Netspar

Network for Studies on Pensions, Aging and Retirement

Netspar DISCUSSION PAPERS

*Eric Bonsang and Valeria Bordone*

# The Effect of Informal Care from Children on Cognitive Functioning of Older Parents

DP 01/2013-008

# The effect of informal care from children on cognitive functioning of older parents[1]

Eric Bonsang[a] and Valeria Bordone[b]

[a] Research Centre for Education and the Labour Market (ROA), Maastricht University, and Netspar.

[b] Wittgenstein Centre (IIASA, VID/ÖAW, WU), Vienna University of Economics and Business, and International Institute for Applied Systems Analysis.

**Abstract**

This study aims to investigate the effect of informal care received from the children, understood as the instrumental component of social support, on the cognitive functioning of elderly parents. As the correlation between informal care and cognitive functioning is likely to be driven by reverse causality or unobserved heterogeneity, we use instrumental variables (IV) approach with the gender ratio of the children as an instrument for the amount of informal care that parents receive from their children. Results from the IV models on data from the Survey of Health, Ageing and Retirement in Europe highlight a significant negative effect of the amount of informal care provided by the children on cognitive functioning of the mothers. This hints that too much support may result in passive behaviors of the elderly, which in turn is detrimental for their cognitive functioning.

[1] This paper uses data from SHARE release 2.5.0, as of May 24th 2011. The SHARE data collection has been primarily funded by the European Commission through the 5th framework programme (project QLK6-CT-2001- 00360 in the thematic programme Quality of Life), through the 6th framework programme (projects SHARE-I3, RII-CT- 2006-062193, COMPARE, CIT5-CT-2005-028857, and SHARELIFE, CIT4-CT-2006-028812) and through the 7th framework programme (SHARE-PREP, 211909 and SHARE-LEAP, 227822). Additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, Y1-AG-4553-01 and OGHA 04-064, IAG BSR06-11, R21 AG025169) as well as from various national sources is gratefully acknowledged (see www.share-project.org for a full list of funding institutions).
This research was partly funded by the Austrian Science Fund (FWF): Z171-G11 and by the Advanced Grant of the European Research Council ERC Grant Agreement No. 241003-COHORT.

## 1. Introduction

Parent-child relationships balance autonomy and dependence over the life course until later in life, when a role reversal typifies this dyadic relationship: elderly parents, who have been providers of care to their children for most of their lives, become receivers of care from the children (e.g. Silverstein et al. 1996).

Among the several dimensions of the parent-child relationship, informal care provided by the children to the parents is likely to have a distinct impact on cognitive functioning (Berkman et al. 2000; Seeman and Crimmins 2001): this effect may either be positive or negative. On the one side, informal care may promote cognitive resilience and provide cognitive reserve that protects against impaired cognition (e.g. Glymour et al. 2008). Intergenerational relationship have been suggested to promote cognitive functioning because of the cognitive demands of social interactions (i.e. communication, recall of shared experiences and problem solving), the reciprocal encouragement to engage in health-preserving behaviors (e.g. medication adherence), and the offsetting of harm to physical and cognitive function arising from highly stressful events. Although suggestive, prior evidence (reviewed in Fratiglioni et al. 2004) hinting that social embeddedness may facilitate cognitive resilience, remains inconclusive. On the other side, some contrasting evidence emerges (e.g. Silverstein et al. 1996) in support of the *theory of social breakdown* (Bengtson and Kuypers 1986), stating that excessive care received from the children may cause a loss of autonomy associated with relying on others for the satisfaction of basic needs. This would in turn negatively affect cognitive functioning.

The difficulty in establishing a temporal order, i.e. whether cognitive change leads or follows engagement/disengagement from social embeddedness, has been the main critique to previous research in this field (Hultsch et al. 1999).

Moreover, despite the large number of attempts to link family relations, quality and number of social contacts, social support, and size of social networks to several health outcomes (e.g. Krause et al. 1992; Lee et al. 1995; Seeman 1996; Shyu et al. 2006; Silverstein and Bengtson 1994; Silverstein et al. 1996; Sugisawa et al. 1994; see also reviews by Berkman et al. 2000; Cohen 2004), to our knowledge so far no study has established a causal association between the specific dimension of informal care received from the children and cognitive functioning in later life.

Informal care is usually defined as a wide range of tasks performed by non-paid non-professionals (i.e. family members, close relatives, friends or neighbors). In this study, we focus in particular on informal care, understood as the instrumental component of social

support (i.e. personal care, practical household help, and help with paperwork), provided by children. The nature of the parent-child relationship is unique and life-long. Moreover, when a person grows old, retirement may act as a form of disengagement from social interactions and, at the same time, the number of ties hold tends to decline. Friends and partner, similar in age and lifestyle, become less likely to provide informal care; while children become a main source of care (Antonucci 1990).

Understanding its effect on cognitive functioning is of high importance to plan intervention that could postpone cognitive decline. Cognitive impairment among the older individuals represents a major public health burden, especially in contexts of population ageing. Even when it does not reach the threshold of dementia diagnosis, cognitive impairment is associated with loss of quality of life, increased dependency, and higher health-related expenditures (Albert et al. 2002; Ernst and Hay 1997; Lyketsos et al. 2002; Tabert et al. 2002).

In this article, we aim to fill in a gap in the literature by investigating the causal effect of informal care to elderly parents provided by their adult children on the cognitive functioning of the parents. In order to identify such an effect, we use an instrumental variables (IV) method on data from the Survey of Health, Ageing and Retirement in Europe (SHARE). To this end, SHARE is a powerful tool as it includes a series of cognitive tests and information on several aspects of life such as work, family relationships, housing, physical and mental health as well as socio-demographic characteristics of a nationally-representative sample of Europeans aged 50 or more from 13 countries.

The paper is organized as follows. We first review the relevant literature and formulate our hypothesis on the effect of informal care received from the children on cognitive functioning of the parents (section two). The empirical strategy and validity of the instrument chosen are discussed in section three. The fourth section discusses data and variables. Results and several robustness checks are then presented in the fifth section and section six sets out our conclusions.

## 2. Background

In a context of increasing diversity of family forms and behaviors, classic studies have expressed concern about levels of intergenerational solidarity (e.g. Shanas et al. 1968; Sussman 1953), exacerbated by family theorizing of the time (e.g. Burgess 1960; Parsons and Bales 1955) that emphasized the centrality of the nuclear family and social disengagement by older family members. However, recent evidence shows a still high frequency of

intergenerational interaction between parents and children even when not living together (e.g. Attias-Donfut et al. 2005a; Hank 2007; Yi and Farrell 2006) and family members remain an important source of informal support crossing generations (Attias-Donfut et al. 2005b; Blome et al. 2009; Fokkema et al. 2008; Hank 2007; Silverstein and Bengtson 1994).

Concerning the United States, Fingerman and colleagues (2011) distinguished different types of families on the basis of the proportion of middle-aged adults who engage in various patterns of intergenerational support: they found that families with upward support favoring parents were 28% of the study participants, with frequency of aid averaging a few times a year to monthly. Albertini and colleagues (2007) reported that 16% of elders in Europe are recipient of instrumental support from children living outside the household; additionally, Bonsang (2009) showed that, on average, the 65 year olds and older with at least one child in Europe receive 5.6 hours of informal care per month from children not living with them.

Not only the fact that informal care from the children is the largest source of long-term care for the elderly (Norton 2000), but also the encouraged development of family-provided care to the frail elderly in order to slow down the increasing costs of long-term care in ageing societies, point to the relevance of identifying its effects.

Several studies have argued the importance of social environment as a predictor of cognitive outcomes among older adults. Fratiglioni and colleagues (2004) discussed several ways through which intergenerational support may be protective against cognitive ageing: in particular, the *stress hypothesis* suggests that social support increases self-esteem and buffers stress; the *vascular hypothesis* states that social support is likely to stimulate physical activity and therefore decrease cardiovascular diseases which are involved in the progression of dementia and Alzheimer's disease. Empirical evidence has confirmed that social engagement reduces the rate of cognitive decline (Barnes et al. 2004; Ertel et al. 2008; Zunzunegui et al. 2003). On the contrary, Eisele and colleagues (2012) found no effect of the emotional component of support on cognition. However, most of this research does not establish a causal relation between social embeddedness and cognitive functioning and it combines several forms of social support, varies in study design, outcomes considered and operationalisations used.

Yet, as parents and children redefine their roles in later life, informal care provided by children may become the main form of intergenerational support. This specific type of support might rather be cognitively depleting, reflecting a perceived loss of independence and thus increasing the risk of depression in the elderly parent (Lee et al. 1995; Finkel et al. 2006; Richeson and Trawalter 2005; Richeson et al. 2005). Research on the parent-child relationship

has shown that elderly parents tend to prefer functional autonomy for as long as possible before relying on their children's informal care; while children observing their parents growing old tend to provide them with vigorous amounts of care (Lawton et al. 1994).

The *theory of social breakdown* (Kuypers and Bengtson 1973) provides a social-psychological framework for the potential negative consequences of informal care on psychological well-being (see also Seeman et al. 1996). It asserts that the elderly in Western society may experience loss of coping abilities and the development of a sense of incompetence as a consequence of unique social reorganizations in late life (e.g. role loss, vague or inappropriate normative information, and lack of reference groups).

