Eliciting the demand for long term care coverage: a discrete choice modelling approach*

Rinaldo Brau,[†]Matteo Lippi Bruni[‡]and Anna Maria Pinna

Abstract

In this paper we aim to evaluate the demand for long term care insurance prospects in a stated preference context, by means of the results of a choice experiment carried out on a sample representative of the Emilia-Romagna population. These techniques have not been used yet for studying the demand for LTC services. The adoption of a choice modelling approach permits to assess the relative importance of the characteristics which together compose the insurance programme. The application of a nested logit specification with "partial degeneracy" is studied in depth because it allows for modeling the determinant factors of the preference for status quo situations where no sistematic cover for LTC exists. On the base of this empirical model, we test for the effects of a series of socio-demographic variables and personal and household health status indicators.

Keywords: Health Insurance, Long Term Care, Choice Experiments, WTP, Nested Logit Models
JEL classification: I11, I18, H40, C25.

1 Introduction

Over the last 15 years, both social policy debate and economic literature have paid growing attention to the problem of ensuring adequate financing and provision of long term care (LTC) services (e.g. Eisen and Sloan 1997).This was reflected in important reforms of the system of public benefits involving countries such as Germany in 1994 (see Cuellar and Wiener, 2000; and Geraedts, Heller and Harrington, 2000), Luxembourg in 1998 and Japan in 2000 (Mitchell, Piggott and Shimizutami, 2004) to mention only a few examples. Even in countries that did not experience analogous radical changes, major concerns have been

*The empirical sections of this study are based on a survey carried out within the research program "Definition of basic standards of care: ethical, epidemiological and economic implications" financed by the Italian Ministry of Health Care and coordinated by the Regional Health Care Agency of Emilia Romagna. Nonetheless, the work reflects exclusively authors' opinions, who are the sole responsible for any mistakes and does not involve in any aspect the above mentioned institutions, whose support is whose support is gratefully acknowledged

†University of Cagliari and CRENoS

‡Department of Economics, University of Bologna

expressed over the increasing trends in LTC expenditures that challenge the financial sustainability of the different systems and raise delicate equity issue (e.g. Garber, 1996 for the US and Royal Commission on LTC for the UK).

According to economic and demographic studies, several phenomena contribute to raise the financial risks related to dependency in the old age, both at the individual and collective level. Tendencies such as the rapid ageing of the population, the raise in real costs of personal caregiving and the changing structure of households generate two major consequences: an expected rise in the need for LTC and, at the same time, a reduction in the potential provision of informal care by families. In fact, the traditional solution of extensively delegating care to family networks is jeopardised by the decline in fertility rates and by the increased mobility of the population, which reduce the availability of adult children as primary caregivers for home care.

The lack of adequate coverage for LTC risk is considered socially detrimental for several reasons. First, experiencing a long-lasting period of dependency has often catastrophic consequences on the assets of the person involved and of his family. This is perceived as particularly inequitable since physical frailty determines also much wider distress on the psychological well being of the household. Moreover, the financial consequences of disability hit the family when the allocation of time for labour and leisure is already constrained by the necessity to provide informal care. This explains why achieving a balanced share between private and public responsibilities is here a particularly delicate issue.

Economic literature on LTC has focused on two main issues. On the one side, researchers have tried to provide indications on expected trends of LTC costs in order to advise policy makers over the amount of resources that are likely to be absorbed by these services. On the other side, a great deal of theoretical and empirical work has tried to understand why the insurance market does not seem to work effectively in transferring LTC risk. Until now, results of both strand of literature are only partially satisfactory.

Unfortunately, complex demographic and economic factors interact and their evolution is predictable only to a limited extent. For instance, increased longevity raises the elderly population both in absolute and relative terms and is expected to raise the demand for formal LTC services. At the same time, it has been shown that this phenomenon tends to be associated with a reduction in the different life-span between females and males. As a consequence, the expected raise in LTC costs may be attenuated by the increased opportunities of mutual support between partners (Lakdawalla and Philipson 2002).

In this context it is extremely difficult to develop reliable forecasts of future LTC costs. Even very accurate projections are extremely sensitive to slight changes in the basic assumptions over the evolution of the main determinants of LTC expenditures, such as disability rates per age group, the distribution of demand between home and residential care and changes in the unit costs of care (Hancock et al. 2003). In principle, lack of accurate information on the demand side would be not so serious, if one could simply rely on market mechanisms for ensuring an adequate coverage against the risk of disability in the old age. Nonetheless, it is well known that private insurance markets for LTC tend to be very small. A series of arguments have been explored in the literature in order to find a rational for this phenomenon that involves very different countries, irrespectively of the way health and social care are organised (Norton 2000).

