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Is caring for older parents detrimental to women's mental health? The role of the European North–South gradient

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Abstract In the last decades, both the lengthening of life expectancy and an accentuated decline in birth rates have reduced the consistency of the younger generational cohorts. Due to an ageing population, the burden of caregiving is expected to intensify in the next quarter of the century in Europe, especially for mature women. This paper investigates the impact of the provision of constant care for older parents on the mental health of adult daughters, between the ages of 50 and 75, living in different European countries. Data is drawn from the Survey of Health, Ageing and Retirement in Europe. Information on mental health status is provided by Euro-D depression scale, a measure of depression standardized across European countries. We focus on differences in the effects according to the North–South gradient: we test whether the relationship between informal caregiving and mental health differs across European macro-regions. Our results, robust under different specifications of the propensity score model, reveal a clear North–South gradient: the provision of informal care has a negative and significant impact on daughters' mental health in the Mediterranean countries only, where the amount of resources allocated to the Long Term Care is minimal and the local system of health and social services for the elderly lacks the necessary structures to meet the increasing demand for eldercare.

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1 Introduction

Over the last few decades, the simultaneous decrease in mortality and fertility rates has induced a progressive ageing of the European population. Declining birth rates have reduced the consistency of the cohorts of young generations, while growing life expectancy has caused the age in which people die to rise. The percentage of people over sixty-five is higher in Europe than in any other continent and the ageing phenomenon is a problem that will make itself felt for the rest of the century. Forecasts for European demographics show that, by 2060, half the population of the EU-27 countries will be over fifty, while over-65-year-olds will increase from the current value of 17.4 to 30 % (Eurostat 2010).

The ageing of the population and the greater longevity of individuals will lead to increasing numbers of older persons in need of long-term care. This need is partly met by formal care (e.g. medical doctors, nurses) either at home or in purpose-built structures (e.g. hospitals, nursing homes). Frequently, however, eldercare is provided by informal caregivers, typically women, who devote part of their time to assist their needy relative and who, in the collective view, are regarded as better suited to taking on home and family responsibilities (Davey and Patsios 1999; Mortensen et al. 2004; Di Novi et al. 2015; Carrieri et al. 2014; Kalwij et al. 2014). This is especially the case in the Southern European countries, commonly referred to as "strong family-ties countries" in contrast to the "weak family-ties countries" of Northern Europe. Mediterranean societies have traditionally been based on family unity and on an intra-generational pact of reciprocity, due both to cultural background and inadequacies in the institutional settings, two factors that are strictly related to each other (Reher 1998; Billari 2004; EOP 2010).

The aim of this study is to estimate the impact of constant caring for older parents (biological parents, parents in law and step-parents) on the self-assessed mental health of women between the ages of 50 and 75, living in different European countries. In spite of the changing gender attitudes and the rapid entry of women into the labour force over the past decades, women continue to play a major role in running the household and giving care to family members, as the previous literature on the traditional roles of women in Europe suggests. Women are therefore more exposed than men to the stress generated by informal caregiving. Furthermore, as the literature shows (Silverstein et al. 2006; Bookwala 2009; El Habhoubi 2012), men react differently than women to stressful experiences, and provide informal care in forms that are different from women. For these reasons, this paper focuses on women and on the effects of informal caregiving on their mental health.

The possible effect of the provision of informal care on daughters' mental health status is measured by the EURO-D scale, a symptom-oriented instrument measuring depression. The empirical investigation is performed using a representative sample

drawn from the Survey of Health, Ageing and Retirement in Europe (SHARE) survey.

Our paper contributes to previous literature by exploring the relationship between informal caregiving and mental health according to a North–South gradient. To this aim, we cluster the different countries into three macro regions, namely Northern, Central and Southern Europe. This subdivision reflects social and cultural factors that historically have influenced the role of the family as a provider of care, with Northern countries designed as "non-family centred societies" and Mediterranean countries characterised by strong family ties (Reher 1998). Since the family role, per se, is not enough to clearly identify different care regime clusters, we referred to two additional parameters: the amount of resources destined by each country to Long Term Care (LTC) and the different eldercare policies across European countries considered in the sample.

In order to account for potential endogeneity due to self-selection in the relationship between the provision of informal care and the informal caregivers' mental health, we matched each informal caregiver with a non-caregiver on each characteristic known to be associated with a caregiver's condition and mental health (Caliendo and Kopeinig 2008). In our analysis, we performed this matching by using propensity score, as formalized by Rosenbaum and Rubin (1983). The perceived mental health of matched individuals was then compared to estimate the average effect of being an informal caregiver.

Our results, robust under different specifications of the propensity score model, reveal a clear North–South gradient: the provision of informal care has a negative and significant impact on daughters' mental health in the Mediterranean countries where support to the elderly comes mainly from family members and welfare policies are not sufficient to cover ageing population needs. These findings may be interesting from a policy standpoint, inasmuch as the health effect and time burden of caregiving translate into larger wealth effects, which may include higher health expenses for the caregivers, early retirement or job interruption (Coe and Van Houtven 2009).

The remainder of the paper is organized as follows: Sect. 2 presents a review of the literature on caregiving and mental health; Sect. 3 describes the data and the structure of the Northern, Continental and Southern sub-samples; Sect. 4 illustrates the empirical model, while the results are presented and debated in Sect. 5. Concluding remarks are reported in Sect. 6.

2 Caregiving and the effects on mental health

An extensive literature exists on the association between physical and psychological health and being a caregiver (Shulz and Beach 1999; Vitaliano et al. 2003; Reinhard et al. 2008; Shulz and Sherwood 2008). According to most definitions (Rubin and White-Mean 2009; OECD 2011; Bonsang 2009; Bolin et al. 2008a, b), informal eldercare encompasses personal care, practical housework and paperwork duties. Providing older parents with informal care over extended periods of time may cause stress and burnout with negative consequences for the occupational and social

spheres (Pavalco and Artis 1997; Crespo and Mira 2010). Adult children are often forced to balance work, their own family, and other responsibilities while administering care with potential detrimental effect on mental health (Coe and Van Houtven 2009). Generally, being an adult child caregiver increases the probability of suffering from episodes of depression (Amirkhanyan and Wolf 2006), especially if the parent–child relationship is not a particularly close one (Lin et al. 2012). Studies concentrating on the psychological health of women, who are normally more involved with the commitment of providing care, trace a direct relationship between caring for parents and depression levels among daughters (Silverstein et al. 2006; Bookwala 2009).

An OECD Report (2011) shows that caregivers who devote over twenty hours a week to looking after their family members, are 20 % more likely than non-caregivers to suffer from mental disturbances, and the percentage is even higher for carers living in Southern Europe. Caring with lower intensity (either less than 10 h/week or between 10 and 20 h/week) does not always lead to a higher prevalence of mental health problems among carers. Often the probability of experiencing mental problems is associated to the number of eldercare weekly hours. Although a common cut-off is difficult to select, most of the literature examined suggests 20 h a week as a threshold to designate high intensity caregiving (Hirst 2002; Grammenos 2005; SPRU 2009; OECD 2011).

Coe and Van Houtven (2009), who investigated the health consequences on the adult child caregivers providing constant care to an older mother, highlighted an association between constant caregiving and depressive symptoms for both married men and women, with persistent effects (at least 2 years after stopping caregiving) for the latter. No impact on depression index was found for single daughters, which suggests that more investigation is required on this category of adult child carers.

El Habhoubi (2012) used SHARE data to study the effect of caring on both employment and mental health. With regard to the second issue, for either men and women, being a caregiver increases the probability of being depressed, but the impact on mental health is higher for women. Not surprisingly, differences in the results were shown according to the intensity and kind of care provided.

