Long Term Care and the Role of In Kind Transfers. Economic Analysis and Empirical Investigation

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This chapter develops a simple economic model to analyze the role of in kind transfers, which can be interpreted as professional care to elderly people with severe disabilities. It is assumed that these people live with their children (in working age) who provide them health care: the amount of health care is determined by free public provision, by additional professional care bought in the market or by informal care directly given by the children in terms of leisure. The choice between professional and informal care depends on the wage rate and on the "productivity" of leisure in providing health care as compared to professional care. Within this model the effect of an increase of in kind transfers is examined combined with an equal cut in cash transfers: this can be interpreted as a generalized cut in pensions whose *ratio* could be found in a sort of intragenerational solidarity between elderly people with and without severe disabilities. The chapter deals with different alternatives and the conditions assuring a benefit to families with elderly people with severe disabilities, which is such to more than compensate the loss imposed to healthy elderly people. Moreover, the conditions assuring a budget surplus are derived: these stem from the incentive such policies give to increase labour supply diverting leisure from informal care. In order to confirm some of the assumptions of the economic model, we exploit microdata coming from different sources (primarily SHARE and EUSILC) to provide a statistical insight. We investigate to what extent available official statistics help in

detecting various aspects of elderly care and estimate a statistical model for the probability of turning to professional home care, conditional on individual and household characteristics.

1 Introduction

The population ageing process is certainly a great challenge for most developed countries: its features directly impact the pension system and the provision of health services but have important indirect effects on labour and insurance markets and on the general tax system. Among the multi faceted realities of this phenomenon the present work focuses on a particular aspect, namely, the need for long term care by older adults. This has been dealt with by a number of authors from different perspectives. To cite only a few examples: Pestieau and Sato (2008) offer a detailed analysis of optimal design of long term care; Jousten et al. (2005) analyze the moral hazard problems which may arise in such context; Mellor (2005) investigates the relationship among insurance policies and informal care from adult children; Van Houtven and Norton (2004) address the substitutability relation between informal care and medical expenses in the US; Engers and Stern (2002) develop a model of bargaining within the family to decide who should care for aging parents. As these examples suggest, long term care requires a wide range of instruments both private and public in nature; the present paper addresses the role played by in kind transfers from the government. Economists are typically thought to be sceptical about in kind transfers but only in a highly simplified context a comparison between in kind and cash transfers favours the latter because of the distortion the former generates in resource allocation. Since the seminal contribution by Guesnerie and Roberts (1984), it has been demonstrated that in kind transfers are preferable in a wide range of situations which are commonly encountered in the real world. The literature on this topic is quite large and has dealt with compulsory education, food stamps, housing subsidies and health care thus encompassing many instruments of the welfare mix of a developed country: the survey by Currie and Gahvari (2008) reviews the main economic arguments in favour of in kind transfers.

The chapter develops a simple model to analyze the role of in kind transfers which can be interpreted as professional care to elderly people needing long term care. It is assumed that these people live with their children (in working age) who provide them with health care: the amount of health care is determined by free public provisions, by additional professional care bought on the market or by informal care directly given

by the children in terms of leisure. The role played by the wage rate in the choice of providing informal care or even of deciding not to enter the labour market can be demostrated: this permits to differentiate "rich" and "poor" households. Then, using a simplified functional form for individual preferences, we analyse the effects, both on public budget and on the welfare of different households, of some policies consisting in an increase of in kind transfers combined with an equal cut in cash transfers.

To assess the validity of some of our model assumptions, we also investigate the empirical relationship between professional and informal care. This is not straightforward; indeed previous studies on this topic provided mixed results. For a recent review, see Bauer and Sousa-Poza (2015) and Broese van Groenou and De Boer (2016). Recent strands of literature have dealt with several aspects, such as the caregiving well-being, the relationship between work and care, the intergenerational solidarity, or the links between formal and informal care. Among others, Bolin and Lundborg (2008) found that informal and formal home care are substitutes, and that this relationship differs according to a European north-south gradient. Bonsang (2009) highlights heterogeneous effects of informal care on formal care use, and suggests that informal care is an effective substitute for long-term care as long as the needs of the elderly are low and require unskilled types of care. Josten and De Boer (2015) argued that an increased need for informal care may lead people to reconsider possible career moves. We estimate a statistical model for the probability of turning to professional home care, conditional on individual and household characteristics, institutional framework and labour market conditions. We expect to find a trade-off between formal and informal care (provided by a family member), which can be affected by the economic/employment status of the family members and by the different level of government assistance for the elderly.

The structure of the chapter is the following. Section 2 introduces the economic model. Based on this theoretical framework, section 3 deals with the effects of different policies which could be implemented with the primary objective of increasing the living standard of older people through an increase in free professional care. Policy effects are analysed in subsections 3.1, 3.2, and 3.3. Data sources and descriptive statistics are reported in Section 4, and Section 5 presents the statistical approach. Section 6 discusses the estimation results and illustrates conclusions.

