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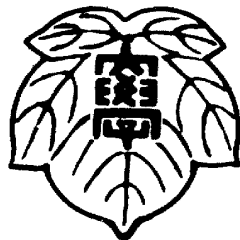
Impact of informal care on well-being of caregivers:  
A cross-national comparison in Europe and Japan

By  
Saki Sugano

(Daito Bunka University)

Discussion Paper No. 19-2, July 2019

Institute of Economic Research  
Faculty of Economics



大東文化大学

DAITO BUNKA UNIVERSITY

TOKYO, JAPAN 175-8571

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大東文化大学経済研究所  
175-8571 東京都板橋区高島平 1-9-1

This paper presents preliminary findings and may be distributed not only to fellow members at the IER or the Faculty of Economics, Daito Bunka University but also to other interested readers exclusively to stimulate discussion and elicit comments.

# Impact of informal care on well-being of caregivers: A cross-national comparison in Europe and Japan

Saki Sugano

Department of Economics  
Daito Bunka University  
sugano@ic.daito.ac.jp

## Abstract

This paper aims to explore the causal effects of providing informal care to parent on the psychological well-being or mental health of caregivers. Using the comparable panel data sets of European countries and Japan, this study considers cross-national variations of informal long-term care on well-being. Although it has been recently recognized that informal care may cause burnout and stress but the differences of the size of impacts by the cross national context has been little studied. Comparing institutional differences in long-term care and family-related cultural norms for these countries, this study analyzes the impact of informal caregiving on the mental health of caregivers according to a north-south gradient in Europe and Asian culture in Japan. The econometric estimates using the instrumental variables show that the matter is time devoting for informal care, not whether or not to provide informal care. People in northern European country with generous long-term care system tend to devote a short amount of time to informal caregiving, and the mental health even improve by providing care. However people in central and southern European countries with less generous public system devote twice or triple hours to provide care and intensive informal care-giving has a significantly negative effect on the mental health scores of informal care-givers. This study also found that Japan is similar to central European countries in terms of generosity of long-term care system, caregiving hours and its effect on mental health.

Keywords: SHARE, JSTAR, cross-national, informal caregiving, well-being, mental health

## 1 Introduction

Japan is first on the list of countries with aging populations, and Italy, Germany and other European countries are not far behind. Such countries face the challenge of ever increasing numbers of sick and disabled elderly people needing care and help. Many are helped by family members, such as spouses and adult children. They also utilize professional care, which is often government-subsidized. The former provision of assistance is called informal care while the latter is called formal care. Although informal care provided by

family and friends is valuable and brings great reward and satisfaction, it often involves considerable time, reductions on work hours, and a loss on caregivers' subjective well-being and worsen physical and mental health because of burnout and stress (Bolin et al, 2008 a; Bolin et al 2008 b; Bonsang 2009; Brenna and Di Novi, 2016; Coe and Van Houtven, 2009; Colombo et al., 2011; Do et al., 2015; Leigh, 2010; Oshio, 2014; Oshio, 2015; Sugawara and Nakamura., 2015; Schulz and Sherwood, 2008; Van den Berg and Ferrer-i-Carbonell, 2007; Van den Berg et al., 2014;).

In step of the aging of the population in many European countries and Japan, formal long-term care (LTC) systems have been created in 1990s and 2000s. Since the main provider of care for frail elderly are the family member for many decades, it is involved with different cultural norms on the responsibility of family for the elderly care (familialism) and government LTC policy in each country. While in some countries, people might have thought that family should care for their elderly parents and LTC is supplement to this, in other countries, many people consist that government should be mainly responsible for providing care and LTC should reduce the burden of informal care. The LTC policies also have geographical variation in Europe and also in Asian countries. Many studies suggest there are north-south differences in Europe as regards familialistic attitudes and LTC policy. In Northern European countries, individualistic values and public responsibility norms are dominant, but in Southern Europe, familialism and duty as a daughter/son prevails. (Kalmijn and Saraceno, 2008; Bolin et al., 2008a; Geerts and Van den Bosch, 2011) These norms may in part be reflected in the development of the public LTC system in each country. The public long-term care finance as a share of GDP in Graph 1 also shows north-south gradients in generosity of LTC system. Colombo et al. (2011) notes that Northern European countries (Sweden, Finland, Denmark, and the Benelux countries) allocate more funding to LTC than would be expected in proportion their elderly populations, while in Southern countries (Portugal, Hungary, Spain) allocate significantly less except for Italy which is in the higher position. Central Europe (Germany, Austria, France, Belgium and Switzerland) and Japan are in the middle. Private households' out-of-pocket expenditures on LTC also vary across countries. In Switzerland, Portugal, Germany,

and Spain, 30% or more of total LTC expenditures are paid out-of-pocket, while in the Netherlands, Iceland, Belgium, France, and Sweden, people pay only about 0 to 1 % (Colombo et al., 2011). In fact, the above classification of LTC care regimes by Simonnazi (2009) is largely consistent with the geographic groupings. In Northern European countries, people in general expect the state to take responsibility for financing LTC, but in Southern European countries, this expectation is not so high. Japan is rather well known for having a strong tradition of filial obligation, as different generations of family often live together, and with duties particularly placed on the eldest son's wife towards her parents-in-law (Tsutsui et al., 2014).

Cultural characteristics about familialism or norms of family obligations and LTC policy differences shape the psychological burden of informal caregivers. Thus a question can be raised regarding whether there is a north-south gradient that effects caregivers' well-being. The hypothesis in this paper is that whether adult children in the country with generosity of LTC systems, which may reflect more state responsibility view, provide less amount of informal care to their elderly parents in need of care than those who in the country with less amount of public LTC resources, and they also feel less burden when they provide informal care because the systems are enough substitute to them.

Therefore the main goal of this paper is to examine whether the formal LTC system functions to reduce the selection into informal caregiving and, even if they select to provide informal care, the generous LTC system may relieve mental burdens on informal caregivers. First whether the decision to provide informal care varies in European countries and Japan is tested according to a north-south gradient. The intensive caregiving decision that is defined as more than 20 hours per week or almost every day caregiving is also explored. Then the causal effects of caregiving on caregiver's mental well-being are examined. One of the empirical challenges to estimate the impact of informal caregiving on caregivers is the endogenous problem. When the decision of informal caregiving is often endogenous to caregiver's health status, and reverse causality may occur between informal care and psychological health, it occurs selection bias in the OLS estimation. Recent studies address the potential endogeneity problem of informal caregiving by the instrumental

variables approaches. Coe and Van Houtven (2009; 2015) use parental health and information of siblings as the instrumental variables to estimate the causal effect of informal care on caregiver's health in United States and Korea. The other approach to aim to estimate the causal effects of informal care is the matching method (Brenna and Di Novi, 2016; Schmitz and Westphal, 2015). The matching method requires to satisfy the monotone assumption of instrumental variables, but it is not always to be valid. Let the treatment be the caregiving involvement and the instrument variable be the health of parents. If the health of parent becomes worse, the probability of informal care may increase, but formal care usage including residential care may also increase, and it may reduce the probability of informal care provision.