The reported literature establishes a relationship between being a caregiver and the risks of suffering from mental health disturbances. We want to investigate further this issue by including in our study a geographical gradient that reflects the different care systems among European Countries. There is substantial evidence on social and cultural differences between Northern and Southern Europe that justifies such a focus. As already mentioned, Southern European countries are commonly designed as ‘strong-family-ties countries’ as opposed to the Northern European nations, also referred to as ‘weak-family-ties countries’ (Reher 1998). This strong–weak dichotomy is deeply rooted in cultural, historical, demographic and religious patterns, which have contributed to shaping different degrees of welfare state according to a North–South gradient (Billari 2004). Considering aging population needs, public spending on long-term care is highest in Northern countries, such as Sweden and Denmark, decreases in Central Countries such as Belgium and Germany and is lowest in Mediterranean Countries, such as Spain, where support to the elderly is historically pledged by family members in an intra-generational pact

of reciprocity (Bolin et al. 2008b). Given this framework we want to test if the impact of providing care differs among the three macro regions, namely Northern, Central and Southern, which are characterized by different welfare policies. Our hypothesis is that the stronger the family ties and the weaker the welfare policies, the greater the detrimental effect of caring on mental health.

3 Data

The Survey of Health, Ageing and Retirement in Europe (SHARE), co-ordinated by the Mannheim Research Institute for the Economics of Aging (MEA), is the most ample and complete European study about ageing. SHARE is subdivided into 22 modules (each one identified by two letters) dedicated to collecting detailed information on a wide variety of aspects, among which the health status, the socio-economic characteristics and the family relationships of people aged 50+ in Europe.[1] The design is based on the Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (Börsch-Supan and Jürges 2005).

The survey information for waves 1 and 2 of SHARE were collected in 2004 and between the end of 2006 and the summer of 2007 respectively, through Computer-Assisted Personal Interviews (CAPI) supplemented by a self-completion paper. The interviews were carried out in eleven European countries in 2004 and in fourteen in 2006. The states fell within three macro areas: Northern Europe (Denmark and Sweden), Central Europe (Austria, France, Germany, Switzerland, Belgium and the Netherlands), and Southern Europe (Spain, Greece and Italy), with the addition, from 2006, of two East European countries (Poland and the Czech Republic) and Ireland.

Our analysis is mainly based on version 2.6.0 of SHARE's second wave (2006–2007) and includes lagged information from the first wave of the same survey. In order to take advantage of lagged information from wave 1, Poland, the Czech Republic and Ireland were not included in the data set as they were only present from the second wave.

In accordance with the previous literature, caregivers are defined as those women between the ages of 50 (who are age-eligible respondents of the survey) and 75 who are currently providing assistance to a parent, step-parent or parent-in-law.[2] By assistance, we mean personal care (e.g. dressing, bathing or showering, eating, getting in or out of bed, and using the toilet), practical household help (e.g. home repairs, gardening, transportation, shopping, and household chores), and help with

[1] The target population of SHARE is defined both in terms of households and in terms of individuals. The interviewers observed families with at least one person and the individuals born before 1954 who speak the official language of the country and who, during the time of the survey, do not live abroad or in an institution like a prison, as well as their spouse/partner, independently of age.

[2] We have included this age cut-off, according to the extant literature, since parents who need constant assistance generally have children aged 50 or over and equally, children who are over 75 are less likely to still have parents to care for, or may be too old themselves to provide care (see also Grundy and Henretta 2006; Rubin and White-Means 2009; Coe and Van Houtven 2009).

paperwork (e.g. filling out forms, and settling financial or legal matters), which we call informal care (Rubin and White-Means 2009).

In defining caregiver we also apply a threshold. SHARE allows one to distinguish between women who provide assistance to older parents living in the same household (3.45 % of the sample) and women who provide care outside the household. In our sample we included both categories of carers (living inside or outside the households). With regard to the latter only, SHARE provides information on the frequency with which care is provided: daily, every week, at least once a month, or just occasionally. In order to avoid including occasional assistance, we excluded from the sample women who do not at least provide care (outside the household) on a weekly basis. For those that reported to have provided care to an older parent living in the same household, it has to be daily because a daily filter is included in the opening question.

3.1 The Northern, Central and Southern sub-samples

The sample, which includes 4430 observations, was stratified into three macro-regions—namely Northern (with 1159 observations—26 % of the sample), Central (with 1498 observations—34 % of the sample) and Southern Europe (with 1773 observations—40 % of the sample) -according to the role of family, the amount of resources destined by each country to Long Term Care and the specific eldercare policies implemented within each macro-region.[3] The clusters differ from the original SHARE classification for the inclusion of the Netherlands within the Northern countries, henceforth the final classification is the following: Northern Europe (Denmark, Sweden and the Netherlands), Central Europe (Austria Belgium, France, Germany and Switzerland) and Southern Europe (Italy, Spain and Greece).

Northern countries, such as Denmark, Sweden and the Netherlands are characterised by generous and universal LTC systems: they spend respectively 2.5, 3.7 and 3.8 % of their GDP on LTC (see Fig. 1). At the opposite side, among Southern countries, Spain spends 0.65 % of its GDP.[4] In between, Continental countries show quite a heterogeneous picture: the level of public expenditure on LTC as a percentage of GDP ranges from 1.9 % in Belgium to 0.9 % in Switzerland.

This financial heterogeneity across Europe reveals the historical differences in the welfare state characterising the three macro-regions. In the Mediterranean Countries the structural inadequacy of welfare policies becomes apparent in the shortage of resources devoted to LTC. Therefore, family links still represent the main providers of services and financial support for most vulnerable members, such as frail elderly requiring care. On the contrary, in the North of Europe, the welfare

[3] Literature suggests different ways of classifying European countries according to the reported characteristics. Consistently with the data availability, we adopted a care regime cluster approach that falls midway between the traditional Esping-Anderson approach (1990) and the countries classification carried out by Bettio and Plantenga (2004). Our clustering approach was also adopted by Crespo and Mira (2010) who used SHARE data.

[4] Data for Italy and Greece LTC expenditure were missing since they are not included in the OECD data we used (see Fig. 1). .

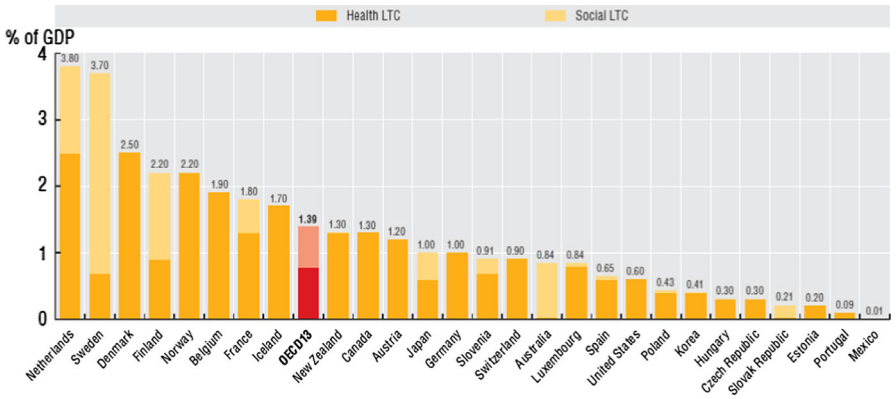


Fig. 1 LTC in OECD countries (as % of GDP), 2009 data or last available year. *Source*: OECD (2011)

state rests on the legal recognition of social rights to every citizen who needs support. According to this vision, it is the Government who provides material resources and services to needy citizens, in particular to the elderly (EOP 2010). These different policies are deeply rooted in cultural and historical factors that characterise the role of the family across Europe and that consequently influence the provision of informal care to the elderly in the three macro-regions (Riedel and Kraus 2011).

