1 Introduction

Mortality projections throughout Europe forecast an increasing life expectancy over the whole age distribution. At the same time, population projections predict that European societies are shrinking. As a result, the old-age dependency ratio is rising. However, it is still not well understood how care risks will evolve. Care prevalence rates could not only increase through demographic trends but also through a relative increase in the number of elderly people who suffer from chronic diseases, multi-morbidity, or dementia illnesses. Cross-European publications also state that these factors may bring people to rely more heavily on costly professional care services than on informal care (Lundsgaard, 2005; Häcker and Raffelhüschen, 2007). These developments might thus have a dramatic impact on public spending on long-term care services in European countries.

Up to today, the focus of most statistical publications in examining care-arrangement-specific demand lies on the effects of gender and age (see e.g. Huber and Hennessy, 2005). Empirical studies have focused on the question whether informal care can substitute for professional health and care services to get an idea of how useful informal care provision is in relieving the government budget or whether the supply of formal care decreases subsidiarity. The interpretation of other determinants of either informal or formal care is often neglected although their impact on care arrangement choice is interesting in their own respect. While descriptive statistics lack conditional information such as the effect of a serious illness given the individual's characteristics, looking at the substitutability either helps to understand the determinants of only one possible care arrangement or mainly provides information on the combination of professional home-based and informal care.

To extent the findings of the previous literature, I take a different methodological approach and examine the choice of care arrangement by a multi-stage analysis. In a first step, I conduct a non-linear regression analysis to examine the individual's determinants of becoming dependent in the first place. Thereby, the main interest lies in the impact of different diseases, of physical and mental limitations, as well as of health behavior. The focus of this paper lies on the analysis in the second step: I am able to jointly concentrate on the determinants of informal and formal care utilization instead of explaining one type by the other. After that, this model is extended to additionally look at the factors that influence the probability of living in a nursing home in a European country for the first time. Moreover, I can control for unobserved factors that influence the choice between care arrangements simultaneously. In addition, the cross-European dataset allows me to examine the effect of public expenditure on long-term care arrangements in the same model context. To look at the impact of demographic change, I afterwards present different

simulations on the development of important care arrangement determinants.

My results show that receiving informal care only is more likely for married males and individuals with major limitations. The probability of professional home-based care increases with being a married female as well as with the number of minor impairments of the individual itself. A combination of both arrangements is more likely to be used with an increasing number of daughters and with a rise in minor and major limitations in everyday activities. The probability of becoming a nursing home inhabitant increases with being a single female, with income and owning a house as well as with one's own and the partner's limitations. Daughters are however an insurance against nursing home stays. The simulation results show that the development in frailty will have a decisive influence on the future structure in care arrangement choice.

In the following, Section 2 provides a literature review on economic publications that deal at least partially with the determinants of care arrangement choice. Section 3 describes the dataset and variables of interest and illustrates the different steps taken in the regression analyses. Section 4 presents the model specifications and the empirical assumptions before the results are presented in Section 5. Simulation results for demographic change are illustrated in Section 6. Section 7 concludes.

2 Literature review

The literature which looks at the question whether certain types of care arrangements are complements or substitutes to each other[1], brings about piecewise information on the signs that can be expected from the determinants of the choice between care types:

Empirical works with European data have been conducted by Bolin et al. (2008) and Bonsang (2009). Both papers are based on SHARE data. They use a sample of single individuals who might receive care from their children or grandchildren. Bolin et al. (2008) do not mention the coefficients of other determinants than the one that indicates the relationship between informal and formal care. However, Bonsang (2009) reports that informal care receipt does increase with being female, living alone and with the age of the elderly. Income has a positive effect while the effect of wealth is not significant.

[1]Overall, policy conclusions state that encouraging informal care can indeed relieve financial distress for public expenditure programs on long-term care as most results illustrate that informal and professional home-based care are substitutes to each other (Pezzin et al., 1996; Johnson and Lo Sasso, 2002; Van Houtven and Norton, 2004; Charles and Sevak, 2005; Viitanen, 2007; Bolin et al., 2008). However, when a measure of disability is taken into account, estimates show a complementary relationship between the two alternatives (Bonsang, 2009).

The proportion of daughters benefits the probability of receiving informal care while an increasing distance to the nearest child is a disadvantage in this respect. In addition, informal care receipt increases with the degree of disability. The inclusion of this last variable shifts informal care to be a complement to paid domestic help and personal care. In this second regression on professional home-based care services, age has again a positive effect. The effect of income is positive but the one of wealth negative. Living alone increases the utilization of paid domestic help in housework. Disability has again a positive effect.

The only empirical information on the determinants of institutional care stems from the US literature on the question whether informal or professional home-based care can substitute for nursing home care (Johnson and Lo Sasso, 2002; Van Houtven and Norton, 2004; Charles and Sevak, 2005). All three studies use data from the Asset and Health Dynamics Among the Oldest-Old Panel Survey (AHEAD) which is designed to survey the oldest-old part of the Health and Retirement Study (HRS). The results are similar in most respect. Individuals who are widowed or living alone have a higher probability of living in a nursing home. This likelihood also increases with age, the number of ADL or IADL needs[2], the number of chronic conditions or mental impairments, and with a higher educational degree. Income has a negative impact while wealth has different signs over the publications. The coefficient on gender is not significant.[3] A comprehensive empirical study that explicitly looks at the determinants of care arrangements and not at their substitutability has been conducted by Kemper (1992). He uses US data from the Channeling experiment and puts weight on estimating the determinants of formal care as well as on those for visiting and in-household informal care use. The results illustrate a strong increase in all care arrangements with a rise in the number of ADL impairments. This is also true for comprehension and behavioral measures of care needs. Being married and having children leads to an increase in informal care and has a negative impact on formal care. Income has the opposite effect though. Two-part models are used to look at every of the three types of care separately but estimators are not adjusted to the correlation between the error terms of care arrangements.

Some of these publications also include regressors to look at the effect of public long-

[2]Activities of Daily Living: Bathing, dressing, transferring from bed or chair, toilet use, walking, eating. Instrumental Activities of Daily Living: Ability to use telephone, shopping, food preparation, housekeeping, laundry, responsibility for own medications.

[3]Significant determinants of informal care are: being male, hispanic, single, age, wealth (negative), education, the number of children, ADL (negative) and IADL needs (positive) (Johnson and Lo Sasso, 2002; Charles and Sevak, 2005). Significant determinants of professional home-based care are: being male, age, and more than a high school degree of a child (Van Houtven and Norton, 2004).)

term care programs or expenditure. Kemper (1992) finds that a state-specific home care program decreases the probability of receiving informal care but benefits the receipt of professional home-based care. The results of Pezzin et al. (1996) show that public home services encourage single individuals to live independently. The probability of living in a nursing home drops. However, Pezzin et al. (1996) emphasize that the substitution effects are only small. Van Houtven and Norton (2004) find that Medicaid has a positive effect on the probability of receiving institutional care. However, Kemper (1992) and Charles and Sevak (2005) cannot confirm this finding when additionally controlling for having a long-term care insurance. Viitanen (2007) presents evidence from the European Community Household Panel (ECHP) from 1994 to 2001. She examines the impact of government expenditure for professional home-based care (OECD Social Expenditure Data) on choosing either no informal care or informal care within or outside the respondent's household. The results illustrate that an extra €1,000 of governmental expenditure on formal residential care and home help significantly reduces informal care giving by women aged 45 to 59.