This study follows the methods of Coe and Van Houtven (2009; 2015) and Do et al. (2015) with instrumental variables approach and estimates the informal care provision decision and its impact on psychological well-being which may vary by cross-national differences in LTC systems. European countries and Japan included in this study provide a useful range of variations in both LTC systems and cultural norms. The analysis is enabled by two comparable datasets, the Japanese Study of Aging and Retirement (JSTAR) and the Survey of Health, Aging, and Retirement in Europe (SHARE), both of which follow the Health and Retirement Study (HRS) in United States. To evaluate the burden on informal caregivers, this paper uses the psychological measures, which is Euro-D in Europe and CES-D (The Center for Epidemiologic Studies Depression Scale) in Japan. Euro-D has been used as an effective measure of depression in comparative studies in European countries (Dewey & Prince, 2005). CES-D is one of the most widely used instruments for screening depression and depression disorder, but this indicator is not included in the SHARE survey.

## 2. The Long-Term Care Systems in Europe and Japan

The difference in the family-state norm introduced different LTC policy in terms of financing, cash or in-kind provision, and family caregiver support (Table 1). Colombo et al. (2011) classifies countries into three categories based on the scope of entitlement to LTC

benefits: (1) universal coverage within a single program, (2) mixed systems, and (3) means-tested safety-net schemes. Those designated as having universal systems include: Japan, Germany, Sweden, Netherlands, Denmark, and Belgium. Secondly, France, Austria, Greece, Hungary, Italy, Czech Republic, Poland, Slovenia, Spain, Switzerland, Portugal, and Ireland are identified as having mixed systems. A means-tested safety-net scheme is adapted in United States and England. Similarly, the previous studies by Geerts and Van den Bosch (2012) and Colombo et al. (2011) summarize the institutional characteristics and degrees of coverage of LTC systems among various European countries. Benefit eligibility varies across countries, ranging from more generous universal eligibility to more scarce and restricted assistance. In their study, Germany, Netherlands, Sweden, Belgium, and Denmark are listed under the universal needs-based entitlement LTC system<sup>1</sup>. Belgium has a more mixed range of assistance depending on the national or regional provision of subsidies and services, while Italy and Spain have more severely limited government support. Based on European Commission definitions (1990), another LTC regime classification based on entitlement structure has been proposed by Simonnazi (2009). One kind of regime is called a Bismarck-oriented schemes, in which care services are universal without means-testing. This regime characterizes the systems of countries in central Europe, including Austria, Germany, Belgium, Netherlands and France. Another kind of regime is a Beveridgean-oriented system, in which care services are universal, but the service provisions are often means-tested. The LTC regimes in Northern European countries including Denmark, Sweden, and Ireland are characterized by this system. A third type of system is based on a principle of social assistance, which is not universal but instead focuses on addressing the needs of the more disadvantaged segments of society. Mediterranean countries such as Greece, Portugal, Italy and Spain have this kind of system in place. Government assistance provided by the fourth type of regime is even more limited, leaving families legally or implicitly obliged to primarily render care. Central Eastern European countries such as Hungary and Poland are in this group. Although it is

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<sup>1</sup> Geerts & Van den Bosch (2011) includes France and Austria as Universal needs-based entitlement systems, but Colombo et al. (2011) in the OECD reports they have mixed systems. In this paper, we follow the OECD definition.

not straightforward to classify countries' LTC care regimes or levels of familialism into the distinct types, such categorization can make cross-country comparisons more fruitful.

In Germany, for example, the use of home care instead of residential care is promoted by the law. LTC is based on the traditional norms regarding the informal care. This German family-oriented care strategy introduces more free decision for care recipients and caregivers in terms of types of benefit to choose cash provision, in-kind provision or both. In Japan, on the other hands, LTC started in 2000 and it originally aimed to shoulder the burden of family caregivers, specifically women, and uncertain risk across members of society through government channels. This is because they have its strong cultural norm of family responsibility as mentioned above (Colombo et al., 2011). To avoid family caregivers into “a low-paid unwanted role” (Colombo et al., 2011), Japanese LTC system offer only in-kind provision and does not allow the cash-benefit. However, in total, many OECD countries recently take policy to encourage home care and postpone institutionalize because institutional care causes psychological and costs for the recipients, high financial burden on families and thus it indicates increase in cost for public expenditure (Colombo et al., 2011).

The burden felt by family caregivers might vary across different cultural norms and LTC regimes. JSTAR asked, “Some people feel that individuals and families should take responsibility for the social needs and medical care of the elderly, while others feel it should be the national or local government’s responsibility. Which opinion do you agree with?” The answer options are: Individual/family; Probably individual/family; Probably national/local government; National/local government; Don’t know. For Japan, about 62% of respondents support one of the state-centric responsibility views while 30% support more the familial responsibility views (Graph 2). In Europe, Southern countries exhibit more familial attitudes compared to Central and Northern countries. In the drop-off questionnaire of SHARE wave 1, there is a question that asks: “In your opinion, who –the family or the State– should bear the responsibility for each of the following...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?". Graph 2 shows the results for the personal care component of the question. Although JSTAR does not have a "both family and state equally" option, which SHARE does, Japanese state-responsible views are comparable with Denmark, Sweden, and Netherlands. Regarding cultural influences, traditional Japanese families exhibit familialism or norms that family, especially women, are expected to care for the elderly members of the family. However Japanese people's views appear to be changing with the times.

In order to estimate the different impacts of familialism, LTC systems, and levels of informal care provided on caregivers' well-being across countries, the countries were analyzed regionally, divided into Northern, Central, and Southern, and Central Eastern Europe groups. Description about these country classifications are summarized in Table 1.

### 3 Data

Cross-national analysis in this paper was performed using data from the Japanese Study of Aging and Retirement (JSTAR) and the Survey of Health, Aging, and Retirement in Europe (SHARE), which are both modeled after the United State's Health and Retirement Survey (HRS) and the English Longitudinal Study of Ageing (ELSA). JSTAR is a multidisciplinary dataset that has been collected through surveys of Japanese residents aged 50 to 80 every two years since 2007. The dataset includes information on respondent health, economic status, social position, family structure, and quality of life in Japan. SHARE is also an interdisciplinary and cross-national panel dataset covering almost the same variables as JSTAR and contains more than 85,000 individuals aged 50 and over from 19 European countries and Israel. This study uses the first wave of JSTAR that was collected in 2007, the second wave in 2009 and third wave in 2011. As for SHARE, this paper uses the first wave of SHARE, which was collected in 2004/2005 in 12 European countries (Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Israel,) and the second wave in 2006/2007, which added the Czech Republic, Ireland and Poland and the fourth wave in 2011, which added Hungary, Portugal,

Slovenia, and Estonia. SHARE third wave in 2008/2009 collect life history survey, and I do not use it in this study. Table 2 summarizes number of respondents in each country in each wave and corresponding region. Since SHARE wave 4 does not contain information of caregiving hour, I use SHARE wave 4 for the analysis except for caregiving hour. The sample in this research are limited to those who are aged 50-80 and those who have at least one parent or parent-in-law.

