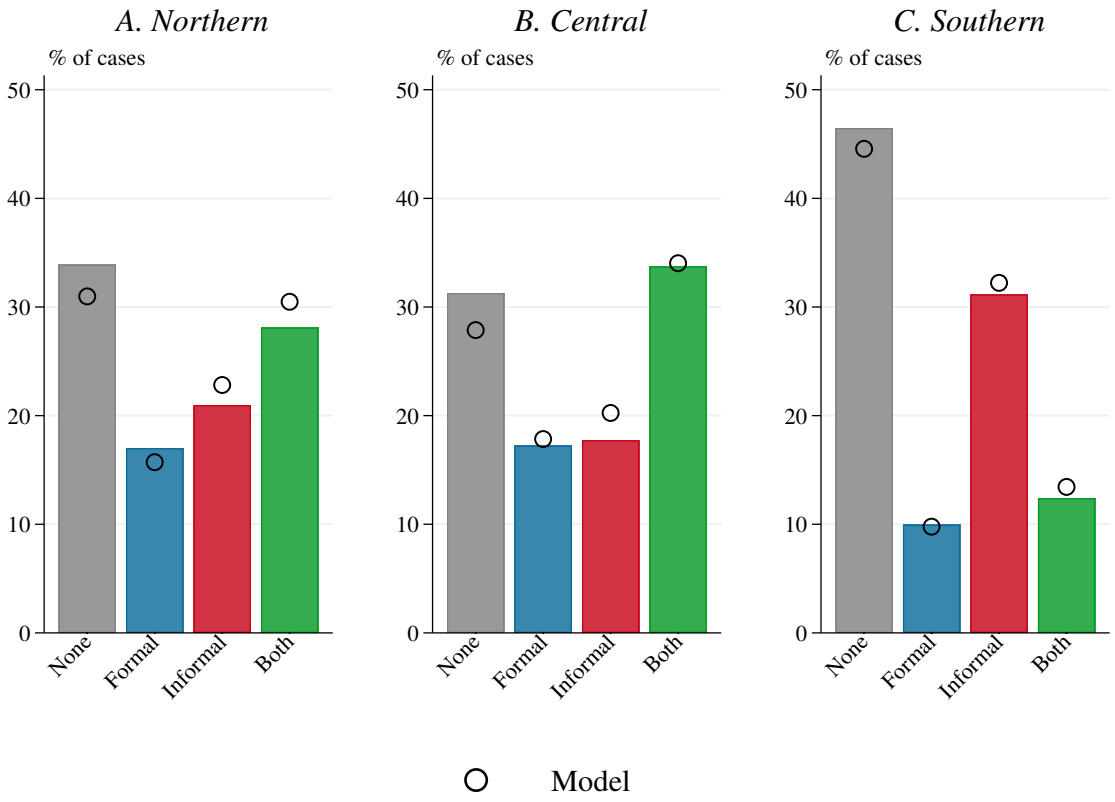
Table C2: Wage estimates by region

	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 parentheses. P-values: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