In the same vein, the concept of *learned helplessness* (derived from animal psychology in the early 1970s, e.g. Seligman 1974) would define those individuals (in our case, the parents) who have learned over time that their actions are ineffective, because someone else intervenes and acts in their place (in our case, the well-intentioned children). Unlike emotional support, the receipt of informal care from the (over involved) children may erode self-confidence, which in turn can foster the process of cognitive ageing either directly causing skills to atrophy or by creating negative emotions, lead to depression and discourage elderly people from engaging in cognitive stimulating and physical activities (e.g. Brown et al. 2005; Pennix et al. 1998). Empirical evidence shows that informal care may result in negative reactions on the receivers, including higher depression (e.g. Wolff and Agree 2004), poorer emotional well-being and greater emotional strain (e.g. Silverstein et al. 1996). Increased inactivity and risk for onset of disability (e.g. Seeman et al. 1996) in older adults who receive informal care in a manner that fosters dependency provide additional indirect evidence of a negative effect of informal care on mental well-being of older parents.

We thus expect that the (well-intentioned) helping behavior of the children in carrying over the basic tasks of daily life (such as personal care, housework and administrative paperwork), which are important to maintain self-control over the own life[2], may result into lower cognitive functioning, by favoring passive behavior of the parents.

In other words, we argue that the simple mechanism so-called *use-it-or-lose-it* is at work: this idea, earlier proposed by Sorenson (1938) and further elaborated by several scholars (see Salthouse 2006 for an evaluation of its validity), suggests that an under-stimulating environment may not prevent or may even accelerate the process of cognitive decline; while

[2] As shown by psychologists' experiments, older people's self-confidence may be enhanced also by little tasks (see for example Langer and Rodin 1976; Searle et al. 1995).

being engaged in cognitively stimulating activities may halt the cognitive decline associated with ageing (e.g. Engelhardt et al. 2010).

In this study, we aim to test the causal direction of the effect of informal care provided to the parents by the children on the parents' cognitive functioning. The mixed results of the literature justify the following empirical analysis in order to determine the dominating causal effect of informal care received from the children on the cognitive functioning of the parents. Because women are more likely to receive informal care (e.g. Arber and Ginn 1993; Tomassini et al. 2003), gender-specific analyses will be carried.

## 3. Empirical strategy

The aim of the empirical analysis is to measure the effect of informal care ($IC_i$) provided by the adult children to their older parents on the cognitive functioning of the parents ($C_i$). The equation to be estimated is the following:

$$C_i = X_i'\beta + \gamma IC_i + \varepsilon_i, \quad (1)$$

where $X_i$ is a vector of control variables that are likely to be related to cognitive functioning, $\gamma$ and the vector $\beta$ are parameters to be estimated, and $\varepsilon_i$ is the error term. Under the assumption that the error term is uncorrelated to $IC_i$ and $X_i$, the parameter of interest $\gamma$ can be estimated by Ordinary Least Squares. This assumption is unlikely to hold in the present context for at least three reasons. First, unobserved characteristics such as unobserved health are likely to be correlated with both cognitive functioning and informal care (omitted variable bias). Second, informal care is likely to be endogenous to cognitive functioning (reverse causality): on the one hand, older individuals with lower cognitive functioning are likely to need more support resulting in an increase in the demand for informal care; one the other hand, older parents with lower cognitive functioning are likely to have a lower bargaining power in the joint decisions with the children resulting in a lower receipt of informal care (Sloan et al. 1997).[3] Third, the measure of informal care is likely to suffer from measurement error resulting in an attenuation bias in the estimate of the coefficient of interest.

In order to identify the causal effect of informal care from the children on cognitive functioning of the parents, we therefore use an IV approach. The instrument, to be valid, should be related to the receipt of informal care and should not be correlated with the error

[3] This possibility occurs in a model of strategic behaviour when the parent has a stronger preference for receiving informal care from the child(ren) than the child(ren) are willing to offer.

term of the structural equation ($\varepsilon_i$). The candidate chosen as a valid instrument for informal care is the gender mix of the children, because of the following reasons. First, this variable is related to the endogenous variable, informal care received from the children: numerous studies showed that daughters provide more care to their parents than sons do (e.g. Horowitz 1985; Spitze and Logan 1990), women are usually seen as kin-keepers (see Walker et al. 1995, for a review) and a consistent amount of studies on intergenerational contact agrees that daughters are more likely than sons to have frequent contact with parents (Bordone 2009; Gerstel and Gallagher 1993; Kaufman and Uhlenberg 1998; Nauck 2009; Rossi 1993). Vice versa, parents were found to have more detached relations with sons than with daughters (Silverstein et al. 2010). Based on previous literature, we could therefore expect parents with more daughters to receive more informal care than those who have more sons. Second, the gender of the children is a natural outcome that is plausibly randomly distributed with respect to major sources of heterogeneity such as preferences and ability. We can thus argue that it is not related to the error term of the cognitive functioning equation: the gender of the children can be argued to be exogenous, conditional on the number of children, given that the only way parents can influence the gender ratio of their children is by having more children.[4] This identification strategy has also been used to identify the causal effect of informal care on formal care by Lo Sasso and Johnson (2002), Van Houtven and Norton (2004, 2008), and Charles and Sevak (2005). Section 5.3.1 provides a more extensive discussion about the exclusion restriction assumption.

Equation (1) is thus estimated by using the 2-Stage Least Squares (2SLS) estimator and the proportion of daughters as an instrument for informal care.

## 4. Data

### 4.1. The sample

[4] In order to check whether the proportion of daughters is randomly assigned and thus provides a good source of exogenous variation to identify the causal effect of informal care on cognitive functioning, we regressed the proportion of daughters on all the control variables that we use in our model (see below for the description of the control variables). The "overall" F-test of the model does not reject the hypothesis that the proportion of daughters is not related to any control included in the model. This result provides some suggestive evidence that the share of daughters is randomly assigned across individuals, at least among the observables included in the model. Note however that we observe some small but statistically significant differences across countries. It thus justifies the inclusion of country dummies in the model to take into account those small discrepancies across countries. Full results are presented in Table A1 in Appendix.

The empirical analysis is based on the pooled data from the first (2004, release 2.5) and second wave (2006-2007, release 2.5) of the *Survey of Health, Ageing and Retirement in Europe* (SHARE).[5] SHARE includes extensive information on health, employment, financial situation, family and activities of a representative sample of the 50+ non-institutionalised population in 13 European countries (Börsch-Supan et al. 2005; 2008). The 30,000 interviewed persons born in or before 1954 come from countries ranging from Scandinavia to the Mediterranean.[6] Data were collected using a computer assisted personal interviewing (CAPI) program, supplemented by a self-completion paper and pencil questionnaire. For more details on the sampling procedure, questionnaire content and fieldwork methodology, we refer readers to Börsch-Supan and Jürges (2005; 2008).[7]

For the following analysis, we restrict the sample to non-working individuals[8] aged 65 or above (27,197 observations) who have at least one child (23,986 observations) and do not live with any of their children (20,612 observations). We exclude individuals living with their children because in case of coresidence between the parent and the child, it is not possible to identify the amount of informal care provided by the children, if any. Moreover, we discard observations with missing or unreliable[9] values for the variables of interest or the controls. The analytical sample includes 19,674 observations.

### 4.2. The measures of cognitive functioning

SHARE measures cognitive functioning of all respondents by using short and simple tests of episodic memory (learning and recall), executive functioning (verbal fluency), numeracy (arithmetical calculations), and orientation in time. In the episodic memory task, participants were asked to memorize ten common words, and to list as many of these words as they could

[5] Since we pool the first and second wave of SHARE, we have two observations for many individuals observed in the sample. In the empirical analysis we thus present the standard error clustered at the individual level. Section 5.3.4 presents a robustness check by estimating our model for each wave separately.

[6] SHARE data include thirdteen European countries: Austria, Belgium, Czech Republic, Denmark, France, Germany, Greece, Italy, the Netherlands, Poland, Spain, Sweden, and Switzerland.

[7] More information can be found on the SHARE website: http://www.share-project.org/.

[8] Working individuals aged 65 or more represent less than 1.6% of the sample.

[9] We found some implausibly high value in the fluency test score (defined below). In order to correct for this, we dropped from the analysis the observations that were above the 99$^{th}$ percentile of the distribution of the fluency test score. The 99$^{th}$ percentile corresponds to 40 names of animals mentioned within one minute.

remember in one minute. The immediate recall phase took place just after the interviewer had read out the ten words, while the delayed recall phase occurred after completing the fluency and the numeracy tests. For the fluency task, respondents had to name as many different animals as possible in one minute. Numeracy was assessed by asking a few questions that involve simple calculations based on real life situations. Respondents who correctly answer the first question were asked a more difficult one, while those who made a mistake were asked an easier one[10]. Additionally, SHARE's orientation test consists in the completion of tasks requiring to think about the current date (i.e. day of the month, month, year and day of the week).

