WIFO WORKING PAPERS
693/2025

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2025/1/W/0

Media owner (publisher), producer: Austrian Institute of Economic Research
1030 Vienna, Arsenal, Objekt 20 | Tel. (43 1) 798 26 01 0 | https://www.wifo.ac.at
Place of publishing and production: Vienna

Free download: https://www.wifo.ac.at/publication/pid/56598381

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Parameter Estimation for microWELT

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Abstract

This paper describes a novel method for the comparative estimation of long-term care needs, care arrangements and care gaps. Our approach generalizes an Austrian administrative procedure for the assessment of care needs and uses data from the Survey of Health, Ageing and Retirement in Europe (SHARE) to quantify the demand for and supply of long-term care in hours, distinguishing between care provided in nursing homes, formal home care, informal care by spouses and other informal care. The resulting estimates serve as parameters to introduce long-term care into the dynamic microsimulation model microWELT. The method developed in this paper thus provides the basis for long-term projections and policy scenarios for the long-term care sector, considering major socio-demographic trends such as population ageing, fertility decline and educational expansion.

Keywords: long-term care, care gap in hours, projections, dynamic microsimulation
JEL codes: C53, I11, J14

This paper is part of the JPI MYBL project WellCARE. Grant PCI2021-121913 funded by the AEI 10.13039/501100011033 by the JPI More Years Better Life by the European Union. The Austrian part of the project is funded by the Austrian Federal Ministry of Education, Science and Research.

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1 Introduction

Escalating demand for long-term care (LTC) against the backdrop of rapidly aging populations in Asia and Europe poses significant challenges to the sustainability of social protection systems. However, ageing is only one among several dimensions in which considerable transformations are co-occurring, many of which, e.g. fertility decline, the education expansion or changing family structures, are simultaneously affecting care supply and demand. This paper is part of an effort to design comprehensive analytical tools that keep track of multiple dimensions while providing comparative and forward-looking assessments of LTC-systems and policy responses in the face of upcoming challenges. In particular, we develop a method to obtain parameters on care demand and supply in hours from the harmonized Survey of Health, Ageing and Retirement in Europe (SHARE) to be used as inputs in the dynamic microsimulation model microWELT (www.microwelt.eu).

We proceed along the following steps. First, we adjust SHARE weights to correct for the undercoverage of the nursing home population. Second, we develop a care need assessment algorithm based on an administrative approach from the Austrian universal care allowance system to map characteristics observed in SHARE (ADLs, etc.) to hours. We calibrate this approach against Austrian statistics. Third, we model care needs (any hours) by age, sex and education. Fourth, we model the distribution of hours (those with care needs) by age, sex and education. Fifth, we model institutionalization, the probability of being in a nursing home by age, sex, care needs in hours, having a partner and number of children. Sixth, we model care received, the probability of receiving care given that there is a need by care need (hours), presence of a (caring) partner and having children. Seventh, we model the care mix received, share of total hours of care received from different sources by care need (hours), presence of a (caring) partner and having children. Eighth, we model care giving, the average hours of care provided by age and sex.

The paper is structured as follows. Section 2 introduces the data source and data adjustments. Section 3 discusses our care need assessment algorithm. Finally, Section 4 presents five parameterization steps.

2 Data

The starting point for our analysis of elderly care is the Survey of Health, Ageing and Retirement in Europe (SHARE)[1]. SHARE offers a wealth of data that is harmonized for many EU countries as well as with the US Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA). It furthermore covers the relevant dimensions of elderly care for our analysis (care demand and supply) in sufficient detail allowing e.g. to distinguish among different modes of care provision (nursing homes, formal home care, informal home care). To estimate parameters for microsimulation below, we make use of pooled samples drawing on SHARE waves 1 (2004) to 9 (2022), except for wave 3 (SHARELIFE), which differs from other waves in its retrospective focus on respondents' life histories.

While the respondents in nursing homes are not excluded from SHARE, they are not explicitly targeted in the sampling frame and it is well known that the nursing home population tends to be underrepresented due to differential attrition (See e.g. Barczyk and Kredler, 2019). Following Banks et al. (2023) and Brugiavini et al. (2023), we therefore recalibrate cross-sectional survey weights from SHARE, which account for attrition and non-response, to match the nursing home

[1] See Bergmann et al. (2019), Börsch-Supan et al. (2013), and Gruber et al. (2014).

population.

For Austria, we obtain the number of people living in nursing homes in 2021 by sex and age from Austrian care services statistics. Since the official age groups do not align with the lower bound of our analysis age window (60-74 vs. 65+), we apply a nonlinear optimization strategy to interpolate the population in the 65-74 age group. Table 1 shows the resulting population proportions which are subsequently used in an iterative proportional fitting algorithm to adjust SHARE survey weights.

Table 1: Austrian population proportions by age, sex and nursing home status (as a share of the total 65+ population in 2021)

	65-74	75-84	85+	Sum
In Nursing Home, Female	0.004	0.012	0.022	0.038
In Nursing Home, Male	0.003	0.006	0.006	0.014
Not in Nursing Home, Female	0.269	0.193	0.063	0.526
Not in Nursing Home, Male	0.237	0.148	0.037	0.422
Sum	0.513	0.359	0.128	1.000

3 Care need assessment

Modeling demand, supply and eventually the cost of care at the micro level requires the quantification of care in hours. While care hours received can be partially observed in SHARE, care need in hours is not directly available. Yet, SHARE covers many of the most important questions that are frequently used by governments to assess whether the care need of an individual meets the payout criteria of public long-term care insurance programs. The approach we select to quantify individual care need in hours is therefore to subject SHARE respondents to a standardized care need assessment based on the Austrian care allowance system.

Austria provides a universal care allowance system designed to support individuals who require regular assistance due to physical, mental, or psychological impairments (Famira-Mühlberger & Österle, 2024; Trukeschitz et al., 2022). The system operates on a tiered structure, in which recipients are assessed and granted an allowance based on their level of dependency, categorized across seven different levels (ranging from a minimum care need of 65 hours per month in level 1 to 180+ hours in levels 5-7). Payments are determined by the degree of care required rather than the recipient's income, ensuring that the support is targeted toward the individual's specific needs. This allowance can be used to cover various services, including in-home care, professional care services, or assistance from family members. The system aims to improve the quality of life for the elderly, allowing them to maintain independence for as long as possible while securing the necessary care and support.

The care need assessment required before being placed in the care allowance system is done by trained and qualified experts (doctors or nurses) (Trukeschitz et al., 2022). This assessment follows the rules and guidelines defined in the Federal Care Allowance Act, the classification regulation[2], the directive for the uniform application[3] of the Federal Care Allowance Act and the Consensus

[2] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10009142
[3] https://www.ris.bka.gv.at/Dokumente/Avsv/AVSV_2012_0084/AVSV_2012_0084.pdfsig

paper "A working document for assessors for the uniform medical and nursing assessment in accordance with the Federal Care Allowance Act". For the purpose of this paper, we implement a simplified version of the Austrian care need assessment for SHARE respondents based on these documents.

Table 2 below shows this simplified care need assessment scheme. For each respondent, the monthly care need in hours is obtained by summing up the hours for stated limitations. The upper part of the table, termed "basic assessment scheme", corresponds closely to the official assessment scheme and is mostly based on questions regarding limitations in Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs). The official assessment scheme also provides hours for motivational dialogue to support people with mental health limitations in their independence in coping with everyday life. We proxy the need for motivational dialogue by IADL questions related to cognitive status. Furthermore, we proxy the hardship supplement provision for severe mental health limitations by questions capturing whether respondents have been diagnosed with severe mental illness such as dementia or psychiatric problems by a doctor. In our "full assessment scheme", we also include the supplementary items in the lower part of the table to adjust the assigned hours to those observed in the Austrian population.

Contrasting the results from using the basic assessment scheme with the Austrian care statistics, as illustrated e.g. in Figure 2 below, we note that too few people are assigned hours based on (I)ADLs alone and that too few hours are assigned. Several factors are likely to contribute to this mismatch. First, the official assessment scheme provides assessors some flexibility to assign more or also fewer hours for specific limitations if there are substantial deviations from the default values. Moreover, health-related attrition (Muszyńska-Spielauer & Spielauer, 2022) and under-reporting of limitations in SHARE may also contribute to the under-assignment of hours. We therefore assign additional hours based on two approaches in our full assessment scheme. First, we allocate extra hours to respondents with limitations on an additional battery of functional limitation questions included in SHARE. Second, we include a quadratic age term in the assessment scheme that captures unobserved factors driving the nonlinear increase in care need by age. This polynomial is calibrated to approximate three alignment targets based on Austrian care allowance statistics for 2021. We target the population share with 65+ assigned hours of care need (entry threshold of the Austrian system), and the distributions of hours observed in the Austrian population conditional on age and sex, both for the binary prevalence of 65+ hours of care need as well as the average number of hours (see further discussion below). Furthermore, the conditional age trend is assigned only to individuals who report limitations on any of the other indicators used in the algorithm or, in addition, who report any limitation on the General Activity Limitation Indicator (GALI). Thus, we do not assign hours of care need to individuals who, based on a broad set of indicators, remain healthy and without limitations throughout their lives.

