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Informal care at old age at home and in nursing homes: determinants and economic value

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Abstract

This paper provides a comprehensive analysis of informal care receipt by the French individuals aged 60 or older. The literature has focused on the community, leaving informal care in residential care settings in the shadow. We leverage data from a representative survey (CARE) conducted in 2015-2016 on both community-dwelling individuals and nursing home residents. Focusing on the 60+ with activity restrictions, we show that 76% of nursing home residents receive help with the activities of daily living from relatives, against 55% in the community. The number of hours conditional on receipt is yet 3.5 times higher in the community. Informal care represents 180 million hours per month and a value equivalent to 1.5% of GDP, care in the community representing 95% of the total. We investigate the determinants of informal care receipt. Using an Oaxaca-type approach, we disentangle between two mechanisms explaining differences observed across settings, namely the differences in population composition (endowments) and the differences in the association of individual characteristics with informal care (coefficients). They are found to have a similar contribution at the extensive margin. Our results imply that private costs make up for the majority (80%) of the costs associated with long-term care provision once informal care is taken into account. They also highlight that informal care is extremely common for nursing home residents. Existing evidence on the determinants of informal care receipt in the community has however limited relevance to understand informal care behaviors in nursing homes.

JEL Classification: D10, I10, J14, I18

Keywords: informal care, long-term care, ageing, valuation, decomposition

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Data access

Access to the data has been provided to both authors through the Quetelet Progedo diffusion network (<http://quetelet.progedo.fr/>). It concerns the following datasets:

- Enquête Capacité, Aides et REssources des seniors (CARE ménages)- Volet seniors-2015
- Enquête Capacité, Aides et REssources des seniors (CARE nursing homes)-Volet seniors-2016
- Enquête Capacité, Aides et REssources des seniors (CARE nursing homes)-Volet établissements-2016

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1 Introduction

Population aging is associated to an increase of long-term care (LTC) needs and costs. Covering a large range of services, long-term care can be provided either by relatives (informal care) or by professional caregivers (formal care). The importance of informal caregivers for individuals living in the community is well-acknowledged. In 2015, 82% of French older individuals living at home reported they received some care from relatives for daily life activities, material or moral support (Brunel et al., 2019). While the economic literature has extensively studied informal care provided at home, there is limited quantitative evidence on the role that relatives play for nursing home residents (Jeanneau et al., forthcoming). Survey data however suggest that caregiving is not limited to relatives living in the community.¹ Some studies, mostly qualitative, confirm that relatives still play a major role in assisting nursing home residents with activities of daily living, on top of providing emotional support (Keating et al., 2001; Gaugler, 2005; Jeanneau et al., forthcoming; Giebel et al., 2020; Van der Roest et al., 2020; Verbeek et al., 2020).

This paper tackles the three following questions: (i) What is the importance and the monetary value of the informal care that older people receive in France, when also taking into account the contributions of the relatives of nursing home residents? (ii) What are the differences in terms of informal care receipt across the community-dwelling population and nursing home residents, and (iii) At the extensive margin, to what extent can such differences be explained by differences between the at-home population and nursing home residents, rather than by differences across the two settings in how individual characteristics predict informal care receipt? We leverage a survey representative of the whole 60+ population, split into a sample representative of the community-dwelling population and a sample representative of individuals permanently residing in an assisted-living facility and or a nursing home.

Many studies have investigated into the determinants of informal care provided at home, focusing on how it relates with older people's and relatives characteristics (see e.g. Balia and Brau (2014)). Another strand of the literature has estimated the economic value of

¹In the Netherlands for example, in 2016, one third of Dutch adults provide informal care. One fourth of them help someone in institutional care (De Klerk et al., 2017).

informal care provided, demonstrating that informal care has a sizable opportunity cost for society despite being provided mostly for free (van den Berg et al., 2004). Such studies differ according to three dimensions: first, whether they estimate the monetary value of informal care at an individual level (typically, such studies assess the full costs and benefits of an intervention by factoring in informal care; see e.g. Hoefman et al. (2019)), or whether they assess the aggregate economic value of informal care provision, typically at the country level. Second, existing studies focus on very specific populations or conditions, or have instead a broad focus. In the field of aging, many studies focus on informal care provided to individuals with Alzheimer’s disease (e.g. Gervès et al. (2014); Peña-Longobardo and Oliva-Moreno (2015)). Third, most research only looks at informal care provided in the community, with a few exceptions (e.g. Rice et al. (1993)). In the case of France, the monetary value of yearly informal care receipt among the 60+ in the community was estimated to reach 6.6 billion euros in 2000, or 50% more than the costs of formal home care at the time (Paraponaris et al., 2012)

In this paper, we first estimate the economic value of informal care, taking into account the unexplored economic value of informal care provided to residents of nursing homes and assisted-living facilities. We use the proxy good method, whereby informal care hours received by individuals are valued using a close market substitute. Plugging in the typical hourly labor cost of professional caregivers, we find that informal care provision represents about 30 billion euros in 2016, the majority of which being provided at home (95%). Second, we study the determinants of informal care receipt at the extensive margin of informal care. The differences in informal care receipt across both residential settings can be attributed to (i) differences in the characteristics of the two sub-populations (composition effect) and (ii) differences in the way individual characteristics relates to the probability to receive informal care (coefficient), and (iii) their interaction. We use an Oaxaca-type approach, which makes it possible to disentangle between these mechanisms (Oaxaca, 1973; Bakx et al., 2015). We find that differences in the composition of the population across the two settings only partially explain differences in informal care provision, thus pointing towards different informal care behaviors in each setting for individuals with the same characteristics. Our study also provides

detailed descriptive statistics on the characteristics of individuals living at home and in nursing homes, thereby providing an original comparative perspective on these two populations.

This work is policy-relevant in several ways. In order to design an efficient and fair long-term care system, policymakers need first to understand the genesis and mechanisms explaining care arrangements. At the individual level, in the current LTC system in France, the average 60+ with activity restrictions in the community receives much more informal care than the average nursing home resident. At the same time, our results show that informal care costs cannot be assumed to go down to zero when someone is admitted to a nursing home, dismissing the idea of a complete eviction of informal care by permanent institutional care. These results have two implications: (i) that policies promoting aging in place (currently) implies shifting additional weight onto relatives and (ii) that caregiving support measures should also consider informal care provided in nursing homes.

Second, policymakers and the public debate need to take into account the total and relative costs of long-term care services, including non-monetary costs (Bozio et al., 2016). At the aggregate level, our results show that only a limited proportion of the costs associated with LTC provision are shared collectively. The costs born privately jump from 20% to 80% of the costs of LTC services when we add the whole value of informal care to the value of formal care services. At the individual level, our econometric analysis sheds light on how different the involvement of relatives into caregiving can be expected to be, for similar individuals in different residential settings.

The rest of the paper proceeds as follows. Section 2 provide information about the data and descriptive statistics. The empirical methods we use are described in Section 3. Results on the economic valuation, the individual determinants of care receipt and the decomposition of the differences across settings are presented in Section 4. After we discuss the interpretation, strengths and limitations of our study in Section 5, Section 6 concludes.

2 Data

2.1 CARE survey

We take advantage of the survey Capacités, Aides et REssources des seniors (CARE), which is a general population survey targeting the French population aged 60 and older. The CARE survey was conducted in 2015-2016 by the statistical division of the Ministry of Health (Drees) in order to document the living conditions of the 60+, their relationships with their relatives, the limitations in the activities of daily living they face as well as the human, technical and financial support they receive. The survey consists of two parts: CARE-Ménages (CARE-M, 2015) is devoted to the individuals living in the community, while CARE-Institutions (CARE-I, 2016) surveys older people whose permanent residence is an assisted-living facility (targeted to the 60+ fully autonomous or with only mild functional limitations) or a nursing home.² For the sake of simplicity, we call the population sampled in CARE-I ‘nursing home residents’.

The CARE survey comes with four main advantages for the purpose of our study. First, the samples are representative of the 60+ French population not only in terms of socio-demographic characteristics, but also in terms of overall health status. This is because the sampling was made in two steps. For CARE-M, a preliminary survey was conducted on a large sample and classified respondents in four health groups; the CARE-M sampling was then stratified based on these health groups. For CARE-I, individuals were sampled within each sampled nursing home based on information on the characteristics of residents. Second, the over-sampling of individuals with poor health allows us to work with relatively large sample sizes even when focusing on the disabled individuals. Finally, the compulsory nature of the survey led to high response rates,³ meaning that selective non-response in terms of unobservable characteristics can be expected to be limited. Finally, respondents are asked to list up to 10 of their informal caregivers: unlike many previous studies relying on data

²In France, assisted living facilities are called either ‘foyer-logement’ or EHPA (*Etablissement d’hébergement pour personnes âgées*). There are also two types of nursing homes: EHPADs (*Etablissement d’hébergement pour personnes âgées dépendantes*) and USLDs (*Unités de soins de longue durée*), the latter one being part of a hospital and providing more specialized and intensive medical care.

³For CARE-I, it was of 88% at the nursing home level and 86% at the respondent level.

on the ‘primary caregiver’ only, using the CARE data means that, for the vast majority of individuals, we are able to include all their informal caregivers (provided they are identified as such by respondents).

2.2 Study population and sample selection

We focus on individuals with restrictions in the activities of daily living: our study population is made of individuals needing assistance with any activity of daily living, either essential (ADL) or instrumental (IADL). For each activity, the individual had to answer to the question: “Do you perform this activity without any help?” by choosing one of the following items: “1. Yes, without any difficulty; 2. Yes, but with some difficulties; 3. Yes, but with a lot of difficulties; 4. No, I need help”. The respondent is included in our sample if she/he ticks item 2, 3 or 4.