Overall, this paper contributes to the existing literature in several dimensions. First, the analyses take a close look at the triggers of long-term care dependency, namely at several diseases, at limitations in ADL and IADL and most importantly at the frailty of spouses and partners which is likely to have a huge impact on long-term care arrangement choices. Second, it provides information on the determinants of informal and professional home-based care without concentrating on their substitutability. The bivariate probit model also allows me to control for unobserved factors that jointly affect the choice between both care arrangements and enables the interpretation of the effects on combined care services. Third, it is the first time that the determinants of institutional care are examined in an empirical analysis with European data. Fourth, the paper studies whether public expenditure on professional home-based as well as on institutional care exerts an incentive to increase the demand for those services. Fifth, the estimated parameter values are used to simulate the effect of demographic change on the distribution of individuals over care arrangements.

3 Data and methodology

This paper analyzes 2004 data on 11 European countries from the Survey of Health, Ageing and Retirement in Europe (SHARE).[4] SHARE is a multidisciplinary panel database

[4]This paper uses data from SHARE Waves 1 & 2, as of December 2008. SHARE data collection in 2004-2007 was primarily funded by the European Commission through its 5th and 6th framework programmes (project numbers QLK6-

of micro data on health, socio-economic status, and social as well as family networks of more than 30,000 individuals aged 50 or over. The first wave was collected in 2004 with eleven participating European countries. For details on the sampling procedure, questionnaire contents, and fieldwork methodology, readers are referred to Börsch-Supan and Jürges (2005). SHARE data is used as it contains rich information on individual and family characteristics as well as on illnesses, health limitations, health behavior, and care provision.

Figure 1 presents an overview of the sample compositions in the different estimation steps that are examined in this paper.[5] Descriptive statistics for all variables can be found in Table 6 in the Appendix.

For Step 1, the sample consists of 10,647 individuals who are older than 50 years and who either live together with their spouse/partner or alone. They may suffer from impairments in ADL or IADL. If they need help in any of these activities, they answer which activity that is. To estimate the individual probability of becoming dependent on caregiving, I construct a dummy variable which equals 1 if an individual has received help in any of these categories in the last year and 0 if otherwise. I use this way of measuring as it is the most objective assessment of long-term care needs that is available in SHARE data. The question on which type of care an individual receives is subjective and does not necessarily imply that individuals are physically or mentally in need of long-term care. Therefore, it is less suitable for estimating the determinants of becoming disabled in old age.

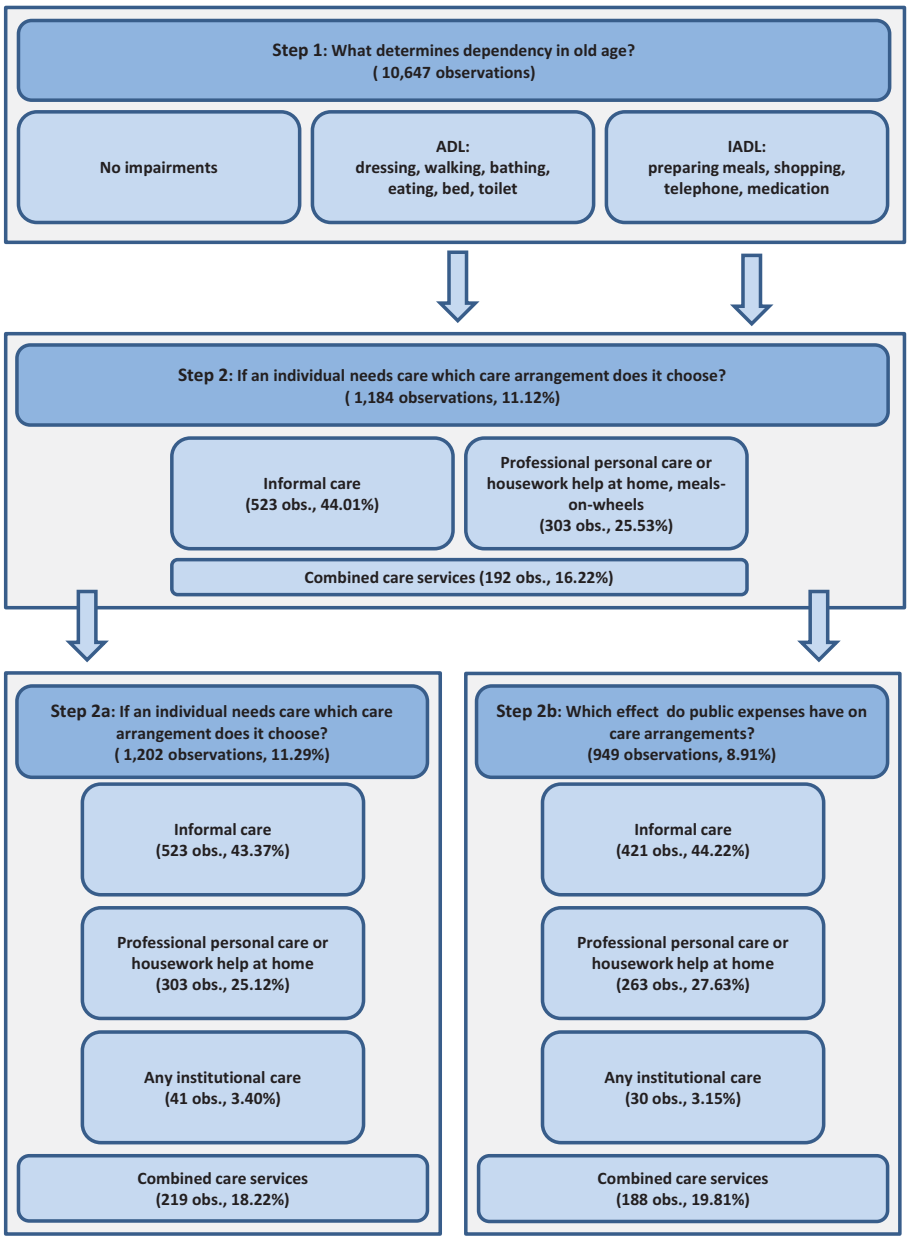
Descriptive statistics in Table 1 show that among all individuals in the dataset 11.3% need assistance in ADL or IADL tasks. Among these, 43.4% report that they received informal care ($informal_i$), 25.1% either receive professional personal care, paid household help or meals on wheels ($formal_i$), and 3.4% say that they have lived for at least some time over the last year in a nursing home ($nursinghome_i$). ADL needs occur more often (1.473 on average) than IADL limitations (0.831 on average). Dressing, bathing/showering, and getting in or out of bed are the ADLs that individuals are mostly in need of. The most frequent IADL needs are difficulties in doing groceries and preparing meals.

For the analysis in Step 2, I define two binary indicators to analyze the care arrangement choice in a two-equation system (bivariate probit model (BPM)). The first one equals

CT-2001- 00360; RII-CT- 2006-062193; CIT5-CT-2005-028857). Additional funding by the US National Institute on Aging (grant numbers U01 AG09740-13S2; P01 AG005842; P01 AG08291; P30 AG12815; Y1-AG-4553-01; OGHA 04-064; R21 AG025169) as well as by various national sources is gratefully acknowledged (see http://www.share-project.org for a full list of funding institutions).

[5] Look at "'The definition of dependent variables"' in the Appendix for the framing of SHARE questions that are used to construct the dependent variables.

Figure 1: Overview of sample composition and regression analyses



1 if respondents answer that they receive informal care, the second one equals 1 if they receive either professional personal care, paid household help or meals on wheels. It is possible that respondents receive help from informal and formal sources of care at the same time or no care at all although they need help in ADL or IADL.[6] Contrary to the regression equation in Step 1, I do not divide the estimation procedure in the BPM (Step 2) into one for men and one for women as this would result in a too low number of observations in the care arrangement categories. To examine the determinants of care service choice, I estimate the BPM only for those individuals who are disabled according to the objective measure which is used as the dependent variable in Step 1. This is necessary to identify effects of care arrangement choice after the individual has become disabled. Otherwise one would not know if the observed effect was due to the need of care in general or due to the type of care provided.