Potential explanations have been suggested both for the supply and demand side. In the first case, they range from market failures such as adverse selection and ex-post moral hazard which affect the LTC more markedly than the health insurance market, to the existence of aggregate undiversifiable risk (Cutler 1993). Lack of demand is mainly attributed to myopic behaviour that may lead young generations to underestimate the risk of disability and to intrafamily strategic behaviour that lead elderly people to limit coverage in order to incentivate to personal care by adult children (Pauly 1990, Zweifel and Strüwe 1996, 1998). Yet, a robust empirical validation for most of these conjectures is still to be found (see Sloan and Norton, 1997, Sloan, Picone and Hoerger, 1997; Mellor 2001). Besides, formal LTC services have partial substitutes that may reduce the demand for risk coverage. Public assistance may crowd out private demand for care or even induce individuals to strategically choose sub-optimal levels of coverage because they rely on last resort public intervention. Moreover, individuals may prefer to purchase formal care at the point of demand rather than getting ex-ante coverage or, more importantly, they rely on informal family care.

It has recently been shown that in the US market, although there is some evidence of the existence of supply side market failures, they do not seem to be primarily responsible for small market size (Brown and Finkelstein 2004). The latter result confirms the importance of a better understanding of demand patterns.

For this scope, our paper proposes a complementary approach with respect to those usually adopted in the literature. We focus on the demand side for LTC coverage in Italy, we are dealing with an institutional context where it would be impossible to evaluate the demand for LTC coverage from expenditure surveys, given that the market is almost non-existent. Moreover, the problems previously discussed suggest that an unmet demand for risk coverage is likely to occur. All this paves the way to adopt a stated preferences approach instead of the more common revealed preferences studies. The advantage of studying demand in hypothetical markets is twofold: it gets rid of supply side imperfections which may hamper voluntary transactions between economic agents; and it enables to explore how preferences vary according to different institutional solutions that may be adopted.

The technique used for our study is discrete choice modelling, and the purpose of this paper is to identify the main determinants of the demand for LTC coverage, and provide estimates of the willingness to pay (WTP) for alternative cover programs. In particular, an ad hoc choice experiment was carried out on a sample representative of the population of the Italian region Emilia-Romagna. While the use of choice modelling, since the seminal works by Propper (1990, 1995), has become standard practice in health economics, to our knowledge these techniques have never been used for studying the demand for LTC services. The choice modelling approach allows to identify the relative importance of the characteristics of the insurance program. Moreover, we test for the effects of a series of socio-demographic variables, family composition (e.g., where adult children are at home or not), personal and household health status indicators. Finally, particular attention is paid to the modelling of the choice whether preferring one of the hypothetical policies proposed, or the existing situation.

The answers to the choice experiment by the respondents have been studied through well established regression techniques (see Louvière, Hensher and Swait, 2000, for a survey). In particular, theoretical reasons and hypothesys testing lead us to rely on a 'nested logit with partial degeneracy' specification. By doing so, we have also endorsed and tried to make more operational the Ryan and Skatun (2004) recommendation to model the "opting out" option in stated preference studies. The main aim is to analyse both the propensity to insurance coverage and the choice probability for different insurance prospects.

We find a strong significance of selected attributes in determining the WTP, with indications in line with economic intuition. Also demographic and personal status indicators display clear significance in modelling the opt-out (i.e. choice of the status quo) stage in the nested logit framework. The preliminary estimates of the mean WTP obtained from econometric estimates seem to conform with the present evaluations of the financial burden which would be related to the introduction of an extensive LTC coverage program.

The structure of the paper is the following. The next section illustrates the empirical analysis which was carried out. Section 3 is then devoted to the presentation of the econometric framework which we have adopted in the elaboration of the sample answers. In section 4 we present the results of our econometric estimates, and comment the main implications of the results which have been found. Finally, section 5 presents some preliminary conclusions of this work.

2 The dataset and the discrete choice experiment

In spite of a growing debate, Italy is characterised by the absence of universal programs for covering LTC expenditures. In order to collect information on the potential interest for implementing new programs aimed at financing LTC expenditures, between October and December 2002 a survey was carried out at regional scale as a part of a "national interest project" on LTC. A questionnaire collecting information on socio-economic status, health conditions and household demographic composition was submitted by means of personal interviews to a representative sample of the population of the Italian region Emilia-Romagna.

A check for the internal consistency of the answers was carried out on the initial 1415 questionnaires (see below for details). This was passed successufully in most cases. In a couple of cases, respondents did not complete the choice experiments. Finally, 148 interviews were dropped in our analysis because of missing information on household income. Therefore, regressions reported in section 4 have been carried out on a subsample of 1176 observations.

As outlined in the introduction, the interview included the elicitation of WTP for LTC coverage by means of a discrete choice experiment, whose main steps are described below. An clear, though introductory, illustration of the methodology can be found in Bateman et al. (2002), while Louvière et al. (2000) provide an in-depth overview of its foundations and current applications. The first issue to be addressed is the definition of the hypothetical scenario that serves as a framework for individual choices. Here it has been constructed following the indications emerged from a panel including economists and statisticians from the University of Bologna and experts of health and social services from the Regional Agency of Health Care Services of Emilia Romagna. The choice of the attributes was based on two main criteria: their policy relevance and feasibility of administration of the interview to a sample of respondents drawn from the general population. In particular this concern has suggested not to exceed the number of four attributes.