We use principal component analysis in order to combine the scores from these five cognitive tests into a more general index of cognitive functioning, defined as the first principal component.[11] We obtain an indicator that we normalize with a mean zero and unit variance. The distribution of our measure of cognitive functioning is shown in Figure 1 and is close to the normal distribution.

[Figure 1 about here]

### 4.3. The measure of informal care

Informal care is measured as the sum of care and assistance received by the respondents and/or their spouse from all their children.[12] In SHARE, informal care includes personal care

[10] A first mathematical task is given to the interviewee: "If the chance of getting a disease is 10 per cent, how many people out of one thousand would be expected to get the disease?" If the first item was answered wrongly, the interviewee got the following question, after which the numeracy test was stopped, independently of whether the answer was correct. "In a sale, a shop is selling all items at half price. Before the sale, a sofa costs 300 (local currency). How much will it cost in the sale?" If the first item was answered correctly, a second question was posed: "A second hand car dealer is selling a car for 6,000 (local currency). This is two-thirds of what it costs new. How much did the car cost new?" Only if both the first and second numeracy items were answered correctly, the interviewee was asked to answer a last question: "Let's say you have 2,000 (local currency) in a savings account. The account earns ten percent interest each year. How much would you have in the account at the end of two years?"

[11] We have also combined those five cognitive test scores using the simple mean of the standardised value of each test score and obtained results in line with those obtained using the first component of the principal component analysis.

[12] In SHARE, information regarding informal care providers is collected for only up to three potential informal caregivers. So, if the respondents and/or their spouse have more than three children who provide them care, it is

(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 paperwork (e.g. filling out forms, and settling financial or legal matters). The measure of informal care is derived from three questions that describe the relationship with the caregiver (if any), the frequency (daily, weekly, monthly or less often) of the care received and the average number of hours per day/week/month/year respectively.[13] Following Bolin et al. (2008) and Bonsang (2009), we transform these variables into a measure of the average total number of hours of informal care received from the children per month: if the respondents answered that they received informal care almost every day, we multiplied the number of hours received on a typical day by 30; if the care was received almost every week, the number of hours per week were multiplied by 30/7; if care was on a monthly basis, the number of hours per months was kept as it is from the answer; finally, if the respondents answered that they received informal care less often than monthly, they were asked to give an estimate of the total number of hours of informal care received over past year and we divided this amount by 12.

### 4.4. Control variables

As control variables, we include country dummies to account for cross-national differences in cognitive functioning due to differences in cultural and institutional backgrounds. We include a dummy that is equal to one if the respondent was born abroad. We also control for gender, age, years of education (number of years of education calculated according to the ISCED-97 classification (OECD 1999)), whether the individual lives in a single household or not, and for the number of children. Health and functional status are considered by including the number of mobility limitations[14], the number of limitations with activities of daily living

possible that our variable of informal care underestimates the amount of informal care received from all the children.

[13] For the observations where the average number of hours per day/week/month/year is missing or clearly unreliable (for instance, when the individual reports receiving more than 18 hours of care per day from one caregiver), we have imputed the sample average of the number of hours of care received from the child for the corresponding frequency (daily/weekly/monthly/yearly). When the frequency is missing, we have imputed the sample average number of hours of care received per month from the child.

[14] It corresponds to the number of limitations with mobility, arm function and fine motor function reported by the respondent. These are: Walking 100 metres; Sitting for about two hours; Getting up from a chair after sitting for long periods; Climbing several flights of stairs without resting; Climbing one flight of stairs without resting;

(ADL) (Katz et al. 1970)[15], and three dummy variables that are equal to one if the individual reports that (the doctor has ever told her/him that) s/he had a heart-related disease (i.e. heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure), stroke, or diabetes, respectively. It is additionally controlled for re-test effect[16]: a dummy variable scores 0 if the respondent is interviewed for the first time, 1 if referring to the second interview. Table 1 presents the means of the variables used in the empirical analysis by country.

[Table 1 about here]

## 5. Results

### 5.1. OLS results

In this section we first look at the association between cognitive test scores of the parents and informal care received in a simple framework that does not take into account measurement error, unobserved heterogeneity and/or reverse causality. We estimate equation (1) with ordinary least squares (OLS) for mothers and fathers separately.

[Table 2 about here]

The results of the model are presented in Table 2. Most coefficient estimates of the control variables are significant and have the expected signs. Note also that the results are quite consistent across men and women.

Concerning the explanatory variable of our interest, the OLS results show that informal care received from the children is significantly and negatively correlated to the cognitive score of both the parents, although the effect is stronger for mothers and only significant at the 10-percent level for fathers. This first result thus suggests that informal care receipt is detrimental

---

Stooping, kneeling, or crouching; Reaching or extending your arms above shoulder level; Pulling or pushing large objects like a living room chair; Lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries; Picking up a small coin from a table.

[15] This variable relates to basic tasks of everyday life. The respondent is asked about having problems to perform the following ADL: Dressing, including putting on shoes and socks; Walking across a room; Bathing or showering; Eating, such as cutting up your food; Getting in or out of bed; Using the toilet, including getting up or down.

[16] Re-test effect consists in the fact that repeated administration of the same cognitive test may improve the individual's test performance.

for the cognitive functioning of older parents, especially for mothers. However, this association between cognitive functioning and informal care received from the children is likely to be contaminated either by the presence of unobserved heterogeneity that might be correlated both with cognitive functioning and informal care, or by the endogeneity of informal care. Moreover, an attenuation bias due to measurement error in the measure of informal care may further affect this result. The direction of the bias is not straightforward given that the different potential mechanisms at work may bias downward or upward the coefficient of interest.

### 5.2. IV results

In order to shed light on the causal effect of upward intergenerational support and cognitive functioning of the receivers, we thus estimate the model using an IV approach. As discussed earlier, we use the gender mix of the children as a source of exogenous variation for informal care received from the children.

[Table 3 about here]

Column (i) of Table 3 presents the results from the first stage regression by gender of the parent. The coefficient estimate related to the share of daughters is positive and highly significant, especially for women: the higher the proportion of daughters, the more informal care is received, as expected. The F-test of the excluded instrument shows that for women the gender ratio of children is a significant predictor of informal care from the children, a necessary condition for being a valid instrument. For men however, it reveals a rather low predictive power relative to women. It thus suggests that the gender mix of children matters less for the receipt of informal care for men than it does for women. This lack of predictive power can be mainly explained by the fact that, giving the higher life expectancy of women and their caregiver role within the family, men usually rely on their wives for care in later life and relatively little on adult children (Katz et al. 2000). Therefore, the IV results for men should be interpreted with caution as they are likely to suffer from weak instrument issues (Bound et al. 1995). Column (ii) reports the reduced form of the cognitive functioning equation that only includes the controls and the instrument as explanatory variables in the model. The coefficient estimate related to the share of daughters is negative and significant at the 0.1% level for mothers, suggesting that having relatively more daughters is negatively related to cognitive test scores for mothers aged 65 or more. For fathers, the estimate is not significantly different from zero. Finally, column (iii) reports the results of the 2SLS model.

The coefficient related to informal care receipt, the main coefficient of interest, is negative and significant at the 1% level for women but not significant for men. Note that the coefficient for males is estimated with very large standard error as a result of the low predictive power of the instrument on the endogenous variable. These results thus suggest that the causal effect of informal care on cognitive functioning is negative for women. We however cannot derive a conclusive result of the effect of informal care on fathers' cognitive performance, given the low predictive power of our instrument for men.

It is also worth noting that whether socio-demographic and health-related variables are or not included in the model barely changes the coefficient estimate of informal care in the 2SLS setting (See Table A2 for the same model as in Table 3, excluding socio-demographic and health-related controls). This is explained by the fact that, as shown in Table A1, the proportion of daughters is uncorrelated with any of those controls.

### 5.3. Robustness checks

#### 5.3.1. *The exclusion restriction*

The IV approach adopted in this study in order to identify the causal effect of informal care from the children on the cognitive functioning of older parents heavily relies on one important assumption regarding the instrumental variable. This central assumption states that the instrument is uncorrelated to the error term of equation (1). In other words, there should be no relationship between the proportion of daughters and cognitive functioning, except through the effect of informal care. However, the literature has highlighted several consequences of having a daughter or a son as offspring. For instance, some studies found that the presence of a son rather than a daughter decreases the likelihood of divorce (e.g. Katzev et al. 1994; Morgan et al. 1988), which may in turn affect many aspects of life and impact on the evolution of cognitive functioning.[17] Other studies suggested that child's gender may affect mothers' labor supply (Lundberg 2005a),[18] which has been shown to affect cognitive functioning (Bonsang et al. 2012; Mazzonna and Peracchi 2012; Rohwedder and Willis 2010). Furthermore, Trivers and Willard (1973) suggested that evolution would favor a systematic deviation from the population sex ratio. Their argument is based on the hypothesis that the reproductive success of males is more variable and resource-sensitive than it is for

[17] Note that other studies found no effect of child's gender on the probability of divorce (see e.g. Diekmann and Schmidheiny 2004).