### 3.1. Informal caregiving

The SHARE CAPI main questionnaire asks: whether the respondent has provided personal care or practical household assistance to a family member outside; to whom the respondent provides this assistance outside the household: which (following) types of help he/she has given to this person in the last twelve months. The respondents were provided room on the questionnaire to list up to three different persons who received the respondent assistance. In the SHARE questionnaire, informal care is divided into three types: (1) personal care, e.g., dressing, bathing, or showering, and eating; (2) practical household help, e.g. with home repairs, gardening, transportation, shopping, and household chores; (3) help with paperwork, such as filling out forms, and settling financial or legal matters. Another question asked how often altogether he/she has given such help to this person in the last twelve months - (1) Almost daily; (2) Almost every week; (3) Almost every month; (4) Less often. The next question asked more specifically about the number of hours caregivers spent (per day, week, month, etc. according to how the respondent answered the prior question). In this study, we converted all answers according to weekly hours of caregiving for each respondent, following Bolin et al. (2008). If the respondent answered (1) Almost every day, the hours given on a typical day was multiplied by 7. If he/she responded (2) Almost every week, the weekly hours of care was kept as it was. If he/she responded (3) Almost every month, then the weekly hours of care was calculated by dividing it by 4.28. Similarly, if he/she answered (4) Less often (i.e., less than every month), then the weekly hours of care was calculated by dividing amount given by 52. Unfortunately, this question on hours of caregiving was not included in SHARE wave 4.

JSTAR asks about respondents' informal care provided to their parents in more detail. In JSTAR, questionnaire contains how many hours did the respondents spent to caregiving to the parents spouse and family in each of weekday and weekend, the level of care of parents, which is used for the certification for government LTC usage, whether the parent needs to care in the house, whether they institutionalize in nursing home, and whether they live together or not live with.

In this study, the main explanatory variables are 1) 1 if respondent provides informal care to parent (parent-in-law), 2) weekly log transformed informal care hours, and 3) whether intensive care (more than 20 hours/week informal care) which the respondents provide to someone outside the household. We use SHARE wave1 and wave 2 dataset and JSTAR wave 1 to wave 3 to analyze the informal care hour effects since SHARE wave 4 do not include care hour information.

The present study combined and reduced more than 30 relationships between the caregivers and care recipients originally detailed in SHARE, simplifying them into 9 relationships as: (1) Spouse/Partner (2) Parent (3) Parent-in-law (4) Child/Child-in-law (5) Sibling (6) Grand-parent (7) Grand-child (8) Other relative (9) Other, e.g., friends, coworkers and so on. This study restricts care provision only to parent (parent-in-law) outside the household. We found that the respondents who provide assistance to parents outside the household comprised more than one-third of total care respondents (e.g., 2299 among 8405 in SHARE wave 1). In JSTAR the relationship of care recipient and caregiver (the respondent) are asked for each mother/ father/ mother-in-law/ father-in-law. We define that the respondent provide informal care to parent if the respondent provide either mother or father outside the household. Table 3 shows the how many the respondents engage in informal care to parent or parent-in-law. Even in Northern European, high percentage of the respondents (33.08% in Netherlands; 35.49% in Denmark) provides informal care to their parent. 15.9% of JSTAR respondents provide care to parent outside the household, and it seems a bit low compared to my expectation. However 23.4% of the respondents provide care to parent within the household although it is not shown in this table. The percentage of respondents that gave informal care to spouse parents varied greatly but represented the

minority, with 4.84% in Poland as the lowest percent, and 14.07% in Denmark is the highest in Table 3. Noteworthy is the variation of weekly hours of care to parent. In Southern European country, hours of care tend to be higher than in Central Europe and much higher than Northern Europe. Thus in Northern Europe countries people often provide informal care to their parent, but the time of care is small and the psychological burden is expected to be lower than other countries.

### 3.2. Dependent variables

To examine whether caregivers experienced a decrease in well-being, the dependent variables selected for this analysis are: CESD (in JSTAR), and Euro-D (in SHARE). Although life satisfaction is another important measure used in the previous literature (Van den Berg et al., 2014; Van den Berg and Ferrer-i-Carbonell) to measure the subjective well-being of the caregivers, the discontinuity of the definition of it between waves make it difficult to analyze in this study<sup>2</sup>. As for the CESD score in JSTAR, it assesses depressive symptoms by asking 20 questions about the mental condition experienced by the respondent during the previous week, covering indicators such as depressed mood, fatigue, sleep problems, and happiness. A higher CESD score indicates stronger symptoms of depression. Both of JSTAR's waves and SHARE wave 2 includes the CESD questionnaire, but SHARE waves 1 and 4 do not, thus we could not incorporate CESD data into the SHARE analysis. Instead, the Euro-D is used to scale the assessment of depression symptoms in SHARE, with 12 items covering depressed mood, concentration, suicidality, guilt, and sleep problem, appetite, etc. A higher Euro-D score indicates stronger depression symptoms. The widely used cut-off score for depression is above three for Euro-D and 16 or greater for CESD. Following this threshold of Euro-D and JSTAR, 22.57 % among SHARE respondents and 21.45% among JSTAR respondents are classified into depression.

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<sup>2</sup> In SHARE, the life satisfaction score alternatives in waves 2 and 4 differed from wave 1. In wave 1, the respondents answered according to a 1-4 scale, with 4 for "Very satisfied". In waves 2 and 4, respondents were presented a 1-10 scale, with 10 for "completely satisfied".

So they are tolerable scores to compare mental health with each other though they are not the same questionnaire.

### 3.3. Instrumental variables

The identification strategy in this study is the instrumental variable approach. Information about age of living parent, the change of expectation of receiving the inheritance, and number of other potential informal caregivers are used as the instrumental variables. The instrumental variables need 1) to be independent from the error terms of the mental health equation, and 2) to have correlate with the potential endogenous variable. Since the age of parent is exogenous and does not directly affect children caregiver's mental health. If the parent become older, adult children is more likely to involve informal caregiving. The change of receiving the inheritance is the subjective expectation that how many percentages the respondent expect to get the inheritance in the future. It is correlated with the caregiving decision, but it does not have relationship with the mental health except through the caregiving. The final possible instrument variable is the number of other potential informal caregivers. In JSTAR, the respondents asked the number of other potential informal caregivers to care for parent (parent-in-law), but not in SHARE, so the number of living siblings is used as the alternatives in SHARE. It possibly correlates with the caregiving involvement, but does not affect the mental health directly.

### 3.4. Other variables

Other explanatory variables analyzed in this study and are standard in mental health equations include: gender, age, age squared, marital states (married or not), education (constructed based on the International Standard Classification of Education code), labor force status (not in labor market, full time worker, part time worker, self-employed,

unemployed), log of household income quantile<sup>3</sup>, log of household assets quantile<sup>4</sup>, health measure (Activity of Daily Living; hereafter, ADL) of respondents, and health of parent. I thus utilize log of household income as well as assets and classify it into 4 quantile in each wave and country to make comparisons between different countries and waves possible. ADL score is used as an indicator of respondent health status. Using a scale from 0 to 6 with 6 for the greatest difficulty, the ADL score measure the level of ability in performing six activities of daily living: walking across a room, dressing, bathing, eating, getting in and out of bed, and using the toilet. The health of parent is measured by the certified long-term care level for JSTAR. Individuals need to be certified to receive LTC insurance in Japan. The certified long-term care level is judged by municipality based on the opinions of a regular doctor with uniformly determined certification, and it is classified into seven level: two support levels and five care levels. Support level 1 is the lowest, Support level 2 is the second lowest, and then Care Level 1 is the next level for disabled individuals in need of care to help basic activities of daily living (Shimizutani, 2013). Care level 5 is the highest care requirement level. In this study, the health of parent takes 1 if the parent does not certified as LTC eligible level, 2 if she/he have certified support level (Support Level 1 or 2), and 3 if she/he have certified care levels (Care Level 1-5). In SHARE the health of parent is measured by five scale respondent's self-reported parental health: from Excellent to Poor<sup>5</sup>. Parental health possibly affects child caregiver's mental health. This is called as the *family effect* (Bobinac et al., 2010).