The definition of the scenario is typically a very critical operation, and in this case difficulties were exacerbated by the very nature of the service involved. First of all, because long term care encompasses a wide range of services dealing with levels of disability that vary considerably among them. Secondly, because for the same health conditions different transfer schemes can be designed, ranging from in-kind provision of care, to cash payment defined according to severity or to the expenses actually afforded.

The survey tackles this complexity by anchoring the insurance coverage to a specific health status, described as a condition in which "people need help for several hours per day for activities of daily living„ and for which "both home and residential care can be considered appropriate from a clinical point of view„ although they are different with respect to the monetary cost and the amount of caregiving left to the family. In order to ensure a homogeneous perception of the health status described above, the need of care has been quantified also in monetary terms, by prospecting a monthly cost of 1550 euros (former

3,000,000 ITL) in case of residential care and of 1033 euros (former 2,000,000 ITL) for home-care. It has been specified that these amounts have to be considered as extra-costs, in addition to the support currently offered by the public sector. The service proposed did not imply the lack of coverage for heavier or less serious syndromes, and respondents had been informed about that.

A second problem is represented by the typical form assumed by existing health insurance schemes, which usually include clauses for the extension of coverage to family members. The extension to additional members of the household is straightforward in case of public coverage, where the service typically covers to the entire population. In the case of private voluntary insurance, extension schemes are usually available in standard contracts. However, had the survey allowed for that, the WTPs recorded would have been refferred to inherently different goods. To avoid that, respondents have been explicitly informed that the prices for the insurance plans proposed in the choice experiment were to be considered as covering only the respondent, notwithstanding the existence of wider range of possibilities in the real world, such as extension to one or more family members with or without additional costs for the subscriber.

Starting from this common framework, some hypothetical insurance schemes for LTC risk are offered to the respondent. Each alternative varies with respect to the values and characteristics assumed by four relevant attributes: a) the insurance premium, b) the funding scheme, c) the copayment rate, d) the option right for extending coverage to the additional expenditures determined by the eventual choice of residential care. The following table describes the attributes and related levels which were used in the choice experiments.

Attributes		***Levels***
Financing scheme:		*Public* (general taxation/compulsory participation)
		Private (insurance premium/voluntary participation)
Yearly cost of coverage:	*(in Euros)*	*103 258 387 516 775*
Degree of coverage :		*Low coverage (70% copayment rate)*
		Medium coverage (50% copayment rate)
		High coverage (25% copayment rate)
		Total coverage (0% copayment rate)
Option for covering additional costs of residential care:		*Included* / *Not included*

Table 1: Attributes and levels of the scenario

Some clarifications are needed, first of all with respect to the funding scheme. In particular, for the public funding case, it is stated explicitly during the interview that the proposed solution consists of a homogeneous coverage provided to the whole population. Participation is compulsory and the service is financed by means of an increase in the income tax actually paid by the respondent. The respondent was explicitly informed that in case of public provision the price indicated as "insurance cost" consisted in a tax price.This typically implies that citizens richer than him or her would have been asked to contribute more, and vice-versa for the poorer. Conversely, in the case of private insurance, participation is voluntary, and the level of coverage is allowed to vary according to the subscriber's preferences. Moreover, each subscriber of the same policy would pay the same premium independently of her or his income.

As for the "option for covering additional costs", it consists of the possibility to apply the copayment rate to the entire amount of expenditures also in case the subscriber would choose a "residential" LTC provision. When this option is not included, the policyholder can still opt for residential care but he has to bear entirely the additional costs which follows from it. In particular, he or she does not receive any reimbursement for the extra expenditures which can be ascribed to the choice of the nursing home.
Given these attributes and their levels we have a full factorial of 64 possible alternative insurance packages. We selected a half of this factorial according to an "end-point fractional design", in order to allow for interactions between the extremes of the attributes (see Louvière et al., 2000; Adamowicz et al., 1998). A status quo option has been also introduced, consisting of no additional coverage with respect to the level ensured by the public sector when the interview was carried out. In this case the choice of the status quo implies that the respondent prefers not to extend his coverage for LTC, withdrawing the two proposed insurance packages. Figure 1 below presents as an example one of the choice sets submitted during the interviews.

Let us assume that only the three solutions below are made available. Which one would you choose?

