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**Working Paper**

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ISSN: 1827-3580  
No. 26/WP/2015





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**Abstract:** In the context of an unprecedented aging process, the role of domiciliary care for older adults is becoming increasingly essential. In order to design effective and proactive policies of formal elderly-care, it is crucial to understand how vulnerable elderly individuals would adjust their informal long-term care utilization to changes in the formal-care provision. Although theoretical frameworks have been proposed, showing that a positive relationship could arise when the elderly exhibit an excess demand of care, empirical evidence is scant, due to the lack of credible instruments to account for the endogenous nature of formal-care decisions. We propose a novel instrument, an index that capture individuals' eligibility status to the LTC domiciliary programmes implemented in their own nation or region. That is, a dummy variable - being eligible or not - which is grounded on the LTC regulation context at national or regional level, but still has individual within region variation due to differences in health conditions and vulnerability assessment. We estimate an IV two-part model using a representative sample of the over 60 population for non-institutionalised individuals in Austria, Germany, France and Belgium. Our results, which are robust to a number of different specifications, point at the lack of crowding-out of the informal- by the formal-care, thus suggesting the existence of a substantial unmet demand of LTC among the elderly.

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**JEL Codes:** C36, I13, J14

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# Demand of Long-Term Care and benefit eligibility across European countries<sup>1</sup>

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August 2015

## Abstract:

In the context of an unprecedented aging process, the role of domiciliary care for older adults is becoming increasingly essential. In order to design effective and proactive policies of formal elderly-care, it is crucial to understand how vulnerable elderly individuals would adjust their informal long-term care utilization to changes in the formal-care provision. Although theoretical frameworks have been proposed, showing that a positive relationship could arise when the elderly exhibit an excess demand of care, empirical evidence is scant, due to the lack of credible instruments to account for the endogenous nature of formal-care decisions. We propose a novel instrument, an index that capture individuals' eligibility status to the LTC domiciliary programmes implemented in their own nation or region. That is, a dummy variable - being eligible or not - which is grounded on the LTC regulation context at national or regional level, but still has individual within region variation due to differences in health conditions and vulnerability assessment. We estimate an IV two-part model using a representative sample of the over 60 population for non-institutionalised individuals in Austria, Germany, France and Belgium. Our results, which are robust to a number of different specifications, point at the lack of crowding-out of the informal-by the formal-care, thus suggesting the existence of a substantial unmet demand of LTC among the elderly.

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<sup>1</sup> The authors wish to thank Eric Bonsang, Mauricio Avendano, Agar Brugiavini, Rinaldo Brau for their valuable comments to previous versions of this paper. The paper benefited as well from comments by participants to seminars at Ca' Foscari University of Venice, University of Trieste, University of Bologna, CRES-Universidad Pompeu Fabra, Barcelona. The authors acknowledge the financial support of Fondazione Farmafactoring.

# 1. INTRODUCTION

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The demand of care by elderly Europeans with age-related vulnerability conditions is rapidly growing due to the unprecedented demographic transition fuelled by declining mortality and fertility rates. With tightening public expenditure budgets, substantial challenges on the supply of Long-Term Care (LTC) need to be faced and are the subject of current policy debate. Indeed, the risk that the demand of care would fail to be met is high and worrisome ([European Commission, 2014](#)). In order to design effective, responsive and good-quality forms of social protection for the vulnerable elderly, it is crucial to understand how the targeted population would adjust the amount of care provided informally by relatives and friends (informal care) as a response to changes in the amount of care provided by public institutions (formal care). If total demand for care is satisfied, an increase in formal-assistance would reduce the burden of care on informal caregivers and the overall care-utilization would remain almost constant. Vice versa, economic theory predicts that if the amount of care provided formally and informally does not satisfy the total demand by the vulnerable elderly, increasing public provision may induce to increase informal care ([Stabile, Laporte, & Coyte, 2006](#)).

The policy evaluation literature faces the struggles with the theoretical cautioning on the simultaneous determination of the formal and informal care utilization. In empirical terms, this implies the need of a source of exogenous variation of formal care in order to identify a causal effect on informal care. So far, most of the applied studies focused on the opposite direction of causality, i.e., the effect that a modification in the informal-care provision (usually, by children only) reflects in formal-care utilization ([Balía & Brau, 2013](#); [Bolin, Lindgren, & Lundborg, 2008](#); [Bonsang, 2009](#); [Van Houtven & Norton, 2004](#)). In this paper, we tackle directly the natural direction of causality: we exploit the variation within Europe in the way each country assesses elderly' vulnerability conditions and determines access to publicly provided home-care programs to identify the causal relation between formal and informal care. Being specific, we use comparative micro data from SHARE (Survey of Health, Ageing, and Retirement) survey and construct a dichotomous individual-specific variable that identifies elderly individuals who are eligible to public programmes (in-kind or in-cash) of formal home-care, based on individual health characteristics and on respondents' own country and/or region regulations. We introduce this legislation-based eligibility indicator in an instrumental-variable two-part model and show, first, that the new instrument proves to be informative under a wide range of different model specification, and second, that increasing formal home-care utilization by elderly adults positively and significantly affect informal home-care provision from family and friends. Our approach does not rely on a formal-care price changes, thus allowing us to interpret results within the relevant theoretical literature. Indeed, according to [Stabile et al. \(2006\)](#), such a result hints at an insufficient supply of public LTC, which forces individuals to buy additional care from private providers. Moreover, while formal-care proves to be endogenous with respect to the aggregate supply of assistance by respondents' children, relatives, friends and neighbours, this is not the case when the informal-care is narrowed to the assistance supplied by children only. This confirms the relevance of accounting for the interplays between all the informal care providers, as recently stressed by ([Kalwij, Pasini, & Wu, 2014](#)).

The paper is organised as follows. We first discuss the relationship between the formal and the informal provision of care and the identification strategy grounded on a novel instrumental variable based on eligibility frameworks in Europe. We then present the SHARE dataset and the variables that will be used in the empirical analysis as well

as descriptive evidence on our instrument and on the population eligible to LTC (section 4). Section 5 describes the two-part model adopted as main specification. Next, we present our results in section 6. Several robustness checks are performed in Section 7, while the last section offers some conclusions.

## 2. SIMULTANEITY OF FORMAL AND INFORMAL CARE

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OECD acknowledges that protecting the right to a life in dignity of frail older people is becoming a major policy challenge ([OECD \(2013\)](#), Foreword), and defines the Long-Term Care (LTC) as a range of services required by persons with a reduced degree of functional capacity, physical or cognitive, and who are consequently dependent for an extended period of time on help with basic activities of daily living (ADL). This personal care component is frequently provided in combination with help with basic medical services such as nursing care (help with wound dressing, pain management, medication, health monitoring), as well as prevention, rehabilitation or services of palliative care. Long-term care services can also be combined with lower-level care related to domestic help or less demanding tasks. LTC can be provided at the recipient's own dwelling (*home-based care / domiciliary care*) rather than in nursing homes or residential care-facilities (*residential- / institutional care*).

It is common to differentiate LTC providers according to their (lack of) formalization, i.e., a contract or an official agreement between the care receiver and the caregiver. Indeed, the *formal-care* includes all care services that are provided in the context of formal regulations, such as (but not necessarily) through contracted services, mostly by trained care workers, that can be paid out of pocket or through reimbursement by public (or, less often, by private) institutions. What characterizes formal care-provision is its acknowledgment by the Social or Health departments at the proper governmental level. *Informal-care* is, conversely, a term that refers to the unpaid assistance provided by partners, adult children and other relatives, friends or neighbours who hold a significant personal relationship with the care recipient.

Most of the empirical work has focused on how a change in the informal-care utilization can affect the probability and/or the intensity of receiving formal-care. [Van Houtven and Norton \(2004\)](#) modelled a family decision-making process where altruistic children choose the optimal provision of informal care to provide to their parents who, in turn, decide the optimal quantity of care to receive from formal-providers<sup>2</sup>. [Kalwij et al. \(2014\)](#) adapted the model to allow for multiple caregiving sources (relatives, friends and neighbours, besides children). [Bonsang \(2009\)](#) conceptually disentangled formal-care in a skilled (personal/nursing care) and in a relatively unskilled part (domestic-help), arguing that the latter would have a higher degree of substitutability to informal care than the former. Typical findings of this literature are that informal home care substitutes for total – skilled and unskilled – formal home-care ([Bolin et al., 2008](#); [Van Houtven & Norton, 2004](#)). The substitution effect is stronger when recipient's vulnerability level is low, while a positive relationship exist for higher levels of disability ([Bonsang, 2009](#)). A positive, though negligible, relation is also found restricting the analysis to skilled formal-care ([Balía & Brau, 2013](#); [Bonsang, 2009](#))

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<sup>2</sup> As pointed out in the literature, the provision of informal-care could be also the result of a strategic game involving future bequests. Although this motivation is excluded in the models hereby mentioned, the hypothesis of pure altruism is hardly believable ([Alessie, Angelini, and Pasini \(2014\)](#)). Nevertheless, no evidence has been provided for pure exchange-driven behavior, either.

There are only a few examples in the literature looking at the causal effect of a change in the availability of formal care on the demand of informal care. [Stabile et al. \(2006\)](#) developed a model of household decision-making where care receivers and caregivers select the amount of formal and informal care in order to achieve the optimal level of health for the care receiver. Formal care  $M$  can be bought from private providers ( $M2$ , at a price  $P$ ), or from public sources ( $M1$ , at a unitary cost  $P-S$ , where  $S$  is subsidy). Publicly provided formal care is rationed: each individual can consume up to a maximum amount  $m$ . The household maximizes utility under a budget constraint (labour earnings can be allocated between expenditures in formal care and other consumption goods) and a time allocation constraint (time is divided between leisure, work and care-giving activities). Private and public formal care are assumed to be equally productive in care-provision and normal inputs in the care receiver health production function. The model delivers clear empirical implications for policy changes affecting the quantity of publicly provided care  $m$  holding prices constant (i.e., holding  $P$ ,  $S$  and the market wage constant). If the household exhaust all the publicly provided care ( $M1 = m$ ) and additionally buys private care  $M2 > 0$  ( $M = m + M2$ ), then increasing  $m$  would increase the household non-wage income (the fraction of subsidized formal care increases), leading to an increase of informal care giving. If, conversely, the household consumes public-care at its limit ( $M1 = m$ ), but does not purchase private-care ( $M2 = 0$ ), increasing the generosity of the public home care programme would lead to a reduction of informal care provision.

The model implications are then tested estimating a demand equation for informal care:

$$(2.1) \quad TIHC_i = \gamma_0 + \gamma_1' HS_i + \gamma_2' CV + \gamma_3 FHC + \varepsilon_i$$

where  $TIHC$  is the total amount of informal home-care,  $FHC$  is the total amount of formal home-care,  $HS$  is a set of health-variables and  $CV$  is a set of socio-economic control.  $TIHC$  and  $FHC$  are both choice variables and are simultaneously determined:  $FHC$  need to be instrumented in order to obtain consistent estimates of the  $\gamma_k$  parameters.