## 4 Methods

The impact of caregiving on the caregiver's mental well-being is estimated based on the following equation.

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<sup>3</sup> Income are divided by two if the respondents have spouse or partner so to define as income per capita. Household income in SHARE wave 1 was defined as the sum of all income minus lump sum payments before any taxes and contributions, but in wave 2 and afterward is defined as the sum of all income minus lump sum payments after any taxes and contributions, at the couple-level economic unit if the respondent has any spouse or partner.

<sup>4</sup> Assets are divided by two if the respondents have spouse or partner so to define as income per capita.

<sup>5</sup> The respondents choose a reported health status of parents from the following choices: 1. Very good, 2. Good, 3. Fair, 4. Poor, 5. Very poor in the first wave. However the choice sets changed to 1. Excellent, 2. Very good, 3. Good, 4. Fair, 5. Poor in other waves.

$$y_{it} = \beta_1 IC_{it} + \beta_2 \mathbb{X}'_{it} + \mu_i + \epsilon_{it}$$

where  $y_{it}$  is the mental well-being which is measured with CESD and Euro-D.  $IC_{it}$  represents informal caregiving. Three measure of informal caregiving are used. First of all, it is the indicator whether the respondents provide informal care or not. Second it is log transformed informal caregiving hour per week. I use weekly hours plus one to incorporate those who are not providing care into the analysis. Another measure of informal caregiving time is whether the person provides intensive care or not. Intensive care encompasses 20 or more hours of care per week (0 or 1).  $\mathbb{X}'_{it}$  represents a vector of observable control variables.  $\mathbb{X}'_{it}$  includes age, age- squared, education, labor force status dummy (not in labor force, full time worker, part time worker, self-employed, unemployed, and not in labor force is the reference group), log of household income quantile (first quantile is the reference group), and respondent's ADL score.  $\mu_i$  is the fixed effect and it is time-invariant unobservable characteristics. It is not necessarily assumed to be independent of the explanation variables.  $\epsilon_{it}$  captures another unobservable characteristics, and is assumed to be conditionally independent and identically distributed. The description of the variables are shown in Table 4.

Treating the caregiving involvement as endogenous, the instrumental variable technique is applied. Informal care involvement is assumed to depend on the age of living parent, the chance of receiving the inheritance, and number of other potential informal caregivers. The instrument validity and the exogeneity of informal caregiving variable are assessed by the specification tests.

## 5 Results

### 5.1 Descriptive statistics

The descriptive statistics of JSTAR and SHARE are shown in Table 5 and Table 6 for informal caregiver and non-caregiver. Caregivers are older in Japan and younger in Europe compared to non-caregivers, and physical health measured by ADL and IADL are better for

caregivers than for non-caregivers in Japan and Europe. This suggests that people with better health can provide support to others. Parental health measured by Certified LTC level in Japan and self-reported health in Europe is worse compared to non-caregivers. It is quite intuitive that when parent health deteriorates, the adult child provides care.

## 5.2 Estimation results

The estimate results by OLS, FE and 2 SLS IV model are shown in Table 7 (A) for Japan and (B) for European countries. The results indicate that caregiving involvement to own parent outside household itself does not bring psychological burden in Japan (Table 7 (A)). However, in European countries (Table 7 (B)), OLS estimation shows that caregiving involvement worsens the mental health of caregiver in Central Europe. Adversely, if people in Northern Europe provide support to their elderly parents, their mental health score significantly improve. Even after controlling for the endogeneity, this pleasing effects remains in Northern Europe. It is explained by the facts that in Table 3, individuals in Northern Europe often help their parents, but the hours of care is quite small. This is possibly relate to the generosity of LTC system in Northern Europe. When their parents are in need of care, they can utilize the alternative formal care enough, and children do not necessarily load to provide care.

Table 8 shows the specification test of instrumental variable estimation. The instruments include the age of living parent, the change of receiving the inheritance, and number of other potential informal caregivers. The instrumental variables need to be correlated with the informal caregiving which is now treated as endogenous and is orthogonal to the error term. It is well known that, as a rule of thumb, an F-statistic below 10 indicates a problem of weak instruments (Staiger and Stock, 1997; Bolin et al., 2008b). The hypothesis is that the instruments are jointly equal to zero on the informal care in the first stage, and this hypothesis is rejected by the F-test of joint insignificance as  $F = 16.42$ ,  $p < 0.01$  for Europe and Japan. The overidentifying restriction tests shows various validation of the instruments. The endogeneity of informal caregiving is tested by Durbin-Wu-Hausman tests. It could not reject the hypothesis that informal care was exogenous for



caregiving involvement and hours of care for JSTAR. Endogeneity for intensive caregiving and caregiving hours are rejected in SHARE data.

Table 9 shows the results of the caregiving hours on mental health of caregivers. OLS regression shows that individuals significantly worsen their mental health by intensive caregiving in Central Europe and Southern Europe. This indicates that in Central and Southern European countries, since the familial norm is strong or generous public LTC system is scarce, when the frail elderly need assistance, the caregiver, usually family member, feel to be obliged to take care of her and psychological burden increase. This is because when the care receivers need intensive care, the level of care is often beyond informal care and need professional nursing care. However, the effects turn to be insignificant when the instrumental variables control for the endogeneity of the caregiving hours. In Japan with regard to providing intensive care, people do not report significant mental deterioration, but to less intensive care compared with the case of 0 hour of caregiving, people significantly worsen their mental health.

## 6 Conclusion

With a focus on the institutional differences among the long-term care systems and family-related cultural norms of 16 countries, we analyze their potential impact on the psychological well-being of informal caregivers. The econometric estimates show that whether or not to provide informal care does not necessarily have an impact on caregiver's mental health, but what really matter is time devoting for informal care. The intensive informal care-giving which is defined as more than 20 hours per week or almost every day has a negative effect on mental health scores in Central Europe and Southern Europe. Compared to people in countries with more scarce LTC generosity, people in countries with more generous LTC system feel better from informal caregiving. The short time of informal care may cause to this results. Japan is similar to central European countries in terms of generosity of long-term care system, caregiving hours and its effect on mental health.

As many policy makers recognize that strenuous caregiving induce to worsen mental health of caregivers, support policies toward caregivers are going to be introduced

in some countries. Countries differ in types and the extent of support policy which are implemented – for example, paid/unpaid care leave from work, maximum periods of care leave, flexible work arrangement, respite care, counseling service, financial allowance and tax credits etc (See Table 1). Many Northern European countries introduced the cash benefits for caregivers to support them. Beside enough availability of the formal care, these financial incentive may play an important role to reduce the burden of the intensive caregiving. In the future research, evaluation of these family supporting policy will be necessary for reducing the burden of informal caregiver in the age of aging population.