Characteristics of the service	**Solution A**	**Solution B**	
Way of payment	Public coverage	Private insurance	**Present situation**
Copayment rate	Total coverage (0% left to the patient)	High coverage (25% left to the patient)	
Option for covering additional costs	Without the option to cover residential costs	With the option to cover residential costs	
Cost of the coverage	Lire 500.000 (€ 258) per year	Lire 1.500.000 (€ 775) per year	
Preference (thick only one)	❒	❒	❒

Figure 1: *Example of the show-cards used in the survey.*

More in detail, each respondent has been asked to repeat 11 times the choice between status quo and two different scenarios that provide additional coverage, where attributes vary at each repetition. In order to control for the respondent actual understanding of the exercise, one of the choices is characterised by the presence of a (strictly) dominant alternative. Strict dominance implies that the two packages (A and B) have the same qualitative attributes (public or private financing and possibility or not to extend the coverage to the additional costs of residential care). One package does better for at least one of the quantitative attributes (cost and copayment rate) and does not do worse for the others. The (very few) respondents who chose the dominated solution were excluded from the sample. For the respondents who made the "correct" choice, the dominant card was excluded from the estimation, since the decision on that choice set could not be considered effectively informative on the trade-off between attributes.

In the case of experiments with several choices, it is unlikely that the replications from the same individual are truly independent. With the purpose of limiting order bias, the show-cards with the experimental choice sets were rotated sequentially. However, as pointed out in Louvière et al (2000), the only effects which are usually implied from repeated choices are on statistical efficiency, but not on unbiasedness. Train (2003, p. 46, 55) observes that logit probability estimations can handle the dynamics of repeated choice, including state-dependence, as far as unobserved factors that affect decision makers are independent over the repeated choice.

The sample used for the estimation also includes individuals who have always chosen the status quo. The fraction of respondents who always prefer the status quo amounts to 23% of the sample. Given this high share, we carried out an analysis aimed at check if this could significantly affect the quality of the results. More precisely, with an *ad hoc* question, we were able to indentify those respondents who actually did not consider at all the possibility to choose one of the insurance alternatives proposed since they were not interested in any LTCcover scheme. Broadly speaking, our control could be considered an analogous of the detection of protest zeroes in contingent valuation studies. We found that these answers were quite uniformely distributed along the sample, whithout significantly changing the distribution of the design and other relevant characteristics, such as family income, respondent's age and education level. so that no systematic bias from their exclusion occurs.

Starting from respondent's choices, the choice modelling approach allows to evaluate the service on a monetary metric basis, under the assumption that the overall utility equals the sum of the utilities obtained from the single attributes. We assume that utility decreases with cost and copayment rate, whereas it increases with coverage extension. Conversely, there are no prior expectations on the effect of moving from a public to a private financing scheme. With respect to the standard approach the utility function in our case must be slightly modified because of the presence of two qualitative attributes which ensure a positive marginal utility only in case the service is purchased. This implies that we cannot make any inference on the WTP for scenarios where coverage is kept fixed at the status quo and the changes concern only the two quantitative attributes. These situations are of scarce interest since monetary evaluations of changing regime of provision as well as extending coverage to residential care become relevant only if the coverage is purchased.

3 The econometric approach

In most economic applications, the analysis of the data obtained from choice experiments has been mostly carried out by means of a discrete choice model labelled by some authors (e.g. Mc Fadden, 1984; Louvière *et al.*,2000) a*s multinomial logit (henc*eforth, MNL), and by others (e.g. Greene, 2003) *conditional logit.* After having been initially developed in the transportation and marketing literature, the choice experiment technique has increasingly found applications in environmental economics (e.g., see Hanley, Mourato, and Wright, 2001) and, in more recent years, in health economics (e.g. Ryan and Gerard, 2003; Propper, 1995).

Despite its large use, the probabilistic structure of the MNL model - which we briefly revise below- has some implications which may result problematic in our case, so that less straightforward approaches may become more appropriate.

It is well known that in the MNL model, data arising from the $k = 1, 2, \ldots K$ mutually exclusive observed choices, and taken by a sample of $h = 1, 2, \ldots, H$ respondents, can be described according to a random utility specification such as the following:

$$U\,(\text{choice } k \text{ by respondent } h) \equiv U_k^h = V_k^h + \epsilon_k^h = \boldsymbol{\beta}'\mathbf{x}_k + \epsilon_k^h, \tag{1}$$

where the vector $\mathbf{x}_k$ may refer whether to characteristics of the choice alternatives or of the respondent. This modelling implies that the individual utility is given by the sum between an observable component V_k^h and and a stochastic unobservable part ϵ_k^h.

Depending on the assumptions made on the distribution of ϵ_k^h,we obtain different discrete choice models. In the MNL, the individual random components $\boldsymbol{\epsilon}_k^h$ are assumed to be independently and identically distributed (IID), with an extreme value type 1 (Gumbel) distribution with mean $\eta + \gamma/\mu$ (η is the mode of the distribution, μ is a positive scale parameter and γ is the Euler's constant equal to 0.577) and variance $\sigma^2 = \pi^2/6\mu^2$. In fact, the IID hypothesis implies that cov $\left(\epsilon_k^h, \epsilon_l^h\right) = 0$ and $Var\left(\epsilon_k^h\right) = \sigma^2, \forall k$ so that on the whole the variance –covariance matrix of the MNL simply is $\Sigma = \sigma^2 I$. One can see, therefore, that in the MNL the equal standard deviations of the unobservables are inversely related to a common scale parameter μ.