The authors resort to data from Canada to validate the model, and use three macro-level exogenous variables as instruments for generosity of the public home care programme: the share of the population aged 65 and older in each province over time; the level of provincial spending on education in each province over time; and the provincial tax rate as a share of federal taxes in each province over time. [Golberstein, Grabowski, Langa, and Chernew \(2009\)](#) rise doubts on the empirical analysis proposed by [Stabile et al. \(2006\)](#) in terms of data limitations (unavailability of data on amount of informal-care in Canada) and potential endogeneity of the public-care generosity measure, given the possibility that if there were fewer informal caregivers per province there might be pressure to expand publicly funded home care. [Goltz and Arnault \(2014\)](#) estimate a bivariate-tobit model and study whether or not incentives to use more formal home care would relieve informal caregivers in France, on a sample of 1687 singles aged 60+, excluding all completely autonomous people. In order to build an instrument for weekly-hours of formal home-care by district, questionnaires were sent to each French Council District to obtain information about formal home-care prices. The authors use the answers to build a district-level variable related to average out-of-pockets expenses (of individuals) for formal-home care. Their results show that the burden of informal care would decrease if the elderly dependents were faced with lower formal home-care prices. Thus, subsidies reducing formal home-care prices would relieve informal caregivers. [Balía and Brau \(2013\)](#) elaborate on the difficulty of finding good instruments for the formal-care utilisation. They propose a latent factor model



that aims at correcting the endogeneity bias through the empirical specification without the need for an instrument. They also propose two individual variables (included in the SHARE data adopted in the study) as candidates for instruments, related to the occurrence of having foregone care because of excessive cost or unavailability. Unfortunately, the frequency of the responses to such questions in SHARE is quite low, and this, paired with the fact that the sample selection chose by the authors limits the analysis to 1375 single individuals in 9 European countries, constitutes a threat to the external validity of the results.

We follow a different approach, exploiting individual-specific information on eligibility status to local public programmes of home-based care. The estimation of causal effects through instrumental variable strategies where the eligibility status is introduced to solve for the endogeneity of the variable of interest has been presented in the economic literature (see, for instance, [Battistin, Brugiavini, Rettore, and Weber \(2009\)](#)) but not, to the best of our knowledge, in long-term care empirical applications, due to the substantial heterogeneity and – often – fragmentation in the regulations. Compared to the previous literature, our approach has three main advantages: first, it does not rely on a formal care price changes, thus allowing us to interpret results within the relevant theoretical literature. Second, being a legislation-based instrument, its exogeneity with respect to individual decisions regarding informal care utilization is harder to question. Third, the identification rely on the cross country, but also individual variation of the index arising from different health conditions across subjects and different eligibility assessments of the same health conditions across public LTC programs. Therefore, the instrument has a sufficient variability to avoid the well-known weak instrument problems of policy evaluations based on discrete policy variations affecting specific subgroups of a population. Moreover, the identification does not rely on matching estimation methods and it is therefore applicable to any sampled population, strengthening its external validity.

Access to formal long-term home-care is by and large not discretionary for older adults in Europe. As discussed in [Carrino and Orso \(2014\)](#), every main public LTC programme across countries or regions performs an assessment-of-need in order to build a “vulnerability profile” of the elder applicant, after which a decision on her eligibility status is taken by comparing the profile with a definition of “minimum objective vulnerability status”, set by eligibility rules in the legislation (this holds true also for main private LTC insurances, which often borrow their eligibility criteria from the public regulations). Relevant heterogeneity exists among countries (and even within countries, when multiple nationwide programmes are implemented) on the very issue of defining vulnerability. Even when restricting the perspective to a comprehensive set of functional (mostly ADL and iADL tasks) and cognitive limitations, it appears that there is almost no regulation that includes them altogether in the assessment-process. Moreover, the health-outcomes are often un-evenly weighted within an assessment-scale: some limitations are given more importance than others in determining eligibility, and there are legislations that characterize some deficit as necessary and/or sufficient for eligibility. As a consequence, an individual with a given medical-profile may well result to be eligible for LTC services under one legislation while being ineligible under others.

We construct an individual-specific dichotomous variable for eligibility status, which takes value 1 if the individual fulfils the minimum requirements of at least one LTC programme implemented in her region/country of residency (i.e., she is *eligible* to LTC home-care services) and 0 otherwise. It represents a non-linear

combination of a set of health-status variables, which are based on regional or national long-term care regulations. This dummy variable will be used to instrument our potential endogenous regressors (annual hours of formal home-care utilization).

It is important to notice that we restrict the analysis to countries (and programs within countries) where the eligibility regulations are *carer-blind*, i.e., eligibility is need-tested (through validation of ADL- iADL- and cognitive limitations), while no role is played by other factors like informal-care availability, quality of family or neighbourhood environment, social-network of the patient ([Eleftheriades & Wittenberg, 2013](#)). Monetary resources are sometimes taken into account to determine the monetary amount of the benefits, but they do not have discriminatory power to define eligibility.

### 3. DATA, DESCRIPTIVE EVIDENCE AND SAMPLE SELECTION

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We use data from the first and the second wave of SHARE (Survey on Health, Ageing and Retirement in Europe), a European multidisciplinary survey on individuals aged 50 or older and on their spouses. Data were collected in 2004 and 2006, and the original sample consists of 63,948 observations from 13 European countries, plus Israel. The design of SHARE is based on the Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA). We refer to [Börsch-Supan et al. \(2005\)](#) and [Börsch-Supan and Jürges \(2005\)](#) for a detailed review of the survey, its methodological details and the sampling procedures.

SHARE data are particularly useful to investigate individual choices on health-care utilization. The survey provides detailed information about respondent's morbidity and disability status, based on self-reports of objective limitations and health conditions. In particular, it contains a set of questions that allow us to build, for each individual, a simplified medical-profile comparable with the LTC regulations of the countries in our sample (see Appendix 8.2). Respondents are asked to report their dependency status in performing fourteen activities of daily livings<sup>3</sup>, which conform to the ADL and iADL taxonomies by [Katz, Downs, Cash, and Grotz \(1970\)](#) and [Lawton and Brody \(1969\)](#). Furthermore, the survey includes ten specific questions on *mobility limitations*<sup>4</sup>. All the aforementioned tasks are assessed on a dichotomous scale: a limitation can either occur or fail to occur, but no intensity is measured.

Depression and loss of orientation are covered by two different set of variables. *First*, the questionnaire assesses a set of 12 mood and behaviour-related conditions (pessimism, depressed mood, suicidal thoughts, guilt, trouble

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<sup>3</sup> These are: (i) dressing, including putting on shoes and socks; (ii) walking across a room; (iii) bathing or showering; (iv) eating, such as cutting up one's food; (v) getting in and out of bed; (vi) using the toilet, including getting up and down; (vii) using a map to determine how to get around in a strange place; (viii) preparing a hot meal; (ix) shopping or buying groceries; (x) making telephone calls; (xi) taking medicines, following medical prescriptions; (xii) doing work around the house or garden; and (xiii) managing money, such as paying bills and keeping track of expenses. An additional question covers the dependency over incontinence, or the involuntary loss of urine.

<sup>4</sup> The tasks covered are: (i) walking 100 meters; (ii) sitting for about two hours; (iii) getting up from a chair after sitting for long periods; (iv) climbing several flights of stairs without resting; (v) climbing one flight of stairs without resting; (vi) stooping, kneeling, or crouching; (vii) reaching or extending your arms above shoulder level; (viii) pulling or pushing large objects like a living room chair; (ix) lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries 10; (x) picking up a small coin from a table.



sleeping, loss of interest, irritability, fatigue, inability to concentrate, lack of appetite, incapacity of enjoyment, tearfulness), that are then summarized in the EURO-D scale ([Prince et al. \(1999\)](#)), whose values range from 0 to 12 depending on the number of occurring symptoms. A EURO-D value of 4 (or higher) has been demonstrated to be associated with a clinically significant level of depression ([Colombo, Llana-Nozal, Mercier, and Tjadens \(2011\)](#)). *Secondly*, four questions on mental orientation and coherence ask respondents to report the current date, month, year and day of week; the number of correct answers is summarized in a generated variable (*orientation*) whose values range from 0 to 4 (the higher the better oriented). We choose to label as impaired (*orientation impairment*) those respondents who gave zero or one correct answers, following the approach suggested by [Verbeek-Oudijk, Woittiez, Eggink, and Putman \(2014\)](#).

As for Long-term care (LTC) services, SHARE encompasses both formal and informal assistance performed at a patient's own dwelling. *Formal home-care* refers to the assistance provided in the context of formal employment regulations, such as through contracted services, by professional care workers, either paid out-of-pocket by the care-receiver or through public or private care-insurance schemes. SHARE distinguishes between *personal/nursing care* (help with basic activities of daily living, medical services such as wound dressing, pain management, medication, health monitoring, prevention, rehabilitation or services of palliative care), *domestic help* (lower-level care provided by low or unskilled workers, typically related to help in instrumental activities of daily living), and *meals-on-wheels* (services that deliver meals to individuals at home). Respondents are asked to report whether they made use of any of these three care-services in the last twelve months because of health problems. We limit our analysis to the skilled formal-care (*personal/nursing care*), which is the most demanding type of help and which is commonly regulated, through reimbursements or direct provision, by public health-care or social policy departments. In fact, domestic help may include some tasks not directly related to health care (like cooking, laundry, cleaning the house), usually performed by private domestic workers to seniors not in need of care. SHARE collects , information about the number of weeks (per year) and the average number of hours (per week) of personal/nursing help care received, from which we build a continuous variable for the average annual number of hours of formal care received. Meals on wheels are measured in weeks of service per year: given the difficulties in aggregating the two types of formal care and its limited diffusion, we decided not to include it in the analysis

*Informal care* is defined as unpaid help received from outside the household from any family member, friend or neighbour. Recipients indicate the nature of the relationship with the caregivers<sup>5</sup>, the frequency (daily, weekly, monthly or annual) and the average number of hours received. In this paper, we introduce two distinct classifications of *informal care*. The first (broad definition) concerns home assistance received from outside the household by children, relatives, friends and neighbours (Kalwij et al., 2014). The second (narrow definition) regards informal assistance provided by children, grandchildren and children-in-law. Consistently with the formal care definition, we build two continuous variables for the average annual hours of informal care received.<sup>6</sup>

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<sup>5</sup> A maximum of three caregivers can be named.

<sup>6</sup> We follow [Bolin et al. \(2008\) in the way we map SHARE questions about intensity of care into average annual hours.](#)

The survey also includes information on *chronic conditions* and *symptoms* that the individual may suffer from,<sup>7</sup> her subjective well-being and life satisfaction as well as on other forms of health-care utilization (e.g., visiting the GPs or the dentist) and health-related behaviours (e.g., smoking, drinking, doing physical activities). Labour-market variables and economic variables are collected, e.g., details on current and past occupations, job opportunities in retirement age, sources and composition of income and wealth, as well as consumption and saving choices. Further socio-economic characteristics include education (both the ISCED classification – see [OECD \(1999\)](#) - and the number of years of completed education), involvement in social activities, as well as information on respondents' children.

Due to the high level of heterogeneity in defining eligibility criteria, among the European countries that have carer-blind home care programs, we focus our attention on Austria, Belgium -Flanders, Wallonia and Bruxelles-Germany and France, whose public LTC regulations clearly identify a minimum level of need corresponding to a condition of “objective dependency” that entitles individuals to receive a public home-care service. Specific details on these LTC frameworks are included in the appendix. However, main LTC programmes in Czech Republic, Spain and some Italian regions feature clearly cut assessment of need methods and carer blind eligibility rules. We excluded them from the analysis because their regulations were introduced after 2006, i.e., after SHARE data were collected.