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## **Acknowledgements**

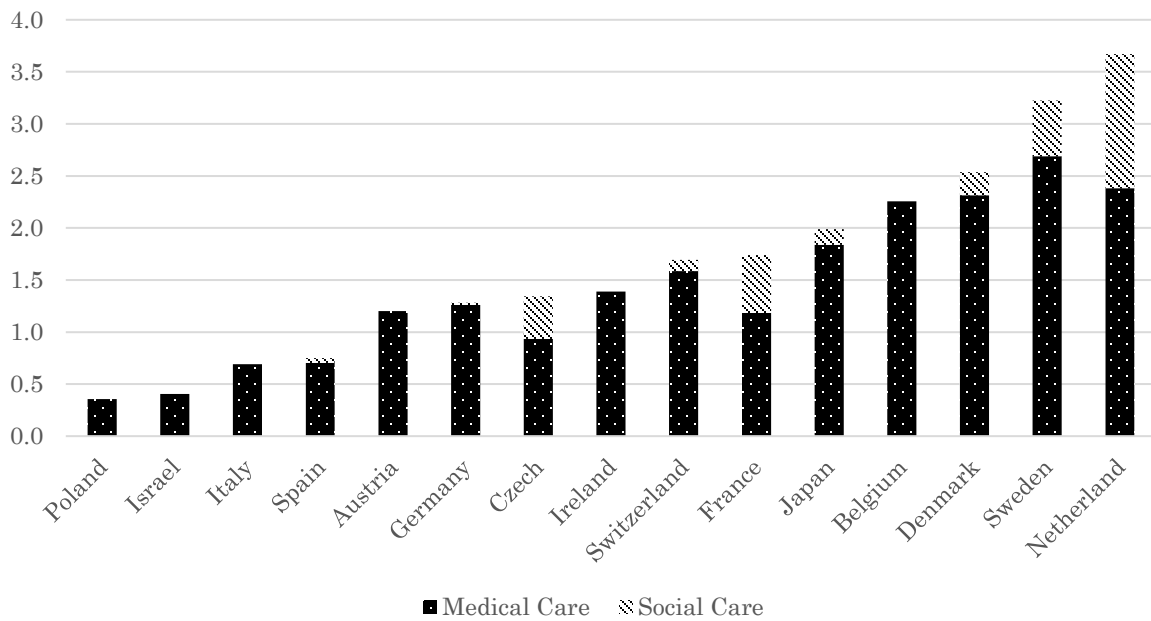
This research uses the micro data “Japanese Study of Aging and Retirement (JSTAR)” (High Level) which was conducted by the Research Institute of Economy, Trade and Industry (RIETI), Hitotsubashi University and the University of Tokyo. This paper also uses data from SHARE Waves 1, 2, and 4 (DOIs: 10.6103/SHARE.w1.700, 10.6103/SHARE.w2.700, 10.6103/SHARE.w4.700). See Börsch-Supan et al. (2013) for methodological details.

Table 1. Country, region, system and caregiver support policy

No. in SHARE	Country	Region	Universal or mixed system	Carer allowance	Cash benefit for care recipient	Tax benefit
11	Austria	Central	Mix	× (○ only in case of dementia)	○	×
12	Germany	Central	Univ.	○	×	○
13	Sweden	North	Univ.	○	○	×
14	Netherlands	North	Univ.	○	○	×
15	Spain	South	Mix	×	○	×
16	Italy	South	Mix	×	○	×
17	France	Central	Mix	×	○	○
18	Denmark	North	Univ.	○	×	×
20	Switzerland	Central	Mix	○	×	○
23	Belgium	Central	Univ.	○	○	△
28	Czech	Eastern	Mix	×	○	×
29	Poland	Eastern	Other	×	○	×
30	Ireland	North	Mix	○	×	○
32	Hungary	Eastern	Mix	○	×	×
34	Slovenia	Eastern	Other	×	×	×
	Japan		Univ.	×	×	×

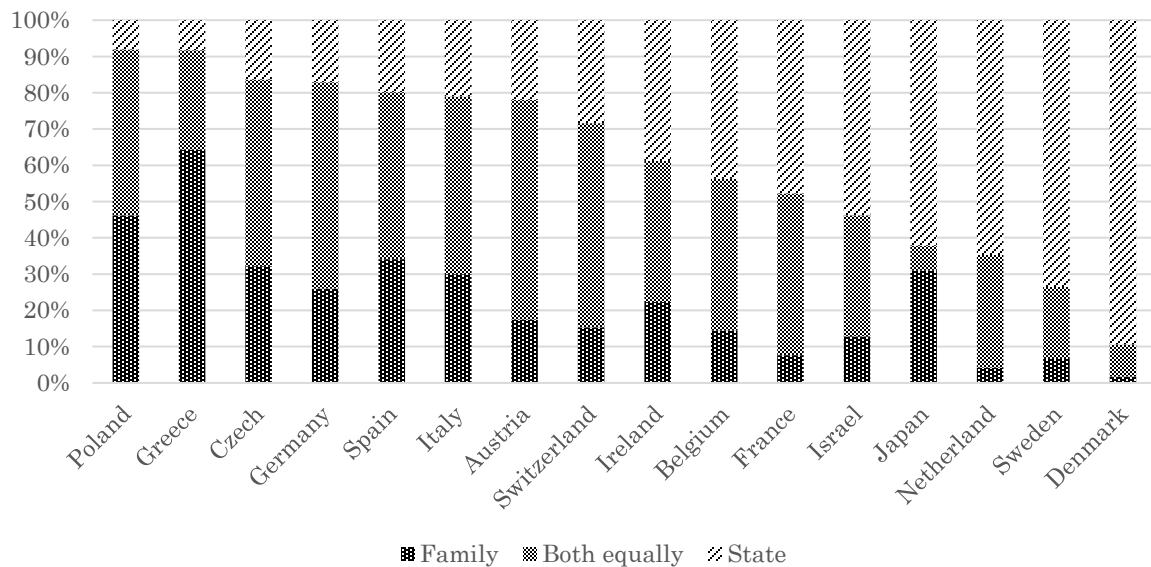
Note. Author summarized following by OECD(2011)

Graph 1. Long-term care expenditure as a share of GDP



Source: OECD Health Statistics 2017

Graph 2. Familial norm: Responsibility of elderly care – Family or State.



Note.