Table 2: Simplified Austrian Care Need Assessment Scheme related to SHARE variables

Limitation	Monthly Hours
BASIC ASSESSMENT SCHEME	
Activities of Daily Living (ADLs)	
Dressing	20
Walking AND getting up	30
Walking AND NOT getting up	15
NOT Walking AND getting up	22.5
Daily hygiene and bathing	35
Eating	30
Using the toilet	30
Instrumental Activities of Daily Living (IADLs)	
Preparing a hot meal	30
Shopping	10
Taking medication	3
House or garden work	10
Leaving home independently	10
Laundry	10
Motivational dialogue (Using a map OR Telephone calls OR Managing money)	10
Severe mental health limitations	
Dementia	45
Psychiatric problem	45
SUPPLEMENTARY ITEMS	
Extra hours 1 (Climbing several flights of stairs without resting OR Stooping, kneeling, or crouching OR Reaching or extending your arms above shoulder level OR Pulling or pushing large objects like a living room chair OR Lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries)	5
Extra hours 2 (Walking 100 metres OR Sitting for about two hours OR Getting up from a chair after sitting for long periods OR Climbing one flight of stairs without resting OR Picking up a small coin from a table)	10
Conditional age trend (IF any limitation OR Global Activity Limitation Indicator)	
	$(age - 65) * 0.73$
	$(age - 65)^2 * 0.042$

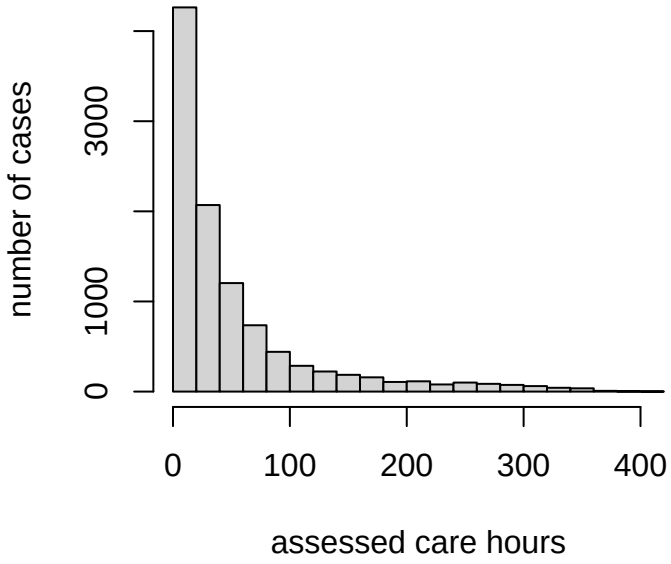

Figure 1: Histogram of assigned monthly care hours for AT SHARE respondents

Figure 1 shows a histogram with the monthly care hours our full assessment scheme assigns to AT SHARE respondents. As discussed above, we calibrate this allocation using Austrian care allowance statistics. Our first alignment target is the population share with 65+ assigned hours, which is the threshold to be placed in level 1 of the Austrian care allowance system. In 2021, the share with 65+ monthly care hours (level 1 or higher) in the population of age 65+ is about 20 percent. The basic assessment scheme assigns 65+ hours to only 10.94 percent of our sample or a weighted population share of 12.39 percent. The corresponding shares of our full assessment scheme amount to 17.46 percent and 19.47 percent, respectively.

The second alignment target used for calibrating our assessment scheme is the conditional distribution of needing 65+ hours of care by age and sex. Figure 2 below shows the prevalence of receiving care allowance by age and sex in black, which is equivalent to a care need of 65 hours or more. The blue and green lines contrast the results from the basic and full assessment schemes and are obtained by applying locally estimated scatterplot smoothing (LOESS) to weighted shares of survey respondents with 65+ assessed hours by age in years and sex.

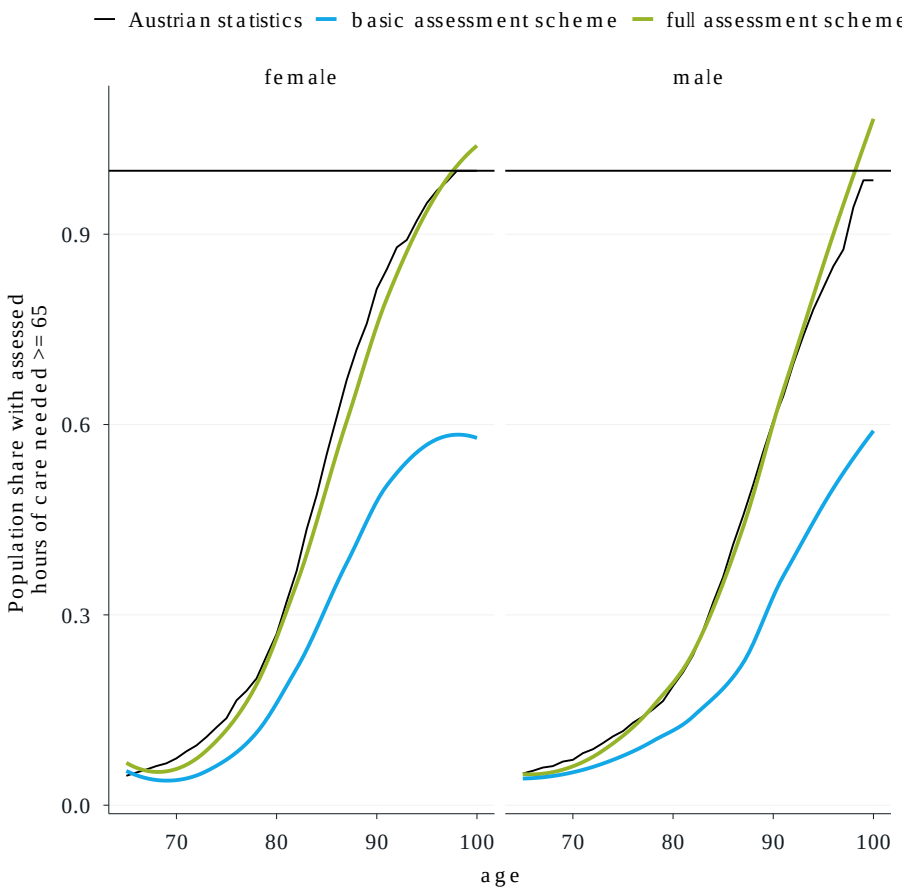

Figure 2: Prevalence of assessed monthly care need larger or equal to 65 hours by age and sex. We apply locally estimated scatterplot smoothing (LOESS) to weighted shares of survey respondents with 65+ assessed hours by age in years and sex. The black line provides a comparison with Austrian administrative data on care allowance prevalence of level 1 or higher, which is equivalent to a care need of 65 hours or more.

Lastly, we align our assessment scheme to the conditional distribution of average hours of care need by age and sex. We obtain monthly average hours from Austrian care allowance statistics by multiplying the prevalence of each care allowance level by its allotted minimum monthly care hours. The black line in Figure 3 below represents the results. In order to facilitate a meaningful comparison with our assessed hours, we restrict the sample to individuals with assessed hours above 65 and decrease individual care hours to the threshold applicable to each respondent. We then calculate averages of minimum monthly assessed hours by age and sex and apply LOESS (blue and green lines). The average hours from the basic scheme are consistently too high in this case because only more severe cases with multiple limitations qualify for the threshold. The results from the full scheme show a better fit, but indicate that we may assign too few hours to women at the lower and upper ends of the age range and too many hours to men at the lower end. However, we need to caution that deviations at the boundaries of the age range may also be related to sample size limitations. Furthermore, the higher average hours for men at the lower end of the age range may also be indicative of lower take up of care allowance in this group, as, in some cases, care work

for these men may be provided informally by their partners and without applying for care allowance.