Table 2-1 summarizes some descriptive statistics of our sample, which consists of non-institutionalised individuals aged 60 and older, having children, but not living with them ([Balía and Brau \(2013\)](#), [Bonsang \(2009\)](#), [Kalwij et al. \(2014\)](#)). SHARE does not include quantitative information about the assistance provided by any caregivers (spouse, children) from *within* the household, while it reports details on the source and the amount of informal care received from *outside* the household (from children, relatives, friends and neighbours). It is therefore hard to distinguish the way and the type of transfers that take place within a family in terms of informal care. The average sample age is 70.5 years old, with the 25-th percentile at 64 years old, the median age at 69 and the 75-th percentile at 75. The population aged 80+ accounts for 13.2% of the sample. Females account for 55.4% of the whole population, while retired individuals and homemakers are, respectively, 80% and 13%. A typical individual has 9.7 years of completed education and 2.4 children. As far as the health-conditions are concerned, statistics show that limitations in iADL are more frequent than in ADL. On average, 19.6% of population have lost at least one iADL while 16.8% have at least one loss in ADL. Regarding mental limitations, the typical individual in the whole sample suffers from 2.3 mood- and behaviour-related conditions of the EURO-D scale, while 2.4% of the sample is labelled as cognitively impaired. Around 9.5% of the sample receive formal nursing/personal home-care, while

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<sup>7</sup> The chronic conditions should have previously been diagnosed to the respondent by a doctor. They include: (i) heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure; (ii) high blood pressure or hypertension; (iii) high blood cholesterol; (iv) stroke or cerebral vascular disease; (v) diabetes or high blood sugar; (vi) chronic lung disease such as chronic bronchitis or emphysema; (vii) asthma; (viii) arthritis, including osteoarthritis, or rheumatism; (ix) osteoporosis; (x) cancer or malignant tumor, including leukaemia or lymphoma, but excluding minor skin cancers; (xi) stomach or duodenal ulcer, peptic ulcer; (xii) Parkinson disease; (xiii) cataracts; (xiv) hip fracture or femoral fracture. Other reported symptoms (if they were present for the 6 months before the interview) include: (i) pain in the back, knees, hips or any other joint; (ii) heart trouble or angina, chest pain during exercise; (iii) breathlessness, difficulty breathing; (iv) persistent cough; (v) swollen legs; (vi) sleeping problems; (vii) falling down; (viii) fear of falling down; (ix) dizziness, faints or blackouts; (x) stomach or intestine problems, including constipation, air, diarrhea.

almost 18.5% receive informal-care from outside the household, by at least one provider among children, relatives, friends or neighbours. Assistance from children is an important share of the total informal-care provision: 14% of the sample receive assistance from their offspring. Statistics on formal- and informal-care utilization confirm previous findings (see, e.g., [Kalwij et al. \(2014\)](#)): the total number of hours of formal care is on average lower than the total hours of informal care (accounting both for incidence and hours of care). Moreover, the provision of formal-care increases with age among couples, and is generally higher for singles. Among those who receive informal assistance from children, 32% report having two and 11% report having three informal home-care providers. We also notice significant differences across European countries, both in terms of care-utilization incidence and of the number of annual hours received.

Table 2-1, Descriptive statistics

	<b>Whole sample</b>	<b>Austria</b>	<b>Germany</b>	<b>France</b>	<b>Belgium Flanders</b>	<b>Belgium Wallonia</b>
<b>Observations</b>	9342	1235	2746	2486	1961	915
<b>Receiving formal personal/nursing care</b>	9.5 %	3.6%	3%	16.5%	10.6%	15.4%
<b>Receiving informal care from any provider</b>	18.5%	20.6%	21.2%	14.4%	17.9%	19.9%
<b>Receiving informal care from children</b>	13.9%	15.7%	16.1%	10.8%	13.6%	13.9%
<b>Annual hours formal personal/nursing home-care</b>	9.6	19	7.3	7.6	10.9	6.1
<b>Annual hours informal care (any provider)</b>	77	80	90	68	78	57
<b>Annual hours informal care from children</b>	57	63	72	48	52	37
<b>Age</b>	70.5	70.1	69.6	71.2	70.7	71
<b>Aged 80+</b>	13.2%	11.6%	10%	16.6%	13.3%	15%
<b>Females</b>	55.4%	60.3%	51.6%	58.3%	53.9%	55.4%
<b>Retired</b>	79.9%	81.3%	79.2%	84.2%	74.6%	75.4%
<b>Homemaker</b>	13.1%	14.5%	9.7%	10.2%	19.5%	18%
<b>Years of education</b>	9.7	7.8	13	7.6	9.1	9.6
<b>Number of children</b>	2.4	2.29	2.22	2.469	2.509	2.56
<b>Fraction of daughters</b>	50.4%	50.3%	52.1%	49.6%	49.5%	49.6%
<b>At least 1 ADL lost</b>	16.8%	14.4%	13.9%	17.6%	16.3%	25.8%
<b>At least 1 iADL lost</b>	19.6%	20%	15.1%	21.3%	19%	28.3%
<b>At least 1 ADL &amp; 1 iADL lost</b>	10%	9%	8%	10.6%	9.7%	16.1%
<b>At least 2 ADL lost</b>	6.3%	5.7%	6.2%	7.1%	6.6%	9.8%
<b># chronic conditions (out of 14)</b>	1.8	1.57	1.76	1.86	1.76	2.19
<b># mobility deficits (out of 10)</b>	1.7	1.77	1.75	1.81	1.49	2.24
<b>Orientation impaired</b>	2.4%	1%	2.4%	3.4%	2.3%	1.8%
<b>EURO-D score</b>	2.3	2	1.9	2.8	2	2.8

**Bad subjective health** 38.3% 32.5% 44.3% 42.1% 28.9% 38.2%

Data from SHARE waves 1&2 for Austria, Belgium, France, Germany. Sample selection: individuals older than 60, with children (no co-residence), not institutionalized.

### 3.1 THE ELIGIBLE POPULATION

The eligible population is determined on the basis of the rules adopted by LTC regulations to assess the degree of vulnerability of individuals and, consequently, to determine who is entitled to receive public home care services. Our aim is to implement countries’ eligibility rules for public LTC programmes on our SHARE sample (details on the correspondence between SHARE and the LTC legislations are reported in Appendix) in order to obtain an exogenous eligibility indicator.

A comprehensive list of the health conditions included (to various extents) in each assessment scale includes ADL, iADL, additional mobility limitations, cognitive limitations, behavioural/depression status, as summarized in Table 2-2, summary of LTC assessment-of-need scales. Among the ADL set, we split the ambulation item in the “moving” and the “transferring” tasks (the latter being originally present in the ADL list), since they are often assessed separately in actual LTC regulations. Albeit the original ADL + iADL taxonomies, two additional categories are included, which are “behavioural / cognitive impairment” and “hygiene for post-surgery conditions or advanced medications”. The former concerns patient’s depression, mental stability and coherence, (coherence and mental impairment are included – to various extents – in a conspicuous number of regulations); the latter refers to those patients who have difficulties in performing advanced medications (“advanced” with respect to taking pills or following medical prescriptions) like enemas or maintenance of tubes/bags resulting from surgical operations. Furthermore, additional mobility limitations are included, as crouching and walking down stairs.

Table 2-2, summary of LTC assessment-of-need scales

ADL	Non ADL
Bathing & hygiene ✓	Communication ✓
Dressing ✓	Shopping for groceries/medicines ✓
Using the toilet ✓	Cooking ✓
Transferring ✓	Housekeeping ✓
Continence ✓	Doing laundry ✓
Feeding ✓	Moving outdoor ✓
<u>Moving indoor</u> ✓	Responsibility for own medications ✓
<u>Hygiene for post-surgery conditions or advanced medications</u> ✘	Behavioral/Cognitive impairment ✓
	Other mobility limitations ✓

✓ = information available in SHARE; ✘ = information missing from SHARE

The underlined tasks do not belong to the Katz’s ADL scale, but are treated as basic activities of daily livings in the LTC regulations that include them.

In the SHARE micro-data, respondents provide self-reported information about the occurrence of each of these health-conditions. For a generic individual  $i$  living in country  $J$ , it is therefore possible to build a medical profile

$$\pi_{i,J}$$

We can define an “eligibility function”  $f_{\tilde{J}} : \Pi \rightarrow \{0,1\}$ , such that  $f_{\tilde{J}}(\pi_{i,J}) = \begin{cases} 1 & \text{if } \pi_{i,J} \in \tilde{J} \\ 0 & \text{if } \pi_{i,J} \notin \tilde{J} \end{cases}$

where  $\pi_i$  is a generic medical-profile for the individual  $i$ , whose components are the limitations as of Table 2-2; and  $\tilde{J} (\subset \Pi)$  is a subset of objectively vulnerable (eligible) medical-profiles among all the possible medical-profiles (set  $\Pi$ ), determined by the eligibility rules for the LTC programmes in country  $J$ .

The function  $f_{\tilde{J}}$  determines the eligibility status of an individual  $i$  (living in country  $J$ ), according to the rules of all the LTC programmes implemented in country  $J$ . In other words, this stage determines whether the  $i$ -th individual is eligible to LTC programmes in her nation/region.<sup>8</sup>

The function  $f$  is a highly non-linear combinations of health-indicators included both in the assessment of need scales and in our dataset. An example will help to clarify the nature of the  $f$  function: the Austrian national LTC programme (Pflegegeld) assesses individuals’ on fourteen dimensions (items), between ADL, iADL and cognitive limitations (see the appendix for details). The need-of-care is defined nationwide in terms of care-time (hours per month) for each dimension. The regulation defines as eligible all the medical profiles that present an overall need-of-care of at least 50 hours per month (raised to 60h since 2011), but with at least one limitation in ADL and one in iADL.

It is worth highlighting that the “eligibility” status does not necessarily identify those individuals who are actually “treated” by public programmes; furthermore, SHARE does not include information on whether an individual did made an application for LTC benefits and consequently received a positive, rather than a negative, response. As argued in Section 2.2, our eligibility variable can be interpreted as a requirement to obtain publicly funded long-term care through the surveyed programs, i.e., a proxy for the country-specific perspectives on the concept of vulnerability. It therefore allows us to account for the heterogeneities in both the assessment-of-need procedures and the eligibility rules in the countries included in our sample.

Descriptive statistics on the eligible population are reported in Table 2-3, compared with three other benchmark-samples, namely: the population of individuals with some functional limitations (*at least* one ADL, iADL), the whole sample population and the sample of non-eligible elderly. A comparison between the first and second column shows how the eligibility status detects a peculiar subsample of the population and does not correspond to an arbitrary selection of “dependent” individuals. Indeed, the characteristics of the sample of eligible individuals, built according to country- or region- specific regulations, is notably different from the one that adopts an arbitrary and fixed-for-all definition of dependency.

*Table 2-3, Formal care utilization among sub-samples*

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<sup>8</sup> We are implicitly assuming that the laws and the guidelines are carefully followed by the medical evaluators and by the medical-board who takes the final decision on eligibility. This is, admittedly, a simplifying assumption and yet, we believe, a necessary step to take in order to perform a comparative analysis.

	<b>Eligible</b>	<b>Individuals with 1+ ADL, 1+ iADL</b>	<b>Whole sample</b>	<b>Non-eligible</b>
Observations	728	2461	9352	8624
<i>% individuals receiving:</i>				
formal-care	41.4%	19.8%	8.1%	5.9%
informal care from any provider	39.7%	32.5%	18.5%	16.1%
informal care from children	34.4%	25.9%	13.9%	11.6%
<i>Average annual hours of:</i>				
formal care	100	34.7	9.6	2
informal care	356	193	77	54
informal care from children	279	148	57	38
formal care (among receivers)	268	176	116	35
informal care from any provider (among receivers)	896	577	420	324
informal care from children (among receivers)	830	555	418	321
Age	77.3	74.2	70.5	70
Number of ADL lost	2.5	1.1	0.29	0.12
Number of iADL lost	2.8	1.5	0.38	0.20
EURO-D score	4.1	3.56	2.3	2.15
Orientation impaired	25.7%	5.7%	2.4%	0.46%

*Data from SHARE waves 1&2 for Austria, Belgium, France, Germany. Sample selection: individuals older than 64, with children (up to 4; no co-residence), not institutionalized.*

Formal-care users are nearly 40% among eligible individuals, while their percentages were 8.1% in the whole sample and 19.8% in the sample of functionally impaired (at least 1 ADL, 1 iADL). Moreover, in the eligible population, the incidence of formal-care provision is almost equal than the informal-care's, while it was substantially lower in the other samples (e.g., 8% versus 18% in the whole sample). When looking at the intensive margin of elderly-care utilization, the eligible sample receive considerably larger amounts of hours of assistance, both informal and formal. Again, the ratio between the mean annual amounts of informal and formal-care narrows down among objectively vulnerable elderly (896 hours vs 268 hours), with respect to the other benchmark samples. Indeed, this ratio peaks among the non-eligible (324 hours of informal care, 35 hours of formal-care). 5.9 percent of the non-eligible population reports to receive formal care, with an average number of 2 hours per year of care received in the sample (compared to 100 hours per year in the eligible sample). There are at least two reasons, besides measurement error, for observing this pattern: first, formal care, as it is asked in SHARE, includes privately paid care not provided by a public authority. Second, our eligibility index is based on national and regional home care programs, while we do not consider home care programs run at municipal level, the reason being that we are not able to identify the exact municipality of residence in the data due to non-disclosure policies.