The previous assumption on the functional form leads to the following specification of the probability that household h chooses alternative k:

$$P\left[y_h = k\right] = \frac{\exp\left(\mu\boldsymbol{\beta}'\mathbf{x}_k\right)}{\sum_{l=1}^{K}\exp\left(\mu\boldsymbol{\beta}'\mathbf{x}_l\right)}, \tag{2}$$

where y_h is an index of the choice made by household h. The scale parameter μ is usually normalized to 1. The vector $\boldsymbol{\beta}$ is common to all choices. This implies that the attributes similarly affect the utility for all the alternatives.

The IID assumption across alternatives of the error term in equation (1) leads to the so-called independence of irrelevant alternatives (IIA) property, which states that the odds of an alternative k being chosen over alternative l is independent of the availability of attributes or alternatives other than k and l (e.g., McFadden, 1984). Intuitively, this assumption is likely to be violated if some alternatives are perceived as closer substitutes than others. From a statistical viewpoint, in the presence of subsets of similar alternatives, the independence condition may result as a very strong one because it is quite likely to have, within these subsets, common unobserved factors which affect the error standard deviation in a common way that is different from less similar alternatives (i.e. giving rise to different scale parameters μ_k).

These considerations suggest that the MNL could be unfit to our case, where two alternatives implying different forms of coverage extension are confronted with a third solution characterised by no additional cover. This point can be better assessed by providing the nature of the decision process implied by our choice experiment with some economic structure. In particular, for any respondent, each repetition of the choice experiment can be interpreted as the outcome of two (simultaneous) decisions:

- whether or not extending the coverage against the risk of LTC expenses or opting for the present level of coverage;

- choice of the preferred insurance scheme between two alternatives that differ in the levels of four relevant attributes.

As an alternative consistent with this framework, let us model the unobservables in (1) according to the following additive error structure:

$$\epsilon^h\,(i,j) = u_i^h + u_{j|i}^h, \tag{3}$$

where now index j relates to the existing elementary alternatives (*insurance A, insurance B, status quo)* and the index i relates to the choice of whether or not extending coverage against LTC risk. In other words, the random term affecting final choices is the sum of two independent components: a specific one (conditional on the two decisions) and a common one.

The previous additive specification is the base for the *nested logit* (NL) model, where the variance (and the scale parameter μ_i) is allowed to differ across "nests of choices" (in our case coverage extension vs status quo), while the IIA property is retained within groups. Independence of unobservable utilities is kept across nests, whereas the $\epsilon^h(i, j)$ are correlated within nests.

Namely, the unobservable terms related to final choices now have a Gumbel distribution with variance

$$Var\left(u^h_{j|i}\right) = \frac{\pi^2}{6\mu_i^2}, \ \forall i, j. \tag{4}$$

The property of an equal variance is instead kept within each cluster at the level of the decision of whether or not to choose a cover against LTC risk, namely:

$$Var\left(u^h_i\right) = \frac{\pi^2}{6\lambda^2}. \tag{5}$$

The NL model represents the most usual technique used when standard testing procedures reject the IIA assumption. By partitioning the overall process according to the two choices, NL keeps the IID condition within each partition, while the non-independence of unobserved heterogeneity is related to nesting.

As outlined for example by Hunt (2000), in a NL model the alternatives are organised in clusters (or partitions) reflecting a supposed similarity between "grouped alternatives", so that individuals are hypothesised to consider as more similar to one another the alternatives placed within the same cluster than those from different clusters. In formal terms, the intra-partition similarity is assumed to arise in the form of a positive correlation of the unobserved utility components deriving from a shared upper-level unobserved utility component (e.g., see Louvière et al. 2000).

Because of these characteristics, the use of NL models has been advocated (e.g. Morey, 1999) for those cases where a “non participation” alternative exists. For these situations, it is remarked (e.g. Carrasco and Ortúzar, 2002) that the NL is still able to reproduce observed market shares at the upper level and for non nested options (i.e. the status quo choice). In the health economics literature, a similar approach has been proposed by Ryan and Skatun (2004), for the analysis of the ‘opting out’ alternatives in discrete choice experiments.

Similarly, in our study a rejection of the IIA assumption indicates that a significantly larger correlation is observed between the choice of two insurance scheme alternatives, than between an insurance alternative with the status quo decision. The latter is actually a non participation alternative, which is intuitively different from a choice among elementary alternatives. By framing the abovementioned two choices which a household should make as the two nests of a two-level NL model, we end-up more precisely in a “NL with partial degeneracy”, given that there is only one single ‘no insurance’ option. In the case of our choice experiments, in the first nest the respondent chooses whether or not to buy an LTC insurance; in the second one he or she selects the preferred alternative conditional on having chosen to insure, or to opt for the status quo otherwise.