Literature suggests two different and geographically polarised family models across Europe, addressed as "strong-family-ties" for the South of Europe and "weak-family-ties" for the North of Europe (Reher 1998; Billari 2004; Bolin et al. 2008b; Kotsadam 2011). According to this vision, in the Northern countries adult children are not even legally responsible for caring for their parents and the ageing population's needs are mainly delegated to the public sector, either through the direct delivery of services, or with a financial provision for those informal carers (relatives, neighbours and friends) who decide to provide intensive care to the frail elderly (Crespo and Mira 2010; EOP 2010).[5] In the latter case, and under specific conditions—such as isolation and very low socio-economic status of the recipient—the carer's activity, after an adequate training provided by qualified personnel, is considered and remunerated as a proper job.[6] Continental countries fall in the middle: during the nineties, countries with social health insurance such as Austria and Germany, implemented new policies to cover elderly needs: respite care, for instance, essential to limit overburdening for informal caregivers, has become part of the benefit package in Austria and Germany and the extent of this benefit has recently increased considerably in Germany. Still, compared to Scandinavian countries, public services cover a minor share of the ageing population's needs, but

[5] In Sweden for example the children's legal obligation to care for their parents has been abolished. The municipality is solely responsible for elderly assistance (EOP 2010).

[6] The issue of informal caregivers' training is very important and well debated. Southern countries in particular lack these kind of services, with the consequence that, without receiving any preparation on this topic, the carers often feel inadequate in coping with the elderly personal care.

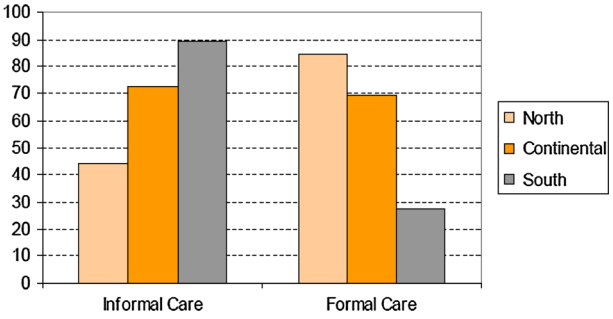
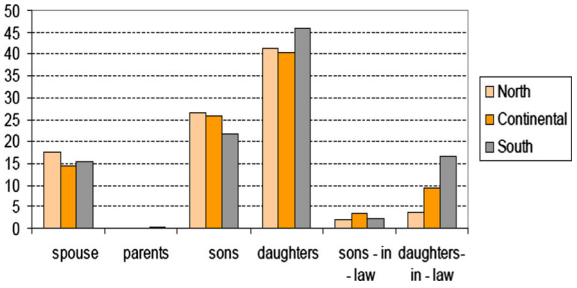


Fig. 2 Prevalence of informal and formal care among respondents aged 80 and over who receive care on a daily or weekly basis (%, SHARE 2004). *Source*: SHARE

Fig. 3 The importance of different relatives as informal caregivers of people aged 80 and over who receive informal care on a daily or weekly basis (%, SHARE 2004). *Source*: SHARE



financial contributions are provided to the elderly in need of care (Sarasa and Mestres 2005; EOP 2010). Conversely, all the Mediterranean countries rely on family centred models of welfare, with few institutional services available and very little help provided to the informal caregivers. Informal care to the older people is still almost totally delivered by families (see Figs. 2, 3), especially by the adult daughters, who are left alone to cope with critical situations arising from the old person's conditions (Crespo and Mira 2010; EOP 2010).

Figure 2, based on data from the "parent-sample" of the first wave of SHARE, shows the distribution of formal and informal care received by respondents aged 80 + assisted regularly (on daily or weekly basis) across the three geographical macro areas.[7] A strong North–South gradient is shown: while in the Northern Countries more than 80 % of respondents receive formal care, this percentage decreases to 70 % for continental countries and becomes less than 30 % for the South of Europe. For the Mediterranean countries the scarcity of institutional answers is solved employing informal care, which is generally provided by a family member. Our hypothesis is that, in the North of Europe, providing informal care does not require the same physical and psychological burden held by the caregivers in the South of Europe, where—beyond devoting time to assist their relatives—

[7] The "parent-sample" provides comprehensive information reported by the elderly parents themselves, among which their access to different sources of care, in addition to informal care provided by their daughter (see also p. 14).

caregivers are required to manage every aspect of their health assistance, with very little institutional help. Mediterranean mature women are expected to be the ones who pay more for the institutional gap in their residence countries, with possible effects on their mental health.

4 Estimation strategy

Identifying an association between informal care and individuals' mental health status may be complicated by the presence of endogeneity due to self-selection. The treatment assignments may not be randomized and outcomes may be biased by differences in the characteristics that influence the selection into informal caregiver status. One method of adjusting an analysis of treatment outcomes for the effects of confounding covariates is to perform propensity score matching, as formalized by Rosenbaum and Rubin (1983).

The propensity score matching technique produces two balanced groups, one of caregivers and one of non-caregivers: the score substitutes a collection of confounding variables with a single covariate that is a function of all the variables. By summarising the intrinsic characteristics that could generate distortions, propensity scores use a matching procedure to allow for comparisons between the treated and control groups.

First of all the method calculates the probability of providing informal care. The values of the parameters for the probability of providing informal care, calculated with a probit model, are transformed into a score that takes into account the observable qualities (age, country of residence, family composition, socioeconomic status, etc.). Such characteristics differentiate the caregivers from those who do not provide care and are associated with the caregiver's condition and individual mental health. The score allows one to select, for each caregiver, a 'twin' individual from among those who do not provide care to the older, so as to minimise all the systematic differences that may otherwise affect the mental health of the interviewed women. The 'twins', who do not provide informal care, are those who show the closest possible score to the reference individual providing care to the older. Lastly, the average treatment effect on the treated (ATT) is measured by the difference in the self-reported mental health indicator: the hypothesis being that, given two individuals whose observable characteristics are as similar to each other as possible, any difference in their mental health status may be attributed to the effect of providing care to the elderly.

Propensity score matching has some important advantages over regression-based methods. Being a non-parametric method, matching does not impose any specific linearity assumptions on the evaluated effects that are inherent in regression-based modeling. Furthermore, matching explicitly tries to find, for each untreated unit, a similar treated unit to evaluate the counterfactual, i.e. what would happen to the treatment group without the treatment.

Concerning the unobserved characteristics, the propensity score matching has, as a drawback, the fact that the identification of the ATTs relies on the validity of the Conditional Independence Assumption (CIA), namely that the potential treatment

outcomes are independent of the assignment mechanism for any given value of a vector of observable characteristics (X) (Ichino et al. 2008). In our specific case, CIA implies that selection into caregiver status is solely based on observable variables included in the propensity score model. The assumption is not testable, but it is expected to be fulfilled if all relevant variables are observable. We do not claim to have access to all variables influencing the outcome; however, we have at our disposal a rich set of care and health relevant variables.

We invoked the common support modelling option, which restricts the set of data points over which the test of the balancing property is sought to those belonging to the intersection of the supports of the propensity score of treated and controls. Imposing the common support condition in the estimation of the propensity score, may improve the internal validity of the estimates under common support (Caliendo and Kopeinig 2008).

4.1 Outcome variable

Women's mental health was measured in terms of the EURO-D scale. This is a scale for measuring depression that was developed and validated by the EURODEP *Concerted Action Programme*. It consists of 12 elements connected to psychological health: depression, pessimism, wanting to die, guilt complexes, sleeping difficulties, lack of interests, irritability, lack of appetite, fatigue, lack of concentration, inability to take pleasure from normal activities and a tendency to cry. Each item is of equal weighting and reported with a 0 if the symptom is absent and a 1 when it is present. We focussed on the clinical definition of depression as indicated by the EURO-D scale with a clinically defined cut-off point at four symptoms identifying the respondent as depressed, i.e. having severe mental health problems (Prince et al. 1999).[8]

4.2 The propensity score model

To begin with, a probit model was set up on which to base the score: the dependent variable is a binary variable that takes a value of 1 for interviewees who provide care to at least one older parent (biological parents, parents in law or step-parents), and 0 otherwise. The independent variables can be grouped in the following categories: demographic variables (age, age squared, country of residence); family composition (marital status, carers' children still living at home); socioeconomic variables (educational level, family income, employment status); information on

[8] Prince et al.(1999) found that reporting four or more symptoms on the EURO-D scale is the optimal cut-off point in predicting clinical depression. Dewey and Prince (2005) suggested to set a threshold at a score of 4 and defined clinically significant depression as a EURO-D score equal or greater than 4. Therefore, we used 4 symptoms as a threshold – i.e. dichotomising the EURO-D scale. We carried out a sensitivity analysis re-running the model using the whole EURO-D scale to examine whether informal care affects the total number of depressive symptoms. This construction did not significantly affect the results: the ATT still results significant for the Southern European macro area only. Providing any type of care to older parents has a positive and significant effect of 0.18 on the total number of depressive symptoms. For the sake of brevity, the results of the sensitivity analysis are not included but they are available on request.

parents receiving care (health status of the respondent's mother and father, last job of respondent's mother and father and geographical distance between the daughters and their parents). Moreover, we controlled for respondent's self-reported probability of receiving an inheritance, respondent's mental health status and caregiver status at the first wave.