2 The model

The model focuses on the behaviour of a representative household where there is also an elderly parent with severe disability: health care to such people, which can be considered a proxy of their utility function, is incorporated into the utility function of the household. Health care is produced by means of leisure and of professional care which is, up to a limit, provided free of charge by the government. A simplifying hypothesis is that these two inputs are perfect substitutes but professional care has a higher productivity: as a general assumption this is surely questionable depending on the kind and/or severity of the disability but can be considered as a starting point. For later reference, leisure used to produce health care is called informal care as opposed to professional. The utility function also depends on an aggregate of consumption goods while there is no pure leisure so that the time endowment is divided into leisure used to produce health care and labour. Labour income is supplemented by a fixed income which can be interpreted, in the context of the model and of the simulations presented below, as a pension accruing to elderly people in the household[1]. The utility function is thus described:

$$U(X, g(LC + \alpha PC))$$

where X is the aggregate consumption good, $g(LC + \alpha PC)$ is the production function for health care, LC and PC denote, respectively, leisure and professional care employed to produce health care where $\alpha > 1$ given the above assumption about their relative productivity. There are two budget constraints in order to model the fact that PC is free up to a limit $\overline{PC}$ and that the household decides the amount of health care (possibly zero) but pays professional care only above this limit:

$$X + PC - \overline{PC} \leq w_N(T - LC) + R$$

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R is the pension of old people, T is time endowment, w_N indicates the net wage while the consumer price of the aggregate consumption good and the price of professional care are normalized to one. The household choice is

[1] If the description of the labour/leisure choice seems unrealistic it is worth pointing out that the model is consistent with an alternative interpretation where in the family there is a primary worker with fixed labour supply and a secondary worker whose labour/leisure choice is modelled as above; some implications of this alternative view are postponed after the policy analysis.

described by the maximization of the utility function subject to the above two constraints and non negativity constraints on X, PC, and LC. From this problem some possible solutions emerge under the assumption that X is always strictly positive: the most important for our purposes are those concerning the level of professional and informal care and a crucial role for the wage rate emerges. If $w_N > 1/\alpha$ leisure is never employed in the production of health care and the level of professional care is $\overline{PC}$ or more; if $w_N \leq 1/\alpha$ leisure can be employed to produce health care; in particular, if the amount of professional care is greater than $\overline{PC}$ labour supply is zero. The intuition for the above results is straightforward; the severity of the disability dictates the choice of total health care: if this is above $\overline{PC}$ (the level guaranteed by free public provision), the net wage determines whether formal (professional) or informal (leisure) care is employed. A unit of leisure provides a unit of health care and the same outcome results if $1/\alpha$ units of professional care are purchased in the market: the latter, given its price, has a cost of $1/\alpha$ while the opportunity cost of the former is net wage, hence leisure is used in the production of health care only if net wage is less than $1/\alpha$. In order to obtain more precise results, as in Pestieau and Sato (2008), a simple specification can be adopted for the utility function of the following (Cobb-Douglas) logarithmic form:

$$U = \log X + \log(LC + \alpha PC)$$

Given this particular (and restrictive) functional form, leisure employed in providing health care and the demands for aggregate consumption good and professional care are the following if $w_N > 1/\alpha$:

$$LC = 0, PC = \frac{\overline{PC} + R + w_N T}{2}, X = \frac{\overline{PC} + R + w_N T}{2} \ if \overline{PC} \leq w_N T + R \quad (1)$$

$$LC = 0, PC = \overline{PC}, X = R + w_N T, \ if \overline{PC} > w_N T + R \quad (2)$$

while for $w_N \leq 1/\alpha$ they are:

$$LC = \frac{w_N T + R - w_N \alpha \overline{PC}}{2w_n}, PC = \overline{PC}, X = \frac{w_N T + R + w_N \alpha \overline{PC}}{2}$$
$$if \ w_N \alpha \overline{PC} < w_N T + R \quad (3)$$

$$LC = 0, PC = \overline{PC}, X = R + w_N T, \ if \ w_N \alpha \overline{PC} \geq w_N T + R \quad (4)$$

$$LC = T, PC = \frac{\overline{PC} + R - T/\alpha}{2}, X = \frac{\overline{PC} + R + T/\alpha}{2} \ if \ \overline{PC} < R - t/\alpha \quad (5)$$

As can be seen, household behaviour depends on a number of parameters some of which are under the control of the government. Given the

interpretation of $\overline{PC}$ as professional long term care freely available to elderly people with severe disabilities, it is reasonable to assume that its level is determined so as to achieve a minimum standard of living: in this light, the most plausible outcomes are those described by (1) and (3) while (5) can emerge only if $\overline{PC}$ is very low (with respect to the desired level of health care) or if pension is a significant component of household income. The role of the government must be further discussed to introduce the policies which will be described in the following section. In particular it is assumed, for simplicity, that the public budget includes $\overline{PC}$, pensions and a public expenditure G on the expenditure side, and indirect and income taxes on the revenue side; it is thus necessary to introduce additional types of individuals, namely labourers, representative of households without old people, and old people living alone not needing long term professional care which will be called healthy retired. Using superscript L for labourers, H for healthy retired and NH for households with old people with severe disabilities (non healthy households), the public budget is:

$$t(X^L + X^H + X^{NH}) + t_i(L^L + L^{NH}) = G + \overline{PC} + R^H + R^{NH}$$

where t_i is the income tax rate and t the indirect tax rate.