[18] She found that, among low educated mothers, having a son decreases labour supply, while among high educated women, it increases labour supply.

females and that the condition of the offspring depends on the maternal condition. Male offspring of parents in good nutritional and material condition are expected to have a better reproductive success than their female siblings. As a result, mothers in good condition obtain more grandchildren through sons and for mothers in bad conditions, daughters out-reproduce sons. Therefore, mothers in good condition (and maybe with better cognitive functioning) would have more sons and mothers in bad conditions more daughters. The Trivers and Willard hypothesis has been supported by many empirical analysis using data from different human societies (e.g. Betzig and Weber 1995; Kanazawa 2005; Mueller 1993). For example, Almond and Edlund (2007) provided suggestive empirical support in favor of this hypothesis using US natality data during the period 1983-2001: they find that married, more educated and younger mothers bore more sons and that infant deaths were more likely to be males if the mother were unmarried and young.

Those findings thus suggest that the gender composition of the children may be correlated with parental condition as well as with a wide range of parental behaviors questioning the exclusion restriction of the instrument we use (Lundberg 2005b). Our results, highlighting a negative correlation between the proportion of daughters and cognitive functioning of mothers, may thus be the consequence of other mechanisms than the one we propose in this paper. In order to investigate whether our results may be driven by other mechanisms than the causal effect of informal care on cognitive functioning, such as those proposed above, we carry out a placebo analysis where we estimate the reduced-form of our model for the sample of individuals aged between 50 and 64, when informal care is not yet likely to take place but when the other mechanisms may have already played a role. Note that, for this analysis, we also include interviewees living with their children and those working, given that an important proportion of people in this age range still has children living at home and is still working.[19] The sample includes 12,139 men and 15,038 women. The results provide a non-significant coefficient estimate for the proportion of daughters in the cognitive functioning equation for both men (coefficient: -0.029; standard error: 0.020) and women (coefficient: -0.023; standard error: 0.018).[20] This suggestive evidence clearly shows that our findings are not driven by the other mechanisms suggested by the literature (as mentioned above) about the consequences of having sons or daughters.

[19] The results remain unchanged when we exclude them from the analysis.

[20] Full results are presented in the Appendix in Table A3.

### *5.3.2. Results by cognitive tests*

In order to check whether the effect of informal care differs across cognitive domains, we estimate the model using the normalized score of each cognitive test separately: the immediate word recall test, the delayed word recall test, the fluency test, the numeracy test and the orientation test. The results of the 2SLS are presented in Table 4. The estimates for women are negative and significant for all measure except for the orientation test, which however is only able to detect serious cognitive impairment. Since a large proportion of participants (about 82%) obtained the maximum score in the orientation test, the non significant effect on this latter might be due to ceiling effect.

[Table 4 about here]

### *5.3.3. Alternative instrument*

An alternative instrument to the proportion of daughters for informal care provided by the children to the parents is a dummy variable that is equal to one if the individual has at least one daughter. Table 5 shows that, even when using this instrument, the effect of informal care on cognitive functioning is negative and significant (at the 5%-level) for women, in accordance with the main results of the analysis.

[Table 5 about here]

### *5.3.4. Results by wave*

The main analysis uses the pooled first and second wave of SHARE in order to maximize the efficiency of the estimation. As a check, we have estimated the model for wave 1 and wave 2 separately (results not shown, available on request). For women, the 2SLS coefficient estimate of informal care is negative and significant at the 5%-level for both waves, with about the same magnitude of the coefficients (Wave 1: coefficient estimate: -0.188, standard error: 0.090. Wave 2: coefficient estimate: -0.210, standard error: 0.089). For men, the predicting power of the instrument for informal care is weak in both waves.

### *5.3.5. Co-resident children and selection bias*

In the main analysis of this paper, we have discarded individuals living with at least one of their children because the occurrence and the amount of informal care that is provided within a household cannot be observed. This sample selection may result in a biased estimate of our parameter of interest. If the probability of living with at least one child is correlated with the proportion of daughters, and if the probability of living with at least one child is correlated

with cognitive functioning, the coefficient estimate of the proportion of daughters in the reduced-form will suffer from a bias because of sample selection.

In order to check whether this sample selection affects our main results, we estimate the reduced-form equation for the larger sample that includes individuals living with at least one child (13.8% of the sample). We find (results not shown, available on request) that, for women, the coefficient estimate of the proportion of daughters is slightly lower in magnitude (coefficient estimate: -0.077, standard error: 0.022), although not statistically different from the estimate obtained from our main analysis (coefficient estimate: -0.086, standard error: 0.024, as reported in Table 3).

However, a lower magnitude does not necessarily mean that our IV estimate of the negative effect of informal care on cognitive functioning in the main analysis is over-estimated. Indeed, the potential bias of the IV estimate due to sample selection also depends on the first stage coefficient estimate obtained from the full sample, and thus on the actual amount of informal care provided by co-resident children (which is not observed in our data as the SHARE question refers to the amount of care provided by children outside the household). If children living with the parents, who in our sample are more likely to be sons than daughters (i.e. the probability to live with a child is negatively correlated with the proportion of daughters), provide more informal care on average than non-co-residing children, the first-stage coefficient estimate of the proportion of daughters on informal care receipt should be attenuated when we include the parents living with at least one child in the analytical sample. Given that the IV estimate is equal to the reduced-form coefficient divided by the first stage coefficient and that those two coefficients are likely to be lower when we include parents with at least one co-resident child, the bias of the IV estimate should not play an important role in our analysis.

As an additional check, we have imputed different amounts of informal care provided by the co-resident child and found that the IV estimate from the sample that excludes parents living with at least one child equals the IV estimate of the full sample when we assume that a co-residing child provides on average 13 hours of informal care per month to the parent. If the actual average amount of informal care received from children within the household is higher, our IV estimate is underestimated; on the contrary, it is overestimated if the children living with the parents provide them with less than 13 hours per month of informal care. Unfortunately, we are not aware of studies reporting the amount of informal care provided by the co-resident children to their older parents in Europe, most likely because such a measure might be very difficult to obtain: it is hard to identify and quantify when the (potential)

caregiver and the (potential) care receiver live in the same household. Compared to the average number of hours of informal care received by all extra-resident children (Table 1 shows that, on average, 6.2 hours per month are provided by 2.5 extra-resident children), the imputed 13 hours would correspond to about five times more care received by parents from their co-residing children, which might be a plausible assumption. It thus suggests that this sample selection is not driving our results and that its impact on our main results is likely to be marginal.

## 6. Conclusion

In this paper we have investigated the causal effect of informal care provided by the children on the cognitive functioning of the receiving elderly parents using data from the Survey of Health, Ageing and Retirement in Europe. As the correlation between informal care and cognitive functioning is likely to be contaminated by reverse causality, unobserved heterogeneity, and/or attenuation bias, our analysis relies on an IV method using the gender ratio of the children as an instrument for informal care.

Our identification strategy does not allow us to draw any conclusion regarding men, given the lack of predictive power of the proportion of daughters on the receipt of informal care for fathers: reflecting the longer life expectancy of women, men are more likely to receive informal care from their spouses (Lowenthal and Haven 1968), whereas women tend to receive more help from their children (Silverstein et al. 2006). Indeed, the powerful identification strategy using the gender of the kids as a natural experiment provides us a convincing estimate of the causal effect of informal care from the children to the parent that mostly receives it, the mother. The literature has largely shown that women are more likely than men to both give and receive informal care (e.g. Brandt et al. 2009).

Results from the IV models highlight a significant negative effect of informal care on women's cognitive functioning: mothers receiving more informal care from the children perform worst in all the cognitive tests taken into account. The only exception is the orientation in time test, which, due to its low level of variability, is only useful for detecting really severe cognitive deficits (as discussed also in Engelhardt et al. 2010).

Therefore, in accordance with the use-it-or-lose-it hypothesis, we find evidence that relying more on the children in carrying daily activities of personal care, household work and paper work makes mothers more likely to perform low in cognitive tests.

We think that, in contexts of population ageing, this study brings an important key message: caregiving children, although acting with the best intentions, should take into account not only

the physical but also the psychological status of their older parents and allow them sufficient challenges in order to maintain their cognitive abilities and skills.

One straightforward continuity to this research would be to analyze whether also formal care affects cognitive functioning of older individuals in a similar way. However, we could not explore that aspect in this paper for two reasons: first, regarding formal care provided at home, we face a serious challenge of finding a proper instrument for formal home care that would satisfy the exclusion restriction; second, the survey design of SHARE does not allow observing individuals who are living in institutions[21] and thus leaves the question of the effect of institutionalization on cognitive functioning open to further research. However, we anticipate that if a negative effect on cognitive functioning also exists for formal care, we may even underestimate the true (negative) effect of informal care on cognitive functioning. Indeed, many studies have found a substitution relationship between formal and informal care (Bolin et al. 2008; Bonsang 2009; Van Houtven and Norton 2004, 2008). Furthermore, our findings are pointing to the possibility that research on the relationship between formal and informal care has provided an underestimate of the true substitution effect, given that lower cognitive functioning resulting from higher informal care may increase the demand for formal care. In this respect, this study also contributes to the literature on the relationship between formal and informal care.