Age was modelled as a continuous variable. Marital status was categorized into "living with a spouse or a partner in the same household" and "living as single". Husband or partner may both represent potential sources of informal care for older parents and influence carers' mental health. In the past decade, many empirical findings have documented a potential health benefit of marriage: married people (including those who cohabit) appear to be healthier and to enjoy better mental health than the non-married (Averett et al. 2013). Some of the most convincing evidence is consistent with the marriage protection hypothesis, which assumes that "married individuals engage in low-risk activities, share resources and enjoy caring from each other" (Hu and Wolfe 2002).

The previous literature suggests that the negative health consequences of caregiving are especially evident for women who care for dependent children and older family members simultaneously (often referred to as "sandwich generation" women) (Riley and Bowen 2005; Grundy and Henretta 2006). Hence, in order to capture additional caregivers' responsibilities other than older parents, we included a binary indicator that assigns a value of 1 if at least one of the care provider's children still lives at home. Concerning the demographic variables, we also included country dummies within each macro-region, so as to capture any single country-level differences.

The International standard classification of education (Isced) was used to classify the education variable. Three levels of education were therefore considered: (1) low education (no educational certificates or primary school certificate or lower secondary education); (2) medium education (upper secondary education or high school graduation); (3) high education (university degree or postgraduate). Income information is based on the total annual household income, obtained summing up its different components assessed in the questionnaire. Income was normalized on the family size and log-transformed to obtain a normal distribution. Occupations were categorized into four groups: employed, retired, homemaker and unemployed.

Among the control variables we also included an indicator of strategic behaviour guided by a bequest motive—the chance of inheritance—that has been studied in the literature as a potential determinant of the provision of informal care (Sloan et al. 1997, 2002). We used the respondent's self-reported probability of receiving an inheritance over the next 10 years.

SHARE supplies information on parents receiving informal care. Concerning the health status of the respondent's mother and father, it is the daughters themselves who assess the state of health of their parents, which is inferred via an indicator of psycho-physical good/bad health, measured on an ordinal scale from 1 to 5, where 1 indicates the healthiest state. Given that the 5 positions are not equidistant, a binary "healthy/non-healthy" variable has been set up assigning a value of 0 if the daughter reported in the survey that the older parent enjoys "excellent, very good or good" health and a value of 1 if the parent's state of health is "bad or very bad"

(O'Donnell et al. 2008). We focus on women with at least one living parent at the moment of the interview (first wave). Since one of the parents may be deceased, we constructed an indicator variable taking on the value 1 if the mother or father, respectively, was dead. In the case of a deceased parent, we assigned the parental health indicator the value one. As with Bolin et al. (2008a) we used death occurring in the second interview as a proxy for the poor health of the parents. We included this indicator since death of a parent may influence caregivers' mental health.

SHARE does not provide any information about the income and education level of the parents. However, for the first wave only, it includes information on their last job. This information has been recorded according to the first digit of the International Standard Classification of Occupations (ISCO-88) by the International Labour Organization (ILO). Given that our sample included women between the ages of 50 and 75, we have assumed that their parent's occupational status did not change between wave 1 and wave 2, and used this information to construct the Treiman's Standard International Occupational Prestige Scale (SIOPS) (Ganzeboom and Treiman 1996).[9] Then, following Alessie et al. (2014) we included, among the regressors in the probit model for propensity score, a variable which reports the maximum value between the SIOPS scale of the parents (Table 1).

SHARE also includes information on the distances between the parental and adult children's homes. We allowed the indicator of distance to take the following categories: daughters living in the same household or in the same building; less than 1 kilometre away; between 1 and 25 km away; between 25 and 100 km away; more than 100 km away. The distance between child and parental home is a proxy for the provision of child services, since services are more costly to offer when the child lives further from her parent's home (Pezzin and Steinberg-Schone 1999; Callegaro and Pasini 2008; Bonsang 2009).

We do not observe parents formal care utilization since SHARE does not offer this information. Indeed, SHARE offers the possibility of constructing two different samples of women with elderly living parents. The "daughters-sample" refers to women who are age-eligible respondents of the survey. This sample includes information about daughters' age, education, current marital status, health status, income, living children, employment status and hours worked, and informal care given. It also provides some information on their living parents such as their health status, their last job, closeness of their residence to children's home, but does not provide any information about any other type of care received (other than informal care). The second sample (the "parents-sample") may include women who are daughters of (older) age-eligible respondents. In this case, the respondents are the elderly parents. The "parents-sample" provides comprehensive information reported by the elderly parents themselves, among which their access to different sources of care, in addition to informal care provided by their daughter. Since our main aim is to investigate the impact of the provision of constant care for older parents on the

[9] In order to construct the occupational prestige scale we employed the STATA command "iskotrei" which transforms ISCO-88 codes into Treiman's SIOPS scale (Standard International Occupational Prestige Scale) (Ganzeboom and Treiman 1996).

Table 1 Variable description

Name of the variable	Definition of the variable
Dependent variables	
EURO-D	Scale measuring depression
Controls	
Age	Age in years
Education	
Low education	1 if low educated, 0 otherwise
Medium education	1 if medium educated, 0 otherwise
High education	1 if highly educated, 0 otherwise
Family composition and marital status	
Carer's children living at home	1 if at least one carer's child still lives at home, otherwise 0
Single	1 if single, otherwise 0
Married or living with partner	1 if she lives with a husband or partner, otherwise 0
Employment and Income	
Employed	1 if employed, 0 otherwise
Unemployed	1 if unemployed, 0 otherwise
Retired	1 if retired, 0 otherwise
Homemaker	1 if homemaker, 0 otherwise
Income	Annual family income (in Euros)
Information on parents receiving care	
Parents health status	1 if at least a parent suffers from bad health, 0 otherwise
Parents last occupation	Treiman's standard international occupational prestige scale
Same household or building	1 if parents live in the same household or building, 0 otherwise
Less than 1 kilometre	1 if parents live less than 1 km from children's homes, 0 otherwise
Between 1 and 25 km	1 if parents live between 1 and 25 km from children's homes, 0 otherwise
Between 25 and 100 kilometres	1 if parents live between 25 and 100 km from children's homes, 0 otherwise
More than 100 kilometres	1 if parents live more than 100 km from children's homes, 0 otherwise
Inheritance	
Inheritance	Respondent's self-reported probability of receiving an inheritance
Depression at the 1st wave	
Wave 1 depression	1 if depressed during the first survey, otherwise 0
Informal care status at the 1st wave	
Informal caregiver wave 1	1 if caregiver during the first survey, otherwise 0

mental health of daughters, we used the "daughters-sample" which includes better information on daughters.