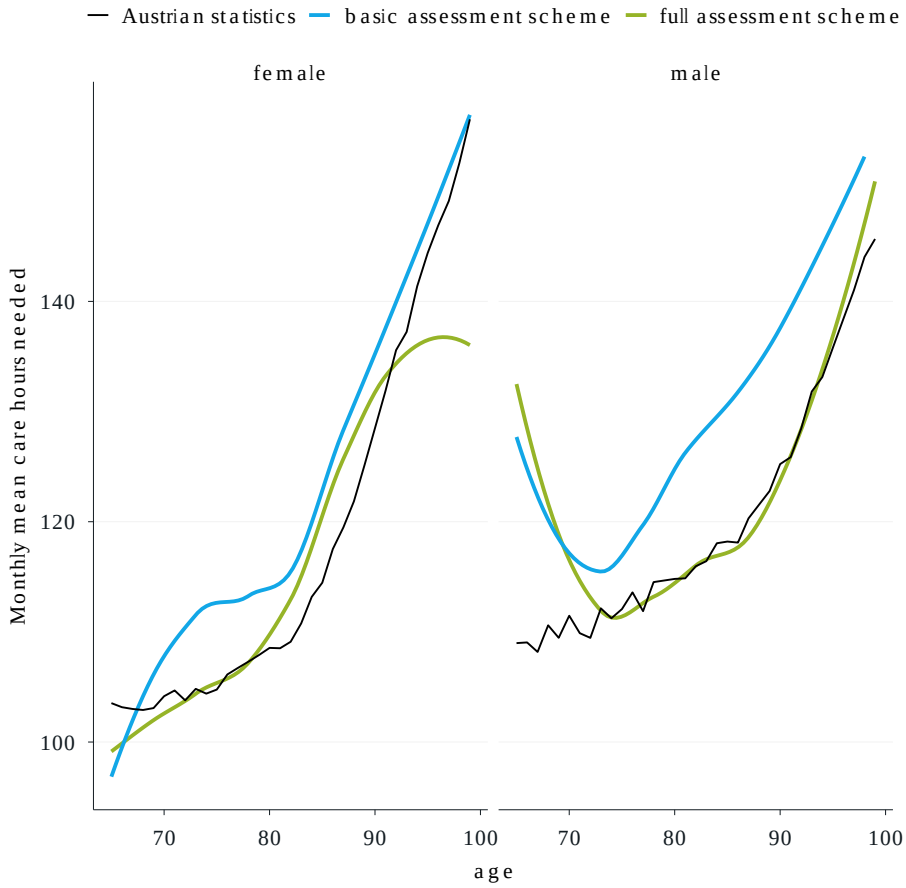

Figure 3: Average assigned hours for those with 65+ hours of care need by age and sex (weighted). Comparison of assessed hours with average hours from Austrian statistics (black line) calculated by multiplying the minimum hours per care allowance level times its prevalence. Subsample: respondents with 65+ hours of care need. Comparability with Austrian statistics is enhanced by assigning each assessed value of monthly hours into a care allowance level before calculating weighted averages and applying LOESS.

Since not all variables used in our care need assessment scheme are consistently available across all waves of SHARE, we resort to imputations and proxies in a limited number of cases. First, the IADL questions on difficulties with "leaving the home independently" and with "doing the laundry" are only available in waves 6-9. We therefore impute these variables in waves 1-5 using a logit model that draws on (I)ADLs and additional functional limitation questions available in all waves to predict the individuals most likely to have these additional limitations. Second, information on dementia and psychiatric conditions is not directly available in wave 1. Regarding dementia, we again use a logit model to impute likely candidates in wave 1 using as covariates IADL questions related to cognitive limitations as well as questions that assess an individual's orientation with respect to the current date. Finally, we proxy psychiatric problems in wave 1

by utilizing a question on whether respondents take drugs against anxiety or depression at least once a week, which identifies a similar (and also very small) share of respondents compared to the diagnosed psychiatric condition variables used in other waves.

In principle, the scheme presented here can be applied to all SHARE countries to obtain care need in hours. The basic assumptions for comparative analysis would be that respondents across countries tend to provide similar answers to the relevant questions based on their limitations and that the care need that corresponds to a given limitation is the same across countries.

4 Parameters

4.1 Step 1: Any care need

In a first step, we obtain estimates for the probability of needing care by age (in years), sex and education (three levels).[4] This is achieved by fitting weighted shape constrained additive models within subgroups to the dummy dependent variable of having positive assessed hours of care need, using monotone increasing P-splines to estimate smooth functions. Due to the limited number of very old medium and highly educated respondents, we do not differentiate by education from age 90 and implement a smooth transition from age 85 using LOESS. Figure 4 below shows the resulting predicted probabilities of having any care need. These probabilities are directly used as input parameters in the microsimulation model. The figure shows the expected strong rise in the probability of having any care need with age across all groups. The less educated group has a somewhat higher chance of needing care over the entire age span.

[4] Regarding education, we group ISCED 1997 levels into the categories low (0,1,2), medium (3,4) and high (5,6).

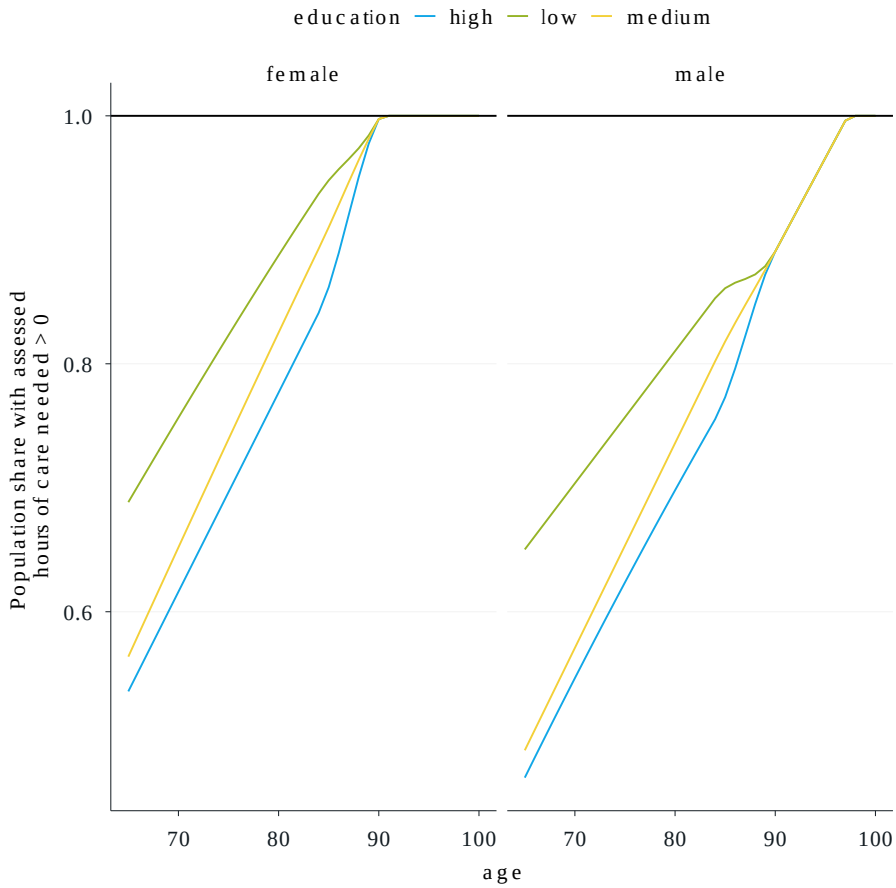

Figure 4: Prevalence of positive assessed monthly care need by age, sex, education (weighted). We use monotone increasing P-splines to estimate smooth functions and stop differentiating by education from age 90 due to data sparsity at the upper end of the age range.

4.2 Step 2: Care need in hours

To obtain estimates for care need in hours by age, sex and education, we restrict the analysis to the subsample with positive assessed hours. In our regression specification, we use assessed monthly hours as dependent variable. As independent variables, we include age, sex and education as well as interaction terms between age and sex as well as age and education. Since we are not only interested in average hours by age, sex and education but also in their distribution, we estimate quantile regressions at decile cutoff values. The regression results can be seen in Appendix Table 3. Subsequently, we calculate decile means for the assessed monthly hours of care need. Due to the linear model specification, we encounter a limited number of negative predicted hours at low ages which we set to zero. Since this concerns only care needs close to zero hours and since the linear specification delivers more comparable and realistic results across countries (observations with high education are limited e.g. in Italy and Spain) we refrain from using non-linear specifications. Figure 5 below shows the resulting decile means of assessed monthly hours of care need by age, sex and education which we use as input parameters for microsimulation. The results appear intuitive, i.e. education does not only impact the probability of needing care, but the monthly care need in

hours also tends to be lower for more educated individuals.