For individuals living in nursing homes, it induces very little selection since 99% of respondents have at least one ADL/IADL limitation.⁴ For individuals living in the community, conversely, it means focusing on 32% of the population. These individuals are older, more frequently women and living alone, they have more children, compared to individuals living in the community without any activity restrictions.

2.3 Information on informal care receipt and outcome definition

The survey provides a rich set of information on the care received by individuals, provided either by relatives or professionals. In particular, we observe the number of informal caregivers and, for each caregiver, the type of care provided (care for ADL/IADL, financial or material support, moral support and the frequency of the care).⁵ Regarding volumes, the individual is asked about the number of hours that each caregiver spends providing informal care with ADL/IADL. They may provide the number of hours per day, per week or per month. When she/he is not able or willing to estimate a precise number, she/he can select an hour range (again, either per day, per week or per month). To convert responses into a care volume,

⁴30 respondents report no information on ADL and IADL. Other important variables have missing values for them. They are therefore not included in our sample.

⁵There is no explicit recall period along the questions relating to informal care receipt.

we use the number of hours declared when it is directly available. When not available, we choose the lowest bound of the interval of hours declared by the individual.⁶ We convert daily (resp. weekly) volumes into a monthly one by multiplying the responses by 30 (resp. 4.33). Finally, we compute the total volume of informal care received by the individual by summing the hours provided by all the caregivers (for which information on the volume of care provided is available). To deal with implausible or extreme values, as is often done in informal care valuation (Oliva-Moreno et al., 2015; Rabier et al., 2019), we censor the volume of hours received at the *caregiver* level to a maximum of 12 hours per day, corresponding to the maximum daily duration of work in France. In addition, we censor the care volume at the *respondent* level to 24 hours per day, in order to make our estimations less sensitive to extreme values.⁷

We focus on informal care that is provided for ADL/IADL activities, for two reasons. First, it can be quantified in hours, while such a quantification might be more difficult for moral support.⁸ As a matter of fact, the CARE survey did not ask respondents to estimate the volume of the moral support they receive. Second, care with ADL/IADL may be provided either formally or informally. This provides a rationale for valuing care with ADL/IADL using the price of professional care, as will be explained in Section 3.1.

2.4 Descriptive statistics

2.4.1 General descriptive statistics

Table 1 presents the socio-demographic characteristics of the individuals aged 60 and more and facing ADL and/or IADL limitations while Table 2 focuses on their health characteristics. Differences have been tested using a Student test (resp. χ^2 test) for continuous or dummy

⁶When the interval included zero, we rather choose half the higher bound: 0.5h for a range [0;1] per day, 3.5h for a range of [0;7] per week, 15h for a range of [0;30] per month.

⁷Appendix A provides descriptive statistics on informal care volumes as reported at the caregiver level and a comparison of censored and uncensored distribution of volumes. Situations in which a volume higher than 12 hours per day is observed virtually non-existent for nursing home residents, and fairly rare for caregivers of at-home respondents. Such situations may indicate very high care needs, but also reporting errors.

⁸A monetary quantification of the financial and material support is feasible using the CARE data, and can be related to the theoretical and empirical economic literature that has investigated into inter-generational transfers. However, the scope of such an exercise is different from the aim of our study, which focuses on in-kind support and the provision of care.

(resp. categorical) variables and they are significant at the 1% level (except for sensory limitations, significance at 5% level).

Individuals living at home are younger and more educated than nursing home residents. Nursing home residents are more frequently women, with limited informal care resources: they are on average more frequently widow, single or divorced, without children nor brother(s) or sister(s) alive. We control for the income of the individual.⁹ We observe the highest diploma obtained by the individual, which gives an insight of her/his social status. Missing values are much more frequent for individuals in nursing homes, making the comparison of distributions difficult.

Regarding health characteristics, nursing home residents more frequently suffer from restrictions and limitations. Following the epidemiological literature, we distinguish between individual with moderate activity restrictions (IADL only), high activity restrictions (ADL) and severe activity restrictions (ADL including those on minimum independence: going to the toilet, self-feeding, getting up and down) (Barberger-Gateau et al., 2000; Edjolo et al., 2016). The prevalence is higher in nursing homes for severe activity restrictions, (self-declared) Alzheimer disease and limitations at the cognitive, sensory, suppleness/handling or locomotion/balance level. Interestingly, the distribution of subjective health indicators show that nursing home residents, however, more frequently declare being in good, very good, rather good health than at-home individuals.

The presence of proxies answering for the individual during the survey is not negligible. 28.3% of community-dwellers receives help for answering the informal care part of the survey, 44.7% when taking the other modules of the questionnaire into account. These proportions increase to 54.9% and 64.5% for nursing home residents. Both dimensions are correlated (correlation coefficient of 0.77) but in the estimations, they are expected to capture two different aspects. Both give an indication on the health status of the individual but the presence of proxy on informal care question additionally shows that the caregiving volume results from an estimation provided by a relative who is potentially a caregiver her/himself.

[Table 1 about here.] [Table 2 about here.]

⁹We consider the income at the household level and use the OECD-modified scale.

2.4.2 Descriptive statistics on informal care

Table 3 provides descriptive statistics on informal care. Part A of the table focuses on care receipt at the extensive margin. About three fifths of the 60+ with activity restrictions living in the community receive some informal care. This share is much higher among nursing home residents, reaching around 80%. Only a minority of the study population declares receiving material or financial support, while moral support and support with ADL/IADL are much more frequent, as documented in Roquebert et al. (2018); Besnard et al. (2019); Jeanneau et al. (forthcoming). In the community, about 50% of the 60+ with activity restrictions receive support with ADL/IADL, against three out of four of nursing home residents.

Among the 4,649 (resp. 2,422) survey respondents at home (resp. in a nursing home) who declared being helped with ADL/IADL, 4,0425 (resp. 2,184) reported a volume of care for at least one of their informal caregivers. The remaining respondents have either not provided any information on caregivers (224 at home, 62 in nursing home) or have not been able to quantify the care provided for any of his/her caregivers (176 in nursing homes).

Part B of Table 3 focuses on individuals receiving informal care with ADL/IADL. Volumes have been provided either directly or in a range. 73.7% (resp. 77.0%) of individuals at home (resp. in a nursing home) have been able to evaluate directly the volume of care provided for at least one caregiver. Conversely, 30.8% (resp. 19.4%) of individuals at home (resp. in a nursing home) have provided a range and 9.0% of individuals in a nursing home have not reported volume information for some of their caregivers.

The absence of information on volume for all or at least one caregiver, i.e. partial non-response to the survey, implies that care volumes are under-estimated for 12.2% of the community-dwellers, and 18.7% (2.6 + 7.1 + 9) for nursing home residents. Furthermore, given that we impute the care volume as the lower bound of the interval when the respondent estimated their care receipt only within a range, we infer that our care volume estimate is a lower bound for 30.8% of the at-home population and 19.4% of nursing home residents. All in all, our measure of care volume is expected to be a lower bound for the true care volume received for 43% of the community-dwellers receiving support with ADL/IADL, and 38.1% of those in a nursing home.

[Table 3 about here.]

Among individuals with a positive volume of informal care available, the average volume of care received at home is estimated to be of 78.9 hours/month, over 3.5 times higher than for nursing home residents (23.8 hours/month). There is a lot of inter-individual variation in care receipt at the intensive margin: the distribution of volumes is widely spread and heavily skewed. This pattern is observed in both settings, but at a higher extent in the community.

Figure 1 plots the distribution of care hours among those reporting a positive volume. Note that the distribution exhibits a series of spikes, induced by the conversion of (rounded) hours of care receipt per day or per week into a monthly value.

[Figure 1 about here.]

Overall, these statistics reflect three interesting patterns. First, informal care receipt is extremely common among nursing home residents, although the empirical economic literature has not attached much attention to it (Jeanneau et al., forthcoming). Second, at the intensive margin, informal care is higher in the community than in nursing homes, reflecting the fact that professional care is more prominent as a factor in the production function of care in nursing homes than at home, relative to informal care. Finally, individual heterogeneity with respect to informal care receipt is higher among individuals living in the community, possibly because of the higher heterogeneity in terms of health and disability and in formal support among the at-home individuals.

3 Methods

3.1 Economic valuation of informal care

In a first step, we evaluate the economic value of informal care provided to the 60+ with activity restrictions in France (both at home and in nursing homes), by computing a monetary equivalent of the informal care hours they receive. Two main types of valuation methods are used in the scientific literature: revealed preference methods and stated preference methods (van den Berg et al., 2004; Van den Berg et al., 2006). The former (e.g. contingent valuation)

require an experimental setting. Among the revealed preference methods, two approaches are particularly popular. The *opportunity cost* method values informal care by the market wage that caregivers earn, or an estimate of their reservation wage if they are not on the labor market. This method takes the perspective of the (potential) informal caregiver: it provides the value at which an individual would be willing to switch from formal employment to caregiving. By contrast, the *proxy good* method takes the perspective of the individual being helped: it estimates what it would cost to replace an informal caregiver by a formal worker, by valuing informal care hours at the cost of a close market substitute (van den Berg et al., 2004; Van den Berg et al., 2006). Each method comes with its assumptions, strengths and limitations. In the general case, the different methods are not expected to deliver the same estimates.

In the context of our study, we opt for a revealed preference method. We choose the proxy good method, for two main reasons: (i) it does not require labor market information on the caregivers, while the opportunity cost method requires estimating a reservation wage; (ii) it is in line with the societal perspective we adopt, by providing an estimate of the minimum cost that society would incur if informal caregivers would need to be replaced by formal caregivers (van den Berg et al., 2004). This approach makes it therefore possible to compare the monetary value of informal care with private and public spending on formal long-term care.