Overall, a partially degenerate NL seems a first appropriate solution, in order to predict the probability of choosing the two alternative insurance schemes, conditional on having chosen to ensure against LTC. We discuss now the structure of this estimation model.

3.1 *A nested logit model with partial degeneracy*

Nested logit models with partial degeneracy have received attention, in recent years (e.g., Hunt, 2000; Hensher and Greene, 2002), and the reference to this literature enables a more rigorous analysis of cases with a 'non participation' option like ours. Moreover, when the 'non participation' alternative reposes on a likely distinct economic rationale, the existence of a degenerate branch allows to include any observation-specific effect effects (e.g. demographic, health and economic status variables) in a utility expression for the top level (e.g. Greene, 2003; Louvière et al., 2000).

We represent our case graphically in figure 2, where it is represented the first stage in which the respondent chooses whether or not to buy an LTC insurance, and the second stage referring to the choice among elemental alternatives

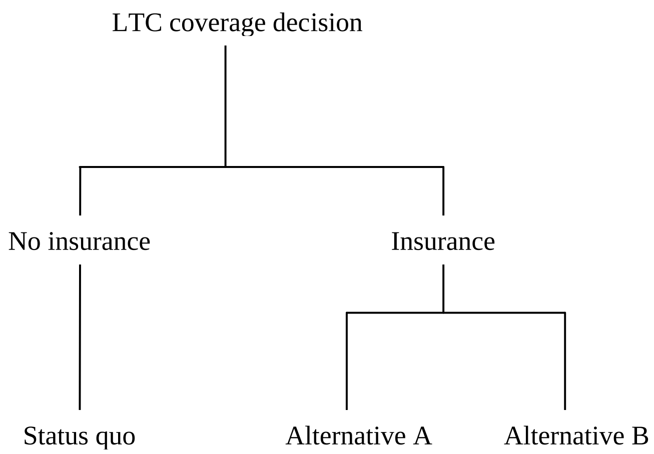

Figure 2: The decision tree for the LTC cover choice experiment

With a partially degenerate choice structure, the non-degenerate partitions display marginal and conditional probabilities of the standard NL model.

Let us now better define the random utility structure (henceforth, we omit the household index h). For a generic elemental choice j, beloging to upper level i, respondent's utility takes the form:

$$U(i,j) = U_i + U_{j|i}, \tag{6}$$

which can also be written as follows:

$$U(i,j) = V(i,j) + \epsilon(i,j), \tag{7}$$

where the $V(i,j)$ indicate the non stochastic utility components and $\epsilon(i,j) = u_i + u_{j|i}$ is the stochastic utility component.

In order to formally define our case, we distinguish between variables which influence the choice at the j level ($\mathbf{x}$), and variables which affect the choice to insure or not to insure ($\mathbf{z}$).

Under the hypothesys that the deterministic part of the indirect utility function is additively separable we can write

$$\begin{aligned} V(i,j) &= V_i + V_{j|i} \\ &= \boldsymbol{\gamma}'\mathbf{z}_k + \boldsymbol{\beta}'\mathbf{x}_l \end{aligned} \tag{8}$$

By using (3), this leads to:

$$U(i,j) = \boldsymbol{\gamma}'\mathbf{z}_i + \boldsymbol{\beta}'\mathbf{x}_j + u_i + u_{j|i}. \tag{9}$$

At the upper (insurance decision) stage, we define the non stochastic utility component as :

$$U_i = \boldsymbol{\gamma}'\mathbf{z}_i + u_i. \tag{10}$$

The joint probability that household h chooses alternative j is given by the product between a marginal and a conditional probability:

$$\Pr[y_h = i, j] = \Pr[w_h = i] \times \Pr[s_h = j|i]. \tag{11}$$

An useful way to make explicit the previous expression for NL models is to define the "probability choice system" (PCS), which includes the marginal choice probabilities associated to the choice at the upper level, the conditional probabilities associated to the choices at the lower level, and the so called "inclusive value" (or "expected maximum utility").