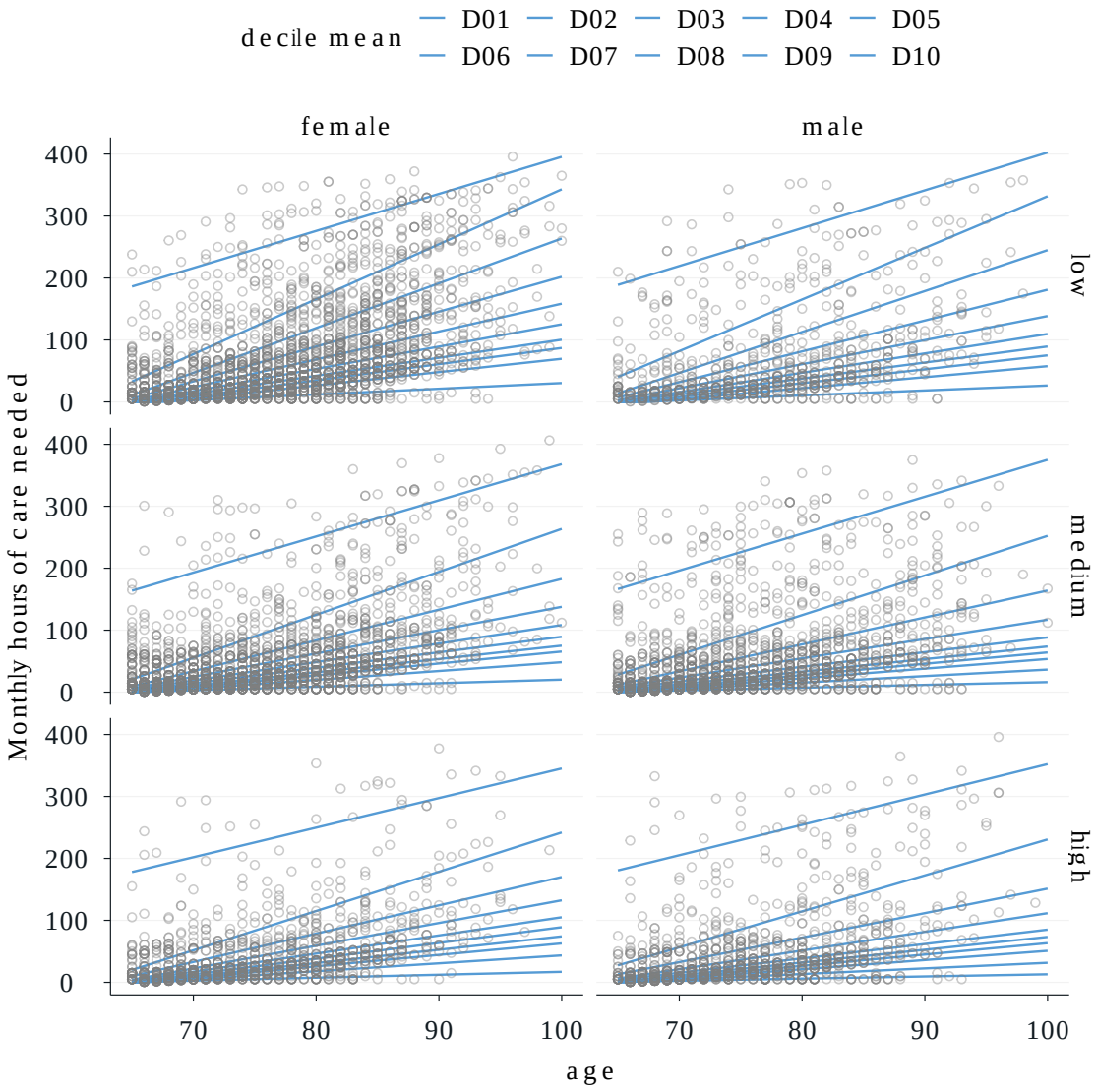

Figure 5: Distribution of care need in hours by age, sex, education (weighted). Subsample: respondents with positive care need. Decile means computed from predictions of quantile regressions. As independent variables, we include age, sex and education as well as interaction terms between age and sex as well as age and education.

4.3 Step 3: Nursing Home care

We next turn to the question of who will be sent to nursing homes. To facilitate comparability of survey questions in SHARE with Austrian care service statistics, we construct a broadly defined nursing home dummy that encompasses nursing homes and residential homes. Depending

on the nursing home definitions in other countries, this indicator could also be narrowed down. Cross-country differences in definitions of what legally counts as a nursing home should ideally be considered and harmonized in our comparative analysis. In the third step of our analysis for Austria, the nursing home indicator is the dependent variable in a logistic regression that controls for age, sex, assessed hours of care need and whether an individual's partner is living in the household[5]. The previous terms are allowed to vary by sex via an interaction term and we also add a separate categorical variable for the number of children. Compared to previous steps, we drop respondents who participated in the SHARELIFE interview in wave 7, because child related questions differ and do not allow for the construction of an indicator for the number of children that is consistent with the regular questionnaire.

In Figure 6 below, we compare the predictions of nursing home status from our model to Austrian care service statistics. We plot smoothed (LOESS) trend lines through average predicted nursing home probabilities by age and sex (in blue) against the nursing home prevalence from official statistics (in black). The Figure indicates that our model tends to capture the nursing home probability of women quite well on average. For men, we somewhat overestimate the nursing home probability for over 90-year-olds (note that only few observations are available in our SHARE sample for men in that age range, n = 100).

[5]Note that in contrast to step 4, we do not differentiate whether the partner is able to care in step 3.

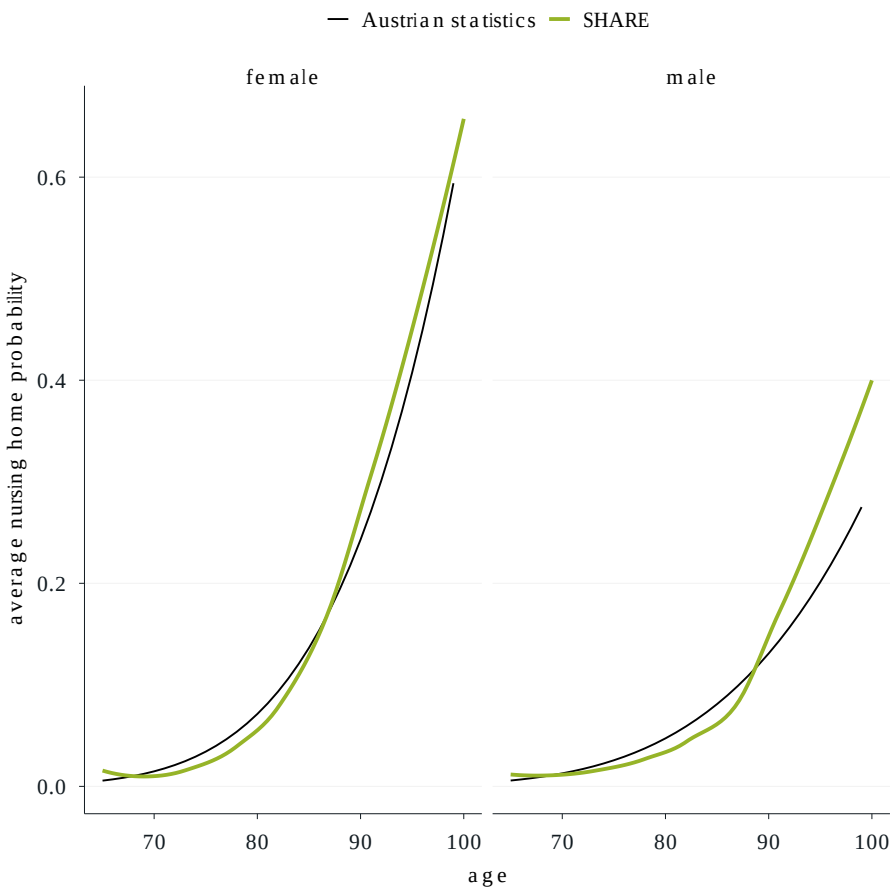

Figure 6: Nursing home prevalence in Austria. The nursing home indicator is the dependent variable in a weighted logistic regression that controls for age, sex, assessed hours of care need and whether an individual's partner is living in the household. The previous terms are allowed to vary by sex via an interaction term and we also add a separate categorical variable for the number of children. We plot smoothed (LOESS) trend lines through average predicted nursing home probabilities by age and sex against the nursing home prevalence from Austrian care service statistics (black line).

Figure 7 shows the predicted nursing home probabilities that are used as parameters to assign nursing home status in the microsimulation model, by age, sex, care need, presence of a partner and number of children. The Figure confirms the expectation that the model consistently assigns higher nursing home probabilities to individuals with higher care need and no partner in the household. Furthermore, we observe that having a child reduces the probability of being in a nursing home and having two or more children reduces this probability even further.