Finally, we employed a binary indicator, which is assigned a value of 1 if the interviewee suffered from depression in the previous survey and a binary indicator

that assigned a value of 1 if the interviewee was an informal care provider during the first survey. The EUROD depression scale dummy from the first wave allowed us to capture the outcome dynamics and to control for selection problems (see also Kim et al. 2008; Coe and Van Houtven 2009; Zantomio 2013).[10] Moreover, propensity score matching, as we have specified before, is built on the assumption that all characteristics influencing carers' mental health and care provision can be observed in practice (CIA assumption). However, there may be differences between carers and non-carers that cannot be observed. Lagged dependent variable estimation makes use of the time dimension of our data set and allows us to control for time fixed characteristics influencing the provision of care and daughters mental health. In the probit model we have used lagged dependent estimation including the informal caregiver status in an earlier period as a proxy for unobserved individual fixed characteristics.[11]

Once the propensity score was calculated, we proceeded with statistical matching so as to form 'twin data' that differ in terms of the caregiver status alone and not in terms of any of the other observed characteristics. Since the sample consists of comparatively few informal caregivers in relation to many untreated ones, Kernel and Radius (with caliper 0.5) matching were chosen as the matching algorithms. These techniques use the maximum amount of data and, in the case of Radius matching, the imposition of a tolerance threshold avoids the risk of bad matches (Caliendo and Kopeinig 2008; Imbens and Wooldridge 2009).[12]

5 Results

Table 2 shows some summary pre-matching statistics: it arises that those women who take care of their parents show better mental health in the Northern and Central Europe and worse in the South. In Mediterranean countries daughters are less likely to be higher educated and employed and are mostly just mothers with dependent children compared to Central and Northern countries. This last aspect is not surprising since in the last decades the medium age of generating the first child is higher in Southern Countries compared to the Northern ones (Billari and Kholer 2006).

The results from the probit model for propensity score matches for each macro area are provided in in Appendix 1. The model (described in Sect. 4) made it possible to obtain a balanced estimate for the propensity score. The covariate

[10] Coe and Van Houtven (2009) claimed: "a certain threshold of health may be needed before becoming a caregiver, making it very important to control for initial health to understand the effects of informal care on health over time".

[11] Using a lagged dependent variable in a cross-sectional data is an alternative way of addressing the unobserved characteristics. The main assumption in a lagged dependent variable approach is that the majority of the same unobserved characteristics affects both current and previous (i.e. lagged) dependent variables. Thus, including a lagged dependent variable in a cross-sectional regression model, makes it easier to account for the unobserved factors that cause the current differences in the dependent variable, which is not feasible in a pure cross-sectional data analysis (see Wooldridge 2000).

[12] The estimation was carried out using the PSMATCH2 program for STATA developed by Leuven and Sianesi (2003).

Table 2 Pre-matching descriptive statistics of variables employed in the probit model

Variable	Full sample		Informal care		No informal care	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
(a) *Northern Europe*						
Dependent variable						
Depression at II wave	0.141	0.348	0.096	0.294	0.157	0.364
Independent variable						
Age	58.090	5.044	58.647	5.128	57.883	5.000
Denmark	0.161	0.368	0.207	0.406	0.144	0.352
Sweden	0.468	0.499	0.411	0.493	0.489	0.500
The Netherlands	0.371	0.483	0.382	0.487	0.367	0.482
Single	0.179	0.384	0.207	0.406	0.169	0.375
Children still living at home	0.068	0.252	0.080	0.271	0.064	0.245
Low education	0.338	0.473	0.303	0.460	0.351	0.478
Medium education	1.000	0.000	0.366	0.483	0.270	0.444
High education	0.366	0.482	0.331	0.471	0.379	0.485
Income	43,912.91	29,312.88	52,360.900	39,086.750	39,890.060	22,235.590
Retired	0.178	0.382	0.191	0.394	0.173	0.378
Employed	0.693	0.462	0.713	0.453	0.685	0.465
Unemployed	0.017	0.130	0.000	0.000	0.024	0.152
Home_maker	0.112	0.316	0.096	0.294	0.118	0.323
Parental health	0.799	0.401	0.761	0.427	0.813	0.390
Parents last occupation	35.408	12.800	35.771	11.148	35.273	13.36606
Same household or building	0.012	0.109	0.045	0.207	0	0
<1 km away from parent's home	0.142	0.349	0.268	0.443	0.095	0.293
Between 1 and 25 km away from parent's home	0.399	0.490	0.557	0.497	0.340	0.474

Table 2 continued

Variable	Full sample		Informal care		No informal care	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Between 25 and 100 km away from parent's home	0.194	0.396	0.096	0.294	0.231	0.422
>100 km away from parent's home	0.274	0.446	0.080	0.271	0.347	0.476
Chance of inheritance >50 %	46.316	41.861	52.787	41.447	43.911	41.784
Depression at I wave	0.172	0.377	0.159	0.366	0.176	0.381
Caregiver at I wave	0.404	0.491	0.777	0.417	0.265	0.442
N	1159		314		845	
(b) *Continental Europe*						
Dependent variable						
Depression at II wave	0.220	0.415	0.184	0.388	0.234	0.424
Independent variable						
Age	58.158	5.081	58.691	5.136	57.959	5.048
Austria	0.242	0.429	0.179	0.385	0.271	0.445
Belgium	0.339	0.474	0.462	0.500	0.282	0.451
France	0.065	0.246	0.051	0.221	0.071	0.256
Germany	0.226	0.418	0.205	0.405	0.235	0.425
Switzerland	0.129	0.336	0.103	0.304	0.141	0.349
Single	0.207	0.405	0.196	0.398	0.211	0.408
Children still living at home	0.146	0.353	0.194	0.396	0.128	0.335
Low education	0.310	0.463	0.282	0.450	0.321	0.467
Medium education	0.420	0.494	0.402	0.491	0.427	0.495
High education	0.270	0.444	0.316	0.466	0.252	0.435
Income	43,371.210	43,526.650	42,348.650	49,380.350	43,753.970	41,140.160
Retired	0.290	0.454	0.257	0.438	0.303	0.460

Table 2 continued

Variable	Full sample		Informal care		No informal care	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Employed	0.463	0.499	0.485	0.500	0.454	0.498
Unemployed	0.087	0.282	0.074	0.261	0.092	0.289
Home_maker	0.160	0.367	0.184	0.388	0.151	0.359
Parental health	0.533	0.499	0.596	0.491	0.509	0.500
Parents last occupation	33.451	15.664	33.510	15.037	33.429	15.899
Same household or building	0.047	0.211	0.061	0.240	0.0413	0.199
<1 km away from parent's home	0.200	0.400	0.368	0.483	0.138	0.345
Between 1 and 25 km away from parent's home	0.463	0.499	0.510	0.501	0.445	0.497
Between 25 and 100 km away from parent's home	0.184	0.387	0.098	0.298	0.216	0.411
>100 km away from parent's home	0.144	0.351	0.025	0.155	0.188	0.391
Chance of inheritance	37.774	39.575	56.397	39.560	30.803	37.276
Depression at I wave	0.206	0.405	0.206	0.405	0.206	0.405
Caregiver at I wave	0.386	0.487	0.755	0.431	0.248	0.432
N	1498		408		1090	
(c) *Southern Europe*						
Dependent variable						
Depression at II wave	0.297	0.457	0.377	0.485	0.272	0.445
Independent variable						
Age	58.422	5.784	58.438	5.334	58.417	5.917
Greece	0.311	0.463	0.185	0.389	0.350	0.477
Italy	0.355	0.479	0.466	0.499	0.321	0.467
Spain	0.334	0.472	0.349	0.477	0.329	0.470
Single	0.178	0.383	0.166	0.372	0.182	0.386