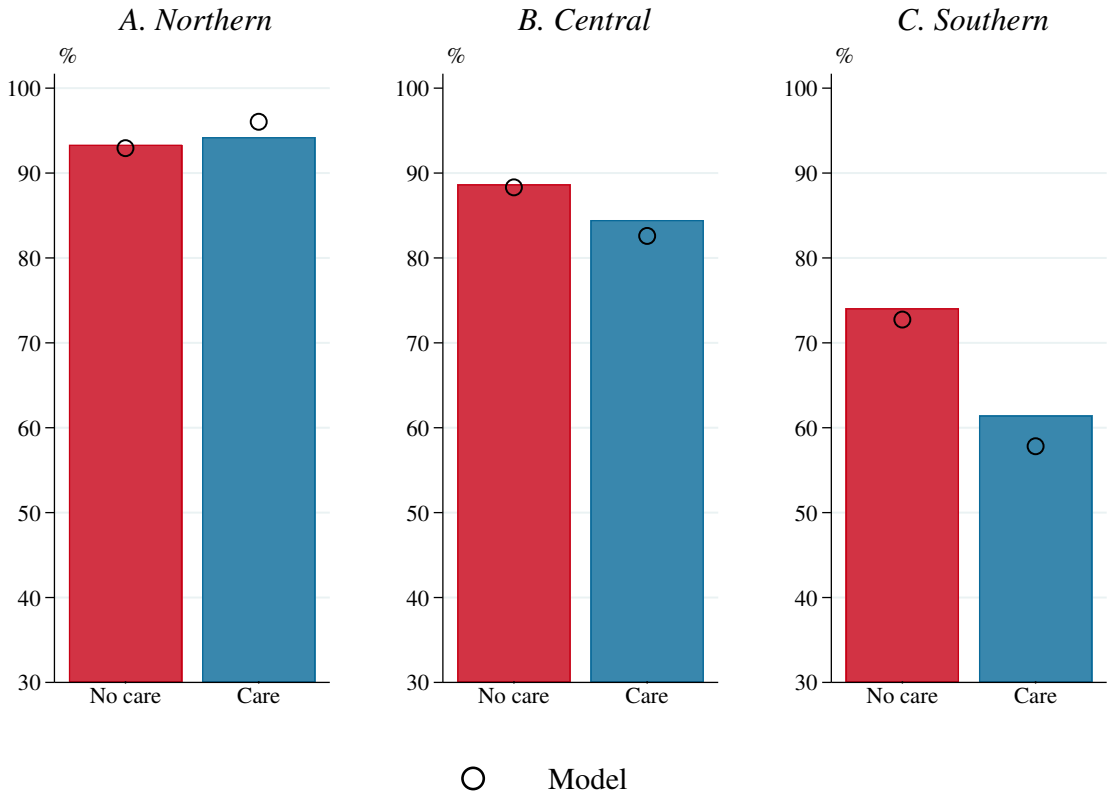
Appendix D: Model Fit

Figure D1: Type of care received by parents – Model fit



Note: The figure plots the percentage of parents aged 70 or older with care needs who receive no care, only formal care, only informal care, or both types of care in the estimation sample (bars) and the model simulations (dots). The country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain).

FIGURE D2: EMPLOYMENT RATE OF CHILDREN BY INFORMAL CARE GIVEN TO PARENTS – MODEL FIT



Note: The figure plots the percentage of individuals who are aged 60 or younger, have at least one parent with care needs aged 70 or older, and are employed, or non-employed while giving informal care or no care in the estimation sample (bars) and the model simulations (dots). The three country groups represented are Northern Europe (Denmark and Sweden), Central Europe (Austria, Belgium, France and Germany) and Southern Europe (Italy and Spain).

Appendix E: Decomposition Analysis

Table E1: Type of care received by parents and employment rate of children in baseline and counterfactual simulations (%)

	Some care	Only formal care	Only informal care	Both types of care	Employed (overall)	Employed non-caregivers	Employed caregivers	Gap between non-caregivers and caregivers
	A. Northern Europe							
Baseline	69.0	15.7	22.8	30.5	93.7	92.9	96.0	-3.1
Prefs. over total care	73.8	13.1	26.1	34.7	93.3	92.6	95.2	-2.6
	B. Central Europe							
Baseline	72.1	17.8	20.2	34.0	87.1	88.3	82.6	5.7
Parameters	73.5	15.9	24.3	33.3	91.5	90.0	94.7	-4.7
Wages	71.9	18.3	21.1	32.5	90.3	91.2	86.7	4.5
Parental health	72.3	17.7	21.0	33.6	86.6	87.3	84.0	3.3
Parental wealth	71.9	17.7	22.0	32.2	86.9	87.9	83.0	4.9
Prefs. over total care	75.5	15.4	22.4	37.6	88.1	89.1	84.7	4.4
	C. Southern Europe							
Baseline	55.4	9.8	32.2	13.4	69.6	72.7	57.8	14.9
Parameters	74.9	15.7	24.1	35.1	91.7	87.1	96.8	-9.7
Wages	48.3	11.5	27.1	9.7	96.5	97.3	89.6	7.7
Parental health	55.3	9.8	33.8	11.7	73.4	75.7	64.3	11.4
Parental wealth	56.1	9.8	35.0	11.3	72.1	74.9	61.9	13.0
Prefs. over total care	61.3	8.5	37.9	14.9	72.0	75.1	61.5	13.5