3 Policy analysis

The first policy proposed in this section consists of a combined increase in $\overline{PC}$ and decrease in R; the justification for the combined decrease in pensions can be motivated by a sort of intragenerational solidarity between healthy and non healthy elderly people: in a bit more sophisticated model the increase in $\overline{PC}$ could be valued by healthy retired if they have a probability of experiencing severe disabilities in the future. Standard economic analysis evaluates the effects of such a policy imposing budget balance and computing the implied change in R and $\overline{PC}$; here it has been chosen to finance the increase in $\overline{PC}$ by an equal decrease in R thus not imposing budget balance; the reason for this choice is mainly due to the fact that this policy affects a number of variables, some of which could be considered possible goals of the policy; to be more explicit, the possibility of having a budget surplus can be considered per se an interesting result. Moreover, even if the public budget can be considered under the control of the government, the proposed policy directly affects three different budgets: that of the social security system, the general fiscal revenue and, possibly, that of the local government responsible for the provision of $\overline{PC}$.

Let N_1 and N_2 be the number of, respectively, non healthy households and healthy old people with $N = N_1 + N_2$. the proposed policy requires:

$$N_1 d\overline{PC} = -N dR$$

or, equivalently:

$$\theta d\overline{PC} = -dR$$

where $\theta = N_1/N$. A starting hypothesis to analyse the effects of the proposed policy is that, among the feasible choices derived in the preceding section, the demands describing household behaviour are (1) and (3) above. For further reference, let us indicate households with $w_N > 1/\alpha$ as non healthy rich and those with $w_N \leq 1/\alpha$ as non healthy poor where non healthy refers to the presence of old people with disabilities; finally let n_1 be the number of non healthy poor.

3.1 Budget effects

The first effect which is dealt with concerns the public budget; in its computation, labourers are not considered since the policy does not affect their behaviour. In order to have a positive change in public budget, the condition is the following, where the term $w_N\alpha$ refers only to the non healthy poor and thus is less than one:

$$\theta(\beta_\gamma + 1) + \beta w_N \alpha(1 + \gamma) > (1 + \beta) \tag{6}$$

where $\beta = n_1/N_1$ is the proportion of the non healthy poor on the total of the non healthy and $\gamma = t_i/t$ is the ratio between direct and indirect tax rates; if these rates are equal the above condition yields:

$$\beta w_N \alpha > (1 - \theta)\frac{1}{2}(1 + \beta) \tag{7}$$

The parameters involved derive from the fact that there are some effects working in opposite directions: healthy elderly people decrease their consumption of the same amount as the decrease in R (being pension their only source of income) thus reducing the revenue from indirect taxes; the non healthy rich increase their consumption (and indirect tax revenue) because the effect of the decrease in R is more than compensated by the effect of the increase in $\overline{PC}$; the non healthy poor increase (decrease) their consumption if $w_N\alpha$ is greater (less) than θ but unambiguously increase their labour supply in response to the increase in $\overline{PC}$: the crucial role played by this last effect, demonstrated by Ghavari (1994) in a

different framework, is best pointed out by observing that, when the ratio between indirect and income taxes is one, the aggregation of the other effects negatively affects the public budget given the assumption about preferences of the present model. Consequently, it is not surprising that if the probability of having a positive budget change is higher, the greater γ is; two other parameters working in the same directions are θ and β: for a given N_1, the greater θ is, the greater the increase in labour supply of non healthy poor is and the less the decrease in consumption of healthy retired is; the positive effect of c is granted only if $\beta w_N \alpha$ is sufficiently close to one. If indirect and income taxes are levied at the same rate a sufficient condition to have a positive budget change is $w_N \alpha > (1-\theta)$[2].

The proposed policy might be modified, perhaps by equity considerations, exempting from the reduction in R the non healthy poor. In this case a positive change in revenue requires, if $t_i = \gamma t$:

$$(1-\beta)\frac{1}{2}(1-\theta') + \frac{1}{2}\beta w_N \alpha(1+\gamma) > \theta''$$

and, with equal tax rates:

$$\beta w_N \alpha + \frac{1}{2}(1-\theta')(1-\beta) > \theta''$$

The new parameters are:

$$\theta'' = \frac{N_2}{N-n_1} = \frac{N_2/N}{1-\beta N_1/N} = \frac{1-\theta}{1-\beta\theta} > 1$$

and:

$$\theta' = \frac{N_1}{N-n_1} = \frac{\theta}{1-\theta\beta}$$

which is less than 1 if $\beta(1+\theta) < 1$. As can be seen, the conditions for a positive budget change are a bit more complex and the only parameter which has an unambiguous positive effect on the budget is the ratio between direct and indirect tax rates. The reason can be found in the fact that the exemption of poor families boosts their consumption but generates a smaller increase in their labour supply and the larger cut in pensions for rich families and healthy retired lowers consumption and thus the revenue from indirect taxes. As a result, a crucial role might be played

[2]The above conditions are more stringent if we consider the possibility that some of the non healthy rich e non healthy poor choose an amount of health care equal to $\overline{PC}$; the explanation of such result derives from the fact that for some households now there is no effect on labour supply.

by θ' because if it is less than 1 the net effect of the change in $\overline{PC}$ and R for rich families increases tax revenue. As a final modification of the proposed policy the change in $\overline{PC}$ could be financed by a decrease in R of non healthy rich only such that:

$$dR = -\frac{N_1}{N_1 - n_1} d\overline{PC} = -\frac{1}{1-\beta} d\overline{PC}$$

Such a policy can be motivated by an additional implicit redistributive goal. Now the change in revenue is, with equal tax rates:

$$t\beta \left(w_N \alpha - \frac{1}{2} \right)$$

which is positive if $w_N \alpha > 1/2$ remembering that $w_N \alpha$ in all the above expressions refers to non healthy poor.