In this valuation exercise, we restrict our attention to caregivers providing care for ADL/IADL activities and for whom a volume of care provision was declared by the respondent. For each of those caregivers we observe the hours spent providing informal care (numerical variable) or the lowest bound of the interval corresponding to the volume they provide. The hours are valued using the hourly labor cost for a worker employed at the minimum wage.¹⁰ In France, formal home care workers are typically employed at the minimum wage. In 2015, the hourly labor cost corresponding to the minimum wage amounted to €13.72. The idea is to measure the monetary equivalent of informal care hours provided, using the cost it would represent if it were provided formally by (unskilled) caregivers.

¹⁰The labor cost is the sum of the gross wage paid to the workers and the social security contributions and taxes levied on employers.

3.2 Econometric approach: informal care determinants and differences across residential settings

In a second step, we examine the difference in the average receipt of informal care in nursing home versus at home. It can be explained as a combination of (a) differences in the composition of the two sub-populations, and (b) differences in how individual or family characteristics influence the probability to receive informal care.

To explore these channels, we use the framework by Oaxaca (1973), which was initially developed to analyze the gender wage differential. The Oaxaca approach aims at explaining outcome quantitative differences across two populations in statistical terms. The approach needs not be causal (O'Donnell et al., 2007), and should therefore not be interpreted as such. It has been widely used in the study of inequalities in health and health care use. In the field of long-term care, Bakx et al. (2015) use a similar decomposition to study the differences in informal care and formal care receipt between Germany and the Netherlands.¹¹

3.2.1 Informal care receipt as a function of observable characteristics

We denote y_i the informal care received by individual i at extensive margin (0/1). For nursing home residents, we assume that y_i can be expressed as:

$$y_i = \beta^{inst} X_i + u_i^{inst} \quad (1)$$

where $X_i = (1, x_i^1, \dots, x_i^J)$ is a vector including J covariates and β^{inst} a vector of parameters including an intercept. u_i^{inst} captures the unobserved determinants of informal care receipt in nursing homes.

Similarly, for individuals living in the community, we assume that y_i can be expressed as:

$$y_i = \beta^{home} X_i + u_i^{home} \quad (2)$$

where β^{home} a vector of parameters including an intercept and u_i^{home} captures the unobserved

¹¹Bakx et al. (2015) assess the extent to which such differences can be explained by compositional differences in the old-age population across the two countries, or by individual and family characteristics having different effects on the probability of care receipt in the two countries.

determinants of informal care receipt at home.

3.2.2 Decomposing the gap in informal care receipt: endowment versus coefficient differences

Using Equations (1) and (2), we can express mean informal care receipt for individuals living in the community, denoted \bar{y}^{home} , as the sum of product of the parameter estimates $\hat{\beta}$ and the population average of covariates for nursing home residents, denoted \bar{X}^{home} : $\bar{y}^{home} = \hat{\beta}^{home} \bar{X}^{home}$. Similarly, for nursing home residents: $\bar{y}^{inst} = \hat{\beta}^{inst} \bar{X}^{inst}$. We can then express the gap in mean informal care receipt across the two settings as:

$$\begin{aligned} \bar{y}^{inst} - \bar{y}^{home} &= \hat{\beta}^{inst} \bar{X}^{inst} - \hat{\beta}^{home} \bar{X}^{home} \\ &= \underbrace{\hat{\beta}^{home} \Delta X}_E + \underbrace{\Delta \beta \bar{X}^{home}}_C + \underbrace{\Delta \beta \Delta X}_{CE} \end{aligned} \quad (3)$$

where:

$$\begin{aligned} \hat{\beta}^{home} \Delta X &= \hat{\beta}^{home} (\bar{X}^{inst} - \bar{X}^{home}) \\ &= \sum_{j=1}^J \hat{\beta}_j^{home} (\bar{x}^{j,inst} - \bar{x}^{j,home}) \\ \Delta \beta \bar{X}^{home} &= (\hat{\beta}^{inst} - \hat{\beta}^{home}) \bar{X}^{home} \\ &= \sum_{j=1}^J (\hat{\beta}_j^{inst} - \hat{\beta}_j^{home}) \bar{x}^{j,home} \\ \Delta \beta \Delta X &= (\hat{\beta}^{inst} - \hat{\beta}^{home}) (\bar{X}^{inst} - \bar{X}^{home}) \\ &= \sum_{j=1}^J (\bar{x}^{j,inst} - \bar{x}^{j,home}) (\hat{\beta}_j^{inst} - \hat{\beta}_j^{home}) \end{aligned}$$

Equation (3) indicates that the gap in mean informal care receipt across the two populations can be decomposed as the sum of the gap in individual characteristics (or gap in *endowments*, denoted E), the gap in the partial correlations between individual characteristics and informal care receipt (or gap in coefficients, denoted C) and the interaction of the

two (CE) .¹²

The interpretation of the endowment term and the composition term goes as follows. If the composition (in terms of observable characteristics) of the community-dwelling and the nursing home populations were exactly the same, the higher probability of informal care receipt among nursing home residents would be entirely attributable to the fact that individual characteristics play differently in the determination of informal care receipt at home and in nursing home. We would have: $E = 0$, $CE = 0$ and $\bar{y}^{inst} - \bar{y}^{home} = C$. In the polar case, all observable characteristics would display the same partial correlation with informal care receipt in nursing homes and in the community; the higher probability of informal care receipt would then be explained entirely by the differences in the composition of the population across the two residential settings: $C = 0$, $CE = 0$ and $\bar{y}^{inst} - \bar{y}^{home} = E$. Between these two polar cases, we may expect the gap in informal care receipt to be attributable to both composition differences and coefficient differences, and to their interplay. The interpretation of the interaction term is less intuitive than for the endowment and the composition terms. It could be regarded as the differential effect of a difference in endowments (resp. coefficients) when coefficients (resp. endowments) differ (Etezady et al., 2020).

Appendix B provides more details on this approach.

3.2.3 Implementation

Empirically, the decomposition of Equation (3) can be achieved by estimating Equations (1) and (2) by Ordinary Least Squares (OLS), and by estimating the empirical mean of each covariate, for the sample of at-home respondents and the sample of nursing home residents separately. The survey weights are used both in the OLS regressions and to compute the population mean of covariates. To take into account potential correlations of disturbances across individuals living in the same nursing home (i.e correlation across the u_i^{inst} in Equation (1)), we estimate standard errors clustered at the nursing home level for $\hat{\beta}^{inst}$. Given that each of the at-home respondents belongs to a distinct household, we estimate unclustered standard errors for estimates $\hat{\beta}^{home}$.

¹²Note that in the general case: $CE \neq C \times E$.

We conduct our econometric analyses using the econometric software Stata (16.1). We use the user command `decompose` developed by Jann (2008), which computes directly the decomposition of Equation (3), as well the command `oaxaca`, which further provides the standard errors.

As we focus on the extensive margin of informal care, we use a linear probability model to shed light on the individual characteristics associated with the probability of informal care receipt and how they differ across both residential settings.

4 Results

4.1 Economic valuation of informal care

We first value the informal care received by older people to help them with the activities of daily living, including both care in nursing homes and in the community. Table 4 presents the result of the valuation. As highlighted earlier, more than half of the community-dwellers and over 3/4 of nursing home residents receive informal care. Using the survey responses, we estimate that a nursing home resident receives 23.8 hours/month on average conditional on care receipt, against 78.9 hours/month in the community. To derive the *unconditional* mean care hours in both settings, we multiply the *conditional* mean by the weighted share of respondents who provided information on the *volume* of care they receive (in Column (2)), which is about 7 percentage points lower than the share of the population reporting care *receipt*. In this way, we use the survey responses conservatively, so as to construct a lower bound for the monetary value of informal care. Unconditional mean hours are about three times higher on average in the community than among nursing home residents (equal to Column (2) multiplied by Column (3), i.e. 43 hours against 15 hours, *not displayed in the table*).

We then scale up these individual-level estimates by the population size: 4.6 million community-dwelling 60+ with activity restrictions on one side, and about 10 times less nursing home residents on the other side (570 thousands; Column (4)). The community-dwellers are estimated to receive 176 million hours of care with ADL/IADL from their relatives every

month, while the hours provided to nursing home residents sum up to (only) 9.4 millions. Plugging in an hourly value of care of €13.7, we get to a total yearly monetary value of about 30.6 billion euros (Column (6)). The value of informal care in the community represents over 95% of the total value.

[Table 4 about here.]

4.2 Determinants of informal care at home versus in nursing homes

Figures 2 to 4 show the OLS estimates for the population in the community and for nursing home residents.¹³

Looking at the socio-demographic characteristics (Figure 2), gender is not significantly associated with the probability of receiving informal care. In both settings there is an age gradient, which is somehow more marked at home: in the community, being aged 90 to 94 years old increases the probability of receiving informal care by over 14 percentage points, against 7 percentage points in nursing homes, relative to the reference category (aged 75 to 84). Interestingly, being aged less than 75 decreases the probability of receiving informal care with ADL/IADL in nursing homes (by 12 percentage points), but not in the community. A nursing home admission before age 75 is relatively rare: young nursing home entrants might have unobserved characteristics that would explain their lower average informal care receipt (e.g. absence of relationships with their relatives).

[Figure 2 about here.]

The probability of receiving informal care is sensitive to the availability of potential caregivers, especially for nursing home residents. Compared to individuals with a partner (whom we call 'married' for the sake of simplicity), those who are single or divorced have a lower probability of receiving informal care in both settings. Being a widow, having no children or no siblings decreases the probability of care receipt among nursing home residents. By

¹³In Appendix C, Table B.1 presents the same estimates and additionally provides the estimates obtained on the pooled sample, i.e. the determinants of informal care receipt in the whole disabled 60+ population in France. Given that the model is estimated by OLS, the estimates on the pooled sample are a weighted average of those on community-dwellers and nursing home residents.

contrast, being single and the presence of children and siblings have no effect for individuals in the community.