Note: The table shows the share of respondents aged 70 or older with care needs who receive some care, only formal care, only informal care, or both types of care in baseline and counterfactual scenarios, as well as the overall share of employed children, the share of children who are employed while giving informal care or no care at all, and the gap between these two. In the counterfactual scenarios represented in rows 2-5 of Panels B and C, differences in model parameters, wage levels, parental health and parental wealth across regions are removed. In row 6 of the same panels, simulations are conducted under the assumption that children have preferences over the total amount of care. 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 E2: Type of care received by parents and employment rate of children – Difference between Northern and Central Europe and Northern and Southern Europe in baseline and counterfactual simulations

	Some care	Only formal care	Only informal care	Both types of care	Employed (overall)	Employed non-caregivers	Employed caregivers	Gap between non-caregivers and caregivers
	A. Northern vs Central Europe							
Baseline	-3.1	-2.1	2.6	-3.5	6.6	4.6	13.4	-8.8
Parameters	-4.5	-0.2	-1.5	-2.8	2.2	2.9	1.3	1.6
Wages	-2.9	-2.6	1.7	-2.0	3.5	1.7	9.3	-7.6
Parental health	-3.3	-2.0	1.8	-3.1	7.1	5.6	12.0	-6.4
Parental wealth	-2.9	-2.0	0.9	-1.7	6.9	5.0	13.0	-8.0
Prefs. over total care	-1.6	-2.4	3.7	-3.0	5.1	3.5	10.5	-7.0
	B. Northern vs Southern Europe							
Baseline	13.6	5.9	-9.4	17.0	24.1	20.2	38.2	-18.0
Parameters	-5.9	-0.0	-1.3	-4.6	2.0	5.9	-0.8	6.6
Wages	20.7	4.2	-4.3	20.8	-2.8	-4.4	6.4	-10.8
Parental health	13.7	5.9	-11.0	18.8	20.4	17.3	31.7	-14.5
Parental wealth	12.9	5.9	-12.2	19.2	21.7	18.0	34.1	-16.1
Prefs. over total care	12.5	4.6	-11.9	19.7	21.3	17.5	33.7	-16.2

Note: The table shows the differences in percentage points between Northern and Central Europe (Panel A) and Northern and Southern Europe (Panel B) in the percentage of parents who receive some care, only formal care, only informal care, or both types of care in baseline and counterfactual simulations, as well as the differences in the employment shares of children overall, the children who do not give informal care, those who do give informal care, and the gap between the last two. In the counterfactual scenarios represented in rows 2-5 of each panel, differences in model parameters, wage levels, parental health and parental wealth across regions are removed. In row 6, simulations are conducted under the assumption that children have preferences over the total amount of care. 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 shares of each region are reported in Table E1.

Appendix F: Policy Experiments

Table F1: Type of care received by parents in baseline and policy simulations (%)

	Some care	Only formal care	Only informal care	Both types of care
	A. Northern Europe			
Baseline	69.0	15.7	22.8	30.5
	B. Central Europe			
Baseline	72.1	17.8	20.2	34.0
Parents receiving FC	76.5	22.7	16.8	37.0
All parents with care needs	72.1	17.7	20.9	33.5
Employed children giving IC	76.8	14.5	23.1	39.1
Non-employed children giving IC	75.0	15.7	22.2	37.1
All children giving IC	77.0	14.5	23.6	38.9
	C. Southern Europe			
Baseline	55.4	9.8	32.2	13.4
Parents receiving FC	65.3	18.6	23.7	23.0
All parents with care needs	56.4	9.6	34.5	12.3
Employed children giving IC	66.7	7.4	44.0	15.3
Non-employed children giving IC	65.0	7.6	42.6	14.9
All children giving IC	67.8	7.3	45.5	15.1

Note: The table shows the share of respondents aged 70 or older with care needs who receive some care, only formal care, only informal care, or both types of care in baseline and policy scenarios. The evaluated policies are a subsidy for parents, conditional on formal care; a subsidy for parents, unconditional on formal care; a subsidy for caregiving children, conditional on employment; a subsidy for caregiving children, conditional on non-employment; and a subsidy for caregiving children, unconditional on employment. 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 F2: Employment rate of children in baseline and policy simulations (%)