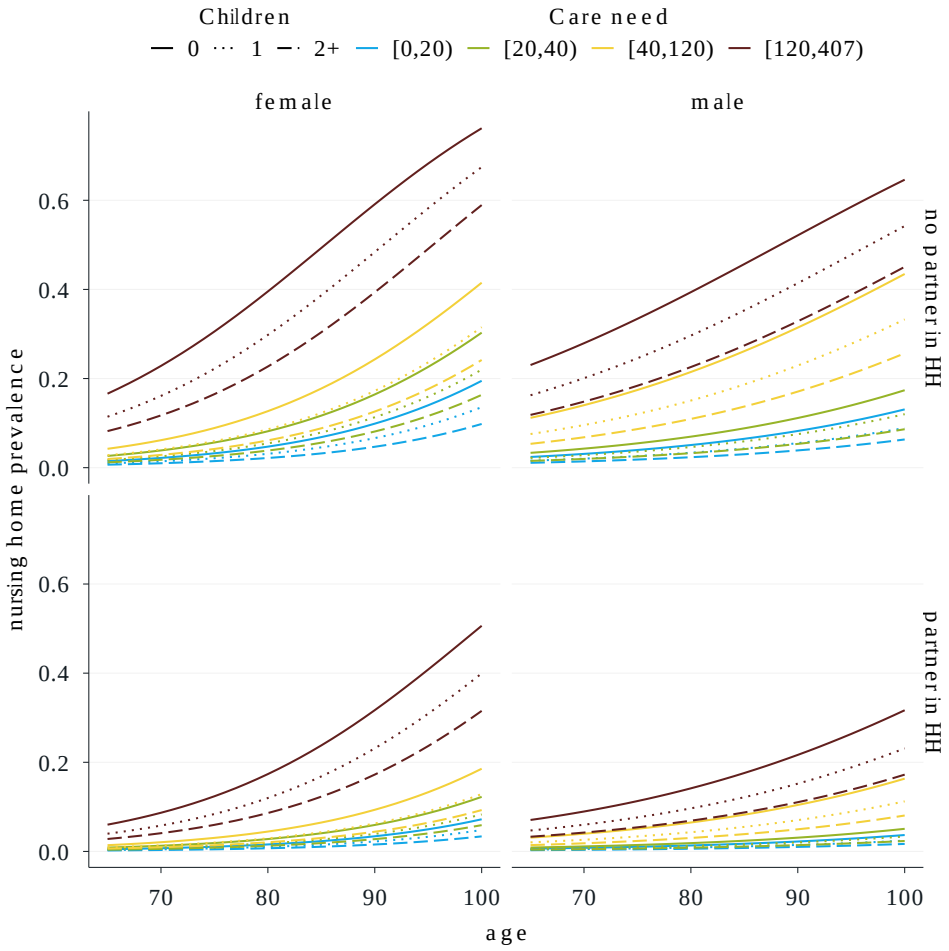

Figure 7: Nursing home prevalence by age, sex, care hours needed, partner, and children. The nursing home indicator is the dependent variable in a weighted logistic regression that controls for age, sex, assessed hours of care need and whether an individual's partner is living in the household. The previous terms are allowed to vary by sex via an interaction term and we also add a separate categorical variable for the number of children.

4.4 Step 4: Home Care

The aim of this step is to determine the probability of receiving any type of care and the average care mix among care recipients, according to family characteristics and care needs in hours. We distinguish between care provided by a partner, informal care provided by others, formal care services and a care gap. Regarding family characteristics, we distinguish people by partnership status (having a partner able to provide care / not having such a partner) and children (no children, children). People without care needs (assessed hours equal to zero) are removed from the sample at this step.

Since home care is not measured consistently across all waves in SHARE, we further restrict the sample and rely on multiple assumptions and imputations. The ultimate goal of our analysis is

to identify care gaps. We thus select SHARE waves 1, 2, and 6-9 as these waves contain questions on whether individuals receive help with ADLs and whether this help is sufficient. We only use regular wave 7 participants for parameter estimation at this step since the receipt of informal care is not available for SHARELIFE respondents.

Formal home care (FHC) is measured by specific questions in SHARE. Waves 1, 2, 7, 8 and 9 include questions on how many weeks in a year personal care, domestic help, or meals-on-wheels, were received, respectively. For personal care and domestic help there is an additional question on the average number of hours received per week. We compute average monthly hours received for each care type. For meals-on-wheels, we assume 7 hours per week in line with the number of hours provided for food preparation in the Austrian care allowance system. Adding together the average hours for the different care types, we obtain the average monthly hours of formal home care received. Outliers receiving above 720 hours per month are capped (only applies to few cases). In wave 6, SHARE only contains dummy variables on whether personal care, domestic help, or meals-on-wheels were received. For respondents in wave 6, we thus assign average hours received for the respective care type, as computed from the other waves[6].

Hours of outside informal care (OIC) can also be obtained in SHARE. The relevant question asks respondents whether they receive help with (I)ADL related tasks from outside of the household and from whom. Three helpers are identified and for each of these helpers the frequency of help is established (daily, weekly, monthly, yearly). In waves 1 and 2 there are also additional questions asking for the number of hours provided for each interval. We calculate average hours received for each interval in waves 1 and 2 and assign them to individuals in waves 6-9 who receive help in the respective intervals. Total monthly average hours of outside informal care received are then calculated by adding up hours across helpers and outliers are again capped at 720 hours per month.

A large share of home care is usually provided by partners or other household members. However, SHARE does not capture help within the household in detail. The related question only asks whether one receives intensive (daily or almost daily) care from another household member. To complete the home care mix, we therefore estimate hours of care received from partners and household members.[7]

The approach we choose to obtain care hours within the household amounts to the assumption that partners and other household members cover any residual hours of care needed. To calculate the individual care mix and whether there is any care gap, we draw on the information available in SHARE and construct a large decision tree (see Figure 8 below). We first split the sample according to the type of information available in SHARE on care received. About one third of respondents report to receive help with ADLs (question ph050), and for these respondents we also have self-reported information on whether there is a gap between the care they need and receive (addressed in question ph051). We label this group "care received: full info". Then there are about 20 percent of respondents who say that they do not get help with ADLs at the respective question, but report that they get ADL related FHC or OIC on other questions (care received: limited info). Furthermore, almost half of the respondents say that they receive none of these types of care. We next determine whether each individual has a partner in the household and whether the partner is able to provide care. The latter is given if the partner is not in a nursing home and has an assessed care need of below 180 hours. Care provided by other persons living

[6]SHARELIFE observations from wave 7 are included in the estimation of average hours by type of FHC.

[7]Note that hours of informal care estimated to be given by other household members are assigned to outside informal care below, because we only model nuclear families in microWELT.

in the household is treated as informal care provided by others (outside the household), because we only model nuclear families. In cases where there is no partner able to provide care, additional household members are assumed to cover any shortfall, so we assume that there is no care gap in these cases. Next, respondents may receive formal home care, outside informal care or both.

Finally, we determine whether there is a gap or not. For this purpose we subtract any hours received from the individual hours needed. We assume that there is no gap if a caring partner or other household member is present who takes any and all remaining hours. This strong assumption may be at odds with a reality in which people with care needs may be confronted with a care gap even if they live in the same household as their partner or other persons. However, without information on the actual amount of care provided within the household, there is no way of capturing differences in care provision between households with similar characteristics. More importantly, the assumption that household members fill any existing care gap is conducive to one of the objectives of our modelling approach, namely to assess the extent to which demographic shifts and changes in household composition will increase the pressure on the provision of formal and informal care from outside the household. Furthermore, we believe that this assumption is instructive because any remaining care gap that we estimate presents a lower bound on the actual care gap.

For respondents without caring partner or other HH member, we make use of the self reported gap information. In case no gap is reported, any remaining hours are allocated to OIC, if both OIC and FHC are received, or to either FHC or OIC, if only one of both is received. In the end, we obtain the individual care mix, and whether there is a full or partial gap between care hours received and needed. Figure 8 below provides further detail and shows only the branches of the tree for which data is available.