## 4. EMPIRICAL SPECIFICATION

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In this section we empirically investigate the effect of receiving formal home care on the utilization of informal care, both at the extensive (i.e. the probability of receiving informal care) and at the intensive margin (i.e. the hours of informal care received). Similarly to previous studies ([Bolin et al., 2008](#); [Bonsang, 2009](#); [Duan, Manning, Morris, & Newhouse, 1983](#); [Van Houtven & Norton, 2004](#)), we use a standard two-part model, which specifies the probability of receiving care and the quantity of care received as two different processes. The two-part model allows for the separation of the individual behavior into two stages: first, a decision concerning receiving some care and second, a decision concerning the amount of care, conditional on receiving any. This kind of model is appropriate for estimating actual outcomes (or conditional outcomes), i.e. fully-observed variables. In our case, zero values for actual formal home care indicate that zero hours of care were received. We refer to these actual zero values as corner solutions, because individuals cannot receive a negative amount of hours of care. In the health economics literature, two-part models are often preferred to Tobit or Heckman selection models to deal with data that include many zero observations ([Dow & Norton, 2003](#); [Duan et al., 1983](#)).

The first part of the two-part model is a probit that models the probability of receiving informal care. Following (2.1), we assume that the parent's utilization of informal care ( $TIHC_i$ ), is a function of hours of formal home care ( $FHC_i$ ), health-status ( $HS_i$ ), and a vector of socio-demographic covariates ( $CV_i$ ). The second part is a linear regression where the dependent variable is logarithm of hours of home care received, run on the conditional sample of home care receivers. Hours of formal home care are instrumented by the eligibility indicator, thus the first part of the model is estimated by IV probit and the second by Two-stage least squares. Consistency of our estimates hinges on two assumptions: the independence between the first and second stage, typical of a two-part model, and the validity of our instrument. Following [Dow and Norton \(2003\)](#), the two part model is often preferred to Tobit and Heckman selection models in the health economic literature. The reason is that despite the necessity to assume independence, the two part model does not impose any constraint on the coefficients, as a in a Tobit model does, and at the same time does not rely on any exclusion restriction or functional form, as in a Heckman type of model.

Exogeneity of the new instrument proposed for hours of formal care comes from its legislation-based nature: the eligibility status is determined on the basis of the assessment-of-need scales used by different country legislations to assess the degree of vulnerability of individuals and, consequently, to determine who is entitled to receive public home care services. Besides being exogenous, the instrument must be informative, i.e. it must correlate with actual formal home care received. Eligibility clearly affects the probability of receiving care since it is a prerequisite to receive formal care provided by national or regional programs. Still, it is not simply a different proxy for receiving formal care: it does not identify who are actually “treated” by formal home care programmes. As we documented in table 2.3, the sample includes both eligible individuals that do not receive any formal care, and individuals that are not eligible for a formal home care program, but report to receive it.

The identification power of the eligibility instrument comes from the variation of the eligibility regulations across countries (or regions): similar individuals (in terms of health conditions) may have a different degree of “eligibility”, or may be eligible or not eligible for public programmes according to the assessment criteria of their country (or region) of residence. In order to be sure that our instrument does not simply capture regional differences

in the generosity of health care systems, we introduce a set of dummies to capture country- and region- fixed effects.

Another source of variation of our instrument is at the individual level, and relies on the different health status and level of vulnerability of respondents exposed to the same formal care programs. Again, in order to rule out the possibility that our instrument simply proxies for individual health conditions, we introduce in the model as controls all the health variables used to build the eligibility indicator. Specifically, first we include a continuous variable that takes value 1 if the respondent has been diagnosed to suffer from at least one chronic condition. Second, we control for a measure taking value 1 if the respondent reports to suffer from some long-term illness, including mental health problems. Among the measures of physical dysfunctions, we include a binary variable that captures mobility limitations, the number of limitations in ADL as well as in iADL. Moreover, we add an interaction term between mobility and ADL as a further control in order to capture the combined effect between having at least one mobility limitation and the number of ADL limitations. As regards mental cognitive limitations, we include in our analysis a dummy variable assessing mathematical skills of elderly respondents (numeracy), and a binary indicator measuring the sense of orientation in space and time (orientation). Furthermore, we introduce a continuous variable based on EURO-D scale. Finally, in order to capture other non-observed health problems, we include a binary variable based on self-perceived health of individuals.<sup>9</sup> The use of self-perceived health status (SPHS) is supported by evidence that shows a strong predictive relationship between individuals' self-rating of health and morbidity (Idler and Benyamini, 1997; Kennedy et al., 1998).

As regards socio-demographic covariates  $CV_i$ , we control for years of education, country-specific wealth quintiles, household income quintiles and residential area (whether he/she lives in a big city, in the suburbs of big city, large town and small town).

## 5. RESULTS

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### 5.1 INFORMAL CARE FROM CHILDREN, RELATIVES, FRIENDS (BROAD DEFINITION)

Table 5-1 reports the coefficients for the determinants of informal home-care from children, relatives, friends and neighbours at the extensive margin. Each part of the model is first estimated by assuming exogeneity of the variable of interest, formal home-care, on the utilization of informal-care, and then by adopting the instrumental variable approach.

Results from the probit model suggest that formal-care utilization increases the likelihood of receiving any informal home-care (p-value <0.001), even though the magnitude of this effect is rather low. A 10% increase (decrease) in the annual hours of personal/nursing domiciliary care leads to a 0.15 percentage point increase (decrease) in the probability of receiving assistance from one's own offspring, relatives, friends or neighbours. Given that the average annual hours of personal/nursing home-care provision is 9.6 among the whole sample, and

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<sup>9</sup> It assigns value 1 if the respondent reports a bad self-perceived health status ("fair", or "poor"), measured on a five-point scale from "excellent" (score 5) to "poor" (score 1).

that the average probability of receiving informal-care is 18.43%, an increase of average formal domiciliary assistance by 1 hour per year would lead to an 18.58% increase in the likelihood of informal-care use with respect to the mean.

As regards the IV-probit specification, the first-stage outcome of our empirical model for the extensive margin of informal-care utilization shows that, indeed, the individual's eligibility status for public programmes of domiciliary assistance is a strong predictor for the log-hours of received formal home-care as defined in section 2.3. The estimated coefficient for eligibility is positive, as expected, statistically significant at the 1% level (p-value less than 0.001). The first-stage F-statistic, which tests the null hypothesis that the instrument is not informative, reports a value of 21.02 with a p-value less than 0.001.<sup>10</sup> However, the Wald test for exogeneity of formal-care cannot be rejected ( $\chi^2=1.71$ , p-value = 0.25). We therefore conclude that the un-instrumented probit specification (column "probit") is appropriate for this part of the model.

*Table 5-1: Two-part model for overall informal-care from outside the household: extensive margin*

Dependent variable	first stage for formal-care		any informal-care from						
	utilization (annual log-hours)		any provider						
	coeff.	S.E.	probit		IV probit		S.E.		
marg. eff.			S.E.	marg. eff.	S.E.				
Log-hours FHC	-		0.015	***	0.004	0.069	0.043		
Age	0.009	***	0.002	0.005	***	0.001	0.005	***	0.001
Being retired	0.026		0.024	0.005	0.010	0.004	0.010		
Female	0.031		0.020	-0.012	0.009	-0.014	0.009		
Living with spouse	-0.091	***	0.028	-0.222	***	0.010	-0.215	***	0.011
Years of education	0.005	**	0.002	-0.001	0.001	-0.001	0.001		
Having 1.t. Illness	0.034	*	0.018	0.016	*	0.009	0.014	0.009	
Euro-D score	0.008		0.006	0.007	***	0.002	0.006	***	0.002
Low numeracy-score	0.026		0.027	-0.019	**	0.010	-0.021	**	0.010
Low orientation-score	-0.279	*	0.145	-0.048	*	0.026	-0.040	0.027	
Any mobility deficit	-0.039	***	0.015	0.068	***	0.009	0.070	***	0.010
# ADL limitations	0.043		0.092	0.060	**	0.030	0.056	*	0.031
# iADL limitations	0.172	***	0.026	0.024	***	0.005	0.013	0.010	
Mobility*ADL	0.134		0.097	-0.072	**	0.031	-0.081	***	0.031
# Chronic dis.	0.017	*	0.009	0.004	0.003	0.004	0.003		
Bad subjective health	0.040	*	0.021	0.021	**	0.009	0.019	*	0.009
<i>Living area (w.r.to rural area)</i>									
Big city	-0.057		0.036	-0.005	0.015	-0.003	0.016		
Suburbs big city	-0.001		0.031	-0.001	0.013	-0.001	0.013		
Large town	-0.042		0.033	-0.010	0.013	-0.008	0.014		

<sup>10</sup> We perform the Kleibergen-Paap Wald statistic ([Kleibergen and Paap \(2006\)](#)) in place of the Cragg-Donald's one, since we adopt a heteroskedastic- and cluster- robust specification (see [Baum, Schaffer, and Stillman \(2007\)](#))

Small town	-0.005		0.026	-0.020 *	0.011	-0.021 *	0.011
Being eligible	0.492	***	0.107				
Constant	-0.588	***	0.163				
F-test	excluded F(1, 6380)=21.02 ***						
instrument							
Wald test of exogeneity							chi2(1) = 1.71
Observations	9342						9342

Additional controls include dummies for country-, income-, wealth-, wave- effects.

*Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home. Informal home-care from outside the household by children, relatives, friends and neighbours corresponds to unpaid help with personal care, practical household tasks and paperwork.*

*Sample selection: individuals aged 60+ from waves 1&2 from SHARE, having children but not living with them.*

*Standard errors are robust to heteroskedasticity and clustered at the individual level.*

*Years of education based on ISCED codes.*

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

The second part of the model – the intensive margin – is the equation for the yearly log-hours of informal-care received from any informal provider (conditional to receiving any) and it is estimated both through OLS (assuming exogeneity of formal home-care use) and through 2SLS (where individuals' eligibility status is adopted as instrument). Conversely to what was found in the first part, the null hypothesis of the Wu-Hausman test for exogeneity of formal-care is now significantly rejected (F-stat= 4.90, p-value = 0.027), thus indicating that decisions about hours of formal assistance (conditional of receiving any) are endogenously determined with respect to the informal-care decision. The 2SLS specification is therefore the preferred specification. The first-stage of the 2SLS reports an F-statistics of 6.7 for the excluded instrument (dummy variable for eligibility status), which is lower than in the first stage, but still strongly significant (p-value of 0.009).