3.2 Welfare effects

The analysis so far developed must be integrated by a description of the effects generated by the proposed policies on the welfare of the different types of households and an immediate result is that the healthy retired are unambiguously damaged by any policy cutting their income, since they gain nothing from the increase in $\overline{PC}$. Then the analysis focuses on the unhealthy rich and poor and computes the sign and magnitude of their welfare loss or gain.

Starting with the first policy proposed (and under the assumption that no household chooses to provide health care in the limit of $\overline{PC}$), it can be demonstrated that aggregate welfare is given by:

$$(N_1 - n_1)\lambda_R(1-\theta) + n_1(\lambda_P^{PC} - \lambda_P^I \theta) - N_2 \lambda_H \theta$$

where λ_R is the marginal utility of income for rich families which also equals the marginal utility of professional care; λ_P^{PC} and λ_P^I are, respectively, the marginal utility of professional care and of income for poor families with the latter greater than the former; finally λ_H is the marginal utility of income for the healthy retired. It is interesting to point out that $\lambda_P^{PC} > \lambda_P^I \theta$ if $\theta < w_N \alpha \leq 1$. Since we are mainly interested in the sign of the welfare change it is useful to divide the above formula by N_1 obtaining the following condition for a positive aggregate welfare change:

$$(1-\beta)\lambda_R(1-\theta) + \beta(\lambda_P^{PC} - \lambda_P^I \theta) - (1-\theta)\lambda_H > 0 \qquad (8)$$

As a result, under some assumptions concerning the behaviour of households with old people with disabilities, the proportion of unhealthy people in the total elderly population, the proportion of unhealthy poor, and the wage rate of poor families, the first policy proposed generates a welfare gain for the unhealthy rich and poor and a welfare loss for the healthy retired. If, in addition, the welfare gain for the unhealthy is sufficiently high it may overcome the welfare loss for the healthy retired. This conclusion can be better qualified if the "private" marginal utilities in the above formula are interpreted as (or replaced by) "social" marginal utilities which, in a utilitarian framework, are simply their private counterparts multiplied by the social weight of the concerned individuals/households: in other terms, they express the value for society of an additional euro given to individuals/households. Taking into consideration the motivation of the proposed policy it is reasonable to assume that unhealthy people have a higher social weight than the healthy retired and this might give an overall welfare gain for society as a whole.

If the policy exempts the unhealthy poor, the condition for a positive aggregate welfare change is:

$$(1-\beta)\lambda_R(1-\theta') + \beta\lambda_P^I - \lambda_H\theta'' > 0 \tag{9}$$

Now the unhealthy poor are unambiguously better off but the condition for a positive welfare change involves parameters θ' and θ'' and only the latter is surely less than 1; if $\theta' < 1$ then the first two terms are positive. Finally, if the policy redistributes from non healthy rich to non healthy poor, a positive aggregate welfare change requires:

$$\beta(\lambda_P^I - \lambda_R^I) > 0 \tag{10}$$

In this case it is sufficient to assume that the social marginal evaluation of the poor is greater than that of the rich to have a positive aggregate welfare change.

3.3 Overall effects

We can put together the results of the previous sections to give an overall evaluation of the proposed policies. The first finances an increase of in kind transfers ($\overline{PC}$) with a generalized cut in pensions; the reason can be found in a desire to alleviate the conditions of old people with severe disabilities living in a family and to permit a substitution of professional for informal care within the family; the financing scheme can be justified by a sort of intragenerational solidarity between healthy and non healthy

elderly people. Conditions have been found such that this policy generates a positive change in the overall public budget and a positive aggregate welfare change. For the latter result, a crucial condition is:

$$w_N \alpha > \theta$$

where w_N is the wage rate of the poor and $\alpha > 1$ is the relative productivity of professional care with respect to informal care in providing health care. Under the assumption that indirect and direct tax rates are the same, the former requires:

$$w_N \alpha > (1-\theta)\frac{1}{2}\left(\frac{1}{\beta}+1\right)$$

where β and θ are, respectively, the share of poor in the unhealthy total and the share of the unhealthy in the total elderly population. What can be said is that the larger β is, the larger the range of values is for the parameters which fulfill both conditions; on the contrary, the smaller β is, the larger the probability that only the former is fulfilled. The second policy proposed differs from the first financing the change of in kind transfers by a reduction of pensions of the rich unhealthy and the healthy retired, thus exempting the non healthy poor: equity reasons can be found behind this choice. The condition for a positive aggregate welfare change is:

$$(1-\beta)\lambda_R(1-\theta') + \beta\lambda_P^I > \lambda_H\theta''$$

where λ_R, λ_P^I and λ_H are, respectively, the social marginal utility of income of the non healthy rich, of the non healthy poor and of the healthy retired, while θ' and θ'' are, respectively, the share of the non healthy and the healthy in the total of the healthy and the non healthy rich. Under the above assumption on tax rates, a positive change in revenue is granted if:

$$(1-\beta)\frac{1}{2}(1-\theta') + \beta w_N \alpha > \theta''$$

Given that it is reasonable to assume that $\lambda_P^I > \lambda_R \geq \lambda_H$, it is highly plausible that a positive change in revenue also implies a positive welfare change. Under the last policy proposed, the burden of the increase in $\overline{PC}$ is entirely borne by the unhealthy rich: if $w_N\alpha > 1/2$ this policy achieves both a positive change in revenue and a positive aggregate welfare change. Even if this result can be interesting from a policy perspective an even stronger result was already established by Gahvari (1995) within a model where only income taxes are levied. A general conclusion is that the choice of the policy to implement requires detailed information about

household net wage rate, and the structure of older population. A more subtle point concerns the interpretation of the model as encompassing a primary and a secondary worker: now the wage rate in the above formula should be representative of the wage rate of the secondary worker and this complicates the identification of poor families because a low wage rate may no longer be correlated with a high family income.

4 Data sources and descriptive statistics

We aim to find empirical evidence supporting our model assumptions and the feasibility of policy measures such as those investigated in the previous section. To this end, we provide a brief overview of the main data sources available on the supply and use of social protection services, with focus on the assistance for elderly care. European official statistics provide data at both macro and micro level.

On the macro side, it is possible to analyze social protection expenditures of EU countries and receipts through four main data sources: the System of Integrated Social Protection Statistics (ESSPROS) and National Accounts by Eurostat, the Social expenditure database by OECD and the Social Security Inquiry by ILO. These data sources, though not perfectly homogeneous, allow one to obtain a detailed and complete description of social protection systems in Europe (Coli et al. 2016). ESSPROS represents a yardstick in the field of social protection statistics. Subsequent statistical frameworks were developed in harmonization with its concepts and definitions. According to ESSPROS, social protection is defined as encompassing "all interventions from public or private bodies directed to relieve households and individuals of the burden of a defined set of risks and needs, provided that there is neither a simultaneous reciprocal nor an individual arrangement involved" (Eurostat, 2011, p. 9). The categories of risks and needs covered are eight, namely: Sickness/health care, Disability, Old age, Survivors, Family/children, Unemployment, Housing, Social exclusion not elsewhere classified.

The Old age function covers the provision of social protection against the risks linked to old age: loss of income, inadequate income, lack of independence in carrying out daily tasks, reduced participation in social life, and so on. Medical care of the elderly is not taken into account, as all health care expenditure is reported under the Sickness/health care function (Eurostat, 2011, p. 45). The Survivors function includes mainly benefits that provide a temporary or permanent income to people who have suffered from the loss of spouse or next-of-kin, usually when the latter represented

the main breadwinner for the beneficiary (Eurostat, 2011, p. 47). ESSPROS distinguishes benefits in kind and benefits in cash, as well as means-tested and non means-tested benefits.

National statistical offices disseminate also micro data on the supply and use of social protection services. However, these statistics seldom permit sound comparisons among countries. Within micro data sources, harmonized household surveys (e.g., EUSILC European statistics on Income and living conditions) are essential in comparing the demographic, economic and social characteristics of households covered by social protection systems. EUSILC is the reference source for comparative statistics on income distribution and social inclusion in the European Union. The reference population includes all private households and their current members residing in the territory of the countries at the time of data collection. EUSILC collects information on social benefits received by households and their members. The Social benefits collected at individual level are the following: unemployment benefits, old-age benefits, survivors' benefits, sickness benefits, disability benefits, and education related allowances.

In addition to the EU official statistics, a rich source of information consists of data coming from the Survey of Health, Ageing and Retirement in Europe (SHARE, Börsch-Supan, 2016; Börsch-Supan et al, 2016)[3]. SHARE is a multidisciplinary and cross-national panel database of micro data on health, socio-economic status and social and family networks of more than 123,000 individuals (approximately 293,000 interviews) from 20 European countries (plus Israel) aged 50 or over. Here, we combine information coming from different sources, so that the result is a pooled dataset containing both individual/households and country level variables. Specifically, we use data from SHARE Waves 2 (reference year 2006/2007) and include in the analysis 11019 individuals aged 65 or over from a selection of 7 European countries. Other individual and household characteristics (for the same target population, i.e., households with a person aged 65 or over) are included as country averages from EUSILC (reference year 2006). Unfortunately, it was not possible to use data on social benefits because of comparability reasons: for 2006, some countries collected benefits in gross

[3]This paper uses data from SHARE Waves 2 release 5.0.0 (DOI: 10.6103/SHARE.w2.500) and easySHARE release 5.0.0 (DOI: 10.6103/SHARE.easy.500). The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N211909, SHARE-LEAP: N227822, SHARE M4: N261982). Additional funding from the German Ministry of Education and Research, 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) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

values other countries in net values. Country-level variables describing old-age welfare services come from ESSPROS (reference year 2006).