[21] A selection bias, over-estimating the negative effect of informal care on cognitive functioning, may follow from this sample selection (according to the same selection mechanism as co-residence with children discussed in section 5.3.5). However, the size of the bias, if any, depends on the proportion of individuals being dropped from the sample (i.e. the institutionalised population), on the correlation between our instrument and the probability of being institutionalised and on the correlation between cognitive functioning and institutionalisation. Yet, this possible bias is unlikely to have sizable consequences on our main results. Indeed, the proportion of institutionalised individuals in Europe is small (the share of individuals aged 65 and over living in institutions ranges between 1.5% in Italy and 7.5% in Sweden in 2004 (OECD 2006). Furthermore the literature about the effect of having daughters on the probability of nursing home entry is mixed and inconsistent (e.g. Grundy and Jitlal 2007), suggesting that, if any, the correlation between the share of daughters and the likelihood of institutionalisation should be low.

**Aknowledgment**

The authors are grateful to Rob Alessie, Raymond Montizaan, Vegard Skirbekk, Olga Skriabikova, Agnese Vitali for their precious comments on previous versions of this paper. We also would like to thank the participants to the Italian SHARE Users' Conference (Venice, 2012), to the British Society for Population Studies Annual Conference (Nottingham, 2012) and to the Netspar Pension Day (Utrecht, 2012), as well as the seminar participants at Università Ca' Foscari (Venice, 2012), Maastricht University (Maastricht, 2012), Ludwig Maximilian University of Munich (January 2013) and the University of Bonn (January 2013).

**References**


Albert, S.M., Glied, S., Andrews, H., Stern, Y., & Mayeux, R. (2002). Primary care expenditures before the onset of Alzheimer's disease. *Neurology*, 59(4), 573-578.

Albertini, M., Kohli, M., & Vogel, C. (2007). Intergenerational transfers of time and money in European families: common patterns different regimes? *Journal of European Social Policy*, 17(4), 319-334.

Almond, D., & Edlund, L. (2007). Trivers-Willard at birth and one year: Evidence from U.S. natality data 1983– 2001. *Proceedings of the Royal Society B: Biological Sciences,* 247(1624), 2491–2496.

Antonucci, T.C. (1990). Social supports and social relationships. In R.H. Binstock and L.K. George (Eds.), *Handbook of aging and the social sciences* (3rd edition) (pp. 205-226). San Diego, CA: Academic Press.

Arber, S., & Ginn, J. (1993). Gender and inequalities in health in later life. *Social Science and Medicine*, 36(1), 33-46.

Attias-Donfut, C., Ogg, J., & Wolff, F.-C. (2005a). European patterns of intergenerational financial and time transfers. *European Journal of Ageing*, 2(3), 161-173.

Attias-Donfut, C., Ogg, J., & Wolff, F.-C. (2005b). Family support. In A. Börsch-Supan, A. Brugiavini, H. Juerges, J. Mackenbach, J. Siegriest, & G. Weber (Eds.), *Health, ageing and retirement in Europe. First results from the Survey of Health, Ageing and Retirement in Europe* (pp. 171-178). Mannheim: Mannheim Research Institute of the Economics of Aging.

Bengtson, V.L., & Kuypers, J.A. (1986). The family support cycle: Psycho-social issues in the aging family. In J.M.A. Munnichs, P. Mussen, & E. Olbrich (Eds.), *Life span and change in a gerontological perspective* (pp. 61-77). New York: Academic Press.

Berkman, L.F., Glass, T., Brissette, I., & Seeman, T.E. (2000). From social integration to health: Durkheim in the new millennium. *Social Science & Medicine*, 51(6), 843-857.

Betzig, L., & Weber, S. (1995). Presidents preferred sons. *Politics and the Life Sciences,* 14(1), 61-64.

Blome, A., Keck, W., & Alber, J. (Eds.). (2009). *Family and the welfare state in Europe. Intergenerational relations in ageing societies*. Cheltenham, UK and Northampton, MA, USA: Edward Elgar.

Bolin, K., Lindgren, B., & Lundborg, P. (2008). Informal and formal care among single-living elderly in Europe. *Health Economics*, 17(3), 393-409.

Bonsang, E. (2009). Does informal care from children to their elderly parents substitute for formal care in Europe? *Journal of Health Economics*, 28(1), 143-154.

Bonsang, E., Adam, S., & Perelman, S. (2012). Does retirement affect cognitive functioning? *Journal of Health Economics*, 31(3), 490-501.

Bordone, V. (2009). Contact and proximity of older people to their adult children: A comparison between Italy and Sweden. *Population, Space and Place*, 15(4), 359-380.

Börsch-Supan, A., Brugiavini, A., Jürges, H., Kapteyn, K., Mackenbach, J., Siegrist, J., & Weber, G. (2008). *Health, ageing and retirement in Europe (2004-2007). Starting the longitudinal dimension*. Mannheim: Mannheim Research Institute for the Economics of Aging (MEA).

Börsch-Supan, A., Brugiavini, A., Jürges, H., Mackenbach, J., Siegrist, J., & Weber, G. (2005). *Health, ageing and retirement in Europe – First results from the Survey of Health, Ageing and Retirement in Europe*. Mannheim: Mannheim Research Institute for the Economics of Aging (MEA).

Börsch-Supan, A., & Jürges, H. (Eds.). (2005). *The Survey of Health, Ageing and Retirement in Europe – Methodology*. Mannheim: Mannheim Research Institute for the Economics of Aging (MEA).

Börsch-Supan, A., & Jürges, H. (2008). The development process: Going longitudinal and including new countries. In A. Börsch-Supan et al. (Eds.), *Health, Ageing and Retirement in Europe (2004-2007) - Starting the longitudinal dimension* (pp. 314-315). Mannheim: Mannheim Research Institute for the Economics of Aging (MEA).

Bound, J., Jaeger, D.A., & Baker, R.M. (1995). Problems with instrumental variables estimation when the correlation between the instruments and the endogenous explanatory variable is weak. *Journal of the American Statistical Association*, 90(430), 443–450.

Brandt, M., Haberkern, K., & Szydlik, M. (2009). Intergenerational help and care in Europe. *European Sociological Review*, 25(5), 585-601.

Brown, W.M., Consedine, N.S., & Magai, C. (2005). Altruism relates to health in an ethnically diverse sample of older adults. *Journal of Gerontology: Psyological Science*, 60B(3), 143-152.

Burgess, E.W. (1960). Aging in western culture. In E.W. Burgess (Ed.), *Aging in Western societies* (pp. 3-28). Chicago: University of Chicago Press.

Charles, K.K., & Sevak P. (2005). Can family caregiving substitute for nursing home care? *Journal of Health Economics*, 24(6), 1174-1190.

Cohen, S. (2004). Social relationships and health. *American Psychologist*, 59(8), 676–684.

Diekmann, A., & Schmidheiny, K. (2004). Do parents of girls have a higher risk of divorce? An eighteen-country study. *Journal of Marriage and Family*, 66(3), 651–660.

Eisele et al. (2012). Influence of social support on cognitive change and mortality in old age: results from the prospective multicentre cohort study AgeCoDe. *BMC Geriatrics,* 12(9), 1-13.

Engelhardt, H., Buber, I., Skirbekk, V., & Prskawetz, A. (2010). Social engagement, behavioural risks and cognitive functioning among the aged. *Ageing & Society*, 30(5), 779-809.

Ernst, R.L., & Hay J.W. (1997). Economic research on Alzheimer disease: a review of the literature. *Alzheimer Disease and Associated Disorders*, 11 Suppl. 6, 135-145.

Ertel, K.A., Glymour, M.M., & Berkman, L.F. (2008). Effects of social integration on preserving memory function in a naturally representative US elderly population. *American Journal of Public Health, 98*(7), 1215-1220.

Fingerman, K.L., Pitzer, L.M., Chan, W., Birditt, K., Franks, M.M., & Zarit, S. (2011). Who gets what and why? Help middle-aged adults provide to parents and grown children. *Journal of Gerontology: Social Sciences*, 66B(1), 87-98.

Finkel, E.J., Campbell, W.K., Brunell, A.B., Dalton, A.N., Scarbeck, S.J., & Chartrand, T.L. (2006). High maintenance interaction: Inefficient coordination impairs self-regulation. *Journal of Personality and Social Psychology*, 91(3), 456-475.

Fokkema, T., de Valk, H., de Beer, J., & van Duin, C. (2008). The Netherlands: Childbearing within the context of a "Poldermodel" society. *Demographic Research,* 19(21), 743-794.

Fratiglioni, L., Paillard-Borg, S., & Winblad, B. (2004). An active and socially integrated lifestyle in late life might protect against dementia. *Lancet Neurology,* 3(6), 343-353.

Gerstel, N., & Gallagher, S.K. (1993). Kin keeping and distress: Gender, recipients of care, and work-family conflict. *Journal of Marriage and Family*, 55(3), 598-607.

Glymour, M.M., Kawachi, I., Jencks, C.S., & Berkman, L.F. (2008). Does childhood schooling affect old age memory or mental status? Using state schooling laws as natural experiments. *Journal of Epidemiology and Community Health*, 62(6), 532-537.