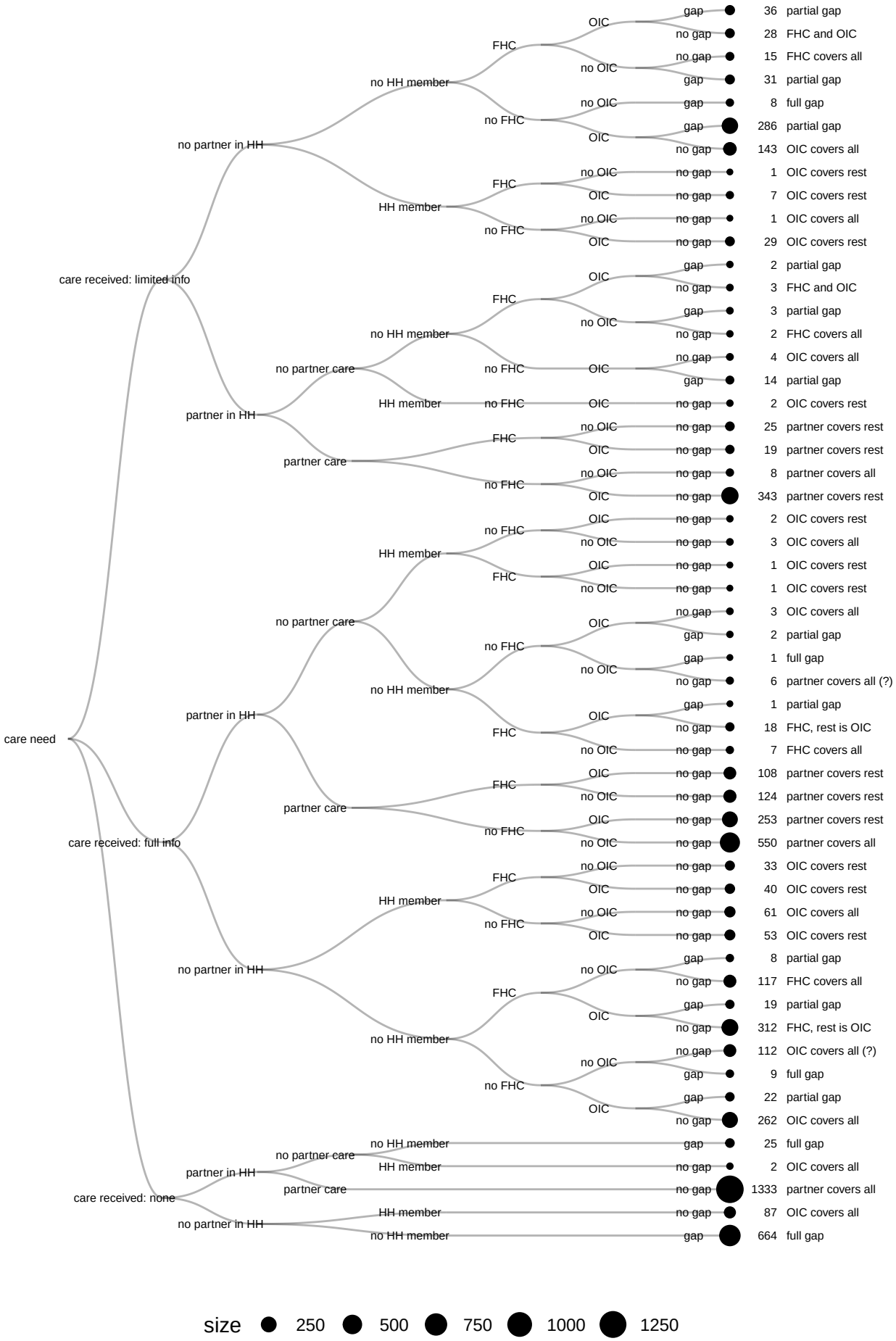

Figure 8: Illustration of our approach to obtain the individual care mix in hours from SHARE to be used as input for parameter estimation.

Having obtained the individual care mix in the sample with positive care need, we next estimate the parameters for microsimulation. We start with the probability of receiving any care. Figure 9 shows predicted care receipt probabilities from a logit model interacting the covariates assessed care need, partner and children. The results show that, as a consequence of our assumptions, virtually all people with partners in their household receive care and only few partners are classified as unable to care. For people with partners, we do not make use of these estimates as parameters, since we can determine a partner's ability to care from assessed care hours in the model. For people without partners in their household, on the other hand, we observe that there is a substantial chance of not receiving care, especially at lower levels of care need. Furthermore, having children improves the chances of receiving care. The estimates of care receipt probabilities for people without partners are used as parameters in the microsimulation model.

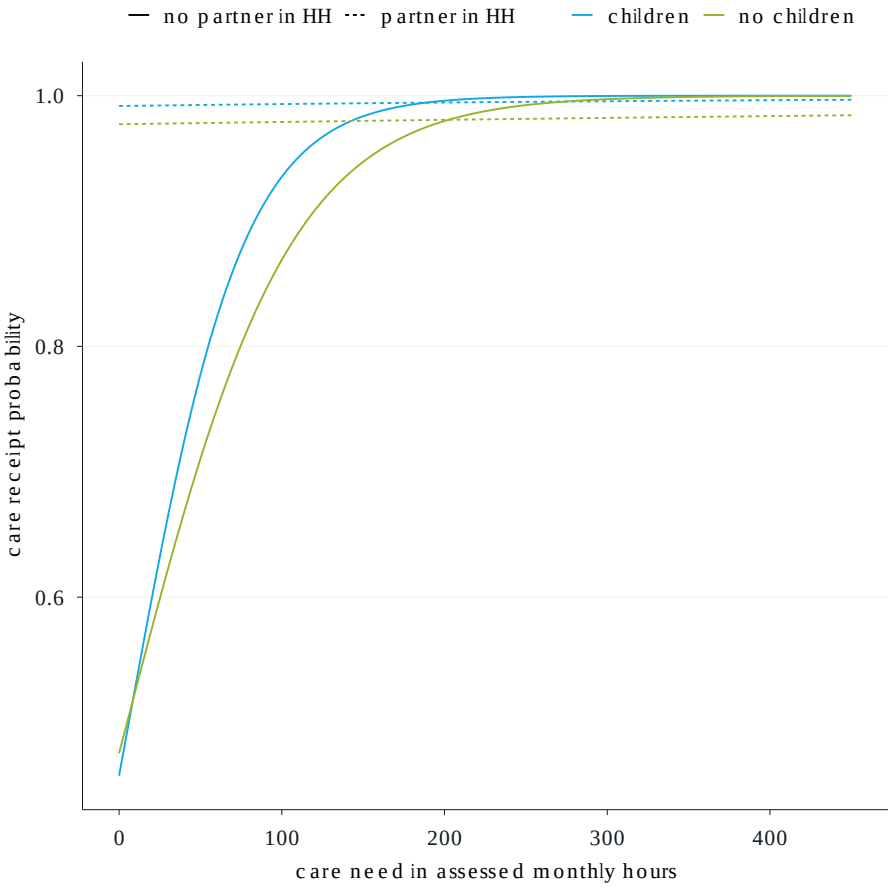

Figure 9: Care receipt probability within the care need sample by assessed care hours, presence of a caring partner and number of children (weighted).

In the next step, we calculate the average care mix across groups of care recipients depending on their care need, the presence of a caring partner and their number of children.[8] For this purpose, we compute the share of total hours received for each care type within each group. Since we

[8] We refrain from modeling this step at the individual level due to sample size limitations.

have previously capped care hours received at care hours needed for our care receipt estimation procedure, we add back "excess" hours received at the individual level before calculating shares of total hours. This is necessary to avoid introducing gaps by our procedure and to maintain consistency with the imputation of average hours to missing observations. Figure 10 shows the resulting care mix for each group. We note that the share of formal home care rises with needed care hours. Furthermore, having 2+ children vs. 0-1 children somewhat increases the share of outside informal care. For those with a partner able to provide care, the share of partner care declines with increasing care need, except for very low levels of care need. On the other hand, people without partners able to care tend to experience the largest gaps at intermediate levels of care need.