Tables 1 and 2 show a synthetic description of variables used in the subsequent analysis with relative data source. Table 3 presents summary statistics of the main individual-level variables used in the analysis. We report averages and shares, respectively for quantitative and categorical variables, by country. In order to be selected in our analysis, respondents had to be at least 65 years old. Finally, Table 4 contains country averages and welfare system indicators, which allow us to better characterize the family status, the institutional framework and the labour market conditions of different countries. Differences across countries emerge, which also reflect different welfare state typologies.

5 Empirical analysis

The objective of our analysis is to contribute to a better understanding of the relationship between professional and informal care. To this end, we consider the individual binary outcome "Home care" as a function of both individual/family-level and country-level characteristics. This variable indicates whether the respondent has received home care during the last twelve months. This includes professional or paid nursing or personal care, professional or paid home help, e.g. meals-on-wheels and may be interpreted, consistently with the theoretical model presented in Section 1, as the professional care demanded in addition to that freely provided by the government. We aim to investigate how different personal and familiar conditions, policy environments and institutions affect the outcome, thus contributing to the policy debate about the role of old-age welfare services in the decision to use formal care.

There is a natural hierarchy within the data: there are observations at the individual/family level nested within the country level. This multilevel structure affects model specification and estimation. Possible strategies in quantitative analyses of multi-country datasets include the following: pooling the data for all countries (and using cluster-robust standard errors), using separate models for each country, country fixed effects models, or multilevel models (also known as random effects models or hierarchical models). Multilevel models appear to be the natural choice when one is interested in the country-level predictors or the variance component structure, investigating to what extent unobserved country factors affect population units (families). Our dataset contains thousands of observation at the individual level, but the number of countries is small. Recently,

Bryan and Jenkins (2015) argued that the small number of countries in most multi-country datasets severely constrains the ability of multilevel regression models to provide robust conclusions about the effects of country-level characteristics on outcomes (see also Austin, 2010). Based on this literature, we opted to estimate a pooled logistic regression model using the whole sample. When the dependent variable is dichotomous (as in our case), or otherwise non-normally distributed, it requires one to estimate a generalized linear model. Considering an individual outcome y_{ij} taking on value 1 with conditional probability p_{ij}, the logit model or generalized linear model (with link function logit) is the following:

$$ln\left[\frac{p_{ij}}{1-p_{ij}}\right] = X'_{ij}\eta + Z'_{ij}\mu$$

for individual unit i and country unit j. We assume y_{ij} conditionally distributed as a Bernoulli random variable; we use X and Z to denote individual and country variables, respectively. Vectors η and μ are parameters to be estimated. Because of the classical assumptions of independence of the observations conditional on the explanatory variables and uncorrelated residual errors, we compute cluster robust standard errors to account for the multilevel structure and make results more reliable.

We present results in Table 5 where the set of explanatory variables includes demographic and socioeconomic characteristics of the respondent, health variables, variables concerning children as informal caregivers and variables representing institutional differences in labour markets and welfare systems, some of which have a direct counterpart in the theoretical model. We can directly examine the sign of the estimates of the coefficients associated with the variables and their standard errors, to assess the role in increasing or decreasing the probability of home care. We can also interpret results as odds ratios (obtained by computing the exponential function of the coefficients).

6 Results and concluding remarks

Estimation results point out some interesting evidence, which generally confirm our economic model assumptions and suggest additional interpretations. Age and education appear to increase the probability to turn to home care: age is implicitly considered a determinant of the need for long term care; while the education level of the elderly subject can be used as an indicator of the socio-economic level. Health variables positively

contribute to the decision of professional care use and in the theoretical model determine the need for health care which enters the household utility function. The significant negative effect displayed by family size may be interpreted within the theoretical framework as the availability of leisure time to devote to informal care; the same explanation may be offered for the variable "Child living close" even if this has no direct counterpart in the economic model. More interesting is the negative effect that the inactivity rate plays in reducing the probability of professional home care: as assumed in the economic model inactive people devote their leisure to provide informal care as a substitute for professional care. As far as old-age welfare policies are concerned, we can see that the increase of in kind benefits over cash benefits seems to reduce the probability of home care (even if the coefficient is no more significant when using cluster adjusted standard errors): this is in line with the theoretical model given that a result of the proposed policies is a reduction in purchased professional care. Similarly, the relative amount of total benefits (which mainly includes cash benefits) positively affecting the decision to use professional care corresponds to the assumption of positive relation between cash and in kind benefits and the demand for professional care. A final reflection concerns the negative effect of income percentiles which is not significant, while in the model a crucial role is played by net wage: a possible explanation may be that household income is a more comprehensive variable and cannot be directly reflected in the net wage; another explanation maintains that income is a good proxy for net wage but in the real world there are frictions and/or costs, not theoretically modelled, in the labour market which prevent the switch from leisure to labour assumed in the model. Moreover, under the interpretation with a primary and a secondary worker, family income might be a poor approximation for the wage rate of a secondary worker.

The empirical investigation vis a vis the theoretical model witnesses that the presence of (inactive) children reduces the probability of purchasing professional care in addition to those freely supplied, but it does not support the further effect on labour supply which plays a relevant role in the results discussed in Section 3 above. This is a limitation of the data set at hand, in that it does not allow us to exactly reproduce the proposed theoretical framework. SHARE data present the advantage of providing a wide picture of elderly people's health and living conditions , but there is no detailed information on relatives, especially with regards to personal income and employment situation. Some variables we used were recovered from other sources (EUSILC and ESSPROS) as family or country averages

in absence of individual values. We plan to extend the analysis by better exploiting the information provided by EUSILC data and/or other sources, with the aim of acquiring personal income data within the family of elderly people.