	Employed (overall)	Employed non-caregivers	Employed caregivers	Gap between non-caregivers and caregivers
	A. Northern Europe			
Baseline	93.7	92.9	96.0	-3.1
	B. Central Europe			
Baseline	87.1	88.3	82.6	5.7
Parents receiving FC	86.8	87.8	83.3	4.4
All parents with care needs	87.0	88.1	83.0	5.0
Employed children giving IC	88.0	87.6	88.7	-1.1
Non-employed children giving IC	80.6	87.5	63.0	24.5
All children giving IC	86.1	87.4	83.3	4.1
	C. Southern Europe			
Baseline	69.6	72.7	57.8	14.9
Parents receiving FC	72.2	75.2	61.7	13.5
All parents with care needs	72.1	75.0	62.1	12.9
Employed children giving IC	76.8	76.4	77.5	-1.1
Non-employed children giving IC	64.6	76.8	39.9	36.9
All children giving IC	71.3	76.4	62.1	14.4

Note: The table shows the share of employed children overall, the share of children who are employed while giving informal care or no care at all, and the gap between the last two in baseline and policy scenarios. The evaluated policies are a subsidy for parents, conditional on formal care; a subsidy for parents, unconditional on formal care; a subsidy for caregiving children, conditional on employment; a subsidy for caregiving children, conditional on non-employment; and a subsidy for caregiving children, unconditional on employment. 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 F3: Results of the policy experiments – Central Europe

Outcome	Parents receiving FC	All parents with care needs	Employed children giving IC	Non-employed children giving IC	All children giving IC
Rate of only FC users	+4.8	-0.1	-3.3	-2.2	-3.3
Rate of only IC users	-3.5	+0.6	+2.9	+2.0	+3.4
Rate of users of both types of care	+3.0	-0.5	+5.1	+3.1	+4.9
Rate of users of FC	+7.9	-0.6	+1.8	+0.9	+1.6
Rate of users of IC	-0.5	+0.1	+8.0	+5.1	+8.3
Rate of care users	+4.4	+0.0	+4.7	+2.9	+4.9
Employment rate	-0.3	-0.1	+0.9	-6.5	-1.0
Employment rate of non-caregivers	-0.5	-0.2	-0.7	-0.8	-0.9
Employment rate of caregivers	+0.7	+0.5	+6.1	-19.6	+0.7
Employment rate gap non-caregivers/caregivers	-1.3	-0.7	-6.8	+18.8	-1.6
Cost (million euros/year)	45,165.0	74,838.3	45,165.0	45,165.0	45,165.0
Cost (% GDP)	0.8%	1.3%	0.8%	0.8%	0.8%

Note: Each row reports the change of each rate in percentage points between each policy experiment (in columns) and the baseline simulations. The last two rows report the total cost of each policy and the share of the GDP that it represents for the region (Austria, Belgium, France and Germany) in 2015.

Table F4: Results of the policy experiments – Southern Europe

Outcome	Parents receiving FC	All parents with care needs	Employed children giving IC	Non-employed children giving IC	All children giving IC
Rate of only FC users	+8.8	-0.1	-2.4	-2.2	-2.5
Rate of only IC users	-8.5	+2.2	+11.8	+10.4	+13.2
Rate of users of both types of care	+9.5	-1.1	+1.9	+1.4	+1.7
Rate of users of FC	+18.3	-1.2	-0.5	-0.8	-0.8
Rate of users of IC	+1.0	+1.2	+13.7	+11.8	+14.9
Rate of care users	+9.9	+1.0	+11.3	+9.6	+12.4
Employment rate	+2.7	+2.5	+7.2	-5.0	+1.7
Employment rate of non-caregivers	+2.5	+2.2	+3.6	+4.1	+3.7
Employment rate of caregivers	+3.9	+4.2	+19.7	-17.9	+4.2
Employment rate gap non-caregivers/caregivers	-1.4	-2.0	-16.0	+22.0	-0.5
Cost (million euros/year)	35,695.5	85,069.0	35,695.5	35,695.5	35,695.5
Cost (% GDP)	1.3%	3.0%	1.3%	1.3%	1.3%

Note: Each row reports the change of each rate in percentage points between each policy experiment (in columns) and the baseline simulations. The last two rows report the total cost of each policy and the share of the GDP that it represents for the region (Italy and Spain) in 2015.