**SHARE** - Responsibility of long-term care to elderly to help “personal care”

**JSTAR** - Responsibility of long-term care to elderly. JSTAR does not have the choice “both equally”.

Table 2. Number of Respondents in SHARE

Country	Region	wave 1	wave2	wave4
11.Austria	Central	398	253	1,690
12.Germany	Central	972	822	430
13.Sweden	North	1,106	829	498
14.Netherlands	North	997	825	687
15.Spain	South	602	578	813
16.Italy	South	752	877	880
17.France	Central	1,245	1,145	2,226
18.Denmark	North	587	939	776
19.Greece	South	994	1,083	N.A.
20.Switzerland	Central	313	534	998
23.Belgium	Central	1,315	1,047	1,475
25.Israel	Other	842	206	N.A.
28.Czechia	Eastern	N.A.	813	1,782
29.Poland	Eastern	N.A.	677	432
30.Ireland	North	N.A.	265	N.A.
32.Hungary	Eastern	N.A.	N.A.	691
33.Portugal	South	N.A.	N.A.	623
34.Slovenia	Eastern	N.A.	N.A.	403
35.Estonia	North	N.A.	N.A.	1,195
Total		10,123	10,893	15,599



Table 3. Percentage of care givers among the respondents and weekly hours of care by country

	(1) Informal care to parent (%)	(2) Informal care to spouse parent (%)	Weekly hours of care to parent
<b>JSTAR(Wave1-3)</b>			
Japan	15.9	10.5	7.9
<b>SHARE (Wave1-2)</b>			
11.Austria	21.71	5.44	7.1
12.Germany	27.69	10.67	6.1
13.Sweden	35.87	11.56	2.6
14.Netherlands	33.08	13.75	4.4
15.Spain	16.63	6.57	13.6
16.Italy	22.86	7.63	14.8
17.France	24.05	7.95	5
18.Denmark	35.49	12.37	1.9
19.Greece	18.47	4.43	11.7
20.Switzerland	27.76	6.73	4.4
23.Belgium	32.26	14.07	6.1
25.Israel	23.25	6.41	7.9
28.Czech	24.96	7.22	8.2
29.Poland	15.49	4.84	9.2
30.Ireland	26.92	5.66	6.9

Table 4. Variable Description

Variable	Description	SHARE (W1&W2)	JSTAR (W1, W2 &W3)
Hours of caregiving per week		0-	0-132
Intensive caregiving	1: Hours of caregiving per week $\geq 20$ , 0: Hours of caregiving per week $< 20$	0, 1	0, 1
Euro-D	Emotional health (depression symptom) score by asking 12 items	0-12	N/A
CESD	Emotional health (depression symptom) score by asking 20 items	N/A	0-57
Age		50-80	50-80
Gender	1: Male, 2: Female	1, 2	1, 2
Married	1: married, partnered, separated, 0: divorced, widowed, never married	0, 1	0, 1
Lower secondary/		0, 1	0, 1
Upper secondary/		0, 1	0, 1
Post-secondary non tertiary/		0, 1	0, 1
First stage of tertiary/		0, 1	0, 1
Second stage of tertiary education		0, 1	0, 1
Fulltime	Whether a respondent work fulltime if in the labor market	0, 1	0, 1
Parttime	Whether a respondent work parttime if in the labor market	0, 1	0, 1
Unemployment	Whether a respondent is unemployed if in the labor market	0, 1	0, 1
Not in labor force	Whether a respondent is not in labor market	0, 1	0, 1
Log (income)	Log of household income minus lumpsum payments after taxes and contributions	0-15	
Mother alive	Whether a respondent mother live	0, 1	0, 1
Father alive	Whether a respondent father live	0, 1	0, 1
Mother's health	[SHARE] Mother's subjective health (1 is very poor, 5 is Excellent)	1-5	N/A
	[JSTAR] Mother's LTC level (0 is not LTC level, 8 is highest LTC level)	N/A	0-8
Father's health	[SHARE] Father's subjective health (1 is very poor, 5 is Excellent)	1-5	N/A
	[JSTAR] Mother's LTC level (0 is not LTC level, 8 is highest LTC level)	N/A	0-8
ADL	Respondent ADLA	0-5	
Hours of work per week		Continuou s	
	In your opinion, who - the family or the State - should bear the responsibility for		

Responsibility for personal care	Personal care for older persons who are in need such as nursing or help with bathing or dressing? (1: Totally family, 2: Mainly family, 3: Both equally, 4: Mainly state, 5: Totally state)	1-5	1-4 (no "Both Equally")
Chance of receiving inheritance	How many percent will you receive inheritance in the future? Do you think you will receive inheritance in the future?		0, 1

Table 5. Summary Statistics of Non-caregiver and Caregiver in Japan

JSTAR	Non-caregiver			Caregiver		
	Obs.	Mean	Std.	Obs.	Mean	Std.
CESD	2451	11.66	6.42	454	11.84	6.05
Age	2419	58.50	5.75	470	60.64	5.82
Gender	2614	1.49	0.50	496	1.62	0.49
Married	2599	0.81	0.39	491	0.83	0.38
Lower secondary education	2608	0.16	0.37	494	0.20	0.40
Upper secondary education	2608	0.43	0.50	494	0.42	0.49
Post-secondary non tertiary education	2608	0.09	0.29	494	0.07	0.26
First stage of tertiary education	2608	0.31	0.46	494	0.31	0.46
Second stage of tertiary education	2608	0.00	0.05			
Full time	2521	0.37	0.48	472	0.25	0.43
Part time	2521	0.20	0.40	472	0.20	0.40
Self-employed	2521	0.15	0.36	472	0.12	0.32
Unemployment	2521	0.05	0.21	472	0.04	0.21
Log(Income per capita)	2438	14.60	0.77	451	14.57	0.78
Log(Asset per capita)	1626	16.34	1.29	262	16.49	1.21
Mother alive	2614	0.93	0.26	496	0.91	0.28
Father alive	2614	0.30	0.46	496	0.29	0.45
Mother Certified LTC level	731	0.65	1.75	118	2.83	2.61
Father Certified LTC level	1870	1.31	2.32	377	4.16	2.15
ADL	2384	0.07	0.45	383	0.03	0.21
IADL	2462	0.09	0.47	462	0.05	0.34
Hours of work per week	1561	39.76	15.43	222	36.83	16.30
Chance of receiving inherit	2284	0.23	0.42	447	0.24	0.43
Age of living mother	2391	84.86	6.30	450	87.60	5.95
Age of living father	776	84.59	5.32	141	87.25	5.34
Number of other potential caregiver	2614	0.97	1.00	496	1.07	1.13

Table 6. Summary Statistics of Non-caregiver and Caregiver in Europe

SHARE	Non-caregiver			Caregiver		
	Obs.	Mean	Std.	Obs.	Mean	Std.
Euro-D	21263	2.15	2.15	6525	2.24	2.09
Age	21582	57.06	5.29	6542	56.75	5.05
Gender	21582	1.52	0.50	6542	1.63	0.48
Married	21571	0.86	0.35	6538	0.80	0.40
Lower secondary education	20771	0.18	0.38	6389	0.18	0.38
Upper secondary education	20771	0.38	0.48	6389	0.37	0.48
Post-secondary non tertiary education	20771	0.04	0.20	6389	0.04	0.20
First stage of tertiary education	20771	0.24	0.43	6389	0.30	0.46
Second stage of tertiary education	20771	0.01	0.10	6389	0.01	0.10
Full time	21283	0.41	0.49	6486	0.45	0.50
Part time	21283	0.03	0.17	6486	0.04	0.19
Self-employed	21283	0.11	0.31	6486	0.10	0.30
Unemployment	21283	0.05	0.23	6486	0.05	0.21
Log(income per capita)	20048	9.40	1.36	5971	9.66	1.26
Log(asset per capita)	20228	11.13	2.01	6217	11.46	1.58
Mother alive	21302	0.80	0.40	6429	0.88	0.32
Father alive	20296	0.32	0.47	6042	0.32	0.47
Mother reported health	15930	3.55	1.14	5251	3.66	1.16
Father reported health	6155	3.45	1.16	1820	3.63	1.19
ADL	21546	0.09	0.45	6542	0.05	0.29
IADL	21546	0.02	0.21	6542	0.01	0.11
Hours of work per week	11820	37.89	13.99	3875	36.52	13.93
Chance of receiving inherit	17657	30.00	36.97	5621	46.75	39.88
Age of living mother	10500	81.51	6.43	3326	82.56	6.12
Age of living father	4413	81.74	6.06	1243	83.02	6.28
Number of siblings	18664	2.72	2.04	5534	2.38	1.75