In the community, there is an education gradient: the lower education, the higher the probability of informal care receipt; in nursing homes, having no diploma is associated to a lower probability to receive informal care.¹⁴ Higher income is associated with a slightly lower probability to receive informal care for individuals living at home.

Regarding health and functional status (Figure 3), we observe overall no significant effect of the disability group both in the community and in nursing homes. Alzheimer's disease is strongly associated with care receipt in the community (+11.2 percentage points), but decreases the probability of informal care receipt among nursing home residents. This may reflect the fact that patients with dementia require constant surveillance, which is provided by the residential structure to nursing home residents, while at home the costs of the round-the-clock presence of a professional caregiver cannot usually be borne. Sensory limitations and limitations with locomotion and balance increase informal care receipt at home, while each type of limitations has no detectable effect on care receipt among nursing home residents. The very high proportion of nursing home residents with such limitations (ranging from 75% for sensory limitations to 96% for limitations in suppleness and handling; cf. Table 2, Column (2)) might explain the low statistical precision on these variables. A poor subjective health is associated with higher informal care receipt at home but not in nursing homes, relative to reporting a fairly good health.

[Figure 3 about here.]

The presence of a proxy (Figure 4) is associated with a substantially higher probability to receive informal care in both settings. However, the presence of a proxy specifically on questions not related to informal care *decreases* the probability of informal care receipt in nursing homes. It might reveal that proxys answering other modules are generally professional caregivers, answering for individuals without informal caregivers.

¹⁴The difference across the two settings should however be interpreted with caution: diploma is missing for a substantial share of nursing home residents and reporting a missing observation is strongly, negatively associated with informal care receipt in nursing homes.

[Figure 4 about here.]

Summing up, in nursing homes, the existence of potential caregivers is the major correlate of informal care receipt. In the community, care receipt is much more related to health characteristics. Note that covariates explain a higher share of inter-individual variation in informal care receipt in nursing homes than in the community (R^2 of 25.0% against 21.7%) (Table B.1, Appendix C).

4.3 Decomposition of the gap in informal care receipt across residential settings

We now turn to the baseline decomposition of the gap in informal care receipt across the two residential settings. We combine the descriptive statistics displayed in Tables 1 and 2 with the coefficient estimates shown in Figures 2 to 4. The decomposition is displayed in Table 5.

[Table 5 about here.]

Would there be only differences in population composition (i.e. in terms of covariates) between the community and nursing homes, we would predict the probability of informal care receipt to be 21 percentage points higher in nursing homes than in the community ($E = 0.216$, row [d]). The positive contribution reflects the fact that, on balance, the characteristics *positively* associated with care receipt at home are *more* prevalent in nursing homes than at home (i.e. when $\beta_j^{home} > 0$, $\bar{x}^{j,inst} > \bar{x}^{j,home}$), and/or that the characteristics *negatively* associated with care receipt at home are *less* prevalent in nursing homes than at home (i.e. when $\beta_j^{home} < 0$ and $\bar{x}^{j,inst} < \bar{x}^{j,home}$). For instance, an older age is positively correlated to informal care and nursing home residents are older on average; conversely, having a higher education diploma is negatively correlated to informal care receipt and is less frequent in nursing homes.

Would there be only differences in how individual characteristics play on informal care receipt, the share of nursing home residents receiving informal care would be 20 percentage points higher than the share of at-home disabled older people receiving such care ($C =$

0.200, row [e]). The positive sign indicates that, on balance, the partial correlation between individual characteristics and care receipt is smaller in nursing homes than at home (i.e.

$$\beta_j^{inst} < \beta_j^{home}).^{15}$$

When summed up over all covariates, the interaction between the gap in the mean value of a given characteristic and the gap in how it associates to informal care receipt contributes to *reducing* the gap between the two settings, by 19.5 percentage points ($CE = -0.204$, row [f]).

5 Discussion

5.1 The value of informal care: comparison with previous estimates and formal long-term care costs

The monetary value of informal care received by the French aged 60 and older is found to reach billion€30.6 in 2015-2016. This amounts to approximately 1.5% of the Gross Domestic Product (GDP). This is equivalent to the spending on formal LTC services provided to the 60+ in 2014, estimated by the Ministry of Health to billion€30 (Barnouin et al., 2016).¹⁶ This figure encompasses public and private spending on LTC services strictly speaking, but also the boarding costs for residential care and the health care costs specifically incurred by the 60+ with activity restrictions. Restricting the focus to the costs of formal LTC services strictly speaking (whose value was around billion€11), we estimate the value of informal care to be 3 times as large as these formal care costs. When taking informal care into account, the share of LTC costs (defined as the sum of informal care monetary value and the costs of formal LTC) that are borne by the individuals and their relatives jumps from 21% to 81%.

The CARE survey has major assets for the purpose of our study. In particular, it allows proxy respondents (which can be either a relative or a professional), thus limiting survey and item non-response. In addition, hours of informal care are reported by (proxy) respondents,

¹⁵This is the case for most disability and health variables; cf. Figure 3.

¹⁶To make the monetary value of informal care in 2015/2016 comparable with the spending on LTC in 2014, we must take into account the inflation that occurred between 2014 and 2015. However, the inflation was then close to zero in France (0.0% in 2015, 0.2% in 2016, Insee (2019)), such that the conversion of current euros into constant euros barely affects the figures.

for all their caregivers. These features make for a major contribution of our study, as most existing literature relies on predicted hours and/or focus on the ‘primary’ caregiver.

Our estimation of informal care value is however expected - and designed - to be a lower bound for several reasons. First, the unit labor cost we use corresponds to the minimum that can legally be found on the job market while care can be charged at a higher price (the wage distribution in the LTC sector is however skewed towards the minimum wage). Second, we do not impute care volume for respondents who declared being helped with ADL/IADL but did not provide *any* information on the volume of care received. Third, for caregivers for whom care hours were as a range, we generally compute the care volume using the lower bound.¹⁷ Another aspect of the survey design may push our estimate *upward*. Care volumes were only asked to respondents reporting help with ADL/IADL. But the questionnaire did not specify that the hours reported for each caregiver should be only hours spend helping with ADL/IADL. We conjecture that this issue is limited as respondents are likely to be reluctant or unable to provide an estimate of the amount of time caregivers spend providing moral support.

Despite its mostly conservative features, our estimation is substantially higher than the one that Paraponaris et al. (2012) derive also for France (call it PDV for the sake of conciseness). Based on the HID survey (1999-2000), PDV estimate the value of informal care provided to the 60+ to reach 6.6 billion 1999 euros. In constant value, our estimation is 253% higher than that of PDV.¹⁸ When plugging in the GDP increase (25% over the period), we still end up with a value of informal care *as a share of GDP* considerably higher than in PDV. How can the difference be explained?

A first potential factor is that wages have increased over the past 15 years. Both PDV and we use the hourly labor cost (gross wage augmented with employer social security contributions and taxes) at the national minimum wage. It amounted to €11.05 per hour in 1999 vs €13.7 in 2016. Once corrected for inflation over the period, the minimum wage was virtually

¹⁷Only for the hour range including zero, we impute a volume equal to half of the upper bound. If the distribution of low volumes of care provision is extremely skewed towards zero, this would bias upward our care volume measure, rather than downward.

¹⁸Inflation between 1999 and 2016 was of 24.7% in the French economy (Insee, 2019), such that PDV estimate is equivalent to 8.2 billion 2016 euros.

the same in the two periods, such that it can not explain why our estimation in constant value is so much higher than PDV. The second explanation relates to demographic changes. The 60+ population has increased from 20.6 million people in 1999-2000 to 25.1 million in 2016 (Insee, 2019), an increase of about 25%. Summing up, these two factors alone are insufficient to explain the discrepancy. A third explanation is that we use a broader definition of activity restrictions. PDV delimit their study population to individuals who report having *a lot of* difficulties or unable to perform an IADL or ADL without help. By contrast, we consider that individuals face an activity restriction as soon as they report having *some* difficulties in performing an ADL or IADL. Our estimation thus arguably encompasses all 60+ individuals with LTC needs. Fourth, the quantification of informal care hours differs in both approaches. We use the volume declared by respondents or their proxy. Instead, the survey leveraged by PDV does not contain any information on care volumes. Their methodology rests on the estimation of the number of hours necessary to perform each ADL and IADL as proposed by Pampalon et al. (1991), combined with the type of ADL/IADL relatives provide care as reported in the survey.

Finally, the difference observed could also reflect the fact that the average volume of informal care received by the 60+ with care needs has changed (either because the distribution of the severity of care needs has changed, or because informal care receipt conditional on care needs as decreased).

5.2 Valuation of informal care: limitations

Our results should be interpreted bearing in mind some data-related limitations and limitations with respect to the valuation method we use.

Regarding the data, we use information on informal care from the CARE survey that results from the respondents' answers to the questionnaire or that of a proxy respondent. Using the respondents' declaration for informal hours care may come along with two types of measurement errors. First, respondents - or their proxy - might be biased in their assessment of who provides care among relatives and the volume of care provided (Davin et al., 2009; Beliard et al., 2013). Second, some individuals are not able, or not willing, to quantify

precisely the volume of care provided by one or several of their caregivers.

In principle, we could value different tasks using different wage rates (e.g. that of unskilled work for domestic help versus that of skilled work for personal care). As already mentioned, it is not possible to make such a distinction with the CARE data. This is not an obstacle to our analysis, given that we primarily aim at providing a lower bound for the value of informal care. Furthermore, the qualification premium for care workers is extremely low in France (i.e. skilled care workers earn only little more than the minimum wage) such that the order of magnitude of the informal care value estimate should be similar, would we value different tasks at distinct market rates.