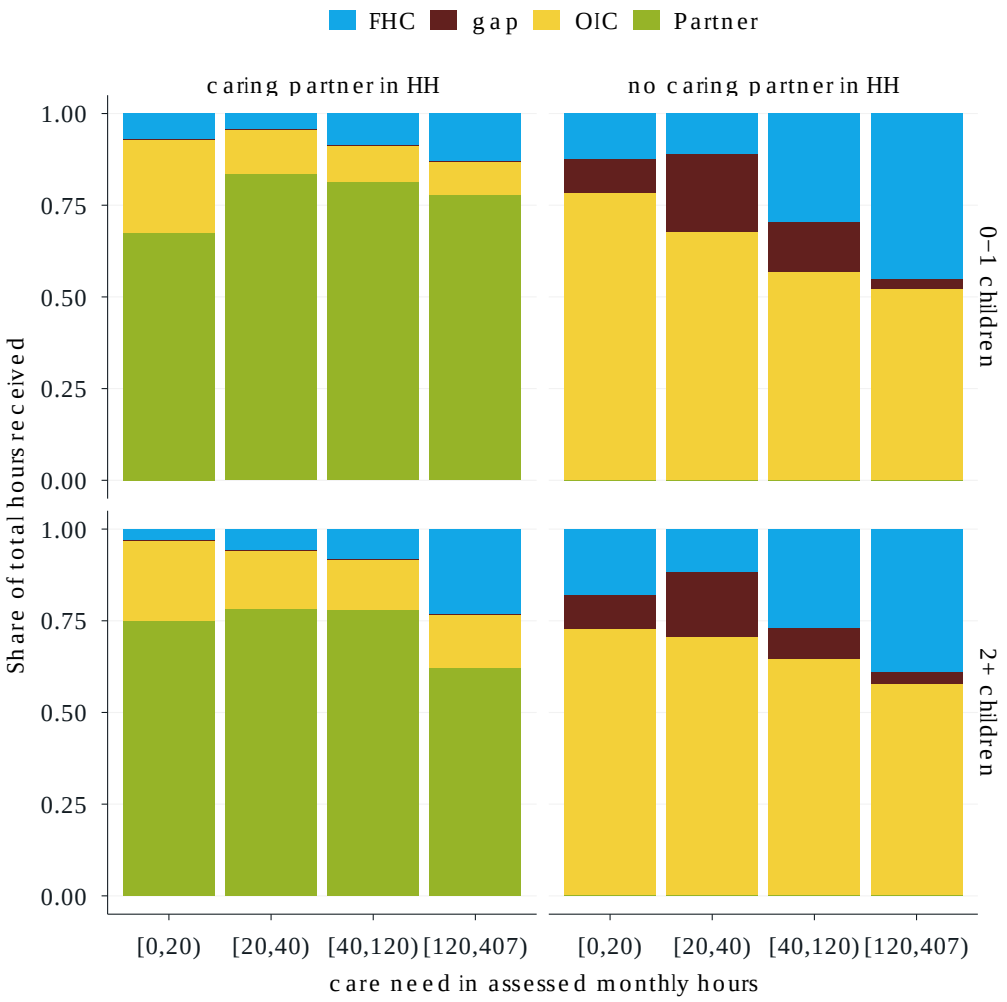

Figure 10: Care mix in Austria by grouped assessed care hours, presence of a caring partner and having children (weighted).

4.5 Step 5: Care giving

In step 5, we obtain parameters on average hours of care provided informally to adults outside the household by age and sex. Ideally, this would be achieved from a single harmonized data source. While SHARE provides data on hours of outside informal care given, however, it does not cover the population below 50. Related comparative data sources that cover the entire age span, on the other hand, do not clearly differentiate care given to people outside the household and do not allow for the measurement of hours (EHIS[9], EQLS[10]) or may underestimate the amount of outside informal care people provide (EU-SILC[11]) (ECORYS, 2021). Since EHIS provides large samples and measures hours in intervals, however, we believe that it is best suited to obtain estimates of hours of care given below 50 that are comparable to SHARE estimates. To obtain complete age profiles, we therefore opt for an approach that combines estimates from SHARE for the 50+ population with estimates from EHIS for people under 50.

The questions asking SHARE respondents about informal care giving outside the household closely resemble the questions on received outside informal care we used at the previous step. Respondents report whether they have given help with (I)ADL related tasks to a family member from outside the household, a friend or neighbor (and to whom). Three persons receiving help are identified and for each of these the frequency of help is established (daily, weekly, monthly, yearly). In waves 1 and 2 there are also additional questions asking for the number of hours provided for each interval. We again calculate average hours given for each interval in waves 1 and 2 and assign them to individuals in waves 4-9 who provide help in the respective intervals[12]. Total monthly average hours of outside informal care given are then calculated by adding up hours across helpers and outliers are again capped at 720 hours per month.

We next turn to EHIS, which asks respondents if they provide informal care at least weekly and then discerns the intensity of weekly care in three categories: "less than 10 hours", "10-20 hours" and "20+ hours". Furthermore, EHIS does not distinguish between help that is given within or outside the household. To facilitate the comparability among measures of informal care between EHIS and SHARE, we first calculate the average weekly hours among SHARE respondents providing care at least weekly in three subgroups corresponding to the EHIS intervals. Then we use the resulting estimates to calculate average hours of care given in EHIS by age group and sex (Appendix Figure 12 illustrates the adjustment of EHIS hours). Since EHIS respondents may partially report care given within the household, we calculate the ratio of average hours given at least weekly within the 50-54 SHARE age group to the respective EHIS figure and use this ratio to discount care within the household from the EHIS estimates. We assume that the youngest possible comparable EHIS age group (50-54) exhibits the same extent of care within the household than younger age groups. Finally, we compute the difference between the averages of hours given at any interval and hours given at least weekly for the 50-54 SHARE age group and add this figure to the discounted EHIS estimates, assuming that the 50-54 age group is similar to younger cohorts in the extent of care given less than weekly. We thus obtain estimates from EHIS on average hours of outside informal care provided by under 50-year-olds.

Figure 11 below shows the resulting parameters for the microsimulation model on average hours of outside informal care given by age and sex. We combine age group averages below 50 from EHIS with SHARE microdata above 50 and apply statistical smoothing techniques. Furthermore, we

[9] European Health Interview Survey
[10] European Quality of Life Survey
[11] European Union Statistics on Income and Living Conditions
[12] We only include regular respondents from wave 7.

impose that people at age 100 provide no hours of care. We observe that average monthly care hours given for women and men peak around age 60 and at around 16 and 10 hours respectively.

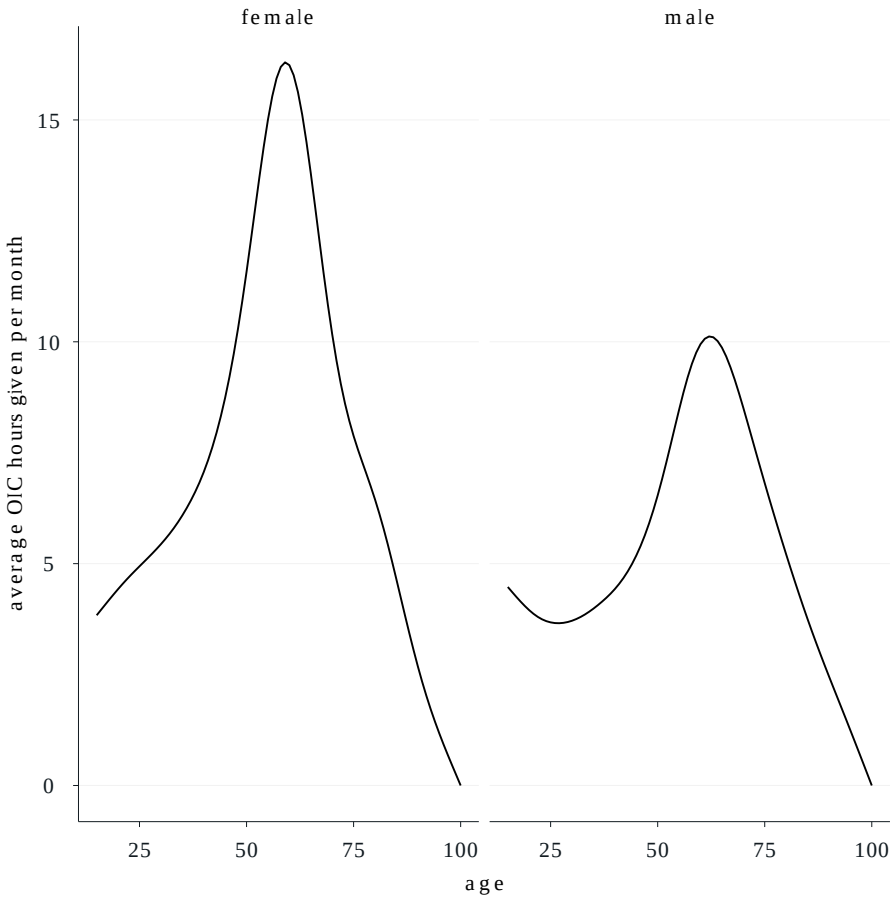

Figure 11: Average hours of care given by age and sex (weighted).

5 SHARE Acknowledgements

This paper uses data from SHARE Waves 1 (SHARE-ERIC, 2024b), 2 (SHARE-ERIC, 2024c), 3 (SHARE-ERIC, 2024d), 4 (SHARE-ERIC, 2024e), 5 (SHARE-ERIC, 2024f), 6 (SHARE-ERIC, 2024g), 7 (SHARE-ERIC, 2024h), 8 (SHARE-ERIC, 2024i) and 9 (SHARE-ERIC, 2024j). See Börsch-Supan et al. (2013) for methodological details.