Different groups of independent variables are used for the risk-of-care regression in Step 1. In the former individual and family characteristics like age, gender, and being married are included. The reference groups are being male and being alone, namely single, widowed, separated or divorced, respectively. The number of children is also included as having children is a very important aspect of everyday life. Moreover, the equation contains information on health behavior through information on smoking and years of smoking. In addition, SHARE allows me to control for multiple diseases from which the individual suffered in the past or is still suffering today.[7] The sum of the number of years in which the respondent lives with these impairments is included as well. This group also contains a dummy variable which equals 1 if the individual ever had depressive symptoms. To control for cultural differences between European countries, a set of country dummies is included. Germany serves as the reference group.

The two regression equations on care type choices in the BPM (Step 2) contain independent variables for gender, being married, an interaction term of both dummies, age, and the number of children. As an additional family characteristic, homeownership is included. The individual monthly income (earnings and transfer income) in thousand euros and household net wealth in million euros are inserted as financial control variables. Furthermore, health variables are used but not as detailed as in the care-prevalence-rate regression equation. I also control for ever having had depressive symptoms. The number of ADL and IADL needs are added together with information on having a spouse or

[6]Only three individuals (0.6%) answer that they do not receive any type of care because it is unavailable.

[7]SHARE supplies information on the following diseases: Heart diseases, high blood pressure, high blood cholesterol, stroke, diabetes, chronic lung disease, asthma, arthritis, osteoporosis, cancer, gastrointestinal diseases, Parkinson, cataracts, hip or femoral fracture and other conditions.

partner suffering from any of these impairments. Again, country dummies are added.

In the multivariate probit model (MPM) in Step 2a, I add another equation to the two-equation system of the BPM (Step 2). The dependent variable of the third equation equals 1 if individuals live temporarily or permanently in a nursing home. Only individuals living in private homes have been included in Step 2 so far. However, as this paper deals with the determinants of care arrangement choice, it is important to include individuals that chose institutional care because neglecting these people could bias the results on the care type choice alternatives in private homes. The regressors of the third equation are the same as the ones of the first two equations in the BPM. However, a MPM has to be used for estimation.

Step 2b repeats Steps 2 and 2a but only for those countries who report their public expenditure on professional home-based and institutional care. Data is taken from the OECD Health Data 2009 which was collected from European national statistics. As data is only available for eight of eleven SHARE countries in wave 2004 the analysis is restricted to Austria, Germany, Sweden, Spain, France, Denmark, Switzerland, and Belgium which leaves us with 939 observations for the BPM and with 946 observations for the MPM.[8] 44.22% of dependent individuals receive informal care and 27.63% use professional home-based care. Institutional care is only used by 3.15% of the sample. These expenses are included instead of the country dummies and are measured as a percentage of national GDP. Relatively higher public expenses for a certain care arrangement could exert an incentive to choose this type of care more frequently compared to countries that do not spend as much of GDP for this kind of service.

4 Empirical methods

For a comprehensive empirical analysis, I start in Step 1 with conducting a logit analysis which regresses the dummy that indicates if an individual has any ADL or IADL needs ($care_i$) on individual and family characteristics (x_i), health conditions (hc_i), health behavior (hb_i), and country dummies (cd_i) to gather information on the factors that influence dependency in the sample. As only a restricted sample of care recipients is used in the BPM (Step 2), this first information is important for understanding the process of exogenous selection into long-term care dependency

[8] Lundsgaard (2005) categorizes Austria and Germany as countries that try to sustain informal care with the payment of care allowances to the care recipient. Belgium and Switzerland follow a similar approach. Sweden and Denmark are countries which concentrate on professional home-based care. Spain only provides usual basic security payments that is extended by public disability insurance.

$$care_i = \alpha_0 + \boldsymbol{x_i'\alpha_1} + \boldsymbol{hc_i'\alpha_2} + \boldsymbol{hb_i'\alpha_3} + \boldsymbol{cd_i'\alpha_4} + \varepsilon_i. \tag{1}$$

Multinomial logit regressions would be one possibility to conduct research on questions of care arrangement choice. However, informal and professional home-based care utilization, for example, are not mutually exclusive. Therefore, a multinomial logit model could only be used if a third choice was introduced which contains all individuals who use a combination of the two. But the strong independence-of-irrelevant-alternatives assumption would be violated "'by design"' because the choice between any two alternatives would not be independent of the third one. Therefore, the bivariate probit estimator is used for the care arrangement choice regression analysis. This two-equation system consists of two recursive equations containing the same set of regressors as interest lies in estimating the reduced-form parameters which illustrate the determinants for each combination of informal and professional home-based care. Individual and family characteristics (ifc_i), measures of frailty (fra_i) as well as country dummies (cd_i) are included as exogenous variables. Previous literature only emphasizes the determinants of one of these services as the other care arrangement is used as a regressor. The BPM reads

$$\begin{aligned} informal_{i1} = &\quad \beta_{01} + \boldsymbol{ifc_{i1}'\beta_{11}} + \boldsymbol{fra_{i1}'\beta_{21}} + \boldsymbol{cd_{i1}'\beta_{31}} + \nu_{i1} \\ formal_{i2} = &\quad \beta_{02} + \boldsymbol{ifc_{i2}'\beta_{12}} + \boldsymbol{fra_{i2}'\beta_{22}} + \boldsymbol{cd_{i2}'\beta_{32}} + \nu_{i2} \end{aligned} \tag{2}$$

if $care_i = 1$ and the error terms are allowed to correlated with each other

$$Cov(\nu_{ij}, \nu_{ik}) = \rho_{jk}. \tag{3}$$

This model corresponds to Model 6 in Maddala (1983) and is identified, although the idiosyncratic errors are allowed to correlated with each other, because the coefficients of the right-hand side dependent variables in Model 6 are set to zero. The model is estimated for those individuals who are in need of long-term care according to the measure used in Step 1.

The literature on testing whether informal and formal care are complements or substitutes has shown that there is a relationship between informal and formal care arrangements. Controlling for endogeneity bias in those regression models does not solve the problem of unobserved preferences for care arrangements that might be decisive for the choice of one arrangement or the other. An important feature of this model is that the sys-

tem takes into account that the error terms of both equations can be correlated with each other. The covariance matrix of errors then illustrates to which extent unobserved preferences and unobserved factors that influence both types of care affect the choice between them. Neglecting heterogeneity would lead to omitted variable bias as the idiosyncratic error (ν_{ij}) would be correlated with some of the exogenous regressors. A Wald test on the null hypothesis $H_0 : \rho = 0$ indicates whether univariate probit equations would be sufficient for estimating the determinants of care arrangements. If the null hypothesis is rejected, separate probit equations lead to inefficient coefficients.

Table 3 in Section 5 presents the bivariate predicted probabilities on either using only informal or professional home-based care, a combination of both, or none of these services. Individuals who receive any kind of nursing home care are dropped from the sample. If they were included they would bias the results as institutional care is not added as a separate choice so far.