Grundy E., & Jitlal, M. (2007). Socio-demographic variations in moves to institutional care 1991–2001: a record linkage study from England and Wales. *Age and Ageing*, 36(4), 424-430.

Hank, K. (2007). Proximity and contacts between older parents and their children: A European comparison. *Journal of Marriage and Family*, 69(1), 157-173.

Horowitz, A. (1985). Family caregiving to the frail elderly. *Annual Review of Gerontology and Geriatrics*, 5(1), 194-246.

Hultsch, D.F., Hertzog, C., Small, B.J., & Dixon, R.A. (1999). Use it or lose it: Engaged lifestyle as a buffer of cognitive decline in aging? *Psychology and Aging*, 14(2), 245–263.

Kanazawa, S. (2005). Big and tall parents have more sons: further generalizations of the Trivers–Willard hypothesis. *Journal of Theoretical Biology,* 235, 583–590.

Katz, S.J., Kabeto, M., & Langa, K.M. (2000). Gender disparities in the receipt of home care for elderly people with disability in the United States. *Journal of the American Medical Association,* 284(23), 3022–3027.

Katz, S.J., Down, T.D., Cash, H.R., et al. (1970). Progress in the development of the index of ADL. *Gerontologist,* 10(1), 20-30.

Katzev, A.R., Warner, R.L., & Acock, A.C. (1994). Girls or boys - Relationship of child gender to marital instability. *Journal of Marriage and the Family,* 56(1), 89-100.

Kaufman, G., & Uhlenberg, P. (1998). Effects of life course transitions on the quality of relationships between adult children and their parents. *Journal of Marriage and the Family*, 60(4), 924-938.

Krause, N., Herzog, A.R., & Baker, E. (1992). Providing support to others and well-being in later life. *Journal of Gerontology: Psychological Sciences,* 47(5), 300-311.

Kuypers, J.A., & Bengtson, V.L. (1973). Social breakdown and competence: A model of normal aging. *Human Development,* 16(3), 181-201.

Langer, E.J., & Rodin, J. (1976). The effects of choice and enhanced personal responsibility for the aged. A field experiment in an institutional setting. *Journal of Personality and Social Psychology*, 34(2), 191-198.

Lawton, L., Silverstein, M., & Bengtson, V.L. (1994). Affection, social contact and geographic distance between adult children and their parents. *Journal of Marriage and the Family*, 56(1), 57-68.

Lee, G.R., Netzer, J.K., & Coward, R.T. (1995). Depression among older parents—the role of intergenerational exchange. *Journal of Marriage and the Family*, 57(3), 823–833.

Lo Sasso, A.T., & Johnson, R.W. (2002). Does informal care from adult children reduce nursing home admissions for the elderly? *Inquiry*, 39(3), 279-297.

Lowenthal, M.J., & Haven, C. (1968). Interaction and adaptation: intimacy as a critical variable. *American Sociological Review*, 33(1), 20-30.

Lundberg, S. (2005a). The division of labour by new parents: Does child gender matters? IZA Discussion Paper No. 1787.

Lundberg, S. (2005b). Sons, daughters, and parental behaviour. *Oxford Review of Economic Policy*, 21(3), 340-356.

Lyketsos, C.G., Lopez, O., Jones, B., Fitzpatrick, A.L., Breitner, J., DeKosky, S. (2002). Prevalence of neuropsychiatric symptoms in dementia and mild cognitive impairment. *Journal of the American Medical Association*, 288(12), 1475-1483.

Mazzonna, F., & Peracchi, F. (2012). Aging, cognitive abilities and retirement. *European Economic Review*, 56(4), 691-710.

Morgan, S.P., Lye, D., & Condron, G. (1988). Sons, daughters and the risk of marital disruption. *American Journal of Sociology*, 94(1), 110-129.

Mueller, U. (1993). Social status and sex. *Nature* 363, 490.

Nauck, B. (2009). Patterns of exchange in kinship systems in Germany, Russia, and the People's Republic of China. *Journal of Comparative Family Studies*, 40(2), 255-278.

Norton, E.C. (2000). Long-term Care. In A.J. Culyer & J.P. Newhouse (Eds.), *Handbook of Health Economics* (pp. 956–994). New York: Elsevier Science B.V.

OECD (1999). *Classifying educational programmes. Manual for ISCED-97 implementation in OECD countries*. Paris: OECD Publishing.

OECD (2006). *Society at a glance. OECD Social Indicators.* Paris: OECD Publishing.

Parsons, T., & Bales, R.F. (1955). *Family, socialization and interaction process*. Glencoe, ILL.: Free Press.

Pennix, B.W., Guralnik, J.M., Ferrucci, L., Simonsick, E.M., Deeg, D.J., & Wallace, R.B. (1998). Depressive symptoms and physical decline in community-dwelling older persons. *Journal of American Medical Association*, 279, 1720–1726.

Richeson, J.A., & Trawalter, S. (2005). Why do interracial interactions impair executive function? A resource depletion account. *Journal of Personality and Social Psychology*, 88(6), 934-947.

Richeson, J.A., Trawalter, S., & Shelton, N.J. (2005). African Americans' implicit racial attitudes and the depletion of executive function after interracial interactions. *Social Cognition*, 23(4), 336-352.

Rohwedder, S., & Willis, R.J. (2010). Mental retirement. *Journal of Economic Perspectives*, 24(1), 1-20.

Rossi, A.S. (1993). Intergenerational relations: Gender, norms, and behavior. In V.L. Bengtson, & W.A. Achenbaum (Eds.), *The changing contract across generations* (pp. 191-211). Hawthorne, NY: Aldine de Gruyter.

Salthouse, T.A. (2006). Mental exercise and mental aging: Evaluating the validity of the use it or lose it hypothesis. *Perspectives on Psychological Science*, 1(1), 68-87.

Searle, M.S., Mahon, M.J., Iso-Ahola, S.E., Sdrolias, H.A., & van Dyck, J. (1995). Enhancing a sense of independence and psychological well-being among the elderly: a field experiment. *Journal of Leisure Research*, 27(2), 107-124.

Seeman, T.E., Bruce, M.L., & McAvay, G. (1996). Social network characteristics and onset of ADL disability: MacArthur studies of successful aging. *Journal of Gerontology Series B: Psychological Sciences and Social Sciences*, 51B(4), 191-200.

Seeman, T.E. & Crimmins, E. (2001). Social environment effects on health and aging: integrating epidemiologic and demographic approaches and perspectives. *Annals of the New York Academy of Sciences*, 954, 88–117.

Seligman, M.E.P. (1974). Depression and learned helplessness. In R.J. Friedman, & M.M. Katz (Eds.), *The psychology of depression: Contemporary theory and research* (pp 83-107). New York: Halstead Press.

Shanas, E., Townsend, P., Wedderburn, D., Friis, H., Milhoj, P., & Stehouwer, J. (1968). *Old people in three industrial societies.* New York: Atherton Press.

Shyu, Y. et al. (2006). Psychometric testing of the social support survey on a Taiwanese sample. *Nursing Research*, 55(6), 411-417.

Silverstein, M., & Bengtson, V.L. (1994). Does intergenerational social support influence the psychological well-being of older parents? The contingencies of declining health and widowhood. *Social Science and Medicine*, 38(7), 943-957.

Silverstein, M., Chen, X., & Heller, K. (1996). Too much of a good thing? Intergenerational social support and the psychological well-being of older parents. *Journal of Marriage and Family*, 58, 970-982.

Silverstein, M., Gans, D., Lowenstein, A., Giarrusso, R. et al. (2010). Older parent - child relationships in six developed nations: Comparisons at the intersection of affection and conflict. *Journal of Marriage and Family*, 72(4), 1006–1021.

Sloan, F.A., Picone, G., & Hoerger, T.J. (1997). The supply of children's time to disabled elderly parents. *Economic Inquiry*, 35(2), 295-308.

Sorenson, H. (1938). *Adult abilities.* Minneapolis: University of Minnesota Press.

Spitze, G., & Logan, J.R. (1990). Sons, daughters and intergenerational social support. *Journal of Marriage and Family*, 52(2), 420-430.

Sugisawa, H., Liang, J., & Liu, X. (1994). Social networks, social support and mortality among older people in Japan. *Journal of Gerontology*, 49(1), S3-13.

Sussman, M.B. (1953). The help pattern in the middle class family. *American Sociological Review*, 18, 22-28.

Tabert, M.H., Albert, S.M., Borukhova-Milov, L., Camacho, Y., Pelton, G., Liu, X., Stern, Y., & Devanand, D.P. (2002). Functional deficits in patients with mild cognitive impairment: Prediction of AD. *Neurology*, 58(5), 758-764.

Tomassini, C., Wolf, D.A., & Rosina, A. (2003). Parental housing assistance and parent-child proximity in Italy. *Journal of Marriage and Family*, 65(3), 700-715.

Trivers, R.L., & Willard, D.E. (1973). Natural selection of parental ability to vary the sex ratio of offspring. *Science*, 179(4068), 90-92.

Van Houtven, C.H., & Norton, E.C. (2004). Informal care and health care use of older adults. *Journal of Health Economics*, 23(6), 1159-1180.