References

Austin, P.C. (2010). Multilevel Logistic Regression Models When the Number of Clusters is Low: A Comparison of Different Statistical Software Procedures. *International Journal of Biostatistics*, 6(1): 16. doi: 10.2202/1557-4679.1195.

Bauer, J.M. and Sousa-Poza, A. (2015). Impacts of Informal Caregiving on Caregiver Employment, Health, and Family. IZA Discussion Paper No. 8851.

Bolin K., Lindgren B., and Lundborg, P. (2008). Informal and formal care among single-living elderly in Europe. *Health Economics*, 17(3), 393-409.

Bonsang, E. (2009). Does informal care from children to their elderly parents substitute for formal care in Europe?. *Journal of Health Economics*, 28, 143-154.

Börsch-Supan, A. (2016). Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 2. Release version: 5.0.0. SHARE-ERIC. Data set. DOI: 10.6103/SHARE.w2.500.

Börsch-Supan, A., C. Hunkler, S. Gruber, A. Orban, S. Stuck, J. Neumann, M. Brandt (2016). easySHARE. Release version: 5.0.0. SHARE-ERIC. Dataset. doi: 10.6103/SHARE.easy.5.0.0

Broese van Groenou, M. I., and De Boer, A. (2016). Providing informal care in a changing society. *European Journal of Ageing*, DOI 10.1007/s10433-016-0370-7.

Bryan M.L. and Jenkins, S.P. (2015). Multilevel Modelling of Country Effects: A Cautionary Tale. *Eur. Sociol. Rev.*, doi: 10.1093/esr/jcv059.

Coli A., Micheletti E., and Pacini, B. (2016). European Welfare State in times of crisis according to macroeconomic official statistics. Proceeding of the 48th Scientific Meeting of the Italian Statistical Society, SIS.

Currie, J. and Gahvari, F. (2008). Transfers in Cash and in-Kind: Theory Meets the Data. *Journal of Economic Literature*, 46, 333-83.

Engers, M. and Stern, S. (2002). Long-Term Care and Family Bargaining. *International Economic Review*, 43, 73-114.

Eurostat (2011). The European System of European System of Integrated Social Protection Statistics.

Eurostat (2016). EU-SILC 2006, cross-sectional, version Jan 05 2016.

Gahvari, F. (1994). In-kind Transfers, Cash Grants and Labour Supply. *Journal of Public Economics*, 55, 495-504.

Guesnerie, R. and Roberts, K. (1984). Effective Policy Tools and Quantity Controls. *Econometrica*, 52, 59-86.

Josten E., and De Boer, A. (2015). Concurrentie tussen betaald werk en mantelzorg [Competition between paid work and informal care]. The National Institute for Social Research, The Hague, the Netherlands.

Jousten, A., Lipszyc, B., Marchand, M. and Pestieau, P. (2005). Long Term Care Insurance and Optimal Taxation for Altruistic Children. *Finanzarchiv*, 61, 1-18.

Mellor, J. (2001).Long-Term Care and Nursing Home Coverage: are Adult Children Substitutes for Insurance Policies?. *Journal of Health Economics*, 20, 527-47.

Pestieau, P. and Sato, M. (2008). Long-Term Care: the State, the Market and the Family. *Economica*, 75, 435-54.

Van Houtven, C.H. and Norton, E.C. (2004). Informal Care and Health Care Use of Older Adults. *Journal of Health Economics*, 23, 1159-80.

Tables

Table 1: Variables description. SHARE

Data source: SHARE		
Variables	Description	Categories
Private care	Received care from private providers	1 if yes
Home (paid) care	Received professional care during past 12 months	1 if yes
Age	Age	Numeric
Family size	Number of family members	Numeric
Education (years)	Years of education of respondent	Numeric
N. children	Number of children	Numeric
Child in hh	At least 1 child in the same household	1 if present
Child less than 1 km	Child living less than 1 km	1 if present
Help outside hh	Received help from outside the household	1 if Yes
Health self perception	Self-perceived health (0-5)	1 if Poor
Difficulties in daily living	Activities of daily living index (0-4)	1 if index high
Difficulties in mobility	Mobility index (0-5)	1 if index high
Retired	Job position	1 if retired
Not able to make ends meet	Household able to make ends meet	1 if not able
Income percentiles	Household income percentiles	From 1 to 10

Table 2: Variables description. EUSILC and ESSPROS.