Table 7. The impact of caregiving on mental health (A) Japan

VARIABLES	Dependent var. = CESD		
	OLS	FE	IV
Caregiving to parent	0.80 [1.20]	1.86 [0.99]	2.72 [0.54]
Gender(Male =1: Female =2)	-0.10 [-0.28]		-0.20 [-0.44]
<b>Age</b>	-1.64*** [-2.68]	-0.52 [-0.20]	-1.20* [-1.82]
<b>Age square</b>	-1.06* [-1.78]	1.39 [0.27]	0.01* [1.71]
<b>Have spouse/partner</b>	0.01* [1.66]	-0.01 [-0.30]	-1.59** [-2.41]
<b>Education [REF: Primary education]</b>			
Lower secondary education			
Upper secondary education {Education 1-7 for IV)	-1.31** [-2.45]		-0.42** [-2.41]
Post-secondary non tertiary education	-0.77 [-1.05]		
First stage of tertiary education	-1.64*** [-2.90]		
Second stage of tertiary education	-8.05*** [-2.66]		
Income 1st quantile	[REF]	[REF]	0.75 [1.40]
Income 2nd quantile	-0.02 [-0.05]	-1.68 [-0.78]	0.69 [1.32]
Income 3rd quantile	-0.47 [-0.92]	0.22 [0.08]	0.15 [0.29]
Income 4th quantile	-0.63 [-1.24]	3.71 [1.34]	[REF]
Assets 1st quantile	[REF]	[REF]	1.49*** [2.93]

Assets 2nd quantile	-0.62	-0.37	1.00*
	[-1.30]	[-0.20]	[1.71]
Assets 3rd quantile	-0.50	2.02	0.86
	[-1.04]	[1.00]	[1.64]
Assets 4th quantile	-1.27***	6.33**	[REF]
	[-2.65]	[2.29]	
<b>ADLA</b>	2.35***	-24.86***	2.17***
	[4.64]	[-10.67]	[3.82]
<b>Health of parent</b>			
No certified LTC	0.48	0.21	0.66
	[0.63]	[0.10]	[0.64]
LTC Support Level	-0.06	1.15	0.95
	[-0.13]	[0.45]	[0.94]
LTC Care Level	[REF]	[REF]	[REF]
Constant	48.13***	-29.29	50.24**
	[2.73]	[-0.18]	[2.57]
wave dummy		YES	
Observations	1,219	1,219	1,099
R-squared	0.05	0.31	0.04
Number of id		1,161	

t-statistics in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 7. The impact of caregiving on mental health (B) Europe

VARIABLES	Dependent var. = Euro-D							
	OLS Northern Europe	OLS Central Europe	OLS Southern Europe	OLS Eastern Europe	FE Northern Europe	FE Central Europe	FE Southern Europe	FE Eastern Europe
Caregiving to parent	-0.14** [-2.51]	0.14*** [2.88]	0.08 [0.95]	0.13 [1.17]	-0.02 [-0.29]	0.08 [1.03]	0.21 [1.25]	0.20 [0.79]
Gender(Male =1: Female =2)	0.58*** [10.92]	0.78*** [18.04]	1.08*** [16.26]	0.61*** [7.12]				
Age	-0.19** [-2.14]	-0.08 [-1.11]	-0.01 [-0.13]	-0.01 [-0.13]	-0.21 [-1.20]	0.35** [2.25]	0.07 [0.25]	-0.97** [-1.99]
Age square	0.00* [1.92]	0 [0.90]	0 [0.21]	0.00 [0.21]	0.00* [1.78]	-0.00* [-1.81]	0 [0.16]	0.01* [1.94]
Have spouse/partner	-0.30*** [-3.96]	-0.45*** [-8.02]	0.11 [1.04]	0.11 [1.04]	0.07 [0.20]	-0.05 [-0.15]	-0.68 [-0.75]	-0.17 [-0.23]
<b>Education [REF: Primary education]</b>								
Lower secondary education	-0.27** [-2.54]	-0.40*** [-4.43]	-0.22** [-2.32]	-0.77*** [-4.75]				
Upper secondary education	-0.31*** [-3.03]	-0.53*** [-6.89]	-0.53*** [-5.72]	-0.74*** [-5.01]				
Post-secondary non tertiary education	-0.16 [-1.03]	-0.65*** [-4.79]	-0.42** [-2.25]	-0.51** [-2.09]				
First stage of tertiary education	-0.27*** [-2.63]	-0.50*** [-5.91]	-0.46*** [-4.33]	-0.77*** [-4.24]				
Second stage of tertiary education	-0.13 [-0.12]	-0.25 [-1.44]	-0.55 [-1.55]					
Income 1st quantile	0.36*** [4.22]	0.23*** [3.58]	0.05 [0.51]	0.54*** [4.68]	[REF]	[REF]	[REF]	0.61** [2.17]
Income 2nd quantile	0.20** [2.52]	0.18*** [2.83]	-0.05 [-0.52]	0.49*** [3.90]	-0.03 [-0.21]	0.17 [1.62]	-0.27 [-1.52]	0.25 [0.89]
Income 3rd quantile	0.04 [0.67]	0.07 [1.30]	-0.1 [-1.13]	0.30*** [2.66]	0.05 [0.39]	0.21** [1.99]	0.16 [0.82]	0.08 [0.34]
Income 4th quantile	[REF]	[REF]	[REF]	[REF]	0.04 [0.31] [REF]	0.17 [1.51] [REF]	-0.01 [-0.03] [REF]	- - -
Assets 1st quantile	0.35*** [4.35]	0.26*** [3.84]	0.02 [0.20]	0.07 [0.62]	0.05 [0.37]	0.17 [1.43]	-0.49** [-2.46]	0.47 [1.30]
Assets 2nd quantile	0.23*** [3.12]	0.20*** [3.35]	-0.20** [-2.13]	0.10 [0.80]	0.11 [0.69]	0.15 [1.07]	-0.23 [-1.05]	-1.08 [-1.08]
Assets 3rd quantile	0.08 [1.09]	0.15*** [2.58]	-0.08 [-0.97]	0.01 [0.09]	0.04 [0.22]	0.09 [0.61]	-0.34 [-1.37]	-0.02 -
Assets 4th quantile	[REF]	[REF]	[REF]	[REF]	0.33**	0.27*	0.45**	-