Table 5-2, Two-part model for overall informal-care from outside the household: intensive margin

Dependent variable	first stage for formal-care utilization (annual log-hours)		annual log-hours of informal home-care from any provider, among receivers			
			OLS		2SLS	
	coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	-		0.059 ***	0.023	0.599 *	0.331
Age	0.141 ***	0.004	0.018 ***	0.005	0.010	0.007
Being retired	0.073	0.083	-0.121	0.081	-0.168 *	0.095
Female	0.001	0.076	0.070	0.080	0.076	0.091
Living with spouse	-0.126	0.082	-0.048	0.090	0.025	0.107
Years of education	0.024 *	0.009	-0.019 *	0.011	-0.031 **	0.014
Having 1.t. illness	0.009	0.066	0.072	0.078	0.069	0.084
Euro-D score	0.031 *	0.017	0.030 *	0.016	0.012	0.022
Low numeracy-score	0.062	0.087	0.112	0.074	0.085	0.088
Low orientation-score	-0.256	0.279	0.484 ***	0.179	0.575 **	0.234
Any mobility deficit	-0.103 *	0.057	0.042	0.086	0.102	0.097
# ADL limitations	0.251	0.229	0.102	0.211	-0.040	0.282
# iADL limitations	0.194 ***	0.047	0.210 ***	0.033	0.086	0.086
Mobility*ADL	0.047	0.236	-0.068	0.212	-0.132	0.274
# Chronic dis.	0.015	0.026	-0.049 **	0.024	-0.059 **	0.027
Bad subjective health	0.001	0.068	0.144 *	0.076	0.139 *	0.081
<i>Living area (w.r.to rural area)</i>						
Big city	-0.226 **	0.112	-0.215 *	0.122	-0.100	0.150
Suburbs big city	-0.093	0.111	-0.025	0.107	0.027	0.125
Large town	-0.093	0.111	0.043	0.106	0.088	0.125
Small town	0.008	0.093	-0.070	0.086	-0.076	0.097
Being eligible	0.505 ***	0.195				
F-test	excluded F(1,1468)=6.68***					
instrument						
Wu-Hausman	F(1,1468) =					
exogeneity test	4.9016**					
Observations	1721		1721			

Additional controls include dummies for country-, income-, wealth-, wave- effects.

Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home. Informal home-care from outside the household by children, relatives, friends and neighbours corresponds to unpaid help with personal care, practical household tasks and paperwork.

Sample selection: individuals aged 60+ from waves 1&2 from SHARE, having children but not living with them.

Standard errors are robust to heteroskedasticity and clustered at the individual level.

Years of education based on ISCED codes.

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

2SLS estimates for yearly log-hours of formal home-care (Table 5-2) confirm the lack of crowding out of informal-care by the formal-care. Indeed, results suggest that an increase of 1% in the intensity of formal-care provision leads to an increase of 0.59% in the intensity of informal-care, among those who receive informal assistance. The positive effect is substantial, and it is better appreciated when computing the cross-elasticity between the two sources of care, evaluated at averages (420 yearly hours of informal-care, 30 hours of formal-care, both conditional to receiving informal-care from any provider). An increase of 1 hour per year in the formal-care provision leads to an increase of 8.26 hours in the overall informal-care from outside the household. According to [Stabile et al. \(2006\)](#), this result points to the existence of an unmet demand for public long term care services satisfied resorting to the private market: households exhaust all the available public formal care and given their budget and time constraints determine hours of informal care. Given total demand of care is not satisfied, they resort to formal care bought on the market. An increase in public, subsidized formal care keeping input prices fixed (i.e., without changing market price for formal care, the unitary subsidy nor market wages) allows to substitute formal care paid out of pocket at price  $P$  with publicly provided subsidized formal care paid  $P-S$ , therefore reducing the average price for formal care. This substitution has the same effect as an increase in non-wage income: if total formal care and informal care giving time are normal goods, they will both increase at the new equilibrium.

As regards other covariates, being older significantly increases both the likelihood of receiving informal care from outside the household and the number of hours of care received. At the extensive margin, the dummy capturing the presence of a spouse in the household is characterized by a significant negative marginal coefficient, in line with the literature underlining the importance of informal assistance from the spouse (see, e.g., [Kalwij et al. \(2014\)](#) and [Motel-Klingebiel, Tesch-Roemer, and Von Kondratowitz \(2005\)](#)). The number of years spent in education is significantly negatively related to informal-care utilization at the intensive margin.<sup>11</sup> This effect (elsewhere found, e.g., in [Bonsang \(2009\)](#)), could depend either on cultural factors, or on the fact that higher educated individuals might tend to have weaker family ties ([Kalmijn, 2006](#)).

Individuals' medical conditions are important determinants of the informal-care provision at the extensive margin. In particular, results show significant positive effects for both functional limitations (limitations in ADL, iADL, or other mobility deficits) and disease-specific conditions (long-term illnesses). A similar effect appears for the Euro-D score, the "numeracy" and "orientation" dummies, as well as for subjective health. The interaction term between the dummy for mobility limitations and the number of ADL deficits takes a significant and negative value, suggesting that for those that have mobility limitations the marginal effect of a further loss in ADL is a lower than for less limited individuals.

Among those who already receive care, cognitive impairment, chronic conditions and bad subjective health still play a significant role in determining informal-care utilisation. Conversely, most of the coefficients for functional health-limitations (ADL, iADL, mobility) lose significance: increase in ADL or occurrence of mobility limitations do not have significant effects on the amount of care received. This result, which is in line with [Bonsang \(2009\)](#) suggests that informal care-giving is not going to fully intervene when vulnerability conditions reach levels that

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<sup>11</sup> We tried a modified specification with ISCED levels 0,1,2 and 3,4 and 5,6 being grouped together, respectively. The results hereby reported are confirmed, with a significant negative coefficient for the *low* education category.



require a higher skilled care. Categorical variables for respondents' income and wealth were not significant. Additional controls include dummies for country and for waves.

## 5.2 INFORMAL CARE FROM CHILDREN (NARROW DEFINITION)

Our research question relies on the identification of the effect of a variation in the provision of formal-care on the care-provision of the other sources of care (informal help from children, relatives, friends and neighbours). In order to offer comparable results with recent literature that mostly focused on informal-care from children<sup>12</sup>, we now adopt a narrower definition of informal-care, limiting our focus to the domiciliary assistance provided by respondent's offspring from outside the household. Table 5-3 reports the coefficients for the determinants of informal home-care from children, both at the extensive and at the intensive margin. As before, each part of the model is first estimated by assuming exogeneity of the variable of interest, formal home-care, on the utilization of informal-care, and then by adopting the instrumental variable approach.

At the extensive margin, results are similar to those found in the previous paragraph. The Wald test for exogeneity of formal-care in the first part of the model cannot be rejected ( $\chi^2=0.63$ , p-value = 0.42), and we therefore turn our attention on the simple probit specification (column "probit"). This result finds a correspondence in the paper by [Bonsang \(2009\)](#), who analyses the other direction of causality (i.e., the role of informal-care in determining formal-care utilization) using data from SHARE and a similar sample selection and finds that exogeneity of informal home-care from children on nursing/personal home-care cannot be rejected. Results from the probit model suggest that formal-care utilization increases the likelihood of receiving any informal home-care from children (p-value <0.001). As before, the magnitude of this effect is rather low. A 10% increase in the annual hours of personal/nursing domiciliary care leads to a 0.09% point increase in the probability of receiving assistance from one's own offspring. Given that the average annual hours of personal/nursing home-care provision is 9.6 among the whole sample, and that the average probability of receiving informal-care from children is 13.8%, an increase of average formal domiciliary assistance by 1 hours per year would lead to a 13.9% increase in the likelihood of informal-care use with respect to the mean.

The second part of the model – the intensive margin – is the equation for the yearly log-hours of informal-care received from children (conditional to receiving any) and it is estimated both through OLS and through 2SLS. Similarly to what was found at the extensive margin, the null hypothesis of the Wu-Hausman test for exogeneity of formal-care cannot be rejected (F-test=6.73, p-value = 0.30), thus indicating the OLS specification as the preferred specification. This results contrasts with the findings in Section 4.1, when the dependent variable included all the possible sources of informal care and where endogeneity was detected.<sup>13</sup>

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<sup>12</sup> This is also due to the fact that most literature treats informal-care as endogenous determinant of formal-care (the opposite direction of causality with respect to ours). Characteristics of respondents' offspring, usually included in health-surveys, have been found to be good instruments for the part of informal-care coming from children. Conversely, it is difficult to adopt plausible strong instruments for help by relatives, friends and neighbours, whose contributions as caregivers are, therefore, not included in the "informal-care" variable.

<sup>13</sup> Because of the reduced sample-size, the first-stage of the 2SLS reports a lower F-statistics for the excluded instrument (eligibility) of 7.1 and still strongly significant (p-value of 0.008). Results are available upon request.

OLS estimates for yearly log-hours of formal home-care confirm the lack of crowding out of informal- by the formal-care: an increase of 1% in the intensity of formal-care provision leads to an increase of 0.064% in the intensity of informal-care from children, among recipients. At sample averages (418 yearly hours of informal-care, 37 hours of formal-care), an increase of 60 minutes per year in the formal-care provision leads to an increase of 43 minutes in the informal-care assistance from children living outside the household.

*Table 5-3, Two-part model of informal home-care provision from children-only*

Dependent variable	any informal-care from children				annual log-hours of informal home-care received from children, among receivers			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.009 ***	0.003	0.034	0.033	0.064 ***	0.023	0.390	0.269
F-test excluded instrument			F(1,6380)=21.02** *				F(1,1101)=6.73** *	
Wald test of exogeneity			chi2(1) = 0.63				-	
Wu-Hausman test of exogeneity			-				F(1,1101) = 2.029	
Observations	9334		9334		1283		1283	
Adjusted R <sup>2</sup>	0.234				0.296		0.249	
Additional controls include dummies for country-, income-, wealth-, wave- effects.								

*Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient's home. Informal home-care from children corresponds to unpaid help with personal care, practical household tasks and paperwork*

*Sample selection: individuals aged 60+ from waves 1&2 from SHARE, having children but not living with them.*

*Standard errors are robust to heteroskedasticity and clustered at the individual level.*

*Years of education based on ISCED codes.*

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

Effects of covariates like age, education, spousal support and health-conditions are consistent with the findings of the previous paragraph. Categorical variables for respondents' income and wealth were not significant. Additional controls include dummies for country and for waves.

Our findings, thus, highlight that there is no statistical evidence of endogeneity at the intensive margin, while the observed use of formal-care turns to be endogenous at the extensive margin only when the contributions of multiple informal providers are included in the analysis. The economic interpretation of this result is that conditional on receiving formal care, individuals simultaneously determine how many hours of formal and informal care to use they need to cover the total demand for care. Then, given the total number of hours of informal care needed, households allocate them to the different potential informal care providers: [Kalwij et al. \(2014\)](#) show that the informal sources of care are substitute between each other. In order to test that this result does not depend on the specific sample selection we choose, in the next section we will repeat the analysis under a number of different sample selections. Under the broad definition of informal care exogeneity is rejected not only at the extensive margin as in the baseline results we just discussed, but also at the extensive margin for some alternative

specifications. Vice versa, endogeneity is never detected when the dependent variable is narrowed to the assistance supplied by children only.

## 6. ROBUSTNESS

Our main specification includes both couples and single-living individuals (not living with their children). We account for the role of spousal support, for which we do not have quantitative information in SHARE, through a dummy variable that capture the presence of a spouse in the household (as in, e.g., [Bonsang \(2009\)](#), [Kalwij et al. \(2014\)](#), [Bakx, Meijer, Schut, and Doorslaer \(2014\)](#)). Other studies using SHARE proposed to restrict the focus to the single-only subsample, in order to avoid potential underestimation of informal caregivers ([Balía & Brau, 2013](#); [Bolin et al., 2008](#)). As a robustness, we replicate our model on the latter specification. The reduced dimensionality causes a drop in the performance of our instrument’s relevance ( $F(1, 1781) = 8.8$ ), although it remains strongly statistically significant (at 1%). The positive and significant marginal effect of formal on informal care is confirmed both at the extensive margin (where endogeneity is rejected) and at the intensive margin (where endogeneity is detected).

*Table 6.1, Two-part model for the population of single-only*

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.023 **	0.009	0.112	0.088	0.066 ***	0.025	0.794 *	0.433
Testing the null of formal-care exogeneity	chi2(1) = 0.90				F(1,880) = 7.889**			
First-stage weak-instrument test	F(1, 1781) = 8.8***				F(1, 880) = 5**			
Observations	2570		2570		1062		1062	

Standard errors are robust to heteroskedasticity and clustered at the individual level.