We use the proxy good method, which relies on a set of assumptions. Two important assumptions relate to computing the relevant measure of care volume. First, when it comes to help with domestic chores, the proxy good method requires distinguishing between the tasks that would have been performed by a relative even absent the health condition of the person being help, from the extra tasks performed because the respondent has a care need. The distinction can be especially blurry for co-residing informal caregivers (e.g. spouses or children). In our analysis of community-living respondents, we add together intra-household and extra-household informal care receipt. For the former, the questions relating to the volume of informal care does not allow us to make a distinction between ‘regular’ domestic chores and ‘extra’ domestic chores. This may play towards an over-estimation of the volume of informal *care* strictly speaking. Second, the proxy good method requires that time simultaneously spent on several activities is not double counted (e.g. a caregiver does the cooking while also taking care of the laundry). As care time is reported globally for each caregiver (rather than per task) in CARE, our estimations are unlikely to suffer from double-counting.

Two other assumptions of the proxy good method relate to the validity of using professional caregivers’ wages to value informal care (van den Berg et al., 2004). First, it is assumed that informal care and formal care are perfect substitutes van den Berg et al. (2004). A formal caregiver should therefore not be more efficient at providing care than an informal caregiver, nor should she provide better care quality (or vice-versa). Second, caregivers and care recipients should not derive (dis-)utility from the care being provided informally rather than by

professional workers. If informal care involves net *dis-utility*, the proxy good method leads to an *under-estimation* of the economic value of informal care. On the other hand, net utility derived from caregiving or care receipt would lead to *over-estimating* the economic value of informal care. There is evidence that caregivers derive utility from the very process of providing care to a relative (*process utility*; see e.g. Brouwer et al. (2005)), while also from seeing their relative appropriately cared for (*altruistic preferences*). On the other hand, the existence of a caregiving burden is now widely acknowledged. It is difficult to conjecture how these effects may weigh on our estimates on balance.¹⁹

5.3 Decomposition of differences in informal care receipt: extensions

Regarding the econometric analysis, we have used the standard, linear Oaxaca-Blinder decomposition. Extensions for non-linear models have been proposed (Bauer and Sousa-Poza, 2015). Given that our outcome (informal care receipt) is binary, we have tested the robustness of our results to a decomposition based on a binary regression. The results, in terms of the contributions of endowments, of coefficients and the interaction term, are quantitatively extremely similar to the estimates derived with the linear probability model.²⁰

The Oaxaca-Blinder decomposition does not require explanatory variables to be exogenous nor the two populations that are compared to be independent. In the context of our study, the fact of living in the community rather than being in a nursing home at a given point in time is likely non-random. It may depend on observed individual characteristics as well as on unobserved factors. In econometric terms, it means that the estimates of the association between the explanatory variables and informal care receipt may be affected by the non-random selection into one setting. If we would like to interpret the estimates causally, we would need to address this potential selection empirically. The Oaxaca decomposition framework can be adapted to incorporate a selection equation, thereby the probability to live in the community rather than in a nursing home is modelled (O'Donnell et al., 2007). However, this requires to find a convincing instrument for nursing home admissions - a variable that

¹⁹Hoefman et al. (2019) have proposed a stated preference method to incorporating (dis)-utility of informal care, which is not transposable to the proxy good method.

²⁰We have used the command `nldecompose`. Results available on demand.

affects admissions while not having a direct impact on informal care receipt. Finding such an instrument is challenging.

6 Conclusion

This paper provides a comprehensive approach of informal care for the activities of daily living for the 60+ in France, taking into account both individuals living in the community and nursing home residents.

Our first contribution is that we provide a global assessment of the importance and value of informal care provided by relatives to the 60+, taking into account both individuals living at home and those in a nursing home. We find that a total of 207 millions hours are provided informally each month. Using the proxy good method, informal care hours are valued using the hourly labor cost and represent a total of million€30,600 per year in 2015/2016, equivalent to 1.5% of GDP. It is essentially composed of informal care provided in the community (95%). This is explained by the fact that the number of the 60+ with activity restrictions in the community outnumbers by 10 times the number of nursing home residents and because the average (unconditional) number of informal care hours received at home is 3.5 times as high in the community as in nursing homes.

We then investigate into the determinants of informal care provision and compare them across the two settings, using an Oaxaca-type approach. Differences in endowments are important in explaining the gap in informal care receipt. The substantial differences in coefficients, and the high contribution of the interaction between coefficients and endowments, suggest that divergent mechanisms are at play in the determination of informal care receipt across the two settings. This result is the second main contribution of our paper. It calls for more quantitative research on informal care receipt in nursing homes and assisted-living facilities, which has been under-explored relative to informal care provision to the community-dwelling individuals.

Our findings have two policy implications. First, we highlight the mechanisms explaining care arrangements in both settings, which are necessary to understand in order to design

an efficient and fair long-term care systems. In the current LTC system in France, the average individual who is aging at home implies much more informal care than the average nursing home resident. Policies promoting aging in place thus implies putting extra weight on relatives. At the same time, our results show that there is not a complete eviction of informal care in nursing homes. This result is useful for the design and targeting of respite and other caregiver support policies, which should not only target the relatives of community-dwelling individuals. Overall, when comparing residential care options *versus* aging-in-place, it can't simply be assumed that professional caregiving within nursing homes replaces all home care (including informal care) after admission.

Second, policymakers need to take into account the total and relative costs of LTC services, including non-monetary costs (Bozio et al., 2016). Although we derive a conservative figure, we estimate that in France the monetary value of help with the activities of daily living provided to the 60+ exceeds formal LTC costs. Adding together the value of informal care and private spending on LTC services, we estimate that households bear 80% of the direct costs associated with LTC provision. The indirect effects of informal care such as reduced labor force participation and adverse health effects for caregivers (Bauer and Sousa-Poza, 2015; Bom et al., 2019), whose estimation lies beyond the scope of this study, would arguably increase the economic costs of informal care. In other words, even in a country with an extensive Welfare State, the economic costs of old-age disability is only to a limited extent borne collectively. Whether this (positive) finding is in line with societal preferences is an essentially normative question.

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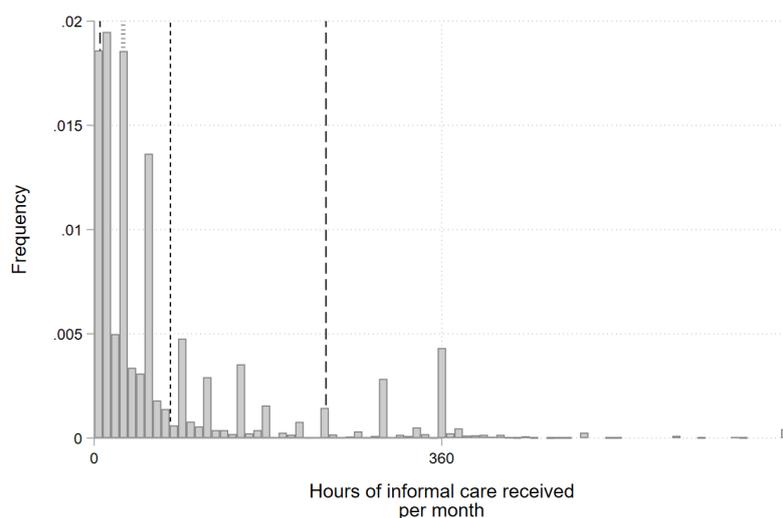
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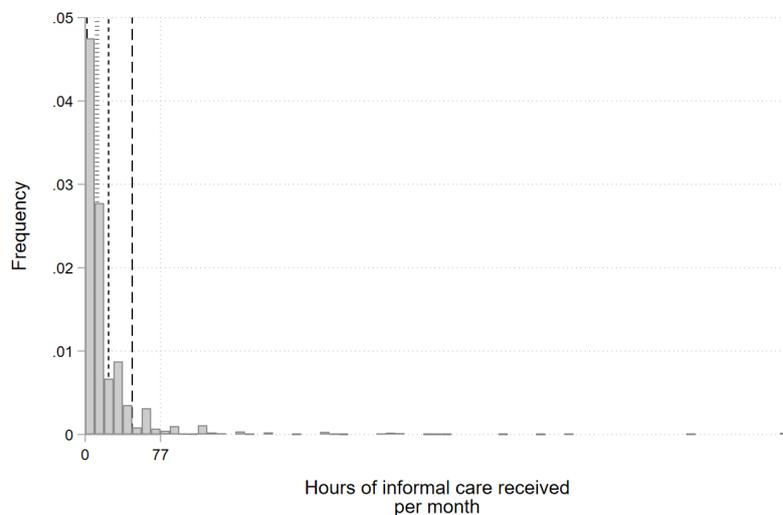
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Figures

Figure 1: Distribution of the number of informal care hours received, per month, among recipients.



(Upper panel) At-home population.