Table 2 continued

Variable	Full sample		Informal care		No informal care	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Children still living at home	0.257	0.437	0.329	0.471	0.235	0.424
Low education	0.691	0.462	0.745	0.436	0.675	0.469
Medium education	0.193	0.395	0.171	0.377	0.200	0.400
High education	0.116	0.320	0.084	0.278	0.125	0.331
Income	22,519.060	20,918.810	22,645.990	18,591.730	22,480.160	21,588.250
Retired	0.213	0.409	0.269	0.444	0.195	0.397
Employed	0.279	0.448	0.212	0.409	0.299	0.458
Unemployed	0.034	0.182	0.036	0.187	0.034	0.181
Home maker	0.474	0.499	0.483	0.500	0.472	0.499
Parental health	0.530	0.499	0.644	0.479	0.495	0.500
Parents last occupation	36.513	15.261	36.474	14.640	36.525	15.452
Same household or building	0.079	0.270	0.168	0.375	0.052	0.221
<1 km away from parent's home	0.321	0.467	0.481	0.500	0.272	0.445
Between 1 and 25 km away from parent's home	0.335	0.472	0.264	0.442	0.357	0.479
Between 25 and 100 km away from parent's home	0.117	0.321	0.053	0.224	0.136	0.343
>100 km away from parent's home	0.155	0.362	0.063	0.242	0.183	0.387
Chance of inheritance	17.671	28.491	18.978	30.014	17.270	28.006
Depression at I wave	0.368	0.482	0.315	0.465	0.384	0.487
Caregiver at I wave	0.267	0.443	0.584	0.493	0.170	0.376
N	1773		416		1357	

balancing test, included in Table 3, shows that the matching is effective in removing differences in observable characteristics between formal caregivers and daughters who do not provide care. In particular, the median absolute bias is reduced by approximately 59–86 % depending on the macro area and the matching technique. The Pseudo R-squared after matching is always close to zero, correctly suggesting that the covariates have no explanatory power in the matched samples. The Chi square test conducted before and after matching proves that the propensity score removed bias due to differences in covariates between treatment and control groups.

Table 4 shows the average effects of providing care to the older (ATTs) as measured on the EURO-D depression indicator. ATTs were computed by adopting two matching methods: Kernel and Radius Matching. Only observations within the common support were used in the matching. The results reveal the presence of a North–South gradient: providing assistance to one's older parents appears not to have a significant effect on depression in North and Central Europe, while in the Mediterranean countries it increases the probability of suffering from mental health problem: a South-European caregiver has a 7 % higher probability than a non-caregiver of suffering from depression.

It is plausible that positive consequences, such as rewards and satisfaction, may buffer the negative effects of caregiving (Walker et al. 1995). This may happen especially in the Northern and Continental countries where, thanks to a stronger formal care system, a daughter can choose to assist an older parent for her own gratification (as opposed to being obliged by necessity). This is particularly true for the less labour intensive domestic help, which can more easily be performed on a voluntary basis. In contrast, intensive care, the provision of which is often determined by the needs of the heavily dependent recipient, requires a balance between caregiving and other activities, such as child-care, leisure and work. Women who provide constant intensive care to older parents may find it more difficult to focus on the positive aspects of caregiving: even though women are less career-oriented and place a higher value on non-market activities such as family responsibilities (Booth et al. 2002; Carrieri et al. 2014), they might feel themselves seriously impaired if they become inactive because of their caregiving duties (Sarasa and Mestres 2005). Therefore it is important to consider these aspects when analyzing the impact of caregiving on women's mental health (Table 5).

SHARE provides the possibility of distinguishing between domestic chores and more labour intensive personal care (such as bathing, body care, dressing). We used this information to further investigate the potential impact that constant intensive care may have on the self-assessed mental health of carers. Hence, we re-estimated our model by excluding from the sample women who help older parents with domestic chores only (14 % of the sample). We computed the propensity score through a probit model for those who provide personal care to older parents, using the same specification as described in Sect. 4.[13] The sample included 3936 observations. Among the caregivers (16 % of the sample), the number of women who provide intensive care to the elderly increases moving southwards: 38 % of

[13] All observed controls used in the propensity score matching analysis satisfy the balancing property again (see Table 6).

Table 3 Results of covariate balancing tests

	No. of treated	No. of controls	No. of treated off support	Probit pseudo R^2 before matching	Probit pseudo R^2 after matching	$p > Chi^2$ before matching	$p > Chi^2$ after matching	Median bias before matching	Median bias after matching	% reduction in median bias
Kernel matching										
Northern Europe[a]	314	825	0	0.288	0.026	0	0.254	13.7	5.6	59
Continental Europe	408	1090	54	0.314	0.01	0	0.979	13	2.6	80
Southern Europe	416	1357	23	0.257	0.012	0	0.886	20.1	2.9	86
Radius matching										
Northern Europe[a]	314	825	0	0.288	0.027	0	0.225	13.7	6.2	55
Continental Europe	408	1090	54	0.314	0.011	0	0.971	13	3	77
Southern Europe	416	1357	23	0.257	0.012	0	0.865	20.1	3	85

[a] 20 observations not used because the variable "unemployed" referred to the carers' occupation predicts perfectly the failure (informal caregiver status = 0)

Table 4 Average treatment effect on the treated (ATT)-informal care

	Kernel matching		Radius matching	
	ATT	SE	ATT	SE
North	−0.037	0.029	−0.040	0.029
Centre	−0.003	0.031	−0.026	0.031
South	0.070 **	0.032	0.073**	0.032

informal carers in the North of Europe provide intensive care to their parents, 40 % in the Continental Europe and 57 % for the Mediterranean area.

Table 6 shows the ATTs for women who provided intensive care to their parents for each macro-area: as before, intensive informal care seems to have an adverse influence on psychological well-being of South-European caregivers but here the ATTs are higher (a caregiver has a 10 % higher probability of a non-caregiver of assessing her own mental health as bad) and more significant. Actually, in Northern and Central Europe the ATTs are not statistically different from zero. These figures mean that a North or a Central European caregiver who provides intensive eldercare has no higher probability than a non-caregiver of suffering from depression.

According to the previous literature (Billari 2004; Bolin et al. 2008b; Crespo and Mira 2010; Kotsadam 2011) the geographic factor seems to play an important role: the result is influenced by the social/cultural norms which characterize each area but also by the degree of provision of formal care. In all the countries of the sample, intergenerational solidarity pushes daughters to provide care to their older parents, however, South European countries are penalised by serious shortcomings in organisational and structural assistance for older citizens. In this macro area, caregivers face all the complexities of organizing a care programme for their parents: they often lack both adequate preparation to provide care and guidance from the formal health care provider. As a consequence they are weighed down with much more responsibility leading to an excessive degree of emotional strain (Table 7).

5.1 Robustness and sensitivity check

We tried a different specification of the propensity score model in order to check to what extent our ATTs were sensitive to the observable variables chosen. For instance, it might be argued that employment status may not be a good pre-treatment variable since it may be determined, in turn, by the informal caregiver status. In our model, we include employment status since it is not only a good proxy of the opportunity cost of care (which may influence the probability of being a caregiver) but it may be also a distraction from the burden of assistance and hence may positively influence women's psychological health. Barnett, et al. (1992), for instance, reported that employed women generally exhibit better mental health than non-employed women do. There is some empirical evidence that employed elder caregivers experience lower levels of depressive symptoms than non-employed caregivers do (Cannuscio et al. 2004). Our results are not driven by the inclusion of

Table 5 Results of covariate balancing tests—intensive care (personal care) model

	No. of treated	No. of controls	No. of treated off support	Probit Pseudo R^2 before matching	Probit Pseudo R^2 after matching	$p > Chi^2$ before matching	$p > Chi^2$ after matching	Median bias before matching	Median bias after matching	% reduction in median bias
Kernel matching										
Northern Europe[a]	129	825	5	0.4	0.08	0.000	0.205	29.9	13.3	56
Continental Europe	183	1090	26	0.385	0.05	0.000	0.423	19.7	10.3	48
Southern Europe	332	1357	10	0.291	0.015	0.000	0.861	23.9	2.5	90
Radius matching										
Northern Europe[a]	129	825	5	0.4	0.08	0.000	0.232	29.9	13.7	54
Continental Europe	183	1090	26	0.385	0.051	0.000	0.395	19.7	9.8	50
Southern Europe	332	1357	10	0.291	0.016	0.000	0.808	23.9	2.7	89

[a] 20 observations not used because the variable "unemployed" referred to the carers' occupation predicts perfectly the failure (informal caregiver status = 0)

Table 6 Average treatment effect on the treated (ATT)—intensive care (personal care)

	Kernel matching		Radius matching	
	ATT	SE	ATT	SE
North	0.021	0.049	0.028	0.056
Centre	0.027	0.045	0.026	0.046
South	0.104***	0.036	0.099***	0.036

this variable because, when excluding employment status from the probit model, the ATTs remain substantially unchanged.