<b>ADLA</b>	0.74***	0.93***	1.06***	0.96***	[2.46]	[1.93]	[1.97]	0.43**
	[10.90]	[16.06]	[12.30]	[10.39]	[REF]	[REF]	[REF]	[2.02]
<b>Health of parent</b>								
Excellent	-0.49***	-0.59***	-0.73***	-0.94**	[REF]	[REF]	[REF]	-0.04
	[-4.53]	[-5.62]	[-4.37]	[-2.54]				[-0.06]
Very good	-0.44***	-0.77***	-0.82***	-0.80***	0.29**	-0.04	-0.08	-0.36
	[-5.11]	[-10.66]	[-7.77]	[-3.51]	[2.23]	[-0.24]	[-0.33]	[-0.55]
Good	-0.45***	-0.65***	-0.96***	-0.76***	0.28**	-0.01	-0.21	-0.00
	[-5.35]	[-10.09]	[-9.29]	[-6.69]	[1.97]	[-0.10]	[-0.81]	[-0.00]
Fair	-0.41***	-0.52***	-0.51***	-0.47***	0.15	0.22	-0.15	-0.47
	[-6.16]	[-9.16]	[-5.99]	[-4.57]	[1.16]	[1.42]	[-0.57]	[-1.61]
Poor	[REF]	[REF]	[REF]	[REF]	0.34**	0.44***	0.02	-
					[2.18]	[2.60]	[0.09]	
Constant	7.61***	4.61**	1.31	-0.44	6.54	-11.10**	-1.73	31.04*
	[2.91]	[2.25]	[0.39]	[-0.09]	[0.97]	[-1.98]	[-0.17]	[1.88]
wave dummy					YES	YES	YES	
Observations	4,728	8,685	4,102	2,523	4,728	8,685	4,102	2,523
R-squared	0.09	0.11	0.14	0.13	0.02	0.02	0.04	0.09
Number of id					3,213	6,175	2,990	2,251

t-statistics in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Dependent var. = Euro-D

VARIABLES	IV	IV	IV	IV
	Northern Europe	Central Europe	Southern Europe	Eastern Europe
Caregiving to parent	-1.53***	0.64	-1.74*	-4.94**
	[-2.97]	[1.51]	[-1.91]	[-2.47]
Gender(Male =1: Female =2)				
<b>Age</b>	-0.14	-0.11	0.04	-0.20
	[-0.99]	[-1.12]	[0.26]	[-0.66]
<b>Age square</b>	0	0	0	0.00
	[0.79]	[0.92]	[-0.29]	[0.47]
<b>Have spouse/partner</b>	-0.51***	-0.64***	-0.3	-1.17***
	[-3.91]	[-7.31]	[-1.61]	[-3.58]
Lower secondary education	0.66	0.22	0.84*	-1.01***
	[0.57]	[0.97]	[1.66]	[-3.84]
Upper secondary education	0.47	-0.17	0.31	-0.96***
	[0.41]	[-0.77]	[0.61]	[-4.09]
Post-secondary non tertiary education	0.24	-0.38*	0.04	-0.76*
	[0.21]	[-1.80]	[0.08]	[-1.79]
First stage of tertiary education	0.31	-0.69***	0.29	-1.03***
	[0.27]	[-2.66]	[0.52]	[-3.49]
Second stage of tertiary education	0.27	-0.38*	0.04	
	[0.24]	[-1.81]	[0.08]	
Income 1st quantile	0.30**	0.36***	0.05	0.42**
	[2.26]	[3.90]	[0.38]	[2.01]



Income 2nd quantile	0.22* [1.89]	0.24*** [2.64]	0.11 [0.76]	0.39* [1.69]
Income 3rd quantile	0.11 [1.10]	0.11 [1.49]	-0.2 [-1.57]	0.19 [0.90]
Income 4th quantile	[REF]	[REF]	[REF]	-
Assets 1st quantile	0.37*** [2.99]	0.29*** [3.04]	-0.12 [-0.83]	-0.36 [-1.46]
Assets 2nd quantile	0.27** [2.48]	0.21** [2.51]	-0.37*** [-2.68]	-0.14 [-0.67]
Assets 3rd quantile	0.17 [1.63]	0.19** [2.27]	-0.08 [-0.64]	-0.11 [-0.55]
Assets 4th quantile	[REF]	[REF]	[REF]	-
<b>ADLA</b>	0.65*** [6.16]	1.01*** [11.27]	0.94*** [7.84]	0.77*** [5.26]
<b>Health of parent</b>				
Excellent	-0.74*** [-4.58]	-0.58*** [-4.26]	-0.63** [-2.43]	-1.18* [-1.77]
Very good	-0.58*** [-4.58]	-0.72*** [-7.71]	-0.90*** [-5.38]	-0.82** [-2.00]
Good	-0.75*** [-4.52]	-0.56*** [-5.01]	-1.00*** [-4.99]	-1.31*** [-5.38]
Fair	-0.49*** [-4.83]	-0.48*** [-6.00]	-0.57*** [-4.19]	-0.74*** [-4.06]
Poor	[REF]	[REF]	[REF]	-
Constant	7.45* [1.73]	6.75** [2.26]	1.89 [0.37]	12.77 [1.41]
wave dummy				
Observations	2,622	4,704	2,392	1,688
R-squared	-0.06	0.07	-0.04	-0.60
Number of id				

t-statistics in brackets

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 8. Specification tests of the instrumental variables estimation

		F-test of joint significance of instruments	Overidentification test, (p-value of null of valid exclusion restrictions)	Endogeneity test (p-value of null of exogeneity, Wu-Hausman test)
Caregiving	Europe	F( 3, 11786) = 115.03, p<0.01	0.21	p<0.01
	Japan	F( 3, 1081) = 7.17, p<0.01	0.29	0.7051
Intensive caregiving/ less intensive caregiving	Europe	F( 3, 11786) = 67.46, p<0.01	0.02	p<0.01
	Japan	F( 3, 1034) = 9.02, p<0.01	0.33	0.4895
Log of caregiving hour	Europe	F( 3, 8627) = 80.42, p<0.01	0.43	p<0.01
	Japan	F( 3, 791) = 1.77, p= 0.15	0.03	0.6127

Table 9. The impact of caregiving hours on mental health: Japan and Europe

	Dependent var. = Euro-D							
	Northern Europe				Central Europe			
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Log (caregiving hour +1)	0.04 [0.78]	-0.66 [-1.33]			0.17*** [5.04]	-0.10 [-0.35]		
Intensive caregiving (1 if h >=20)			-0.18 [-0.65]	-1.95 [-0.18]			0.74*** [4.03]	-4.14 [-0.41]
less intensive caregiving (1 if 0<h<20)			0.03 [0.48]	-0.95 [-1.10]			0.12* [1.95]	0.29 [0.22]

	Dependent var. = Euro-D							
	Southern Europe				Eastern Europe			
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Log (caregiving hour +1)	0.13*** [3.22]	0.19 [0.42]			-0.01 [-0.07]	-1.01* [-1.93]		
Intensive caregiving (1 if h >=20)			0.49*** [2.63]	4.31 [1.45]			-0.09 [-0.22]	-9.28 [-1.25]
less intensive caregiving (1 if 0<h<20)			0.26** [2.38]	-2 [-1.43]			-0.03 [-0.16]	-1.12 [-0.84]

Dependent var. = CESD			
	OLS	IV	
<b>Japan</b>			
Log (caregiving hour +1)	0.29 [0.61]	2.56 [0.78]	
Intensive caregiving (1 if h >=20)			1.74 [1.33]
less intensive caregiving (1 if 0<h<20)			-12.86 [-0.76]
		1.83*** [2.61]	3.33 [0.33]

t-statistics in brackets, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Note. Age, Age square, education, Whether have spouse/partner, income quantile, assets quantile, ADLA, health of parent are included as dependent variables. Instrumental variables are the age of parent, chance of receiving inheritance, and number of potential caregivers.