Van Houtven, C.H., & Norton, E.C. (2008). Informal care and Medicare expenditures: testing for heterogeneous treatment effects. *Journal of Health Economics*, 27(1), 134-156.

Walker, A.J., Pratt, C.C., & Eddy, L. (1995). Informal caregiving to aging family members: A critical review. *Family Relations*, 44(4), 402–411

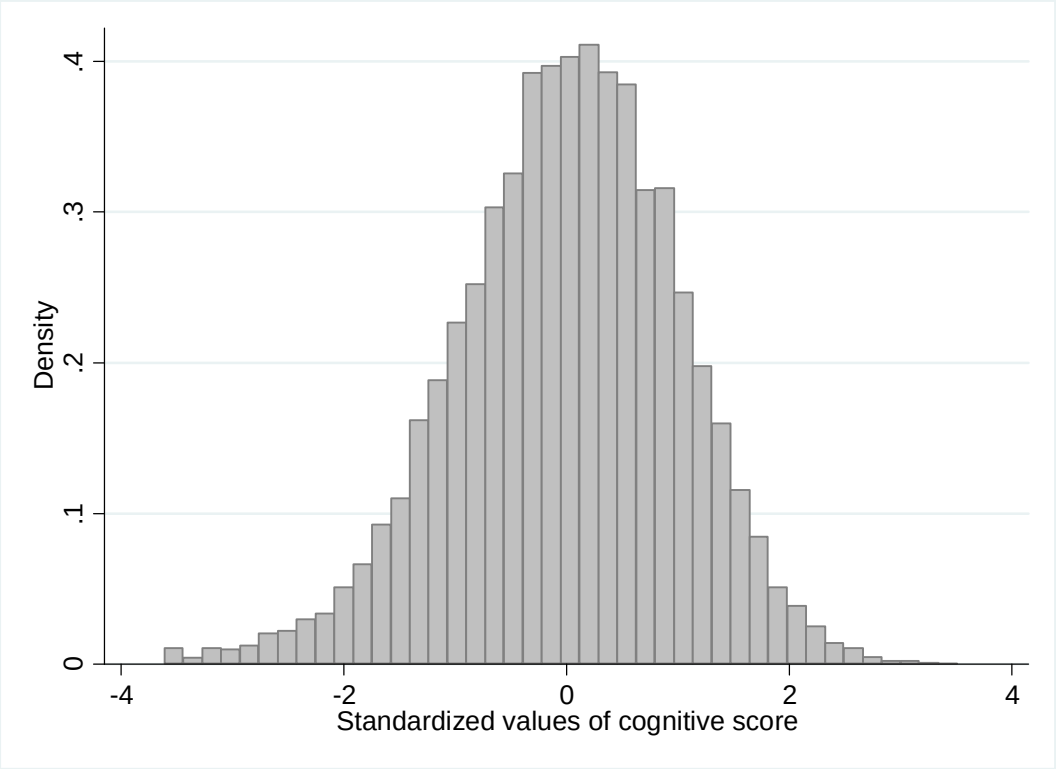
Wolff, J.L., & Agree, E.M. (2004). Depression among recipients of informal care: The effects of reciprocity, respect, and adequacy of support. *Journal of Gerontology Social Sciences*, 59B(3), S173-S180.

Yi, C., & Farrell, M. (2006). Globalization and the intergenerational relation: Cross-cultural perspectives on support and interaction patterns. *Journal of Family Issues*, 27, 1035-1041.

Zunzunegui M., Alvarado B.E., Ser T., & Otero A. (2003). Social networks, social integration, and social engagement determine cognitive decline in community-dwelling Spanish older adults. *Journal of Gerontology*, 58B(2), S93–100.

**FIGURES**

**Figure 1. Density of the cognitive score.**




Source: SHARE 2004/2006, release 2.5. Authors' calculations.

## TABLES

### Table 1: Descriptive statistics

| | All | AT | BE | CZ | DK | FR | DE | EL | IT | NL | PL | ES | SE | CH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Immediate word recall test | 4.4 | 4.8 | 4.4 | 4.5 | 4.9 | 4.1 | 5.0 | 4.0 | 3.7 | 4.8 | 3.5 | 3.1 | 4.8 | 4.7 |
| Delayed word recall test | 2.9 | 3.2 | 2.7 | 2.7 | 3.5 | 2.6 | 3.3 | 2.5 | 2.2 | 3.3 | 2.0 | 1.8 | 3.4 | 3.3 |
| Fluency test | 17.0 | 18.9 | 17.9 | 16.4 | 19.3 | 17.2 | 18.9 | 12.6 | 12.6 | 18.0 | 13.2 | 13.0 | 20.7 | 18.5 |
| Numeracy test | 3.2 | 3.5 | 3.1 | 3.3 | 3.3 | 3.0 | 3.5 | 2.9 | 2.7 | 3.5 | 2.6 | 2.2 | 3.5 | 3.6 |
| Orientation test | 3.7 | 3.8 | 3.7 | 3.7 | 3.7 | 3.7 | 3.8 | 3.8 | 3.7 | 3.8 | 3.7 | 3.5 | 3.8 | 3.8 |
| Informal care received (hours / month) | 6.2 | 5.3 | 4.9 | 15.3 | 3.2 | 4.9 | 6.6 | 12.6 | 8.5 | 1.5 | 10.2 | 9.5 | 2.5 | 2.0 |
| Proportion of daughters | 50.4% | 50.2% | 49.8% | 52.6% | 50.4% | 49.4% | 51.7% | 49.1% | 51.4% | 50.7% | 48.2% | 50.2% | 50.1% | 51.4% |
| Gender (woman=1) | 54.5% | 59.5% | 54.7% | 56.8% | 56.2% | 58.7% | 51.9% | 58.9% | 51.7% | 50.7% | 52.3% | 53.3% | 50.8% | 55.2% |
| Age | 73.7 | 73.0 | 73.8 | 73.5 | 74.3 | 74.2 | 72.4 | 74.8 | 73.0 | 73.3 | 73.4 | 73.9 | 73.9 | 74.8 |
| Years of education | 9.1 | 9.0 | 9.8 | 11.2 | 11.6 | 8.4 | 12.2 | 6.1 | 6.1 | 10.2 | 7.7 | 5.4 | 9.7 | 10.3 |
| Born abroad | 7.0% | 8.4% | 6.8% | 5.5% | 2.7% | 12.1% | 18.5% | 2.1% | 1.4% | 4.6% | 3.5% | 1.1% | 6.6% | 14.9% |
| Single household | 29.7% | 43.0% | 29.8% | 38.1% | 38.2% | 35.4% | 21.6% | 41.2% | 20.1% | 24.8% | 22.6% | 18.0% | 25.8% | 34.1% |
| # mobility limitations | 2.0 | 2.0 | 1.9 | 2.3 | 1.5 | 2.0 | 2.0 | 2.7 | 2.5 | 1.4 | 3.9 | 2.5 | 1.5 | 1.2 |
| # ADL limitations | 0.3 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 | 0.8 | 0.3 | 0.2 | 0.1 |
| Heart disease | 18.9% | 14.9% | 20.2% | 24.5% | 15.6% | 21.1% | 18.2% | 18.5% | 16.1% | 15.9% | 31.1% | 14.5% | 24.7% | 11.4% |
| Stroke | 5.4% | 4.6% | 5.1% | 7.7% | 7.1% | 4.7% | 5.3% | 4.7% | 4.7% | 5.7% | 8.5% | 2.6% | 6.7% | 4.0% |
| Diabetes | 13.2% | 11.3% | 10.7% | 19.8% | 9.6% | 10.9% | 16.5% | 14.2% | 16.7% | 11.7% | 14.0% | 19.5% | 11.2% | 7.9% |
| # children | 2.5 | 2.3 | 2.6 | 2.0 | 2.6 | 2.5 | 2.3 | 2.2 | 2.4 | 2.9 | 2.8 | 2.8 | 2.5 | 2.5 |
| Second time interview | 35.2% | 45.3% | 42.7% | 0.0% | 33.1% | 36.0% | 33.4% | 42.6% | 38.4% | 38.9% | 0.0% | 34.5% | 37.9% | 34.2% |
| Number of observations | 19,674 | 1,104 | 2,371 | 906 | 1,444 | 1,913 | 1,968 | 1,710 | 1,545 | 1,808 | 598 | 1,307 | 2,217 | 783 |

Source: SHARE 2004/2006, release 2.5. Authors' calculations.