The main focus of this paper is on the bivariate probit results of Step 2 which examine the characteristics that affect informal and/or professional home-based care. However, it is important to take all possible care arrangements into account when examining the choice between them. Therefore, Step 2a also presents regression results when individuals live at least temporarily but also permanently in a nursing home. In the vast majority of microeconomic datasets, nursing home inhabitants are usually not surveyed and exogenous selection is a serious concern. In SHARE, respondents are randomly chosen by their telephone numbers (Börsch-Supan and Jürges, 2005). Therefore, only 3.4% of observations answering the SHARE questionnaire are nursing home inhabitants. Although the share of care recipients among the population aged 65 plus lies between 2.4% (Netherlands) and 7.9% (Sweden) in the year 2000 (Huber and Hennessy, 2005), this is only a small number of observations for the purpose of estimation.[9] To mitigate this shortcoming, I use the calibrated weights from the main and vignette samples that are provided by the SHARE group as these account for the underrepresented institutionalized population. Nevertheless, I handle this extension to nursing home patients as a first attempt to learn more about the determinants of choosing to live in a nursing home.

[9]The differing percentages mainly result from institutional differences in the countries' care-insurance systems.

A MPM has to be used for estimating this three-equation system. The model reads

$$\begin{aligned} informal_{i1} &= \gamma_{01} + \boldsymbol{ifc'_{i1}\gamma_{11}} + \boldsymbol{fra'_{i1}\gamma_{21}} + \boldsymbol{cd'_{i1}\gamma_{31}} + \eta_{i1} \\ formal_{i2} &= \gamma_{02} + \boldsymbol{ifc'_{i2}\gamma_{12}} + \boldsymbol{fra'_{i2}\gamma_{22}} + \boldsymbol{cd'_{i2}\gamma_{32}} + \eta_{i2} \\ nursing\ home_{i3} &= \gamma_{03} + \boldsymbol{ifc'_{i3}\gamma_{13}} + \boldsymbol{fra'_{i3}\gamma_{23}} + \boldsymbol{cd'_{i3}\gamma_{33}} + \eta_{i3} \end{aligned} \tag{4}$$

if $care_i = 1$ and the error terms are allowed to correlated with each other

$$Cov(\eta_{ij}, \eta_{ik}) = \rho_{jk}. \tag{5}$$

The GHK simulator (Geweke-Hajivassiliou-Keane smooth recursive condition simulator) is used for estimation by Stata's `mvprobit` command (Cappellari and Jenkins, 2003). This simulated maximum likelihood (SML) estimator generates unbiased simulated probabilities which are bounded between 0 and 1 and are at the same time more efficient than other estimators used previously for this purpose (Börsch-Supan and Hajivassiliou, 1993). The literature on these models suggests to use the square root of the sample size as the number of draws for the GHK simulator to render simulation bias negligible (Hajivassiliou and Ruud, 1994). I estimate the model with 150 Halton draws which more than fulfills this rule of thumb for 1,202 observations. Thus, in this model for a sample size of more than 1,000 observations, the seed that is taken to choose random numbers from the multidimensional normal probability distribution function for which the simulated probabilities are calculated does not pose any problems (Cappellari and Jenkins, 2003).

Step 2b again uses the bivariate and multivariate probit models. The only difference lies in the regressors included into the model. The country dummies are exchanged with the country-specific expenditure for professional home-based care and for institutional care which is measured as a percentage of GDP. In addition, the sample is restricted to those countries for which expenditure information is available from the OECD Health Data 2009, namely Austria, Germany, Sweden, Spain, France, Denmark, Switzerland, and Belgium.

5 Determinants of the choice of care arrangement

Table 1 presents the individual marginal effects of the regression analysis in Step 1 which examines the impact of individual and family characteristics, of health behavioral variables and of frailty measures on the likelihood of needing assistance in ADL or IADL.

Table 1: Determinants of becoming dependent

	All individuals	Women	Men
Female	−0.005		
	(0.013)		
Married/Partnership	−0.020	−0.017	−0.030
	(0.014)	(0.014)	(0.026)
Interaction:	−0.001		
Female/Married	(0.016)		
Age	0.005***	0.006***	0.006***
	(0.001)	(0.002)	(0.002)
Number of children	0.001	0.002	−0.002
	(0.002)	(0.005)	(0.005)
Ever smoked	−0.035***	−0.056*	−0.047**
	(0.012)	(0.029)	(0.023)
Years smoking	0.001	0.002**	0.001
	(0.000)	(0.001)	(0.001)
Ever had depression	0.031***	0.027*	0.055***
	(0.008)	(0.014)	(0.021)
Heart disease	0.028***	0.032	0.061***
	(0.009)	(0.020)	(0.022)
High blood pressure	0.002	−0.005	−0.009
	(0.006)	(0.012)	(0.014)
High blood cholesterol	−0.020***	−0.020	−0.038**
	(0.007)	(0.014)	(0.017)
Stroke	0.171***	0.184***	0.191***
	(0.026)	(0.056)	(0.051)
Diabetes	0.044***	0.054**	0.028
	(0.011)	(0.024)	(0.021)
Chronic lung disease	0.046***	0.041	0.047
	(0.016)	(0.031)	(0.029)
Asthma	0.035**	0.065*	0.006
	(0.015)	(0.034)	(0.028)
Arthritis	0.074***	0.074***	0.064**
	(0.012)	(0.022)	(0.025)
Osteoporosis	0.055***	0.039*	0.183***
	(0.014)	(0.020)	(0.071)
Cancer	−0.006	−0.036	0.010
	(0.011)	(0.022)	(0.033)
Stomach, duodenal or	0.011	0.019	−0.038*
peptic ulcer	(0.012)	(0.028)	(0.022)
Parkinson	0.183***	0.142	0.108
	(0.060)	(0.111)	(0.109)
Cataracts	−0.007	−0.018	−0.004
	(0.009)	(0.016)	(0.022)
Hip/femoral fracture	0.149***	0.191***	0.085**
	(0.031)	(0.070)	(0.042)
Other conditions	0.061***	0.058***	0.079***
	(0.012)	(0.021)	(0.026)
Years suffering from	0.001	0.002**	0.001
health conditions	(0.000)	(0.001)	(0.001)
Country dummies	*yes*	*yes*	*yes*

continued

Table 1: *continued*

	All individuals	Women	Men
Constant	*yes*	*yes*	*yes*
Observations	10,647	5,763	4,884
χ^2	577.94	319.08	309.69

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
All columns present individual marginal effects.

The results illustrate that gender does not have an effect on becoming dependent when controlling for diseases. The effect of age is, of course, positive. The negative health behavior effect of smoking confirms findings in the health literature that healthier people smoke while those being already ill do not start it. Illnesses that increase the probability of needing care for women are hip fractures (19.1 percentage points (pp)), strokes (18.4 pp), arthritis (7.4 pp), asthma (6.4 pp), diabetes (5.4 pp), osteoporosis (3.9 pp), and depressive symptoms (2.7 pp). Men mainly are dependent when they had a stroke (19.1 pp) followed by osteoporosis (18.3 pp), hip fractures (8.5 pp), arthritis (6.4 pp), heart disease (6.1 pp), and depressive symptoms (5.5 pp). High blood cholesterol and gastro-intestinal diseases seem to exert a positive effect on health behavior as they decrease the probability of needing assistance (-3.8 pp). While strokes heavily constrain physical as well as mental functions, most of the illnesses mentioned here restrict physical mobility. One should further note, that heart diseases do not have an effect on the women's probability of becoming dependent but only on the men's.

The bivariate probit results (Step 2) are presented in Columns (1) and (2) of Table 3.[10] However, to examine the effects that individual and family characteristics as well as ADL and IADL impairments have on the choice of different combinations of care arrangements, most interest lies in the marginal effects of choosing either only one ($Pr(informal = 1, formal = 0$; $Pr(informal = 0, formal = 1)$), both ($Pr(informal = 1, formal = 1)$) or none ($Pr(informal = 0, formal = 0)$) of the possible care arrangements in Table 2.