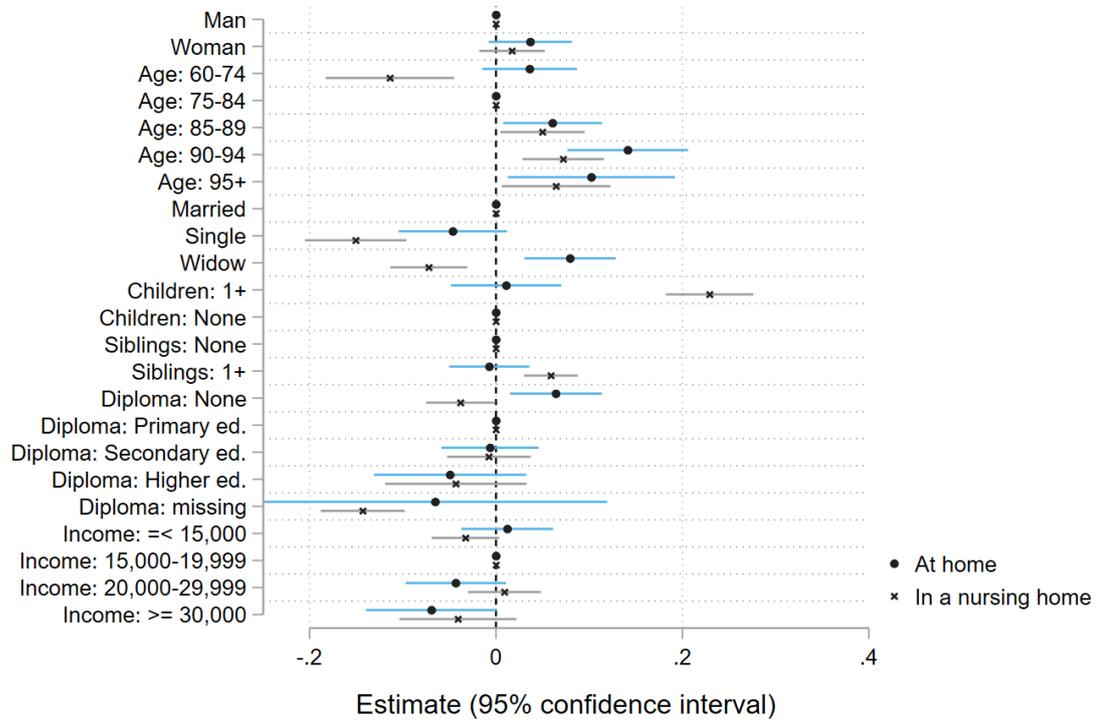
(Bottom panel) Nursing home residents.

SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home (left) or in a nursing home (right), receiving informal care for the activities of daily living.

NOTES: Statistics are weighted using the survey weights. The vertical continuous and dotted lines correspond to the mean and the median of the number of hours received respectively, computed in each population separately. The dashed lines correspond to the 10th and 90th percentiles.

Figure 2: Socio-demographic determinants of informal care (extensive margin)

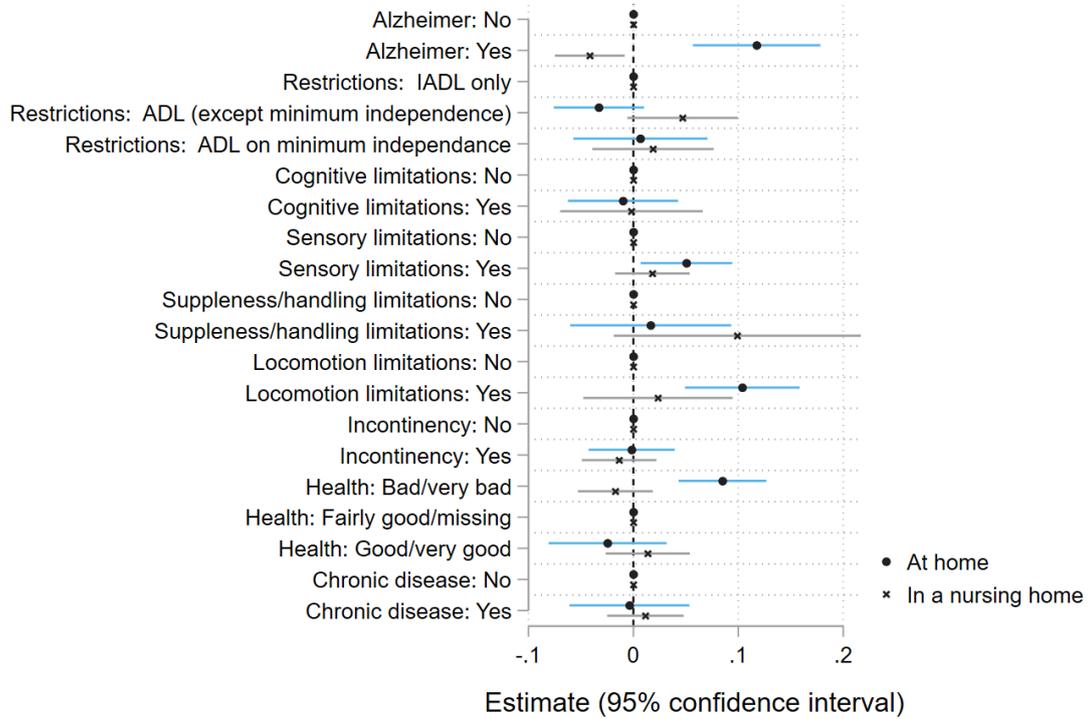


SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home or in an nursing home.

NOTES: Coefficients corresponding to the OLS regressions of the probability to receive informal care on socio-demographic, limitations and proxy variables.

Figure 3: Limitations as determinants of informal care (extensive margin)

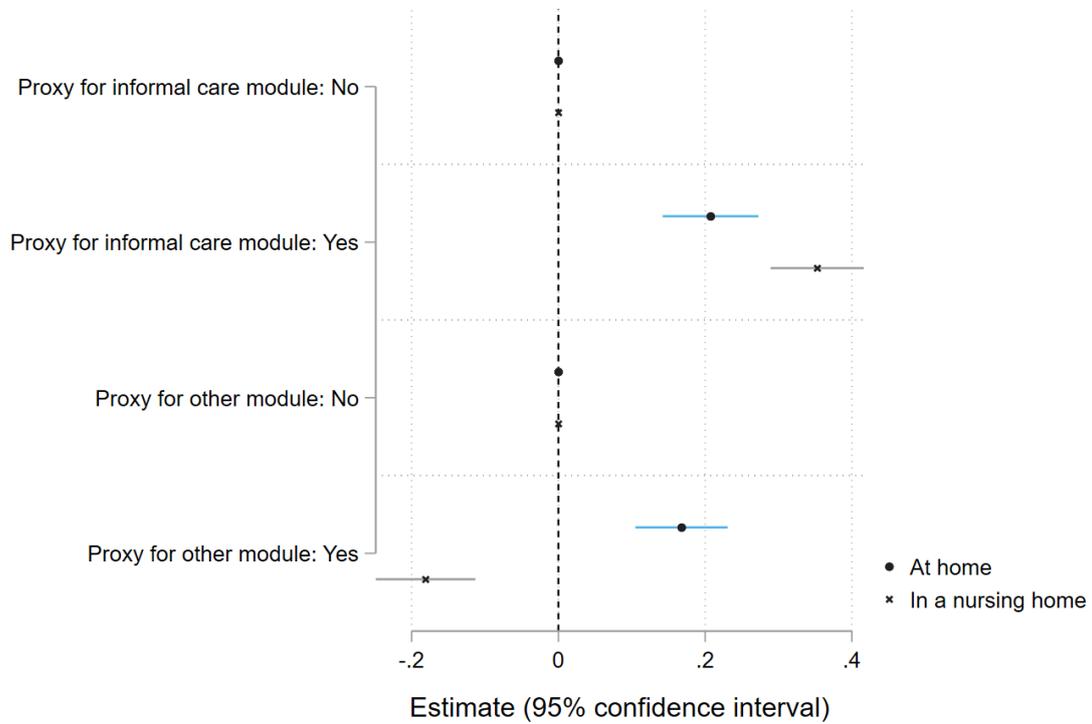


SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home or in an nursing home.

NOTES: Coefficients corresponding to the OLS regressions of the probability to receive informal care on socio-demographic, limitations and proxy variables.

Figure 4: Proxy determinants of informal care (extensive margin)



SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home or in an nursing home.

NOTES: Coefficients corresponding to the OLS regressions of the probability to receive informal care on socio-demographic, health and proxy variables.

Tables

Table 1: Descriptive statistics: socio-demographic characteristics

	(1)	(2)	(3)
	At home	In nursing homes	Entire population
Woman	64.9	74.8	66.0
Age: 60-74	36.3	10.1	33.5
Age: 75-84	35.1	21.7	33.6
Age: 85-89	17.2	27.8	18.4
Age: 90-94	9.0	26.9	11.0
Age \geq 95	2.3	13.6	3.5
Married	49.1	12.9	45.1
Widow	35.0	63.3	38.2
Single or divorced	15.8	23.9	16.7
Children: none	11.6	25.6	13.2
Children: 1	20.4	22.5	20.6
Children: 2	30.5	23.9	29.8
Children: 3 or more	37.5	28.0	36.4
Sister(s) or brother(s) alive	71.0	43.9	68.0
Diploma: none	29.2	27.3	28.9
Diploma: primary education	32.1	30.8	32.0
Diploma: secondary education	30.5	18.4	29.2
Diploma: higher education	7.6	4.3	7.3
Diploma: missing	0.6	19.2	2.6
Income: \leq 14,999	33.4	43.5	34.5
Income: 15,000-19,999	25.8	25.1	25.7
Income: 20,000-29,999	26.7	21.3	26.1
Income: \geq 30,000	14.2	10.1	13.7
Observations	6889	3161	10050

SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home or in a nursing home.

NOTES: Percentages of population are computed taken into account survey weights. Income in annual current euros.