The SHARE data collection has been funded by the European Commission, DG RTD through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812), FP7 (SHARE-PREP: GA N°211909, SHARE-LEAP: GA N°227822, SHARE M4: GA N°261982, DASISH: GA N°283646) and Horizon 2020 (SHARE-DEV3: GA N°676536, SHARE-COHESION: GA N°870628, SERISS: GA N°654221, SSHOC: GA N°823782, SHARE-COVID19: GA N°101015924) and by DG Employment, Social Affairs & Inclusion through VS 2015/0195, VS 2016/0135, VS 2018/0285, VS 2019/0332, VS 2020/0313, SHARE-EUCOV: GA N°101052589 and EUCOVII: GA N°101102412. Additional funding from the German Federal Ministry of Education and Research (01UW1301, 01UW1801, 01UW2202), the Max Planck Society for the Advancement of Science, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064, BSR12-04, R01_AG052527-02, R01_AG056329-02, R01_AG063944, HHSN271201300071C, RAG052527A) and from various national funding sources is gratefully acknowledged (see www.share-eric.eu).

This paper uses data from the generated easySHARE data set (SHARE-ERIC, 2024a), see Gruber et al. (2014) for methodological details. The easySHARE release 9.0.0 is based on SHARE Waves 1, 2, 3, 4, 5, 6, 7, 8 and 9.

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A Additional Results

A.1 Step 2

Table 3: Quantile regressions, dependent variable: assigned hours of care need, weighted

	Q0	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90	Q100
Constant	-9.194^{***}	-114.524^{***}	-175.773^{***}	-172.797^{***}	-208.518^{***}	-260.707^{***}	-320.780^{***}	-400.199^{***}	-516.921^{***}	-569.339^{***}	164.632^{***}
	(0.653)	(8.576)	(9.234)	(10.145)	(12.800)	(12.659)	(15.990)	(23.342)	(29.120)	(33.130)	(49.359)
Age	0.151^{***}	1.696^{***}	2.599^{***}	2.629^{***}	3.192^{***}	4.006^{***}	4.980^{***}	6.268^{***}	8.177^{***}	9.547^{***}	2.410^{***}
	(0.010)	(0.118)	(0.127)	(0.141)	(0.179)	(0.178)	(0.230)	(0.338)	(0.419)	(0.420)	(0.621)
Male	0.827^{*}	16.081	34.604^{***}	14.774	27.787^{**}	34.610^{***}	47.805^{***}	40.856^{*}	45.227	39.137	-50.068
	(0.398)	(9.189)	(5.283)	(7.993)	(9.230)	(7.337)	(11.460)	(18.839)	(33.700)	(43.803)	(51.607)
Educ Medium	-1.196	50.755^{***}	51.677^{***}	42.691^{***}	58.700^{***}	89.091^{***}	112.775^{***}	130.801^{***}	159.961^{***}	66.646	-92.826
	(0.750)	(12.902)	(8.985)	(10.986)	(12.694)	(12.615)	(15.768)	(27.264)	(36.486)	(54.943)	(65.497)
Educ High	-1.196	64.256^{***}	57.301^{***}	46.859^{***}	51.768^{***}	88.397^{***}	117.337^{***}	135.407^{***}	207.831^{***}	94.424	45.662
	(0.813)	(13.754)	(10.213)	(11.560)	(13.594)	(14.185)	(19.228)	(27.173)	(47.074)	(72.398)	(123.005)
Age * Male	-0.013^{*}	-0.236	-0.509^{***}	-0.224	-0.420^{**}	-0.517^{***}	-0.707^{***}	-0.596^{*}	-0.640	-0.428	0.677
	(0.006)	(0.133)	(0.075)	(0.115)	(0.128)	(0.103)	(0.165)	(0.274)	(0.482)	(0.619)	(0.656)
Age * Educ Medium	0.018	-0.720^{***}	-0.731^{***}	-0.646^{***}	-0.876^{***}	-1.322^{***}	-1.703^{***}	-2.018^{***}	-2.511^{***}	-1.348	1.059
	(0.011)	(0.182)	(0.123)	(0.154)	(0.177)	(0.177)	(0.229)	(0.397)	(0.521)	(0.766)	(0.806)
Age * Educ High	0.018	-0.919^{***}	-0.819^{***}	-0.709^{***}	-0.802^{***}	-1.327^{***}	-1.801^{***}	-2.116^{***}	-3.191^{***}	-1.856	-0.552
	(0.012)	(0.196)	(0.141)	(0.162)	(0.189)	(0.201)	(0.279)	(0.396)	(0.673)	(1.009)	(1.519)
Num. obs.	10150	10150	10150	10150	10150	10150	10150	10150	10150	10150	10150
Percentile	0.000	0.100	0.200	0.300	0.400	0.500	0.600	0.700	0.800	0.900	1.000

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$.
SHARE waves 2,4-8

A.2 Step 5

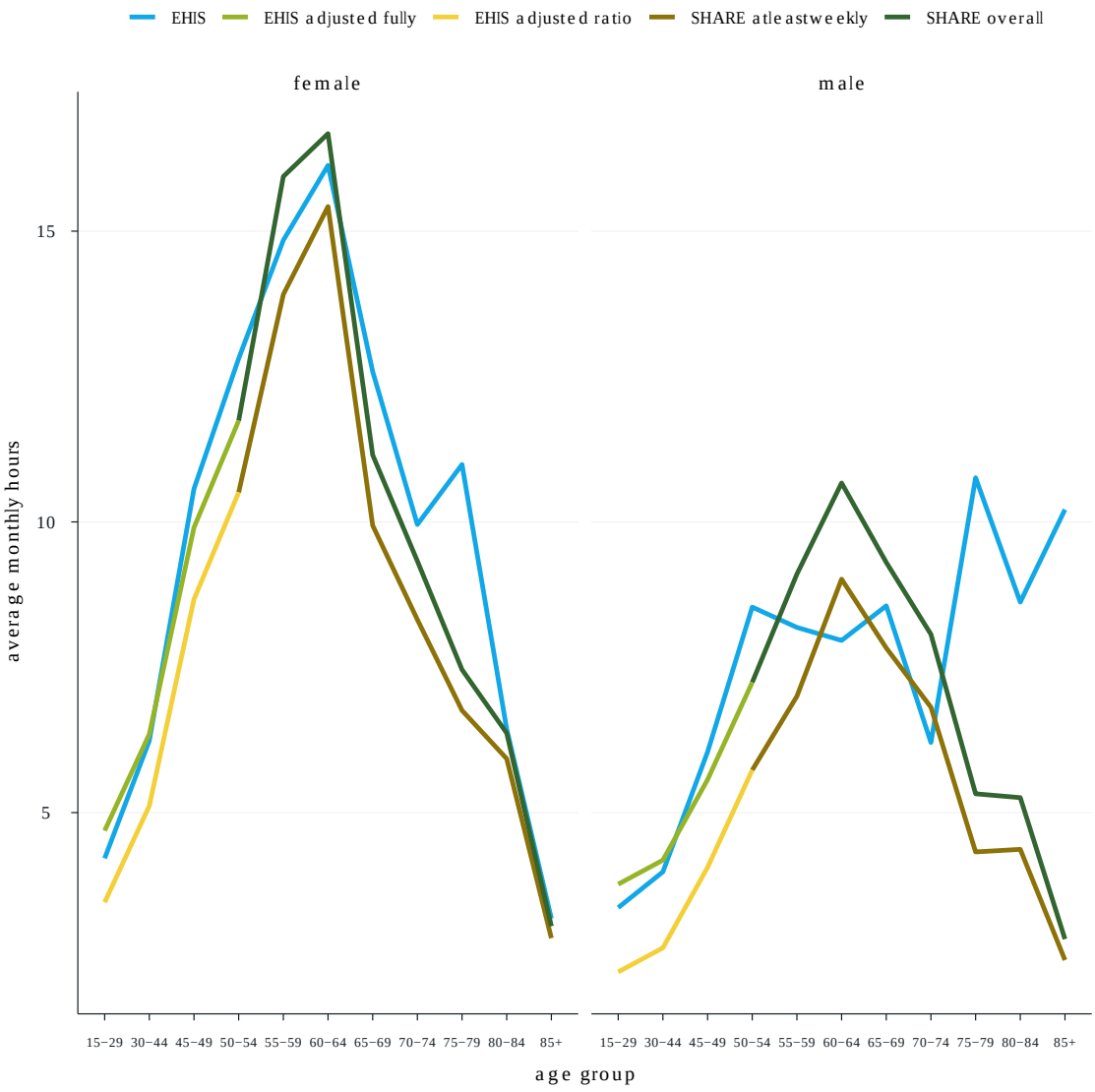

Figure 12: Average hours of care given by age and sex (weighted). EHIS and SHARE comparison and adjustment.