The Wald test on the correlation of errors between the two equations in the BPM rejects the null hypothesis of separate regression equations on the ten-percent level. Therefore, there are unobserved factors like preferences and unobserved health and frailty that have an effect on both types of care arrangements and controlling for the effects is important. The positive sign of the correlation coefficient Rho_{21} indicates that both care services are affected in the same way by the unobserved information.

[10] The univariate probit results are available on request.

Table 2: Determinants of choice of care arrangement

Bivariate probit marginal effects				
	Both care types	Informal care only	Formal care only	No care type
	(1)	(2)	(3)	(4)
Female	−0.032	0.224***	−0.101**	−0.092
	(0.041)	(0.077)	(0.041)	(0.088)
Married/Partnership	−0.143***	0.169**	−0.154***	0.128
	(0.050)	(0.070)	(0.048)	(0.083)
Interaction:	0.065	−0.262***	0.183***	0.014
Female/Married	(0.054)	(0.076)	(0.071)	(0.102)
Age	0.005***	0.004	0.002**	−0.011***
	(0.001)	(0.003)	(0.001)	(0.002)
Number of girls	0.038**	0.036	0.012	−0.086***
	(0.015)	(0.028)	(0.012)	(0.030)
Number of boys	0.011	−0.022	0.013	−0.003
	(0.009)	(0.021)	(0.008)	(0.022)
House owner	0.025	0.043	0.001	−0.068
	(0.021)	(0.045)	(0.018)	(0.046)
Total income	0.002	0.016***	−0.004	−0.014**
in thousand	(0.003)	(0.006)	(0.003)	(0.007)
Household net wealth	−0.015	−0.009	−0.007	0.031
in million	(0.013)	(0.037)	(0.016)	(0.025)
Number of ADL needs	−0.037	−0.095*	0.004	0.128**
of partner	(0.023)	(0.051)	(0.027)	(0.058)
Number of IADL needs	0.055	−0.048	0.050	−0.056
of partner	(0.040)	(0.065)	(0.039)	(0.067)
Number of ADL	0.034***	0.087***	−0.007	−0.114***
limitations	(0.008)	(0.018)	(0.007)	(0.019)
Number of IADL	0.038***	−0.013	0.027**	−0.052**
limitations	(0.011)	(0.026)	(0.011)	(0.024)
Ever had depression	0.007	−0.074	0.030	0.038
	(0.021)	(0.046)	(0.021)	(0.046)
Country dummies	*yes*	*yes*	*yes*	*yes*
Constant	*yes*	*yes*	*yes*	*yes*
Rho_{21}				0.165*
				(0.088)
Wald test				3.542*
				(0.060)
Observations				1,184
χ^2				3,003.87

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

All columns present conditional marginal effects of a bivariate probit model. Example: Conditional on receiving no professional home-based care, the probability to use informal care increases by 8.7 percentage points (pp) for any additional ADL needs holding all other covariates at their means.

Single females have a higher probability of receiving informal care only (Column (2)) compared to married or single males. Married females have a 3.8 pp lower probability though. Compared to single males or females, married men have a higher probability of using informal care only while the probability is lower for married females. Women seem

to have better access to informal caregivers if they are single. The picture is the opposite for using formal care services only. Women who live on their own as well as married males have a lower probability of receiving formal care only. The results for married males in particular are in line with the expectation that wifes who are usually healthier and younger than their husbands provide informal care to them. On the other hand, husbands seem unable to insure their wifes against the utilization of formal care. Age has a negative effect on receiving no care at all and a positive one on using formal care only or a combination of both care arrangements. Only the number of daughters exerts a positive effect on receiving both, informal and formal care while it becomes less likely to receive no care although it is needed. The number of boys is not a significant determinant. Total income does have a positive effect on using informal care only and decreases the probability of receiving no care although it is needed. As I cannot find a significant effect for homeownership and wealth, it is unlikely that this effect is due to a bequest motive. The probability of receiving informal care only decreases by 9.5 pp for an additional ADL impairment of the spouse or partner. It is the probability of receiving no care at all which heavily increases in this case by 12.8 pp. Thus, couples who are both impaired at the same time seem to lack adequate care. With an increase in the individual's own ADL limitations, the probability of using informal care or a combination of both care arrangements increases by 8.7 pp and 3.4 pp, respectively. At the same time, the probability of receiving no care at all decreases by 11.4 pp for one further ADL limitation. As far as an additional IADL need is concerned, this probability is also falling by 5.2 pp while receiving both care types and using formal care services is more likely by 3.8 pp and 2.7 pp, respectively. This last effect implies that paid household help is responsible for this increase.[11]

Table 3: Comparison of bivariate and multivariate probit results

	Bivariate probit		Multivariate probit		
	Informal care	Formal care	Informal care	Formal care	Nursing home care
	(1)	(2)	(3)	(4)	(5)
Female	0.492**	−0.520*	0.451*	−0.501*	0.704*
	(0.234)	(0.287)	(0.232)	(0.280)	(0.404)
Married/Partnership	0.067	−1.076***	0.028	−1.069***	0.496
	(0.223)	(0.276)	(0.224)	(0.271)	(0.409)
Interaction:	−0.512*	0.852**	−0.434	0.842***	−1.340**
Female/Married	(0.269)	(0.333)	(0.267)	(0.326)	(0.566)

continued

[11] The results that present separate regression equations for paid household help and personal care at home are available on request.

Table 3: *continued*

	Bivariate probit		Multivariate probit		
	Informal care	Formal care	Informal care	Formal care	Nursing home care
	(1)	(2)	(3)	(4)	(5)
Age	0.024***	0.028***	0.023***	0.027***	0.009
	(0.007)	(0.008)	(0.007)	(0.008)	(0.012)
Number of girls	0.188**	0.201**	0.195***	0.201**	−0.396***
	(0.078)	(0.102)	(0.075)	(0.100)	(0.145)
Number of boys	−0.027	0.098	−0.015	0.101*	−0.073
	(0.061)	(0.061)	(0.059)	(0.060)	(0.089)
House owner	0.17	0.103	0.171	0.119	0.495**
	(0.127)	(0.142)	(0.123)	(0.139)	(0.213)
Total income	0.044**	−0.007	0.041**	−0.008	0.050**
in thousand	(0.018)	(0.022)	(0.017)	(0.022)	(0.025)
Household net wealth	−0.061	−0.089	−0.042	−0.062	−0.075
in million	(0.085)	(0.110)	(0.076)	(0.091)	(0.090)
Number of ADL needs	−0.339**	−0.139	−0.348**	−0.161	0.601**
of partner	(0.154)	(0.209)	(0.148)	(0.204)	(0.264)
Number of IADL needs	0.017	0.369*	0.094	0.413*	−1.367***
of partner	(0.189)	(0.221)	(0.183)	(0.215)	(0.389)
Number of ADL needs	0.305***	0.108**	0.236***	0.074	0.255**
	(0.052)	(0.052)	(0.051)	(0.050)	(0.099)
Number of IADL needs	0.062	0.262***	0.054	0.250***	0.271**
	(0.071)	(0.073)	(0.068)	(0.070)	(0.122)
Ever had depression	−0.171	0.144	−0.166	0.162	0.346*
	(0.129)	(0.146)	(0.127)	(0.142)	(0.209)
Country dummies	*yes*	*yes*	*yes*	*yes*	*yes*
Constant	*yes*	*yes*	*yes*	*yes*	*yes*
Rho_{21}		0.165*			0.233***
		(0.088)			(0.081)
Rho_{31}					−0.462***
					(0.101)
Rho_{32}					−0.309**
					(0.123)
Wald test		3.542*			$1.1e+07$***
		(0.060)			(0.000)
Observations		1,184			1,202
χ^2		3,003.87			2,882.02

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
All columns present regression coefficients.