The formal expressions for the PCS of the NL proposed by a recent stream of literature (Hensher and Greene, 2002; Louvière *et al*, 2000; Hunt, 2000) pay special attention to the peculiarities of NL with degenerate branches and the role of normalizations of the scale parameters which are associated with the variances of the nests of the model. As we have seen with (4) and (5), in the two-level NL model, these variances are related to scale parameters λ_i associated to the upper level, and to μ_i parameters for the elemental alternatives level. At the level of each branch level choice i, the conditional choice probability for the elemental alternatives can be written in the following way:

$$\Pr[s_h = j|i] = \frac{\exp\left(\mu_i \boldsymbol{\beta}'\mathbf{x}_{j|i}\right)}{\sum_{j=1}^{J_i} \exp\left(\mu_i \boldsymbol{\beta}'\mathbf{x}_{j|i}\right)} = \frac{\exp\left(\mu_i \boldsymbol{\beta}'\mathbf{x}_{j|i}\right)}{\exp\left(IV_i\right)}, \quad \text{for all } i \tag{12}$$

where J_i is the number of possible elemental choices in branch i (*1 if i=not insure, 2 if i = insure*)

The marginal probability at the "branch" level, that is for the decision whether or not to insure against the LTC risk, is:

$$\Pr[w_h = i] = \frac{\exp\left[\lambda_i \boldsymbol{\gamma}'\mathbf{z}_i + \frac{\lambda_i}{\mu_i} IV_i\right]}{\sum_{i=1}^{I} \exp\left[\lambda_i \boldsymbol{\gamma}'\mathbf{z}_i + \frac{\lambda_i}{\mu_i} IV_i\right]}, \tag{13}$$

where the symbol IV_i defines the following "inclusive value":

$$IV_i = \ln \sum_{j=1}^{J_i} \exp\left(\mu_i \boldsymbol{\beta}'\mathbf{x}_{j|i}\right). \tag{14}$$

Hence the joint probability (11) takes the form (e.g. Louvière *et al.*, 2000):

$$\Pr\left[y_h = i, j\right] = \frac{\exp\left[\lambda\boldsymbol{\gamma}'\mathbf{z}_i + \frac{\lambda_i}{\mu_i}IV_i\right]}{\sum_{i=1}^{I}\exp\left[\lambda\boldsymbol{\gamma}'\mathbf{z}_i + \frac{\lambda}{\mu_i}IV_i\right]} \cdot \frac{\exp\left(\mu_i\boldsymbol{\beta}'\mathbf{x}_{j|i}\right)}{\sum_{j=1}^{J_i}\exp\left(\mu_i\boldsymbol{\beta}'\mathbf{x}_{j|i}\right)} \tag{15}$$

Two considerations are usually reported in the literature about the role of the scale parameters and their ratio λ_i/μ_i, known as the "inclusive value coefficients" (or parameter). The first relates to the value which this inclusive value coefficient should assume. It is observed that, given that the assumption of the NL model that the lower level (with error component $\left(u_i + u_{j|i}\right)$) shares part of its unobservables with the higher level (with has error component u_i), then the variance at the lower level must be the highest. As a consequence, given the proportionality between the scale parameters of the assumed Gumbel distribution and the standard deviation of unobservable terms, if the NL specification is correct, the estimated inclusive value coefficient λ_i/μ_i must lie in the interval $(0, 1)$. Under a slightly different perspective, this result is economically related to the higher degree of similarity between alternatives which share the same upper level. In fact, it can be shown (e.g. Ben Akiva and Lerman, 1985; Hunt, 2000) that the correlation of the indirect utilities of any pair of elemental alternatives within the same nest is $\rho_i = 1 - (\lambda_i/\mu_i)^2$, which is clearly zero for $\lambda_i/\mu_i = 1$. Hence, to reflect plausibly the preferences of utility-maximizing individuals, the IV coefficient must be between 0 and 1). The closer the coefficient is to unity (zero), the less (more) the degree of perceived similarity of the alternatives considered.

The second consideration refers to the identification issues which the presence of the scale parameters entails. In fact, we can see from equation (13) that the IV parameter is identified (since an estimate of the ratio can be obtained). However, this is not the case for the utility index $\boldsymbol{\gamma}'\mathbf{z}_i$, since its value is multiplied by the (unidentified) scale parameter λ_i. A similar consideration applies for the lower level utility index $\boldsymbol{\beta}'\mathbf{x}_{j|i}$, given the presence of μ_i.

A normalisation of the general representation of the PCS given by equations (12-14) is therefore needed, by setting one scale parameter equal to 1 (and common to all nests). As outlined by Louvière *et al.* (2000), there are no clear indications of the particular implications of normalizing with respect to the branch level scale parameter ($\lambda = 1$) rather than to the lower level scale parameter ($\mu = 1$). The same authors report that most empirical studies normalise the branch level utility index by setting $\lambda = 1$. From a practical point of view, it is remarked that this kind of normalization, in a few works (e.g. Hensher and Greene, 2002) labelled as "random utility model 2" (RU2), has the advantage to enable the researcher to carry out a direct confrontation of NL estimates with the parameters obtained with a MNL model, relate normalization to total variance of the error distribution, and lead to a simpler PCS. (Carrasco and Ortùzar, 2002). In the next section, we follow this convention, also in light of some invariance results in the case of degenerate branches enlighted by Hunt (2000). We therefore report below the expressions of the PCS for the case $\lambda = 1$.