*Notes: formal home-care corresponds to nursing- and personal-care assistance at the patient’s home. Informal home-care from outside the household by children, relatives, friends and neighbours corresponds to unpaid help with personal care, practical household tasks and paperwork.*

*Sample selection: individuals aged 60+ from waves 1&2 from SHARE, having children but not living with them.*

*Standard errors are robust to heteroskedasticity and clustered at the individual level.*

*Years of education based on ISCED codes.*

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

Besides spouses, also cohabiting children may provide help and the way intergenerational households are treated in the estimation sample may affect the results. Our baseline specification excludes all the individuals living with at least one of their offspring, since SHARE data do not allow us to quantify the amount of care provided by household members. Following [Bonsang \(2009\)](#), we replicate our analysis by including in the sample selection all those individuals having *at least one* child living outside the household (thus not ruling out living arrangements

that see children living with their parents). Co-residence is accounted for with a dummy indicating whether any of respondent’s children live in the same household. Results from this specification entirely confirm the positive relationship between formal and informal home-care previously reported. Endogeneity is detected at both hurdles of the two-part model.

*Table 6.3, Two-part model for the population aged 60+, including households with cohabiting children.*

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.013 ***	0.003	0.083 *	0.043	0.067 ***	0.021	0.593 *	0.325
Testing the null of formal-care exogeneity	chi2(1) = 2.78*				F(1,1578) = 4.80**			
First-stage weak-instrument test	F(1,6897) = 20.9***				F(1, 1578) = 6.56**			
Observations	10221		1022		1855		1855	
			1					

Standard errors are robust to heteroskedasticity and clustered at the individual level

*Sample selection: individuals over 60 from waves 1&2 from SHARE, having children. At least one child lives outside the household.*

*Health controls include: having long-term illnesses, Euro-D score, having cognitive limitations, having mobility limitations, #ADL limitations, #iADL limitations, interaction mobility\*ADL limitations, # chronic diseases.*

*Additional controls include: age, gender, marital status, education (years), country-, housing location-, income-, wealth-, wave- dummies.*

Next, we test different age-selections proposed in the literature. Our main specification includes individuals aged 60 or older. We repeat the exercise on the population over 55 ([de Meijer, Koopmanschap, d’Uva, & van Doorslaer, 2011](#)), 65 ([Bonsang, 2009](#)) and 70 ([Van Houtven & Norton, 2004](#)). Our instrument remains strongly relevant and all findings are confirmed. Results are available upon request. Furthermore, we in order to rule out the possibility that the lack of crowding-out of informal-care by formal-care is driven by the oldest-old population, we repeat our analysis on the sub-sample of individuals aged 80+ (1232 observations). In this subsample, the eligible population is 23.3%, the incidence of formal home-care utilization is 21.2%. The eligibility variable is still a good instrument for annual hours of formal home-care (the weak-instrument test returns an F-statistic of 11.6 and 9.5 at the extensive and intensive margin, respectively), and it allows us to implement our two-part model of informal-care utilization. Both at the extensive and at the intensive margin the positive relation between formal and informal care is confirmed, though we find no statistical evidence of endogeneity. Still, in this case the reduced sample size may lead to a lack of power of the Hausman test.

Table 6.4, Two-part model for the oldest old (80+) population

Dependent variable	any informal-care from children, relatives, friends				annual log-hours of informal home-care from children, relatives, friends (among receivers)			
	probit		IV probit		OLS		2SLS	
	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.	marg. coeff.	S.E.
Log-hours FHC	0.017 *	0.010	0.085	0.064	0.042	0.030	0.281	0.194
Testing the null of formal-care exogeneity	chi2(1) = 1				F(1,429) = 1.79			
First-stage weak-instrument test	F(1, 929) = 11.6***				F(1, 429) = 9.56***			
Observations	1232		1232		521		521	

Standard errors are robust to heteroskedasticity and clustered at the individual level

Sample selection: individuals over 80 from waves 1&2 from SHARE, having children but not living with them.

Health controls include: having long-term illnesses, Euro-D score, having cognitive limitations, having mobility limitations, #ADL limitations, #iADL limitations, interaction mobility\*ADL limitations, # chronic diseases.

Additional controls include: age, gender, marital status, education (years), country-, housing location-, income-, wealth-, wave- dummies.

Once we checked the results do not depend on the specific sample selection chosen in the baseline specification, we tested the robustness of the estimation procedure. Results from a tobit and an IV tobit specification, available upon request, are in line with the two-part model not only in terms of sign and significance of the marginal effects, but also of magnitude: the implied elasticity of informal to formal care is very similar. Next, we ran our model separately for wave 1 (4846 observations) and wave 2 (4499 observations) and fully confirm the results of a positive relationship between formal and informal care utilization (available upon request). Finally, as explained in Section 2.3, we built our dependent variable for annual hours of informal-care based on categorical questions on how often and for how many hours informal-care were received in the twelve months previous to the interview following the procedure proposed by (Bolin et al., 2008). This mechanism of building a continuous variable from an ordinal variable could raise some doubts on the accuracy of our adopted measure of informal-care. We then perform an ordered-probit analysis in place of the linear specification in the second part of our two-part model. Results confirm the results of the baseline model.

In our main empirical specification, we included information on several health outcomes as independent variables that could explain, alongside the individual eligibility status, the utilization of formal and informal care. In particular, our model imposes a linear relationship between the receipt of informal care (and of formal care, in the first-stage equation) and the number of ADL and iADL limitations. It is important to notice that different types of ADL and iADL limitations might have different effects on the health of the individuals (which drives the demand of both formal and informal care) and that the LTC regulations put different weights on specific ADL, iADL, cognitive/behavioural deficits. For such reasons we performed a robustness check on our instrument's validity by changing the way in which the health information enter the model.

At first, we implemented a specification where, instead of the number of ADL and iADL, a dummy for each limitation is considered. Indeed, such methodology turned out to be highly data demanding: the results are confirmed at the extensive margin, while at the intensive margin the sample size is too narrow to obtain precise estimates. The second alternative specification follows a methodology frequently adopted in the recent literature, which consists in generating, at the individual level, a disability index that would substitute for the entire set of health information (Kapteyn & Meijer, 2013; Poterba, Venti, & Wise, 2013). In particular, we replicate the strategy introduced by Bonsang (2009), who follows the strategy of Bound et al. (1999) by using objective health variables available in SHARE to predict self-reported measure of functional limitation. Adopting this disability index results are strongly confirmed.

Table 6.5: alternative health measures

Marginal coefficients for yearly log-hours of formal home-care									
Dep. Variable:	Probit	IV probit	<i>F</i> -test	<i>Exogeneity</i>	OLS	2SLS	<i>F</i> -test weak	<i>Exogeneity</i>	
informal care utilization	coeff	coeff	weak instr.	Test	coeff	coeff	instr.	Test	
				$\chi^2(1)$				F(1,1468)	
<b>With disability index</b>	0.01***	-0.01	110***	0.02	0.12***	0.49***	46.8***	33.1***	
<b>All health dummies</b>	0.01***	0.06	9.21***	0.48	0.05**	0.91	1.9	4.25	

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

The last set of robustness checks regards the external validity of our results: in our study we consider a limited range of countries, we want to test whether our results holds true only in the specific set of countries. We chose four out of eleven SHARE countries participating in the first two waves of SHARE because all those countries have carer-blind policies, with clear enough guidelines to be translated into an eligibility index without further assumptions needed by the researcher. Still, Austria LTC regulations (at 2004, 2006) was rather unclear on the boundaries to the discretionary use of the allowance and no clear obligation to pay for care or to use care services was identifiable. As highlighted in Carrino and Orso (2014), Austrian patients have a high degree of freedom in the use of the benefit for financing their formal-care services, although the allowance can be converted into an in-kind benefit in case of improper use of the money. After excluding Austria (1235 observations), results are in general confirmed. Next, given we cannot extend our result to broader samples, we decided to replicate the analysis of Bonsang (2009), where the author uses wave 1 SHARE data and looks at the opposite causal relation. Indeed, he estimates a two-part model to study the causal effect of informal care on formal care, using an instrumental variables approach (fraction of daughters in the household as instrument for informal care). We replicate his results on our sample, and obtain very similar results, thus strengthening the external validity of our original analysis. The estimates for this last set of robustness checks are available upon request.



## 7. CONCLUSIONS

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Long-term care programmes are facing substantial challenges in dealing with unprecedented demographic changes with tightening public budgets and socioeconomic dynamics that can undermine the role so far played by informal care. This paper investigates the effects of a change in the formal home-care provision on the informal-care by children, relatives, friends and neighbours among elderly adults in Europe. We use data from SHARE wave 1 and wave 2, for Austria, Belgium, France and Germany. We concentrate on home-based services, as in Europe they are now prioritized by policy makers with respect to residential/institutional care. This causal relationship has been less studied in the economic literature compared to the opposite one, due to the lack of an instrument to address the potential endogeneity of formal-care. We propose a novel instrumental variable approach that accounts for the role of national/regional eligibility rules to home LTC programmes. Our instrument is an individual-level dichotomous variable, which indicates whether the individual is eligible to receive public LTC benefits (in-kind or in-cash) and which is based on binding regulations at respondents' national or regional level. Adopting a two-part model for informal-care utilization, we show that an increase in formal-care use (nursing/personal assistance) among elderly Europeans has a positive and significant effect on the informal-care provided by family and friends. This result, which can be interpreted along the lines of the theoretical framework proposed by [Stabile et al. \(2006\)](#), points to the existence of an unmet residual demand of long-term care, as a result of an insufficient supply of public LTC. This shows that further social-protection is needed to address the LTC risk, both with public and private forms, enhancing accessibility, affordability and effectiveness of care programmes.

## BIBLIOGRAPHY

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- Alessie, R., Angelini, V., & Pasini, G. (2014). Is It True Love? Altruism Versus Exchange in Time and Money Transfers. *De Economist*, 162(2), 193-213. doi: 10.1007/s10645-013-9221-5
- Baker, M., Stabile, M., & Deri, C. (2004). What do self-reported, objective, measures of health measure? *Journal of Human Resources*, 39(4), 1067-1093.
- Bakx, P., Meijer, C., Schut, F., & Doorslaer, E. (2014). Going formal or informal, who cares? The influence of public long-term care insurance. *Health economics*.
- Balia, S., & Brau, R. (2013). A country for old men? Long-term home care utilization in europe. *Health economics*.
- Battistin, E., Brugiavini, A., Rettore, E., & Weber, G. (2009). The retirement consumption puzzle: evidence from a regression discontinuity approach. *The American Economic Review*, 99(5), 2209-2226.
- Baum, C. F., Schaffer, M. E., & Stillman, S. (2007). ivreg2: Stata module for extended instrumental variables/2SLS, GMM and AC/HAC, LIML and k-class regression.
- BMASK. (2013). *Ein : Blick 5. Pflege. Orientierungshilfe Zum Thema Behinderungen*. (978-3-85010-315-2). Wien: Bundesministerium für Arbeit, Soziales und Konsumentenschutz Retrieved from [http://www.sozialministerium.at/site/Soziales/Menschen\\_mit\\_Behinderungen/EINBLICK](http://www.sozialministerium.at/site/Soziales/Menschen_mit_Behinderungen/EINBLICK).
- 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.
- 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 Research Institute for the Economics of Aging (MEA) Mannheim.
- Börsch-Supan, A., & Jürges, H. (2005). The Survey of Health, Ageing and Retirement in Europe—Methodology. MEA Eigenverlag, Mannheim. *SHARE Codebook*, 8.