For the MPM (Step 2a), Table 3 presents the multivariate probit results in Columns (3) to (5). The Wald test on independence of the three equations rejects the null hypothesis that the correlation coefficients are jointly zero. Rho_{21} shows a positive correlation between the informal care equation and the one for professional home-based care like in the bivariate probit case. Rho_{31} and Rho_{32} have a negative sign which indicates that unobserved factors work into opposite directions for home-based and institutional care. The diverging effect

is smaller between professional home-based and nursing home care though.

Table 3 also illustrates that little has changed in the magnitudes of effects when the bivariate (Columns (1) and (2)) and the multivariate probit approach (Columns (3) and (4)) of the informal care and professional home-based care equations are compared to each other. The results of the BPM are thus robust to including another care arrangement. However, the MPM additionally provides information on the determinants of living at least temporarily in a nursing home. Females who are without a partner because they are either single, widowed or divorced have a much higher probability of having had a nursing home stay during the last year than males. If females are still married and living with their partner, this probability is negative. It is likely that the strong effects for women stem from their higher life expectancy. Nevertheless, the coefficient of age is not significant in the nursing-home equation. The number of daughters that an individual has is an insurance against a nursing home stay. Surprisingly, house owners are much more likely to stay in a nursing home. Total income does also increase this probability. This second effect is in line with what one would expect as staying in nursing homes is very expensive. If the partner suffers from ADL impairments the probability to reside in a nursing home rises. The negative effect of IADL needs of a partner stems from paid household help as it increases the probability of professional home-based care only.[12] In addition to these effects, the individual's ADL and IADL impairments increase the probability of nursing home care. This is also true for having ever suffered from depressive symptoms.

In Step 2b, I exchange the country dummies with the share of GDP expenditure on home-based and institutional care. Table 4 illustrates that the probability of receiving informal care alone is decreasing in countries with relatively higher public expenditure on professional home-based care. However, the effect is small. If expenditure increases by 1 pp, the probability to receive informal home care only will decrease by 0.159 pp. Thus, the public expenditure's impact is much less than in the analysis of Viitanen (2007). At the same time, the probability of receiving help from professional services at home is increasing by 0.124 pp. Choosing both care types becomes more common as well, although the impact of benefits are not as pronounced as in the case of receiving formal care only. The results from the MPM (Table 5, Columns (3) to (5)) also show an increase in professional home-based care services. The share of GDP expenditure on institutional care also increases the probability of using this type of care arrangement but does not raise nursing home care use.[13]

[12]The results that present separate regression equations for paid household help and personal care at home are available on request.

[13]Reversed causality would only be problematic in this case if a larger share of individuals from a

Table 4: Determinants of choice of care arrangement - Expenditure data included

	Both care types (1)	Informal care only (2)	Formal care only (3)	No care type (4)
Female	−0.026	0.170**	−0.102*	−0.043
	(0.056)	(0.086)	(0.053)	(0.094)
Married/Partnership	−0.178***	0.153**	−0.155***	0.180**
	(0.065)	(0.076)	(0.055)	(0.084)
Interaction: Female/Married	0.032	−0.210**	0.152**	0.026
	(0.067)	(0.091)	(0.077)	(0.108)
Age	0.005**	0.002	0.001	−0.008***
	(0.002)	(0.003)	(0.002)	(0.003)
Number of girls	0.053***	0.009	0.020	−0.081***
	(0.019)	(0.031)	(0.018)	(0.030)
Number of boys	0.024*	−0.029	0.025**	−0.020
	(0.013)	(0.024)	(0.012)	(0.023)
House owner	0.023	0.052	−0.016	−0.060
	(0.028)	(0.048)	(0.026)	(0.046)
Total income in thousand	0.005	0.011	−0.003	−0.013*
	(0.004)	(0.007)	(0.004)	(0.007)
Household net wealth in million	−0.015	−0.027	0.007	0.035
	(0.014)	(0.040)	(0.021)	(0.027)
Number of ADL needs of partner	−0.034	−0.071	0.018	0.087
	(0.037)	(0.057)	(0.042)	(0.069)
Number of IADL needs of partner	0.058	−0.068	0.063	−0.053
	(0.054)	(0.071)	(0.054)	(0.073)
Number of ADL needs	0.043***	0.077***	−0.018	−0.102***
	(0.011)	(0.021)	(0.011)	(0.021)
Number of IADL needs	0.051***	−0.005	0.025	−0.072***
	(0.015)	(0.029)	(0.016)	(0.026)
Ever had depression	0.007	−0.062	0.036	0.019
	(0.029)	(0.050)	(0.030)	(0.049)
Public expenditure on professional home-based care (% of GDP, 2004)	0.100*** (0.026)	−0.159*** (0.042)	0.124*** (0.023)	−0.065 (0.045)
Rho_{21}				0.074
				(0.095)
Wald test				0.592
				(0.442)
Observations				935
χ^2				184.42

Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

All columns present conditional marginal effects of a bivariate probit model. Example: Conditional on receiving no professional home-based care, the probability to use informal care increases by 7.7 percentage points (pp) for any additional ADL needs holding all other covariates at their means.

European country comes along with a higher share of GDP expenditure. However, descriptive statistics not presented here show that this is not the case in this sample.

Table 5: Bivariate and multivariate probit results - Expenditure data included

	Bivariate probit		Multivariate probit		
	Informal care	Formal care	Informal care	Formal care	Nursing home care
Female	0.364	−0.393	0.369	−0.484	1.085***
	(0.267)	(0.284)	(0.268)	(0.313)	(0.373)
Married/Partnership	−0.063	−0.989***	−0.043	−1.086***	0.817**
	(0.252)	(0.273)	(0.259)	(0.299)	(0.380)
Interaction:	−0.453	0.539	−0.394	0.699*	−1.582***
Female/Married	(0.307)	(0.335)	(0.307)	(0.362)	(0.556)
Age	0.017**	0.019**	0.017**	0.023***	−0.004
	(0.008)	(0.009)	(0.008)	(0.008)	(0.013)
Number of girls	0.153*	0.225**	0.180**	0.231**	−0.300*
	(0.086)	(0.100)	(0.084)	(0.111)	(0.170)
Number of boys	−0.013	0.152**	0.007	0.157***	−0.023
	(0.068)	(0.065)	(0.066)	(0.061)	(0.095)
House owner	0.190	0.023	0.151	0.065	0.573**
	(0.140)	(0.143)	(0.136)	(0.149)	(0.250)
Total income	0.040**	0.009	0.041**	−0.010	0.035
in thousand	(0.019)	(0.024)	(0.018)	(0.023)	(0.027)
Household net wealth	−0.105	−0.025	−0.062	−0.082	−0.224
in million	(0.103)	(0.089)	(0.095)	(0.103)	(0.228)
Number of ADL needs	−0.265	−0.049	−0.317*	−0.091	0.578
of partner	(0.175)	(0.228)	(0.171)	(0.234)	(0.412)
Number of IADL needs	−0.026	0.350	0.080	0.512**	−1.397**
	(0.217)	(0.242)	(0.212)	(0.244)	(0.546)
Number of ADL needs	0.301***	0.077	0.242***	0.063	0.049
	(0.064)	(0.053)	(0.057)	(0.055)	(0.063)
Number of IADL needs	0.116	0.238***	0.095	0.220***	0.543***
	(0.083)	(0.080)	(0.075)	(0.077)	(0.103)
Ever had depression	−0.137	0.132	−0.156	0.206	0.202
	(0.145)	(0.156)	(0.139)	(0.154)	(0.231)
Public expenditure	−0.149	0.700***	−0.268*	1.183***	0.479
on professional	(0.122)	(0.127)	(0.152)	(0.183)	(0.321)
home-based care[a]					
Public expenditure			−0.374	2.238***	0.365
on nursing home care[a]			(0.283)	(0.337)	(0.602)
Constant	−2.114***	−2.490***	−1.882***	−4.178***	−3.670***
	(0.652)	(0.727)	(0.680)	(0.778)	(1.146)
Rho_{21}		0.074			0.164*
		(0.096)			(0.088)
Rho_{31}					−0.437***
					(0.123)
Rho_{32}					−0.248
					(0.169)
Wald test		0.592			8.6e+06***
		(0.442)			(0.000)
Observations		935			946
χ^2		184.42			432.65