**Table 2. Determinants of cognitive functioning among individuals aged 65 or over. OLS estimate.**

| | Cognitive score | |
|---|---|---|
| | Men | Women |
| Hours of informal care from the children per month/10 | -0.008† | -0.011*** |
| | (0.004) | (0.003) |
| Age | -0.039*** | -0.042*** |
| | (0.002) | (0.002) |
| Years of education | 0.067*** | 0.072*** |
| | (0.002) | (0.002) |
| Born abroad | -0.179*** | -0.102** |
| | (0.039) | (0.033) |
| Single household | -0.052† | -0.106*** |
| | (0.027) | (0.019) |
| # mobility limitations | -0.049*** | -0.029*** |
| | (0.006) | (0.004) |
| # ADL limitations | -0.104*** | -0.139*** |
| | (0.018) | (0.013) |
| Heart disease | -0.005 | 0.013 |
| | (0.022) | (0.024) |
| Stroke | -0.255*** | -0.199*** |
| | (0.041) | (0.044) |
| Diabetes | -0.068** | -0.116*** |
| | (0.026) | (0.026) |
| Number of children | -0.004 | 0.001 |
| | (0.007) | (0.007) |
| Second time interview | 0.126*** | 0.102*** |
| | (0.015) | (0.014) |
| Constant | 2.509*** | 2.674*** |
| | (0.123) | (0.118) |
| Country fixed-effects | yes | yes |
| $R^2$ | 0.386 | 0.425 |
| N | 8,960 | 10,714 |

Source: SHARE 2004/2006, release 2.5. Authors' calculations. Note: Robust standard errors clustered at the individual level are in parentheses. (†), (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1%, 0.1% levels, respectively.

**Table 3. IV estimate of the effect of informal care from the children on cognitive functioning of the parents.**

| | First stage | Reduced form | 2SLS |
|---|---|---|---|
| | | Men | |
| Hours of informal care from the children per month/10 | - | - | 0.079 |
| | | | (0.200) |
| Share of daughters | 0.126† | 0.010 | - |
| | (0.068) | (0.025) | |
| Control variables | yes | yes | yes |
| F-test of excluded instrument | | | 3.43 |
| N | 8,960 | 8,960 | 8,960 |
| | | Women | |
| Hours of informal care from the children per month/10 | - | - | -0.202** |
| | | | (0.070) |
| Share of daughters | 0.426*** | -0.086*** | - |
| | (0.090) | (0.024) | |
| Control variables | yes | yes | yes |
| F-test of excluded instrument | | | 22.66 |
| N | 10,714 | 10,714 | 10,714 |

Source: SHARE 2004/2006, release 2.5. Authors' calculations. Note: Robust standard errors clustered at the individual level are in parentheses. (†), (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1%, 0.1% levels, respectively. The control variables are the same as Table 2.

**Table 4. IV estimate of the effect of informal care from the children on different cognitive test scores of the parents.**

| | 2SLS | | | | |
|---|---|---|---|---|---|
| | Immediate word recall | Delayed word recall | Fluency test | Numeracy | Orientation test |
| | Men | | | | |
| Hours of informal care from the children per month/10 | 0.040 | -0.138 | -0.065 | 0.362 | 0.185 |
| | (0.219) | (0.242) | (0.220) | (0.294) | (0.262) |
| Control variables | yes | yes | yes | yes | yes |
| Number of observations | 8,960 | 8,960 | 8,960 | 8,960 | 8,960 |
| | Women | | | | |
| Hours of informal care from the children per month/10 | -0.180** | -0.209** | -0.124* | -0.128* | -0.064 |
| | (0.069) | (0.074) | (0.063) | (0.065) | (0.064) |
| Control variables | yes | yes | yes | yes | yes |
| Number of observations | 10,714 | 10,714 | 10,714 | 10,714 | 10,714 |

Source: SHARE 2004/2006, release 2.5. Authors' calculations. Note: Robust standard errors clustered at the individual level are in parentheses. (†), (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1%, 0.1% levels, respectively. The control variables are the same as Table 2.

**Table 5. IV estimate of the effect of informal care from the children on cognitive functioning of the parents. Alternative instrument.**

| | First stage | Reduced form | 2SLS |
|---|---|---|---|
| | | Men | |
| Hours of informal care from the children per month/10 | - | - | 0.372 |
| | | | (0.408) |
| Having at least one daughter | 0.077 | 0.029 | - |
| | (0.061) | (0.022) | |
| Control variables | yes | yes | yes |
| F-test of excluded instrument | | | 1.63 |
| N | 8,960 | 8,960 | 8,960 |
| | | Women | |
| Hours of informal care from the children per month/10 | - | - | -0.138* |
| | | | (0.070) |
| Having at least one daughter | 0.334*** | -0.046* | - |
| | (0.072) | (0.022) | |
| Control variables | yes | yes | yes |
| F-test of excluded instrument | | | 21.31 |
| N | 10,714 | 10,714 | 10,714 |

Source: SHARE 2004/2006, release 2.5. Authors' calculations. Note: Robust standard errors clustered at the individual level are in parentheses. (†), (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1%, 0.1% levels, respectively. The control variables are the same as Table 2.

## APPENDIX

**Table A1. Association between the proportion of daughters and the explanatory variables among individuals aged 65 or over. OLS estimate.**

| | Proportion of daughters | |
|---|---|---|
| | Men | Women |
| Age | 0.000 | 0.001 |
| | (0.001) | (0.001) |
| Years of education | -0.002 | -0.001 |
| | (0.001) | (0.001) |
| Born abroad | -0.007 | -0.020 |
| | (0.018) | (0.017) |
| Single household | -0.004 | -0.002 |
| | (0.014) | (0.009) |
| # mobility limitations | -0.001 | -0.002 |
| | (0.003) | (0.002) |
| # ADL limitations | -0.008 | -0.002 |
| | (0.006) | (0.005) |
| Heart disease | -0.000 | -0.001 |
| | (0.010) | (0.011) |
| Stroke | 0.017 | -0.005 |
| | (0.017) | (0.017) |
| Diabetes | 0.004 | 0.009 |
| | (0.013) | (0.012) |
| Number of children | -0.005 | -0.000 |
| | (0.003) | (0.003) |
| Second time interview | 0.002 | -0.008 |
| | (0.005) | (0.005) |
| Constant | 0.531*** | 0.481*** |
| | (0.060) | (0.055) |
| Country fixed-effects | yes | yes |
| $R^2$ | 0.002 | 0.002 |
| "Overall" F-test (p-value) | 0.795 | 0.917 |
| N | 8,960 | 10,714 |

Source: SHARE 2004/2006, release 2.5. Authors' calculations. Note: Robust standard errors clustered at the individual level are in parentheses. (†), (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1%, 0.1% levels, respectively.

**Table A2. IV estimate of the effect of informal care from the children on cognitive functioning of the parents, excluding the control variables except for country fixed effects.**

| | First stage | Reduced form | 2SLS |
|---|---|---|---|
| | | Men | |
| Hours of informal care from the children per month/10 | - | - | 0.025 |
| | | | (0.264) |
| Share of daughters | 0.114 | 0.003 | - |
| | (0.070) | (0.030) | |
| Socio-demographic and health-related variables | no | no | no |
| Country fixed effects | yes | yes | yes |
| F-test of excluded instrument | | | 2.65 |
| N | 8,960 | 8,960 | 8,960 |
| | | Women | |
| Hours of informal care from the children per month/10 | - | - | -0.225** |
| | | | (0.080) |
| Share of daughters | 0.419*** | -0.094** | - |
| | (0.092) | (0.030) | |
| Socio-demographic and health-related variables | no | no | no |
| Country fixed effects | yes | yes | yes |
| F-test of excluded instrument | | | 20.57 |
| N | 10,714 | 10,714 | 10,714 |

Source: SHARE 2004/2006, release 2.5. Authors' calculations. Note: Robust standard errors clustered at the individual level are in parentheses. (†), (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1%, 0.1% levels, respectively.

**Table A3. Determinants of cognitive functioning among individuals aged 50 to 64. OLS estimate.**

| | Cognitive score | |
|---|---|---|
| | Men | Women |
| Age | -0.010*** | -0.009*** |
| | (0.002) | (0.002) |
| Years of education | 0.067*** | 0.074*** |
| | (0.002) | (0.002) |
| Born abroad | -0.301*** | -0.288*** |
| | (0.028) | (0.026) |
| Single household | -0.116*** | -0.083*** |
| | (0.028) | (0.021) |
| # mobility limitations | -0.038*** | -0.039*** |
| | (0.006) | (0.004) |
| # ADL limitations | -0.070** | -0.028 |
| | (0.024) | (0.020) |
| Heart disease | -0.029 | -0.077** |
| | (0.025) | (0.029) |
| Stroke | -0.254*** | -0.185*** |
| | (0.058) | (0.055) |
| Diabetes | -0.019 | -0.074** |
| | (0.026) | (0.026) |
| Number of children | -0.017* | -0.016* |
| | (0.007) | (0.006) |
| Second time interview | 0.106*** | 0.109*** |
| | (0.013) | (0.011) |
| Working | 0.136*** | 0.104*** |
| | (0.017) | (0.015) |
| Living with at least one child | -0.002 | -0.028† |
| | (0.016) | (0.015) |
| Proportion of daughters | -0.029 | -0.023 |
| | (0.020) | (0.018) |
| Constant | 0.227† | 0.209† |
| | (0.126) | (0.110) |
| Country fixed-effects | yes | yes |
| $R^2$ | 0.286 | 0.343 |
| N | 12,139 | 15,038 |

Source: SHARE 2004/2006, release 2.5. Authors' calculations. Note: Robust standard errors clustered at the individual level are in parentheses. (†), (*), (**), (***) mean that the coefficient estimate is significantly different from zero at the 10%, 5%, 1%, 0.1% levels, respectively.