- Bound, J. (1991). Self-Reported Versus Objective Measures of Health in Retirement Models. *Journal of Human Resources*, 106-138.
- Carrino, L., & Orso, C. E. (2014). Eligibility and inclusiveness of Long-Term Care Institutional frameworks in Europe: a cross-country comparison. *Working Paper Series, Ca' Foscari University of Venice*, 28/2014.
- Chan, K. S., Kasper, J. D., Brandt, J., & Pezzin, L. E. (2012). Measurement Equivalence in ADL and IADL Difficulty Across International Surveys of Aging: Findings From the HRS, SHARE, and ELSA. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 67B(1), 121-132. doi: 10.1093/geronb/gbr133
- Colombo, F., Llena-Nozal, A., Mercier, J., & Tjadens, F. (2011). *OECD Health Policy Studies Help Wanted? Providing and Paying for Long-Term Care: Providing and Paying for Long-Term Care* (Vol. 2011): OECD Publishing.
- de Meijer, C., Koopmanschap, M., d'Uva, T. B., & van Doorslaer, E. (2011). Determinants of long-term care spending: Age, time to death or disability? *Journal of health economics*, 30(2), 425-438.
- Dewey, M. E., & Prince, M. J. (2005). Mental Health. In A. Börsch-Supan & H. Jürges (Eds.), *Health, Ageing and Retirement in Europe - First Results from the Survey of Health, Ageing and Retirement in Europe* (Vol. SHARE Codebook 8). Mannheim: MEA Eigenverlag.
- Dow, W. H., & Norton, E. C. (2003). Choosing between and interpreting the Heckit and two-part models for corner solutions. *Health Services and Outcomes Research Methodology*, 4(1), 5-18.
- Duan, N., Manning, W. G., Morris, C. N., & Newhouse, J. P. (1983). A comparison of alternative models for the demand for medical care. *Journal of business & economic statistics*, 1(2), 115-126.
- Dupourqué, E., Schoonveld, S., & Bushey, J. B. (2012). AGGIR, the Work of Grids. *Long-term Care News*, 32.
- Dwyer, D. S., & Mitchell, O. S. (1999). Health problems as determinants of retirement: Are self-rated measures endogenous? *Journal of health economics*, 18(2), 173-193.
- Eleftheriades, C., & Wittenberg, R. (2013). A critical review of international practice on assessment and eligibility in adult social care: Lessons for England. Oxford: Centre for Health Service Economics & Organisation (CHSEO).
- European Commission, d. o. E., Social Protection Committee. (2014). Adequate social protection for long-term care needs in an ageing society. Bruxelles: European Commission.
- Golberstein, E., Grabowski, D. C., Langa, K. M., & Chernew, M. E. (2009). Effect of Medicare home health care payment on informal care. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 46(1), 58-71.
- Goltz, A., & Arnault, L. (2014). Can formal home care reduce the burden of informal care for elderly dependents? Evidence from France: Paris Dauphine University.
- Kalmijn, M. (2006). Educational inequality and family relationships: Influences on contact and proximity. *European sociological review*, 22(1), 1-16.
- Kalwij, A., Pasini, G., & Wu, M. (2014). Home care for the elderly: the role of relatives, friends and neighbors. *Review of Economics of the Household*, 12(2), 379-404.
- Kapteyn, A., & Meijer, E. (2013). A Comparison of Different Measures of Health and their Relation to Labor Force Transitions at Older Ages *Discoveries in the Economics of Aging* (pp. 115-150): University of Chicago Press.
- Katz, S., Downs, T. D., Cash, H. R., & Grotz, R. C. (1970). Progress in development of the index of ADL. *The gerontologist*, 10(1 Part 1), 20-30.
- Kleibergen, F., & Paap, R. (2006). Generalized reduced rank tests using the singular value decomposition. *Journal of Econometrics*, 133(1), 97-126.
- LaPlante, M. P. (2010). The classic measure of disability in activities of daily living is biased by age but an expanded IADL/ADL measure is not. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 65(6), 720-732.
- Lawton, M. P., & Brody, E. M. (1969). Assessment of older people: self-maintaining and instrumental activities of daily living. *The gerontologist*, 9(3).
- Motel-Klingebiel, A., Tesch-Roemer, C., & Von Kondratowitz, H.-J. (2005). Welfare states do not crowd out the family: evidence for mixed responsibility from comparative analyses. *Ageing and Society*, 25(06), 863-882.
- OECD. (1999). *Classifying educational programmes: Manual for ISCED-97 implementation in OECD countries*: OECD.
- OECD. (2013). *A Good Life in Old Age?*: OECD Publishing.
- Paaßen, G. (2012). *Pflegereform 2012*. Essen: Pflegestufe.info.
- Poterba, J. M., Venti, S. F., & Wise, D. A. (2013). Health, education, and the post-retirement evolution of household assets: National Bureau of Economic Research.

- Prince, M. J., Reischies, F., Beekman, A., Fuhrer, R., Jonker, C., Kivela, S.-L., . . . Fichter, M. (1999). Development of the EURO-D scale--a European, Union initiative to compare symptoms of depression in 14 European centres. *The British Journal of Psychiatry*, 174(4), 330-338.
- Stabile, M., Laporte, A., & Coyte, P. C. (2006). Household responses to public home care programs. *Journal of health economics*, 25(4), 674-701.
- 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.
- Verbeek-Oudijk, D., Woittiez, I., Eggink, E., & Putman, L. (2014). Who cares in Europe? A comparison of long-term care for the over 50s in sixteen European countries. . Den Haag (NL): Institute for Social Research.

## APPENDIX: IMPLEMENTING LTC ELIGIBILITY REGULATION IN SHARE

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This appendix compare each ADL and iADL assessment-of-need scale with the information from the SHARE survey. Nearly all of the tasks included in the LTC regulations have a close correspondent in SHARE, yet some adjustments had to be made, as it will be described hereafter. The aim of this correspondence-exercise is not to replace or mimic the work and the expertise of the trained professionals who actually conduct the assessments. Our goal is to implement legal benchmarks into our micro-data in a prudent and robust fashion, in order to identify a sub-population of “eligible individuals” out of the total sample.

Three major issues must be acknowledged when comparing actual legislations with micro-data information. *First*, as already mentioned, the correspondence between *each* assessment-of-need and the SHARE survey is not perfect: some information are not available in our data, and some medical definitions may slightly differ. *Secondly*, most of the evaluation of functional limitations in SHARE are scored dichotomously (0 or 1), i.e., a limitation can either occur or fail to occur, but no intensity is measured. Although this is consistent with [Katz et al. \(1970\)](#) ADL and ([Lawton & Brody, 1969](#)) iADL original design, some comparability issue arise with respect to those LTC assessment-of-need adopting a multi-step scale evaluation, i.e., requiring information about the *degree* of the potential loss-of-autonomy. Nevertheless, it should be highlighted that, regarding ADL, iADL and mobility limitations, SHARE respondents are asked not to report difficulties that are expected to last less than three months. *Lastly*, the information collected in SHARE are self-reported, even though the interviewer is able to signal unreliable answers. Respondent’ subjectivity is, therefore, a potential issue that affect also the information on the health-status, e.g., the occurrence of ADL or iADL limitations.<sup>14</sup>

### AUSTRIA – Pflegegeld

What follows is a summary of the assessment-of-need for the Austrian *Pflegegeld*, together with the corresponding information from SHARE.

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<sup>14</sup> Similar concerns are expressed by [Bonsang \(2009\)](#) and [Balia and Brau \(2013\)](#). Reliability of self-reported health-conditions is investigated in [Bound \(1991\)](#), [Baker, Stabile, and Deri \(2004\)](#), [Dwyer and Mitchell \(1999\)](#), [LaPlante \(2010\)](#). A cross-survey comparison between HRS, SHARE and ELSA is performed in [Chan, Kasper, Brandt, and Pezzin \(2012\)](#).

Table A-1, Austrian Pflegegeld and SHARE

Core / Auxiliary	Limitation	Fixed need- of-care (hours/month)	SHARE tasks (binary: yes / no)
c	Daily body care	25	Bathing or showering
c	Preparation of meals	30	Preparing a hot meal
c	Taking meals	30	Eating (+cutting up your food)
c	Defecation	30	Using the toilet (+ getting up or down)
c	Dressing and undressing	20	Dressing (+ putting on shoes and socks)
c	Cleaning for incontinence sufferers	20	Incontinence or involuntary loss of urine
c	Colostomy care	7.5	-
c	Care cannula tube care	5	-
c	Catheter care	5	-
c	Enemas	15	-
c	Taking medication	3	Taking medications
c	Mobility aid in the narrow sense	15	Walking across a room or Getting in or out of bed
a	Motivational talks	10	EURO-D scale
a	Emptying and cleaning the toilet chair	10	-
a	Procuring of food and medicines	10	Shopping for groceries
a	Cleaning the home and personal effects	10	Doing work around the house
a	Care of underwear and towels	10	Doing work around the house
a	Heating the living space (+procuring of fuel)	10	Doing work around the house
a	Mobility aid in a broader sense	10	Using a map to figure out how to get around in a strange place
	Cognitive impairment*	25*	Orientation in time (day, week, month, year): cannot answer three or more

Source: Gesamte Rechtsvorschrift für Einstufungsverordnung zum Bundespflegegeldgesetz, BGBl. II Nr. 37/1999, BGBl. II Nr. 453/2011

\*Since January 1<sup>st</sup>, 2009.<sup>15</sup>

The care allowance is provided to individuals who present a decline in functional status that require at least 60 hours of need-of-care per month (it was 50 hours before 2011). The decline is expected to last for at least 6 months due to a physical, mental or emotional disability or sensory impairment in at least one core activity *and* at least one auxiliary activity.<sup>16</sup> Since January 1<sup>st</sup> 2009, people with mental illnesses, dementia or severe behavioural disorders are given a fixed supplementary amount of care-time in terms of 25 hours per month.<sup>17</sup> Since our data have been collected from 2004 to 2006, we cannot compute the additional 25-hours for cognitive impaired individuals; furthermore, we adopt the minimum threshold of 50-hours threshold when simulating the eligibility rules.

#### BELGIUM – Flanders supplementary LTC programme Zorgverzekerings

<sup>15</sup> [BMASK \(2013\)](#)

<sup>16</sup> [BMASK \(2013\)](#)

<sup>17</sup> [BMASK \(2013\)](#)

The *BEL-foto* assessment-of-need adopts a four-step scale for each item (from 0 to 3), where 0 corresponds to full-autonomy and 3 corresponds to impossibility to perform the specific task. Since most of the health-conditions in SHARE are reported on a binary scale (yes/no)<sup>18</sup>, we prudently chose to assign a score of 2 in the BEL-scale to each activity that respondents report to be limited in, instead of assigning the full score of 3.

Table A-2, Belgium (Flanders) Zorgverzekering and SHARE

Limitation	Value	SHARE tasks (binary: yes / no)
<i>Household ADL</i>		
House-holding	2 out of 3	Doing work around the house
Laundry	2 out of 3	Doing work around the house
Ironing	2 out of 3	Doing work around the house
Shopping	2 out of 3	Shopping for groceries
Meal preparation	2 out of 3	Preparing a hot meal
Housework planning	2 out of 3	Doing work around the house
<i>Physical ADL</i>		
Bathing and showering	2 out of 3	Bathing or showering
Dressing	2 out of 3	Dressing (+ putting on shoes and socks)
Functional mobility	2 out of 3	Getting in or out of bed
Using the toilet	2 out of 3	Using the toilet (+ getting up or down)
Incontinence	2 out of 3	Incontinence or involuntary loss of urine
Feeding	2 out of 3	Eating (+cutting up your food)
<i>Social ADL</i>		
Social loss	2 out of 3	EURO-D scale = 4 or higher
Commitment to therapy and medical rules	2 out of 3	Taking medications
Safety inside/outside the house	2 out of 3	Doing work around the house or garden
Administration	2 out of 3	Managing money, such as paying bills and keeping track of expenses
Financial operations	2 out of 3	Managing money, such as paying bills and keeping track of expenses
<i>Mental Health</i>		
Orientation in time	2 out of 3	Orientation in time (day, week, month, year): cannot answer three or more
Orientation in space	2 out of 3	Orientation in time (day, week, month, year): cannot answer three or more
Orientation in persons		-
Purposeless behaviour	2 out of 3	EURO-D scale = 4 or higher
Disruptive behaviour	2 out of 3	EURO-D scale = 4 or higher
Lack of initiative	2 out of 3	EURO-D scale = 4 or higher
Depressed mood	2 out of 3	EURO-D scale = 4 or higher
Anxious mood	2 out of 3	EURO-D scale = 4 or higher

Source: Second Annex to the Ministerial Decree of 6 January 2006 regulating the determination of the severity and duration of the reduced autonomy on the basis of the BEL-profielschaal under the Flemish care insurance.