Table 2: Descriptive statistics: health characteristics

	(1)	(2)	(3)
	At home	Nursing home	Entire population
Restrictions: IADL only	51.6	14.0	47.4
Restrictions: ADL, except those of minimum independence	44.5	41.6	44.2
Restrictions: ADL on minimum independence	3.9	44.4	8.4
Alzheimer's Disease	4.0	36.0	7.6
Limitations: cognitive	80.0	92.4	81.4
Limitations: sensory	68.2	75.0	68.9
Limitations: suppleness, handling	85.8	95.6	86.9
Limitations: locomotion, balance	66.4	92.7	69.3
Incontinence	27.1	64.9	31.3
Self-reported chronic disease or health condition	80.2	68.3	78.9
Subjective health: bad or very bad	31.3	35.2	31.7
Subjective health: rather good	46.5	41.5	46.0
Subjective health: good or very good	22.2	22.5	22.2
Subjective health: missing	0.0	0.8	0.1
Proxy on informal care questions	28.3	54.9	31.3
Proxy on other parts of the questionnaire	44.7	64.5	46.9
Observations	6889	3161	10050

SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home or in a nursing home.

NOTES: Percentages of population are computed taking into account survey weights.

Table 3: Descriptive statistics: informal care receipt

	At home		In a nursing home	
A. Informal care receipt - extensive margin				
	Sample	%	Sample	%
Study population	6,889	100.0	3,161	100.0
<i>Receives:</i>				
Any informal support	4,819	57.9	2,581	81.3
Moral support	2,436	26.2	2,433	76.6
Financial support	395	4.3	398	12.9
Support with ADL/IADL	4,649	55.4	2,422	76.5
B. Informal care receipt - intensive margin				
<i>Among recipients of informal care with ADL/IADL</i>				
Declares a positive volume of care	4,425	87.8	2,184	90.5
Does not provide information on caregivers	224	12.2	62	2.6
All caregivers have missing volume	0	0	176	7.1
At least one caregiver with volume:				
Provided directly	3,358	73.7	1,788	77.0
Provided in a range	1,294	30.8	477	19.4
Missing volume	0	0	228	9.0
<i>Among recipients with positive volume of care with ADL/IADL, in hours/month</i>				
Mean		78.9		23.8
Standard deviation		109.2		53.5
Skewness		2.4		7.7
Maximum		720		720

SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home or in an institution.

NOTES: Percentages of population are computed taking into account survey weights. Informal care is censored at 12 hours per day as a maximum for each individual receiving care.

Table 4: Economic valuation of informal care in 2015/2016

	Receives informal care (%)	Provides volume information (%)	Mean number of care hours ^a	Weighted population (in thousands)	Total hours (in M.hours /month) ^b	Monetary value (yearly, M€) ^c
	(1)	(2)	(3)	(4)	(5)= (2) × (3) × (4)	(6)
At home	55.4	48.6	78.9	4,600	176	29,100
In nursing homes	76.5	69.2	23.8	570	9.4	1,550
Total	57.7		70.6	5,170	186	30,600

NOTES: ^aMean number of hours of informal care conditional on receiving any. ^bTotal hours expressed in million hours per month. ^cMonetary value expressed in million euros.

Statistics in Columns (1) to (3) are weighted using the CARE survey weights. Each hour is valued using the hourly labor cost corresponding to the minimum wage in France in January 2016 (€13.7).

Table 5: Decomposition of the gap in informal care receipt across residential settings

	Point estimate	Standard error	95% confidence interval
[a] Mean care receipt in nursing homes	0.765***	(0.008)	[0.748;0.781]
[b] Mean care receipt at home	0.554***	(0.010)	[0.532;0.575]
[c] Difference in means = [a] - [b] = [d] + [e] + [f]	0.211***	(0.013)	[0.184;0.237]
[d] Contribution of endowments (E)	0.216***	(0.023)	[0.169;0.261]
[e] Contribution of coefficients (C)	0.200***	(0.021)	[0.156;0.242]
[f] Contribution of interaction (CE)	-0.204***	(0.029)	[-0.261;-0.142]

SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home or in a nursing home.

NOTES: Computations made using the Stata command `oaxaca`. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Informal care at old age at home and in nursing homes: determinants and economic value

Supplementary material

Appendix

A Additional descriptive statistics on informal care

A.1 Descriptive statistics at the caregiver level

Our measure of informal care receipt at the *respondent* level is constructed using care volume declared at the *caregiver* level. We therefore investigated the occurrence of extreme values at the caregiver level.

Table A.1 reports statistics on the volume of care reported for caregivers in the community and for nursing home residents. No caregiver has a volume higher than an equivalent of 24 hours a day (Column (1)). However, the share of caregivers for which a very higher number of hours is reported (higher than 16 hours/day) reaches 2.8% at home, and 8.0% when we consider instead a threshold of 8 hours a week. As could be expected, the probability of high care volumes is fairly small among caregivers of nursing home residents (Column (2)).

Table A.1: Information on care volume, at caregiver level.

	At home (1)	In nursing homes (2)
Proportion with non-missing volume	100.0%	81.3%
Proportion with volume > 24h/day	0.0%	0.1%
Proportion with volume > 16h/day	2.8%	0.1%
Proportion with volume > 12h/day	3.6%	0.3%
Proportion with volume > 8h/day	8.0%	0.6%
Number of informal caregivers	6,512	3,538

SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: Informal caregivers providing help with the activities of daily living (ADLs/IADLs) as reported by the survey respondents with activity restrictions.

NOTES: These statistics are *not* weighted by the survey weights at the respondent level.

Co-residence is a major determinant of reporting an extreme care volume. For caregivers of at-home respondents who co-reside with the respondent, the probability of an extreme volume

(> 16 days) equals 7% against less than 2% for non-coresiding caregivers. An extreme value is also more frequent among caregivers who are partners (8% report more than 16 hours a day).

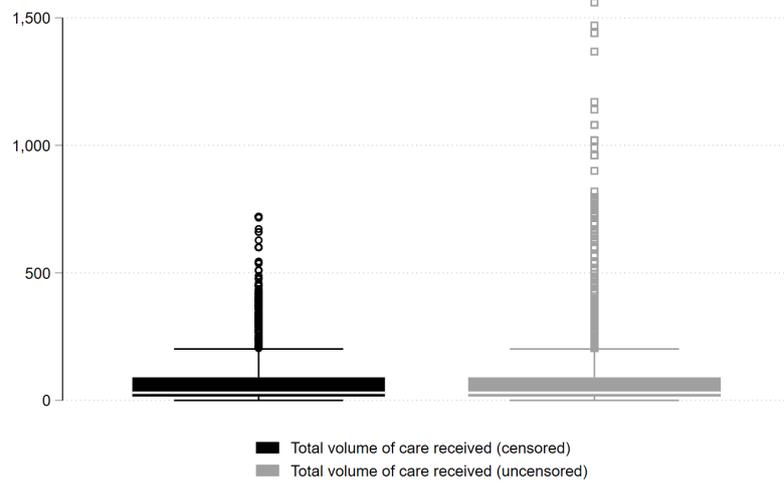
Also among nursing home residents, a high volume generally indicates that the caregiver is the partner of the respondent. In almost all cases, for nursing home residents a partner reports a high volume only if h/she lives with the respondent in the nursing home.

A.2 Informal care volume with and without censoring

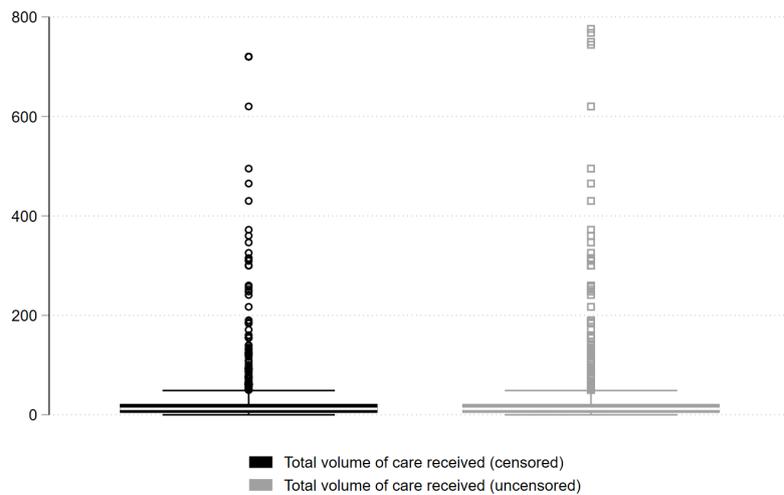
The measure of informal care volume we use in the valuation exercise and the comparative analysis of individual determinants of informal care receipt was censored, so as to avoid outliers and reporting errors to weigh excessively on our results.

This section compares the censored and uncensored distributions of informal care volumes. Focusing on informal care volumes for at-home population, we see that both distributions are rather similar, with a median value at 45 hours, and similar percentiles (25% = 16 hours, 75% = 120 hours, 90% = 300 hours). Censoring affects the extreme values (95th percentile = 450 hours without censoring, 360 with censoring; (99th percentile=733 without censorship, 438 hours with censoring; maximum values at 1,560 hours without censoring, 720 hours with censoring), which has consequences for the mean value of the distribution (110 hours without censoring, 95 hours with censoring). Similarly, in nursing homes, the distribution of volumes is close except for the 1% extreme highest values.

Figure A.1: Distribution of the number of informal care hours received, per month, among recipients (censored and uncensored volumes)



(Upper panel) At-home population.



(Bottom panel) Nursing home residents.

SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home (upper) or in a nursing home (bottom), receiving informal care for the activities of daily living.

NOTES: Statistics are weighted using the survey weights. Censored volumes correspond to volume with censoring (i) at the caregiver level (12 hours per day over 30 days in the month, maximum) and (ii) at the respondent level (24 hours per day over 30 days in the month, maximum). Uncensored volumes correspond to volume without any censoring.

B Decomposition approach

B.1 Framework: the Oaxaca decomposition

We adopt here the framework initially developed by Oaxaca (1973). A useful overview of this approach is proposed by O'Donnell et al. (2007).