The variables that measure the geographical distance from parents may also be endogenous: older parents may choose to move closer to their daughters when their own health deteriorates, or daughters may choose to live near their parents when they are in potential need of care (Bonsang 2009). We carried out a sensitivity analysis re-running the probit model for the propensity score in which we eliminated from the control variables the indicators of distance. Again this construction did not significantly affect the results: the ATTs were fairly unchanged.

We also tried a different specification of the propensity score model in which we excluded the variable that indicates the probability of receiving an inheritance. Family relations may indeed be characterised by altruism but this does not necessarily rule out a pact of reciprocity. One example of reciprocity would be that those who have provided care may have a higher chance of being a beneficiary of an inheritance (Brown 2006). Hence, the variable that indicates the probability of receiving an inheritance may be endogenous. Again the estimated treatment effects were not very sensitive to this last specification of the propensity score.

Finally, we also included in the probit model an indicator which describes the different attitudes towards parent's care. We use a variable that is available in an additional "drop-off" SHARE questionnaire. Among others, the respondents are required to express their opinion on who—the family or the State (on a scale from 1 to 5—totally family; mainly family; both equally; mainly State; totally State) should bear the responsibility for each of the following tasks: help with household chores for older persons who are in need (such as help with cleaning, washing); personal care for older persons who are in need (such as nursing or help with bathing or dressing). Unfortunately, including this information in the probit model greatly reduces the dimension of our sample (3319 vs 4430 observations of the original sample) due to the high rate of non-response in the drop-off questionnaire (more than 20 % of the respondents did not answer these questions).[14] Once again, the ATTs remained very similar to those related to the model presented in Sect. 4 (see Appendix 2).

As a further check, we consider in our analysis the initial onset of caregiving: among women who reported to have provided care to an older parent in the second wave (1138 observations), 343 daughters only did not provide any type of assistance

[14] Respondents fill in the drop-off questionnaire only once. Individuals who weren't interviewed in wave 1 were asked to answer the drop-off questionnaire in wave 2. Our sample includes, however, women who were interviewed for the first time in wave 1 and again in wave 2. Hence, the indicator of attitudes towards parent's care refers to wave 1. We assumed that the attitude towards care did not change between wave 1 and 2.

Table 7 Results of covariate balancing tests—onset of caregiving

	No. of treated	No. of controls	No. of treated off support	Probit pseudo R^2 before matching	Probit pseudo R^2 after matching	$p > Chi^2$ before matching	$p > Chi^2$ after matching	Median bias before matching	Median bias after matching	% reduction in median bias
Kernel matching										
Northern Europe[a]	70	825	8	0.262	0.062	0.000	0.875	29.4	11.3	62
Continental Europe	100	1045	0	0.238	0.029	0.000	0.988	18	10.7	41
Southern Europe	173	1281	11	0.251	0.012	0.000	0.998	23.5	3.2	86
Radius matching										
Northern Europe[a]	70	825	8	0.262	0.065	0.000	0.851	29.4	11.4	62
Continental Europe	100	1045	0	0.238	0.03	0.000	0.983	18	11.5	36
Southern Europe	173	1281	11	0.251	0.08	0.000	0.999	23.5	3.4	86

[a] 20 observations not used because the variable "unemployed" referred to the carers' occupation predicts perfectly the failure (informal caregiver status = 0)

Table 8 Average treatment effect on the treated (ATT)—onset of caregiving

	Kernel matching		Radius matching	
	ATT	SE	ATT	SE
North	0.079	0.068	0.076	0.069
Centre	−0.004	0.043	0.002	0.044
South	0.078*	0.045	0.075*	0.045

in the previous wave. We re-ran the same model again including among carers only onset caregivers. The sample included 3494 observations. The results were again consistent with those presented in the Sect. 4: informal care has an adverse influence on psychological well-being of South-European caregivers; the ATTs show that a caregiver has an 8 % higher probability of a non-caregivers of suffering from depressive symptoms even though the ATT is significant at the 10 percent level (see Table 8).

Finally, we re-ran the model by using as dependent variable in the probit model a different proxy of intensive/constant care. We employed the number of weekly hours dedicated to eldercare. During the survey, the respondent was asked to give an estimate of the number of hours of informal care given on a typical day or week. Following Bolin et al. (2008a) we created a variable indicating for each respondent the total number of hours per week that she devoted to informal care. If the respondent gave informal care on a daily basis, we multiplied the number of hours provided on a typical day by 7. If the respondent provided assistance to parents almost every week, the number of hours was kept as it was. We defined 10 h as the threshold of care intensity. We excluded from the sample those who reported to have provided care to an older parent living in the same household (3.45 % of the full sample as reported in the Sect. 3), since no information on hours of care is reported in this case. Moreover, we excluded from the sample those who provided less than 10 h of care (16 % of the full sample) (Table 9).

The new sample included 3418 observations: 42 % of the caregivers provide more than 10 h of care to the parents (12 % of the full sample), and they are mainly concentrated in the South of Europe (70 % of the caregivers against 28 % of the North and 31 % of the Continental Europe).

Table 10 shows that the results are consistent with those obtained from the model using personal care as proxy of intensive care (see Table 6).[15] The ATTs of intensive caregiving, expressed as more than 10 h per week of informal care, are still positive and significant at the 5 percent level for the Southern macro-region.

We also tried different thresholds: 15 and 20 h of care. Only 31 % of the caregivers provide more than 15 h of care and only 29 % more than 20. Intensive care is again mainly concentrated in the South of Europe: (60 % of the caregivers against 18 % of the North and 17 % of the Continental Europe when we considered 15 h of care and 59 % of the caregivers against 17 % of the North and 13 % of the Continental Europe when we included 20 h of care as threshold). When we raised

[15] All observed controls used in the robustness checks satisfy the balancing property (see Tables 7 and 9).

Table 9 Results of covariate balancing tests—intensive care (>10 h of caregiving) model

	No. of treated	No. of controls	No. of treated off support	Probit pseudo R^2 before matching	Probit pseudo R^2 after matching	$p > Chi^2$ before matching	$p > Chi^2$ after matching	Median bias before matching	Median bias after matching	% reduction in median bias
Kernel matching										
Northern Europe	80	771	5	0.484	0.089	0.000	0.518	25.4	6.8	73
Continental Europe	115	885	16	0.435	0.095	0.000	0.205	26.7	5.5	79
Southern Europe	210	1357	14	0.301	0.017	0.000	0.979	28.8	4.2	85
Radius matching						0.000				
Northern Europe	80	771	5	0.484	0.107	0.000	0.372	26.1	5.8	78
Continental Europe	115	885	16	0.435	0.097	0.000	0.162	26.9	6.8	75
Southern Europe	210	1357	14	0.301	0.019	0.000	0.966	28.8	4.7	84

Table 10 Average treatment effect on the treated (ATT)—intensive care (>10 h of caregiving)

	Kernel matching		Radius matching	
	ATT	SE	ATT	SE
North	0.071	0.057	0.0916	0.052
Centre	0.026	0.057	0.030	0.060
South	0.116**	0.043	0.123**	0.045

The ATT figures were obtained using Kernel and Radius matching techniques (with calliper 0.05). A restriction was applied to the common support by excluding observations whose propensity scores were either above the maximum or below the minimum propensity scores of the combined controls

***, **, *: respectively indicate a significance level of 1, 5, a and 10 %

the threshold, the caregiver sample included a sufficiently large number of observations to produce consistent estimates for the South only: again the ATTs were statistically significant and increased slightly when the number of weekly hours devoted to informal care increased and the pressure was more intense.