[a]% of GDP, 2004

All columns present regression coefficients. Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

These findings correspond to the statement of Huber and Hennessy (2005) who state that professional home-based care is more supported than institutional care. On the one hand, this implies additional public expenditures. On the other hand, care recipients become more independent and the caregiving burden of families, that comes along with economical and emotional costs, can be relieved. The goal of European social security programs is to insure their citizens against the risk of care in the sense of preventing poverty, bad quality care, and to avoid the neglect of care opportunities because of high costs for the care recipients and their families. However, it is important to note, that the private costs of individuals nevertheless are likely to increase with the choice of professional services as the care insurance does not cover all costs as long as individuals are not dependent on the basic security level (Keese et al., 2010).

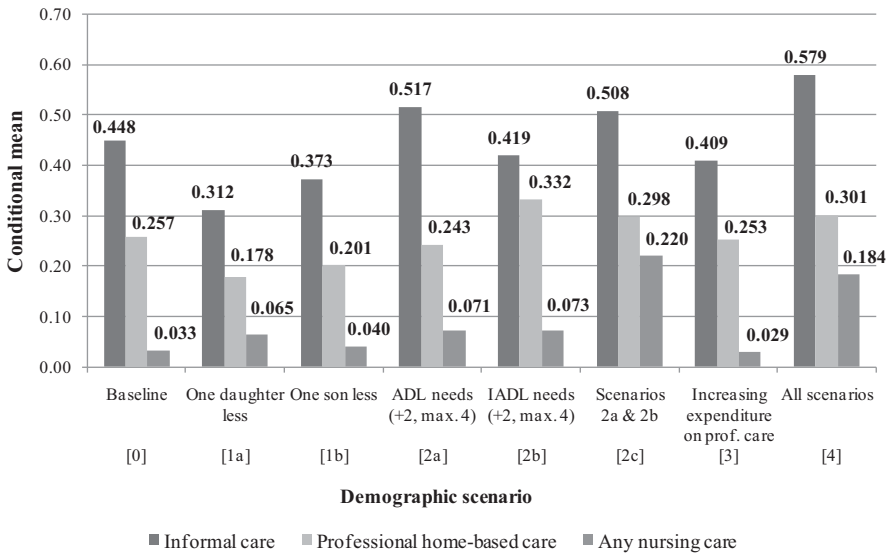
6 The impact of demographic change

To predict the impact that demographic change may have on the choice of care arrangements in this sample, this section presents how the proportion of individuals using either informal care, professional home-based care, or institutional care will develop if their determinants change in magnitude. The simulations are based on the estimated parameter values of the MPM of Step 2a and, for the simulation of public expenditure on care developments, Step 2b. I look at three different main scenarios which I afterwards combine in a scenario in which all different changes are jointly included. Figure 2 presents the conditional means of the simulations. In the baseline scenario (0), the situation in the actual sample is shown: 44.8% of individuals are predicted to receive informal care while 25.7% use professional care at home and 3.3% professional services in an institution. The prediction procedure is reliable as these results are very close to the descriptive distribution over these care arrangements.[14]

In the first scenario (1a - 1b), I reduce the number of either daughters or sons by one. Although the number of children is already low in most European countries, this simulation can also represent a reduction in the number of available caregivers among own children. The increasing labor-force participation of women may lead to a reduction in the amount of informal care that daughters can provide to their parents (Jenson and Jacobzone, 2000). Figure 2 shows that if the number of daughters reduces in the future, the utilization of care at home will drop while the use of institutional care will rise. If

[14] These percentages do not sum to one as some individuals might either receive a combination of these services or no care at all.

Figure 2: The impact of demographic change on the utilization of care arrangements



Note. Own simulations based on the estimated parameter values of the MPM of Step 2a and, for the simulation of public expenditure on care developments, Step 2b.

the number of sons declines, informal and professional home-based care services will be reduced less than in 1a but institutional care will only increase to a low extent. Indeed, Langa et al. (2001) find that sons have an important gate keeping function for parents to receive formal care services. Thus, the number of individuals to whom care is not available will increase if less children are available to organizing long-term care.

In the second scenario (2a - 2c), the number of ADL and IADL needs of the care recipients are increased by two but only up to the possible maximum number in limitations of six (ADL) or four (IADL). This scenario represents more severe disability in old age and therefore an increased need for help. It is in line with the so-called "medicalization hypothesis" (Verbrugge, 1984). According to this hypothesis, the increasing life expectancy will lead to a higher demand for long-term care services and thus comes along with a worse age-specific health status and increased care prevalence rates. The conditional means of the three different care arrangement equations show that an increase in the impairments in ADL or IADL of the care recipients themselves have a very strong effect on all care arrangements (2a, 2b). Increasing the overall needs in ADL would increase informal care

by 6.9 pp and nursing home care by 3.8 pp. The utilization of professional services is mainly affected after a possible rise in IADL needs. Professional care at home increases by 7.5 pp and institutional care by 4 pp. If both scenarios of frailty are considered together (2c), institutional care will be the most likely care arrangement in the future and will rise by 18.7 pp compared to the baseline scenario (0).

As the old-age dependency ratio throughout Europe further increases, it is likely that the public expenditure on long-term care increase as well. I follow Jacobzone (1999) and increase the public expenditure as a share of GDP on professional care at home by 0.813% and the one of institutional care by 1.24% in scenario 3. These percentages represent the mean development in the share of public expenditure that is forecasted under a constant utilization of these care arrangments until 2020 for those countries who are considered in this OECD publication and in SHARE at the same time.[15] The percentages of care recipients in the different care arrangements does indeed change very little. Here, professional home-based care will react most and will increase by 2.3 pp. Informal care stagnates. Overall, it becomes clear that the development of care prevalence rates and the frailty of individuals will decide on the structure of future care markets. Thus, it is crucial to discover trends in frailty as early as possible.

7 Conclusion

This paper has taken several steps to present a comprehensive analysis on the determinants of becoming a care recipient and on the choice of care arrangements. First of all, the analysis on the determinants of becoming an individual which needs care in any ADL or IADL activities illustrates that only age and the diseases from which individuals suffer have an effect. Strokes and limitations due to bone-related diseases exert the main impacts on men as well as women. Secondly, I jointly examined the determinants of three different types of care arrangements, namely informal care at home, professional home-based care, and nursing home care. Bivariate and multivariate probit models have been used for this purpose as they not only estimate the effects jointly for all three outcomes but also allow the researcher to control for unobserved preferences, health and frailty factors that are very likely to have an impact on the choice of care arrangement. The probability of receiving informal care only is increasing with being a single female or a married male as well as with income. In addition, ADL needs have a positive effect. Receiving professional

[15] These countries are France, Germany, Sweden, Netherlands.

home-based care is more likely for a married woman and additionally rises with age. The positive effect of IADL limitations represent the increased need for paid household help. A combination of both care arrangements is less likely for singles but increases with age and the number of daughters. IADL and ADL limitations are both significantly positive. Living at least temporarily or even permanently in a nursing home increases with being a single female which is a result of the higher life expectancy of women. The choice of this kind of care arrangement also increases with income and being a house owner. On the other hand, it decreases with the number of daughters. Daughters seem to be an insurance against nursing home entry. As far as the effects of frailty are concerned, the probability of living in a nursing home increases with the number of ADL limitations of the partner and with a rising number of own ADL and IADL needs. If the partner suffers from IADL limitations the effect is negative. This will be a result from the couples age composition if the husband is older than his wife and the first one to become dependent on help.