Variables	Description	Source
NDEGREE M	Household number of members with tertiary education	EUSILC
NFEM M	Household number of female members	EUSILC
NINACTIVE FL M	Household number of inactive members	EUSILC
NINACTIVE FEM M	Household number inactive female members	EUSILC
NINACTIVE MALE M	Household number of inactive male members	EUSILC
NRETIRED M	Household number of retired members	EUSILC
NUNEMP M	Household number of unemployed members	EUSILC
AGE M	Average age of household members	EUSILC
NWORK M	Household number of members with a job	EUSILC
BENEFITS OLD SUV	Benefits for old age and survivors functions (PPS per head)	ESSPROS
NMT OLD SUV	Non means-tested benefits for old age and survivors functions (PPS per head)	ESSPROS
MT OLD SUV	Means-tested benefits for old age and survivors functions (PPS per head)	ESSPROS
BIK OLD SUV	Benefits in kind for old age and survivors functions (PPS per head)	ESSPROS
CASH OLD SUV	Cash benefits for old age and survivors functions (PPS per head)	ESSPROS
NMT MT	Ratio between non means-tested and means-tested benefits (old age + survivors)	ESSPROS
BIK CASH	Ratio between in-kind and cash benefits (old age + survivors)	ESSPROS
BENEFITS REL	Ratio between country and EU15 benefits (old age+survivors, PPS per head)	ESSPROS

Table 3: Descriptive statistics (individual variables - SHARE data).

Age 65 and over	Sweden	Netherlands	Spain	Italy	France	Denmark	Grece
Variable							
Private care	0.112	0.061	0.071	0.195	0.101	0.071	0.171
Home (paid) care	0.080	0.159	0.102	0.066	0.255	0.174	0.040
Age	74.767	74.035	75.393	73.343	75.104	74.832	74.765
Family size	1.740	1.757	2.397	2.249	1.727	1.653	1.877
Education (years)	9.498	9.791	4.712	6.284	9.481	11.889	6.207
N. children	2.243	2.644	2.689	2.254	2.227	2.353	1.948
Child in hh	0.033	0.039	0.419	0.465	0.121	0.040	0.455
Child less than 1 km	0.135	0.171	0.599	0.580	0.209	0.112	0.575
Help outside hh 0.264	0.248	0.173	0.188	0.211	0.283	0.296	
Difficulties in daily living	0.029	0.022	0.080	0.060	0.048	0.044	0.040
Difficulties in mobility	0.120	0.130	0.264	0.258	0.202	0.160	0.372
Retired	0.978	0.736	0.618	0.752	0.899	0.944	0.697
Not able to make ends meet	0.026	0.029	0.178	0.211	0.084	0.022	0.292
Income percentiles	4.938	4.923	5.081	5.414	4.783	3.695	5.241

Table 4: Descriptive statistics (country variables - ESPROSS and EUSILC data).

	Sweden	Netherlands	Spain	Italy	France	Denmark	Grece
Variable							
NDEGREE M	0.275	0.291	0.236	0.122	0.167	0.287	0.163
NFEM M	0.910	0.917	1.285	1.144	0.950	0.921	1.188
NINACTIVE FL M	0.072	0.563	0.706	0.552	0.189	0.080	0.457
NINACTIVE FEM M	0.047	0.480	0.633	0.469	0.161	0.055	0.408
NINACTIVE MALE M	0.024	0.083	0.073	0.083	0.028	0.025	0.050
NRETIRED M	1.370	0.928	0.997	1.021	1.328	1.385	1.133
NUNEMP M	0.012	0.003	0.091	0.058	0.030	0.004	0.064
AGE M	71.401	71.327	65.572	67.400	71.002	70.773	66.408
NWORK M	0.188	0.107	0.461	0.369	0.125	0.206	0.435
BENEFITS OLD SUV	3294.48	3489.23	2052.80	3768.65	3329.23	3028.21	2655.84
NMT OLD SUV	3290.45	3227.24	1781.87	3684.97	3134.62	3028.19	2561.58
MT OLD SUV	4.030	261.990	209.330	83.670	111.630	0.000	68.110
BIK OLD SUV	664.24	261.99	99.80	24.00	101.16	517.16	23.05
CASH OLD SUV	2630.25	3227.24	1951.95	3744.33	3211.22	2508.79	2625.20
NMT MT	0.120	8.120	11.750	2.270	3.560	0.000	2.660
BIK CASH	25.250	8.120	5.110	0.640	3.150	20.610	0.880
BENEFITS REL	1.046	1.108	0.652	1.196	1.057	0.961	0.843

Table 5: Estimation results.

Coefficients	Estimate	Odds Ratio	Std. Error		Adj. Std. Error	
(Intercept)	-11.975	0.000	0.683	***	0.803	***
Age	0.104	1.109	0.006	***	0.015	***
Education (years)	0.031	1.032	0.010	**	0.010	**
Family size	-0.398	0.672	0.075	***	0.166	*
N. children	0.023	1.023	0.029		0.020	
Child in hh	-0.193	0.825	0.181		0.150	
Child less than 1 km	-0.387	0.679	0.139	**	0.137	**
Help outside hh	0.484	1.622	0.092	***	0.124	***
Health self perception	0.875	2.398	0.110	***	0.056	***
Difficulties in daily living	0.981	2.667	0.161	***	0.175	***
Difficulties in mobility	1.057	2.878	0.104	***	0.098	***
Not able to make ends meet	-0.085	0.918	0.144		0.104	
Income percentiles	-0.044	0.957	0.019	*	0.036	
NINACTIVE FL M	-5.012	0.007	0.340	***	0.560	***
BIK CASH	-0.021	0.979	0.006	***	0.017	
NMT MT	0.323	1.381	0.023	***	0.047	***
BENEFITS REL	2.707	14.990	0.336	***	0.524	***

0 *** 0.001 **
0.01 * 0.05 .