We denote y_i the informal care received by individual i . For individuals living in institutions, we assume that y_i can be expressed as:

$$y_i = \beta^{inst} X_i + u_i^{inst} \quad (\text{B.1})$$

where $X_i = (1, x_i^1, \dots, x_i^J)$ is a vector including J covariates and β^{inst} a vector of parameters including an intercept. u_i^{inst} captures the unobserved determinants of informal care receipt in institutions.

Similarly, for individuals living in the community, we assume that y_i can be expressed as:

$$y_i = \beta^{home} X_i + u_i^{home} \quad (\text{B.2})$$

where β^{home} a vector of parameters including an intercept and u_i^{home} captures the unobserved determinants of informal care receipt at home.

Using Equations (B.1) and (B.2), we can express mean informal care in both populations as a function of the parameter estimates $\hat{\beta}$ and of the covariates, and the gap between mean informal care receipt in institution (denoted \bar{y}^{inst}) and mean informal care receipt at home (\bar{y}^{home}) as:

$$\bar{y}^{inst} - \bar{y}^{home} = \hat{\beta}^{inst} \bar{X}^{inst} - \hat{\beta}^{home} \bar{X}^{home} \quad (\text{B.3})$$

where \bar{X}^{inst} (resp. \bar{X}^{home}) denotes the population average of covariates for the institutionalized population (resp. for the non-institutionalized population).

Going one step further, we can decompose the gap in average outcomes into two parts.

One first possible Oaxaca decomposition is:

$$\bar{y}^{inst} - \bar{y}^{home} = \hat{\beta}_0^{inst} + \sum_{j=1}^J \hat{\beta}_j^{inst} \bar{x}^{j,inst} - \hat{\beta}_0^{home} - \sum_{j=1}^J \hat{\beta}_j^{home} \bar{x}^{j,home} \quad (\text{B.4})$$

$$= (\hat{\beta}_0^{inst} - \hat{\beta}_0^{home}) + \sum_{j=1}^J \bar{x}^{j,home} (\hat{\beta}_j^{inst} - \hat{\beta}_j^{home}) + \sum_{j=1}^J \hat{\beta}_j^{inst} (\bar{x}^{j,inst} - \bar{x}^{j,home}) \quad (\text{B.5})$$

$$= \Delta_1^U + \Delta_1^E \quad (\text{B.6})$$

Δ_1^E equals $\sum_{j=1}^J \hat{\beta}_j^{inst} (\bar{x}^{j,inst} - \bar{x}^{j,home})$ and is the part of the gap in informal care receipt that can be explained by compositional differences between the institutionalized population and the non-institutionalized elderly, scaled up by the association between covariates and informal care receipt among the institutionalized elderly. Δ_1^U equals $(\hat{\beta}_0^{inst} - \hat{\beta}_0^{home}) + \sum_{j=1}^J \bar{x}^{j,home} (\hat{\beta}_j^{inst} - \hat{\beta}_j^{home})$ and corresponds to the part of the gap in informal care receipt that cannot be explained by differences in the observed determinants of care. This part can be attributed either to differences in the association between a given covariate and care receipt across home and institutional settings (i.e. the difference $(\hat{\beta}_j^{inst} - \hat{\beta}_j^{home})$), scaled up by the population mean of the covariates in the home care setting, or to systematic residual differences (captured by the difference in the intercepts, $(\hat{\beta}_0^{inst} - \hat{\beta}_0^{home})$).

Put it differently, Δ_1^E would be equal to zero if the composition of the non-institutionalized population were the same as the composition of the institutionalized population. Δ_1^U is the residual gap.

Note that the gap in informal care receipt across the two settings can also be written as:

$$\bar{y}^{inst} - \bar{y}^{home} = (\hat{\beta}_0^{inst} - \hat{\beta}_0^{home}) + \sum_{j=1}^J \bar{x}^{j,inst} (\hat{\beta}_j^{inst} - \hat{\beta}_j^{home}) + \sum_{j=1}^J \hat{\beta}_j^{home} (\bar{x}^{j,inst} - \bar{x}^{j,home}) \quad (\text{B.7})$$

$$= \Delta_2^U + \Delta_2^E \quad (\text{B.8})$$

where Δ_2^U and Δ_2^E are, respectively, the unexplained part and the explained part of the

gap in informal care receipt in this second Oaxaca decomposition.

B.2 Interpretation and extensions

The difference between the two decompositions is which setting (home or institution) is taken as the reference for the scaling of the difference in the β 's and of the difference in the x 's. In the general case, the two decomposition formulas will *not* deliver the same results. This is because the first decomposition implicitly attributes the interaction between the compositional difference and the difference in coefficients in the unexplained part (Δ_1^U), while the second decomposition attributes it to the explained part (Δ_2^E) (see O'Donnell et al. (2007)).

Several extensions of the Oaxaca (1973) decomposition have been provided. See e.g. Cotton (1988); Neumark (1988); Reimers (1983).

B.3 Implementation

The user command `decompose` can be used to implement the Oaxaca and related decompositions in Stata.

As we use survey data with unequal sampling probability and non-response correction, we must take into the survey weights to derive average informal care receipt and the average values of covariates among the non-institutionalized and the institutionalized populations. In addition, we run weighted regressions to estimate coefficients β^{inst} and β^{home} in Equations (1) and (2).

To take into account potential correlations of disturbances among individuals living in the same setting, we estimate standard errors clustered at the household level (for the elderly in the community) or institution level (for nursing home residents).

C OLS estimations of the determinants of informal care receipt

Table B.1: Determinants of informal care receipt

Outcome:	<i>Receives informal care</i>		
	At home (1)	In nursing homes (2)	All (3)
Woman	0.037 (0.023)	0.017 (0.018)	0.033 (0.021)
Age: 60-74	0.036 (0.026)	-0.114*** (0.035)	0.021 (0.025)
<i>Age: 75-84</i>	Ref.	Ref.	Ref.
Age: 85-89	0.061** (0.027)	0.050** (0.023)	0.072*** (0.024)
Age: 90-94	0.141*** (0.033)	0.072*** (0.022)	0.145*** (0.027)
Age \geq 95	0.102** (0.046)	0.064** (0.030)	0.118*** (0.033)
<i>Married or civil union</i>	Ref.	Ref.	Ref.
Widow	0.080*** (0.025)	-0.072*** (0.021)	0.072*** (0.023)
Single or divorced	-0.046 (0.030)	-0.150*** (0.028)	-0.053** (0.027)
Children: none	-0.011 (0.030)	-0.229*** (0.024)	-0.046* (0.026)
Sister(s) or brother(s) alive	-0.007 (0.022)	0.059*** (0.015)	0.003 (0.019)
Diploma: none	0.064** (0.025)	-0.038** (0.019)	0.055** (0.022)
Diploma: secondary education	-0.006 (0.027)	-0.008 (0.023)	-0.007 (0.025)
<i>Diploma: primary education</i>	Ref.	Ref.	Ref.
Diploma: higher education	-0.049 (0.042)	-0.043 (0.039)	-0.046 (0.039)

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Table B.1 – Continued from previous page

Outcome:	<i>Receives informal care</i>		
	At home (1)	Nursing home (2)	All (3)
Diploma: missing	-0.065 (0.094)	-0.143*** (0.023)	-0.168*** (0.030)
Income: \leq 14,999	0.012 (0.025)	-0.033* (0.018)	0.005 (0.022)
<i>Income: 15,000-19,999</i>	Ref.	Ref.	Ref.
Income: 20,000-29,999	-0.043 (0.027)	0.009 (0.020)	-0.039 (0.025)
Income: \geq 30,000	-0.069* (0.036)	-0.041 (0.032)	-0.068** (0.033)
<i>Activity restrictions: moderate</i>	Ref.	Ref.	Ref.
Restrictions: ADL, except those of minimum independence	-0.033 (0.022)	0.047* (0.027)	-0.021 (0.021)
Restrictions: ADL on minimum independence	0.007 (0.033)	0.019 (0.029)	-0.010 (0.025)
Alzheimer's Disease	0.117*** (0.031)	-0.042** (0.017)	0.048** (0.021)
Limitations: cognitive	-0.010 (0.027)	-0.002 (0.035)	-0.005 (0.026)
Limitations: sensory	0.051** (0.022)	0.018 (0.018)	0.044** (0.020)
Limitations: suppleness, handling	0.016 (0.039)	0.099* (0.060)	0.016 (0.038)
Limitations: locomotion, balance	0.104*** (0.028)	0.023 (0.036)	0.110*** (0.027)
Incontinence	-0.002 (0.021)	-0.014 (0.018)	-0.002 (0.019)
Self-reported chronic disease or health condition	-0.004 (0.029)	0.011 (0.019)	-0.016 (0.025)
Subjective health: bad or very bad	0.085*** (0.021)	-0.017 (0.018)	0.074*** (0.019)
<i>Subjective health: fairly good</i>	Ref.	Ref.	Ref.

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Table B.1 – *Continued from previous page*

Outcome:	<i>Receives informal care</i>		
	At home (1)	Nursing home (2)	All (3)
Subjective health: good or very good	-0.025 (0.029)	0.014 (0.020)	-0.017 (0.026)
Proxy on informal care questions	0.207*** (0.033)	0.353*** (0.032)	0.224*** (0.030)
Proxy on other parts of the questionnaire	0.168*** (0.032)	-0.181*** (0.035)	0.137*** (0.030)
Constant	0.230*** (0.058)	0.679*** (0.067)	0.261*** (0.054)
Observations	6889	3161	10050
R^2	0.220	0.252	0.217
Number of clusters	6889.000	613.000	7502.000

SOURCES: CARE-M (2015), CARE-I (2016).

SAMPLES: French 60+ population, with activity restrictions, living at home or in a nursing home.

NOTES: Standard errors in parentheses, clustered at the household level (at-home respondents) or at the institution level (institutionalized respondents). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.