We followed a strict approach in defining the Mental Health conditions related to purposeless/disruptive behaviors, lack of initiative, depressed/anxious mood. In principle, a direct correspondence could be established between the items in the BEL-scale and the questions in SHARE (“In the last month, have you been sad or depressed”, “Have

<sup>18</sup> SHARE respondents are asked not to report difficulties that are expected to last less than three months.

you been irritable recently?“, etc.). Nevertheless, given the potential inherent subjective interpretation of the questions by the respondents, we felt more comfortable with adopting the EURO-D measure and threshold proposed by [Dewey and Prince \(2005\)](#) (having at least 4 disturbances among a set of 12<sup>19</sup>) as a more objective signal of latent psychological issues. In order to be eligible, a patient should score at least 35 on the BEL-scale.

BELGIUM – APA

The assessment process is performed through a scale (APA scale) which depicts vulnerability as determined by six items that are evaluated on a scale from 0 (no difficulties in performing the selected item) to 3 (impossibility in performing the selected item without help from others), and the overall profile of vulnerability is constructed by summing each item’s scores. We chose to assign the score of 2 whenever a respondent reports to suffer from a limitation in the corresponding SHARE task:<sup>20</sup>

Table A-3, Belgian APA and SHARE

<i>Limitations</i>	<i>Value</i>	<i>SHARE tasks</i>
Moving and transferring around the house	2 out of 3	Walking across a room <i>or</i> Getting in or out of bed
Preparing meals and ingesting food	2 out of 3	Preparing a hot meal <i>or</i> Eating (+cutting up your food)
Performing body-care and being able to dress	2 out of 3	Bathing/showering <i>or</i> Dressing (+ putting on shoes and socks)
Taking care of own house and performing house-tasks	2 out of 3	Doing work around the house <i>or</i> Managing money, such as paying bills and keeping track of expenses
Communication: being able to have contacts with others	2 out of 3	Making telephone calls
Need of supervision. Being able to assess and avoid dangerous situations	2 out of 3	Orientation in time (day, week, month, year): cannot answer three or more

The minimum level of vulnerability corresponds to a score of 7 in the APA scale: all the applicants who get an overall index of less than 7 are not eligible to the monetary allowance. The minimum age requirement is 65 years old.

BELGIUM – nursing home-care by INAMI/RIZIV

The assessment-of-need for public home help adopts a four-step scale for each item (from 1 to 4), where 0 corresponds to full-autonomy and 4 corresponds to impossibility to perform the specific task. Dependency-status on a single task arises when the need-of-care is either severe (3) or full (4). We chose to assign the score of 3 whenever a respondent reports to suffer from a limitation in the specific task.<sup>21</sup>

Table A-4, Belgian nursing home-care programme and SHARE

<i>Criteria</i>	<i>Value</i>	<i>SHARE tasks (binary: yes / no)</i>
Washing	3 out of 4	Bathing or showering
Dressing	3 out of 4	Dressing (+ putting on shoes and socks)

<sup>19</sup> The 12 disturbances are pessimism, depressed mood, suicidal thoughts, guilt, trouble sleeping, loss of interest, irritability, fatigue, inability to concentrate, lack of appetite, incapacity of enjoyment, tearfulness.

<sup>20</sup> SHARE respondents are asked not to report difficulties that are expected to last less than three months.

<sup>21</sup> SHARE respondents are asked not to report difficulties that are expected to last less than three months.

Moving and transferring	3 out of 4	Walking across a room <i>or</i> Getting in or out of bed
Using the toilet	3 out of 4	Using the toilet (+ getting up or down)
Continence	3 out of 4	Incontinence or involuntary loss of urine
Eating	3 out of 4	Eating (+cutting up your food)
Orientation in time	3 out of 4	Orientation in time (day, week, month, year): cannot answer three or more
Orientation in space	3 out of 4	Orientation in time (day, week, month, year): cannot answer three or more

The minimum level of vulnerability (category A) in order to be eligible corresponds to limitations in washing and dressing *or* to being disoriented in time and space (but physically independent).

### FRANCE: APA and Aide Sociale

Each variable (item) in the French AGGIR scale is evaluated on a three-step scale (A, B, C or 1, 2, 3), depending on the degree of limitation experienced by the patient in the specific task.<sup>22</sup> Since we do not have information on the intensity of the limitations reported by the SHARE respondent, we chose to prudently assign the label B (the intermediate level) whenever a respondent reports a limitation in a specific task.<sup>23</sup>

Table A-5, French AGGIR scale and SHARE

<i>Discriminatory variables</i>	<i>description</i>	<i>assigned value</i>	<i>SHARE tasks</i>
coherence	converse or behave in a logical and sensible manner	2 out of 3	Orientation in time (day, week, month, year): cannot answer three or more
orientation	locates oneself in time and space		
toileting	upper and lower body hygiene	2 out of 3	Bathing or showering
dressing	upper, middle and lower body dressing	2 out of 3	Dressing (+ putting on shoes and socks)
alimentation	serving and eating	2 out of 3	Eating (+cutting up your food)
elimination	using the toilet for urine/faecal eliminations	2 out of 3	Using the toilet (+ getting up or down)
transfers	lying down, sitting down, getting up	2 out of 3	Getting in or out of bed
indoor movement	with or without technical assistance	2 out of 3	Walking across a room
outdoor movement	same as above, but outdoors	2 out of 3	Walking across a room <i>or</i> Using a map to figure out how to get around in a strange place
distant communication	using the phone and tele-alarm	2 out of 3	Making telephone calls

The APA regulation requires individual to be at least 60 years old in order to make an application for the allowance. Moreover, the AGGIR categorization of dependency must correspond to, at least, GIR 4. We went through a rather

<sup>22</sup> A: The individual performs the task spontaneously, habitually, completely and correctly alone. B: The individual can perform the task alone, yet not spontaneously, and/or correctly and/or habitually and/or completely. C: The individual cannot perform, requires assistance or must have someone else's help to do the activity.

<sup>23</sup> SHARE respondents are asked not to report difficulties that are expected to last less than three months.



complex algorithm<sup>24</sup> to population into 6 ISO-groups. Individuals with difficulties in - roughly - at least two ADL are categorized in GIR 4 regardless of their mental health status. This holds whenever the limitations are reported with at least a B (or, 2) intensity-score. It should be highlighted that being limited in “moving inside the house” is not a sufficient limitation for eligibility when the only other loss-of autonomy concerns the “transferring” task. When the “moving” limitation is selected, there should be at least one further difficulty among “using the toilet”, “dressing”, “eating” or “washing” in order to determine GIR 4. Regardless to other functional deficits in ADL, those who have cognitive impairment are assigned to, at least, GIR 2.

In order to be eligible to the Social Assistance to seniors (*Aide Sociale*), three conditions must be met by the applicant, as the next table highlights: a minimum age-requirement of 65 years old; the presence of limitations in activities related to personal hygiene and to small acts of daily livings as meals preparation and shopping for groceries (GIR 5 or GIR 6 classification); not being beneficiary of the Personalized Autonomy Allowance (APA) program. In order to simulate eligibility for *Aide Sociale*, we exploit the following SHARE information: “Bathing or showering”, “Preparing a hot meal” and “shopping for groceries”. In order to perform a prudent implementation of the regulation, we exclude the SHARE task “doing work around the house or garden”, as it seems too generic with respect to the *Aide Sociale* rationale.

Table A-6, French *Aide Sociale* eligibility rules

<i>Aide sociale</i> eligibility criteria	Description	SHARE information
Age	At least 65 years old	Age
Vulnerability	Needing assistance with personal hygiene / meals preparation / shopping for groceries	Bathing or Showering / Preparing a hot meal / Shopping for groceries
Non-cumulation	Not receiving APA allowance	-

### GERMANY – Pflegeversicherung

The assessment-of-need for the German LTC Insurance programme shares some similarities with the Austrian one, to the extent to which they are both detailed and they both assign to each task a measure of need-of-care expressed in units of time. The time guidelines are not significantly different between Germany and Austria, although the former programme adopts a measure in minutes/day while the latter’s measurement unit is in hours/month. Nevertheless, the German regulation does not fix time-guidelines for the iADL limitations (which mostly correspond to the so-called “non basic activities” in the scale): indeed, Table 8-8 shows how some limitations have an “unspecified” time-requirement in the “need-of-care” column. The term “unspecified” refers to the fact that the need-of-care should be assessed on an individual basis by the evaluation-team. In order to be able to implement the whole German legislation on SHARE data, we chose to fill the limitations having “unspecified” requirements with the corresponding guidelines coming from the Austrian *Pflegegeld* regulation (moving inside the house, leaving and returning to house, shopping, cooking, doing housework). As an example, the “cooking” task has a time-requirement of 30 hours/month (1 hour per day) in Austria, which translates in 60 minutes per day in Germany.

<sup>24</sup> Details are available in [Dupourqué, Schoonveld, and Bushey \(2012\)](http://www.ibou.fr/aggir/). A free AGGIR simulator is available at <http://www.ibou.fr/aggir/>

Table A-7, German Pflegeversicherung and SHARE

Basic care	Limitations	Need-of-care (minutes per task)	Assumed daily need	SHARE tasks (binary: yes / no)
✓	Washing body (upper- lower- body, hands)	20-25	40'	Bathing or showering
✓	Dental care	5	10'	Bathing or showering
✓	Combing	1-3	-	Bathing or showering
✓	Shaving	5-10	-	Bathing or showering
✓	Taking a shower	15-20	6'	Bathing or showering
✓	Bathing	20-25		
✓	Defecation and urination	8	32'	Using the toilet (+ getting up or down)
	<i>If also dependent for: mobility inside the house</i>	8+2	40'	
✓	Maintenance of urinary drainage bag / ostomy bag	2-4 each	-	-
✓	Incontinence	11	44'	Incontinence or involuntary loss of urine
✓	Bite sized food preparation	2-3	51'	Eating (+cutting up your food)
✓	Food in-take	15-20		
✓	Moving in and out of bed / changing positions	1-3 each	4'	Getting in or out of bed
✓	Dressing-undressing (upper- lower body)	Unspecified	12'	Dressing (+ putting on shoes and socks)
✓	Moving inside house	Unspecified	(30')	Walking across a room
✓	Standing (transferring)	Unspecified	-	Getting in or out of bed
✓	Climbing stairs	Unspecified	-	Climbing one flight of stairs without resting
✓	Leaving and returning to house	Unspecified	(20')	Walking across a room
✗	Shopping	Unspecified	(20')	Shopping for groceries
✗	Cooking	Unspecified	(60')	Preparing a hot meal
✗	Cleaning dwelling	Unspecified	(60')	Doing work around the house
✗	Washing dishes,	Unspecified		
✗	Washing and ironing clothes,	Unspecified		
✗	Managing the heating	Unspecified		

Guidelines in brackets are taken from the Austrian legislation

The minimum requirements of daily care-needs in order to be eligible (*Pflegestufe I*) are an overall need for 90' of help, with at least 45' attributable to basic care tasks. Following the 2012 reform, individuals affected by cognitive impairment are given access to an additional allowance, irrespective of their functional disability status (even if they are classified as *Pflegestufe 0*).<sup>25</sup> The SHARE survey contains information that allow to identify cognitive-impaired individuals, with the generated variable "Orientation in time (day, week, month, year)". In particular, cognitive deterioration is defined as not being able to answer correctly to three (or more) out of the four questions (see Section 2.3 for details on SHARE data). Since our data have been collected from 2004 to 2006, we do consider the 2012 reform and therefore we do not account for cognitive impairment in defining eligibility in Germany.

<sup>25</sup> Paaßen (2012)