Unfortunately, the number of care recipients who live in a nursing home is quite low in the dataset which is the case for most microeconomic surveys. Thus, their determinants have to be interpreted with some caution as exogenous selection cannot be solved by the researcher. However, the share of nursing home inhabitants in European populations will even increase due to the shift in the age structure only. Therefore, nursing home inhabitants should be included into the sampling procedure of datasets with more than the basic information on individual characteristics. This would allow researchers to analyze questions on financial and insurance issues which are especially important for further research on social assistance expenditures and precautionary savings.

When public expenditure data have been introduced into the analyses, results illustrated that individuals who live in a country that expends a relatively higher share of GDP for professional care services are more likely to make use of it. Therefore, individuals seem to react to the incentive of subsidies here although professional services do also increase private expenditure when using these services.

The simulation results illustrate that future research needs to scrutinize the development in future care prevalence rates. This is on the one hand important to plan investment in care infrastructure. On the other hand, public expenditure on different care services can be channeled to set incentives in its choice according to the societal preferences and the financial sustainability of care insurance systems.

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Appendix

The definition of dependent variables

STEP 1: Dependent variable: Being in need of long-term care

PH049 MORE HEALTH AND ACTIVITIES

(...) Here are a few more everyday activities. Please tell me if you have any difficulty with these because of a physical, mental, emotional or memory problem. Again exclude any difficulties you expect to last less than three months. (...)

1. Dressing, including putting on shoes and socks
2. Walking across a room
3. Bathing or showering
4. Eating, such as cutting up your food
5. Getting in or out of bed
6. Using the toilet, including getting up or down
7. Using a map to figure out how to get around in a strange place[16]
8. Preparing a hot meal
9. Shopping for groceries
10. Making telephone calls
11. Taking medications
12. Doing work around the house or garden[16]
13. Managing money, such as paying bills and keeping track of expenses[16]

96. None of these

STEP 2: Dependent variable: Informal care from in or outside the own household - ADL or IADL

SP004 WHICH TYPES OF HELP

(...) Which types of help has this person provided in the last twelve months? *Code all that apply. Question does not include looking after grandchildren.*

1. personal care, e.g. dressing, bathing or showering, eating, getting in or out of bed, using the toilet
2. practical household help, e.g. with home repairs, gardening, transportation, shopping, household chores

[16]Option not included in this paper.

SP020 SOMEONE IN THIS HOUSEHOLD HELPED YOU REGULARLY WITH PERSONAL CARE

And is there someone living in this household who has helped you regularly during the last twelve months with personal care, such as washing, getting out of bed, or dressing? By regularly we mean daily or almost daily during at least three months. We do not want to capture help during short-term sickness of family members.

1. Yes

5. No

STEP 2: Dependent variable: Professional home-based care

HC032 RECEIVED HOME CARE IN OWN HOME

(...) During the last twelve months, did you receive in your own home any of the kinds of care mentioned on this card? *Code all that apply.*

1. Professional or paid nursing or personal care

2. Professional or paid home help, for domestic tasks that you could not perform yourself due to health problems

3. Meals-on-wheels

96. None of these

STEP 2a: Dependent variable: Staying permanently or temporarily in a nursing home

HC029 IN A NURSING HOME

During the last twelve months, have you been in a nursing home overnight? *By "'nursing home"' we mean institutions sheltering older persons who need assistance in ADL, in an environment where they can receive nursing care, for short or long stays.*

1. Yes, temporarily

3. Yes, permanently

5. No

Source: SHARE main questionnaire 2004. Available at http://www.share-project.org/.

Table 6: Descriptive summary statistics

	All individuals		Dependent individuals only	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
In need of care	0.113	0.317	1	0
Received informal help	0.167	0.373	0.434	0.496
Received formal care	0.072	0.258	0.251	0.434
Stayed some time in nursing home	0.007	0.083	0.034	0.181
Stayed permanently in nursing home	0.004	0.061	0.022	0.145
Female	0.541	0.498	0.561	0.497
Age	66.776	8.994	72.438	10.066
Number of girls	1.516	0.732	1.489	0.699
Number of boys	0.968	0.923	1.092	1.013
Number of children	1.347	1.520	1.464	1.638
for women Married/Partnership	0.806	0.396	0.702	0.457
House owner	0.484	0.500	0.448	0.498
Total income in thousands	3.079	3.22	3.039	3.283
Household net wealth in million	0.390	1.108	0.279	1.092
Ever smoked	0.478	0.500	0.423	0.494
Years smoking	14.071	18.129	14.177	19.778
Number of ADL limitations of partner	0.056	0.229	0.174	0.379
Number of IADL limitations of partner	0.036	0.186	0.097	0.296
Number of ADL limitations	0.167	0.664	1.473	1.406
Number of IADL limitations	0.094	0.439	0.831	1.043
difficulties dressing, including shoes and socks	0.059	0.236	0.524	0.500
difficulties walking across a room	0.013	0.114	0.116	0.320
difficulties bathing or showering	0.042	0.201	0.373	0.484
difficulties eating, cutting up food	0.013	0.115	0.119	0.323
difficulties getting in or out of bed	0.025	0.157	0.222	0.416
difficulties using the toilet, incl getting up or down	0.013	0.115	0.119	0.323
difficulties preparing a hot meal	0.025	0.156	0.220	0.414
difficulties shopping for groceries	0.043	0.203	0.381	0.486
difficulties taking medications	0.012	0.111	0.109	0.312
difficulties telephone calls	0.014	0.116	0.121	0.326
Ever had depression	0.265	0.441	0.339	0.474
Heart disease	0.139	0.346	0.245	0.431
High blood pressure	0.337	0.473	0.420	0.494
High blood cholesterol	0.211	0.408	0.219	0.414
Stroke	0.041	0.198	0.133	0.340
Diabetes	0.099	0.299	0.164	0.371
Chronic lung disease	0.053	0.224	0.109	0.311
Asthma	0.048	0.214	0.087	0.282
Arthritis	0.202	0.402	0.390	0.488

continued

Table 6: *continued*

	All individuals		Dependent individuals only	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Osteoporosis	0.075	0.263	0.154	0.361
Cancer	0.061	0.239	0.071	0.257
Stomach, duodenal or peptic ulcer or peptic ulcer	0.058	0.233	0.087	0.282
Parkinson	0.006	0.078	0.024	0.153
Cataracts	0.088	0.284	0.166	0.372
Hip/femoral fracture	0.021	0.142	0.070	0.256
Other conditions	0.173	0.378	0.258	0.438
Years suffering from health conditions	20.956	26.970	38.730	37.881
Germany	0.097	0.297	0.104	0.306
Austria	0.062	0.24	0.059	0.235
Sweden	0.171	0.376	0.153	0.36
Netherlands	0.130	0.337	0.090	0.287
Spain	0.064	0.245	0.075	0.263
France	0.115	0.319	0.148	0.355
Italy	0.061	0.239	0.078	0.268
Denmark	0.076	0.265	0.069	0.253
Greece	0.054	0.225	0.046	0.209
Switzerland	0.034	0.182	0.022	0.148
Belgium	0.137	0.344	0.157	0.364
Observations		10,647		1,202

SHARE 2004. Unweighted in-sample means.