The fact that the estimates are very similar after several robustness checks is evidence of their robustness.[16]

6 Conclusions

Our paper contributes to the previous literature by exploring the relationship between informal caregiving and mental health according to a North–South gradient. Overall, our results show that the provision of care to parents has a negative and significant impact on daughters' mental health in the Mediterranean countries where the amount of resources allocated to the Long Term Care is minimal and the local system of health and social services for the elderly lacks the necessary structures to meet the increasing demand for eldercare. In the South macro area, it is the family that historically has shouldered the burden of looking after its older parents, both financially and in terms of assistance. Similarly, it is still the family that supports the new generations facing the lack of job opportunities, even if these generations have already left the family nucleus, in a reciprocal pact that reflects the structural absence of institutional answers.

In contrast, Northern European countries, state and municipalities are by law responsible for the elderly's care and assistance: under these circumstances, a daughter's choice to assist her parents does not represent a stressful experience, which may explain why we did not find evidence of detrimental consequences on mental health of caregivers in this macro-region. The same considerations apply to the Central geographical area, even if it presents a more heterogeneous and less developed framework of welfare regimes compared to the Northern ones; continental countries tackled the problem of elderly care with different measures during the nineties. Again, no evidence exists of a negative impact on the daughters' mental health. The attention of policymakers is henceforth to be focused on the Mediterranean countries, where the issue of eldercare policies has yet to be addressed.

[16] We performed additional robustness checks displayed in Online Appendix.

Informal care, until today, has been the backbone of care provision in Southern Europe: unpaid family labor has been very common, in particular for women, who devote part of their time in providing child care and elder care. However, this model is now under pressure: changes in demographics and social values and the dramatic increase in female educational achievements and labour force participation are reducing the number of family members available to care for impaired older relatives. Hence, unpaid care provided by daughters can no longer be taken for granted. Complete replacement of informal care by formal care is neither financially feasible (since financial resources available for public long term care assistance are continuously decreasing) nor socially desirable. However, more attention should be paid to patterns of service use among older people: a re-arrangement of this sector in this sense is necessary in view of the already urgent problem of demographic ageing, which is inevitably destined to become more pronounced in the near future. Policy makers have to stimulate community living and care, including home care, as a sustainable approach to ease the burden of care on family members. This would also help in preventing the need for long-term institutionalization in order to maintain individuals in their home and community as long as possible.

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Appendix 1

See Tables 11, 12 and 13.

Table 11 Probit model for the propensity score matching Northern Europe (baseline model—Section 4)

Variables	Coef.	Std. err.
Age	0.044***	0.013
Carer's children living at home	0.120	0.222
Single	0.376**	0.210
Employed	0.113	0.162
Home maker	0.128	0.198
Low educational degree	−0.189	0.125
High educational degree	−0.114	0.116
Income	−0.120**	0.041
Parents SIOPS	0.006*	0.004

Table 11 continued

Variables	Coef.	Std. err.
Parents health status	−0.039	0.123
Parents live between 1 and 25 km	−0.198	0.129
Parents live between 25 and 100 km	−0.926***	0.163
Parents live more than 100 km	−1.00***	0.163
Chance of inheritance	0.003**	0.001
Caregiver at I wave	1.277***	0.103
Eurod at I wave	0.164	0.134
Denmark	−0.07*	0.145
Sweden	−0.345**	0.144
Number of obs.	1139	
Pseudo R^2	0.2857	

20 observations not used because the variable "unemployed" referred to the carers' occupation predicts perfectly the failure (informal caregiver status = 0); for the Northern Europe macro-area only we grouped together the two dummy variables that indicate where daughters live "in the same household or in the same building" and "less than 1 km away" because of the limited number of observations falling in these categories

***, **, *: respectively indicate a significance level of 1, 5, a and 10 %

Table 12 Probit model for the propensity score matching Central Europe (baseline model—Section 4)

Variables	Coef.	Std. Err.
Age	0.074***	0.012
Carer's children living at home	0.377	0.150
Single	0.118	0.169
Employed	0.783	0.145
Unemployed	0.509**	0.192
Home maker	0.51**	0.153
Low educational degree	0.199*	0.105
High educational degree	0.372**	0.111
Income	−0.007	0.035
Parents SIOPS	0.001	0.003
Parents health status	0.068**	0.087
Parents live in same household or building	−0.096	0.210
Parents live between 1 and 25 km	0.000	0.108
Parents live between 25 and 100 km	−0.784***	0.150
Parents live more than 100 km	−1.333***	0.202
Chance of inheritance	0.0087***	0.001
Caregiver at I wave	1.257***	0.093
Depression at I wave	−0.266**	0.109
Austria	0.319**	0.169
Germany	0.355**	0.159
Belgium	0.395**	0.139

Table 12 continued

Variables	Coef.	Std. Err.
France	0.302**	0.128
Number of obs.	1498	
Pseudo R^2	0.3140	

***, **, *: respectively indicate a significance level of 1, 5, a and 10 %

Table 13 Probit model for the propensity score matching Southern Europe (baseline model—Section 4)

Variables	Coef.	Std. Err.
Age	−0.006	0.009
Carer's children living at home	0.177*	0.093
Single	0.253**	0.115
Employed	−0.391**	0.132
Unemployed	−0.094	0.235
Home maker	−0.305**	0.114
Low educational degree	0.176	0.110
High educational degree	−0.062	0.157
Income	−0.067**	0.026
Parents SIOPS	−0.002	0.003
Parents health status	0.464***	0.079
Parents live in same household or building	0.621***	0.128
Parents live between 1 and 25 km	−0.263**	0.092
Parents live between 25 and 100 km	−0.566***	0.153
Parents live more than 100 km	−0.759***	0.138
Chance of inheritance	0.001	0.001
Caregiver at I wave	1.233***	0.082
Depression at I wave	−0.441***	0.084
Italy	0.120**	0.090
Greece	−0.34**	0.112
Number of obs.	1773	
Pseudo R^2	0.2566	

***, **, *: respectively indicate a significance level of 1, 5, a and 10 %

Appendix 2

See Tables 14 and 15.

Table 14 Results of covariate balancing tests—attitudes towards care model

	No. of treated	No. of controls	No. of treated off support	Probit pseudo R^2 before matching	Probit pseudo R^2 after matching	$p > Chi^2$ before matching	$p > Chi^2$ after matching	Median bias before matching	Median bias after matching	% reduction in median bias
Kernel matching										
Northern Europe[a]	224	581	1	0.291	0.031	0.000	0.503	11.1	4.5	59
Continental Europe	348	964	35	0.314	0.009	0.000	0.998	8.9	2.2	75
Southern Europe	281	903	10	0.242	0.015	0.000	0.971	13.4	5	63
Radius matching										
Northern Europe[a]	224	581	2	0.291	0.031	0.000	0.532	11.1	4.8	57
Continental Europe	348	964	39	0.314	0.009	0.000	0.998	8.9	2.3	74
Southern Europe	281	903	10	0.242	0.017	0.000	0.929	13.4	5.4	60

[a] 18 observations not used because the variable "unemployed" referred to the carers' occupation predicts perfectly the failure (informal caregiver status = 0)

Table 15 Average treatment effect on the treated (ATT)—attitudes towards care

	Kernel matching		Radius matching	
	ATT	SE	ATT	SE
North	−0.040	0.035	−0.042	0.035
Centre	0.026	0.034	0.023	0.034
South	0.089**	0.039	0.089**	0.040

The ATT figures were obtained using Kernel and Radius matching techniques (with caliper 0.05). A restriction was applied to the common support by excluding observations whose propensity scores were either above the maximum or below the minimum propensity scores of the combined controls

***, **, *: respectively indicate a significance level of 1, 5, a and 10 %

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