a) conditional choice probability for the elemental alternatives:

$$\Pr\left[s_h = j|i\right] = \frac{\exp\left(\mu_i\boldsymbol{\beta}'\mathbf{x}_{j|i}\right)}{\sum_{j=1}^{J_i}\exp\left(\mu_i\boldsymbol{\beta}'\mathbf{x}_{j|i}\right)} = \frac{\exp\left(\mu_i\boldsymbol{\beta}'\mathbf{x}_{j|i}\right)}{\exp\left(IV_i\right)}, \quad \text{for all } i \tag{16}$$

b) marginal probability at the "branch" level:

$$\Pr\left[w_h = i\right] = \frac{\exp\left[\boldsymbol{\gamma}'\mathbf{z}_i + \frac{1}{\mu_i}IV_i\right]}{\sum_{i'=1}^{I}\exp\left[\boldsymbol{\gamma}'\mathbf{z}_i + \frac{1}{\mu_i}IV_i\right]}, \quad \text{for all } i \tag{17}$$

c) “inclusive values”:

$$IV_i = \ln \sum\nolimits_{j=1}^{J_i} \exp\left(\mu_i \boldsymbol{\beta}' \mathbf{x}_{k|i}\right), \qquad \text{for all } i. \tag{18}$$

As it can be seen, the change is in the marginal probability at the branch, where the utility index is directly computable, and the IV parameters reduces to $\frac{1}{\mu_i}$ (this is true for the non degenerate partition, whereas for the degenerate brach it is not identified: see Hunt, 2000). By using the estimate of the latter, it follows that also the lower level utility index can be identified. Notice that, given the theoretical condition $\lambda/\mu_i<1$, in this case the estimated lower scale parameter μ_i is expected to be larger than one.

4 Main estimation results

In this section we present the results of our estimates. By following an usual presentation scheme, we start with the outcome of a MNL estimation carried out with the attributes as regressors, whose results are reported in Table 2. On the right hand side of the table, we report the results obtained by running a regression where the endpoint design of the experiment has been exploited. Namely, we had to the regressors of the main effects deseing the interactions between public coverage and cover esxtension for the extreme cases of 100 and 30 per cent coverage. Here we present only the interactions which are significant.

The paramaters for all attributes are highly significant. In accordance with economic expectations, increases in the percentage of covered expenditures and the option for covering the extra costs from residential care are both positively evaluated. As reported later in Table 4, by computing the ratio between the parameter related to the copayment rate and the price coefficient we obtain an estimated marginal willingness to pay of 11 Euros for an additional percentage point of coverage. At this level of the analysis, the most interesting result in a policy perspective is that public coverage emerges as the preferred institutional solution; and that a quite strong effect emerges with regard to the option to extend the percentual coverage to residential care. The latter effect is even stronger with the estimation based on the ‘endpoint design’.

We do not proceed with a deeper comment of the multinomial estimates since the McFadden-Hausmann test indicated (chi-sq. = 650) a strong violation of the IIA hypothesis. Although based on a regression with the design attributes only, this test is totally relyable, given that the variation of individual specific attributes which do not vary among the choices are clearly not affecting the stated choices.

Hence, we move to the estimates of the NL model described in the previous section. One of the consequence of estimating a model with a degenerate branch is that it allows to include all attributes of the degenerate alternative and all the observation-specific effects in a utility expression for the top level of the decision tree (as suggested by Louvière *et al*, 2000, p. 154). In our case, there are no specific attributes related to the status quo alternative, and we simply relate the whole vector z_l of individual characteristics to the choice between extending coverage against LTC risk or maintaining unchanged the level of protection that emerges from current public support for disable elderly people.

The NL estimations are reported in Table 3. As anticipated above, they have been carried out by normalising on $\lambda_i = 1$, for all i. In particular, this permits a direct comparison of the values of the parameter of the attributes with the MNL specification. As can be seen, a quite long series of socio-demographic indicators suggested by theory have been successfully used to define the index $\boldsymbol{\gamma}'\mathbf{z}$. Following most examples in the literature, they have been inserted

Table 2: Multinomial logit estimation and McFadden-Hausmann IIA test

Variable	***MNL model with main effects only***			***MNL model with design interactions***		
	Coefficient	*z-stat.*	*Prob*	*Coefficient*	*z-stat.*	*Prob*
Financing scheme (0 private, 1 public)	0.2960	11.26	0.000	0.3442	10.39	0.000
Extension to residential care expenses	0.5564	21.31	0.000	0.6258	22.20	0.000
Degree of percentage coverage	0.0178	31.20	0.000	0.0156	16.65	0.000
Yearly cost of coverage	-0.0016	-25.91	0.000	-0.0016	-25.86	0.000
Interaction between "extension" and "low coverage"				-0.4460	-6.13	0.000
Interaction between financing scheme and "total coverage"				-0.0729	-1.29	0.198
Alternative specific constant (0=status quo)	-1.3933	-25.81	0.000	-1.2328	-16.35	0.000
Diagnostic statistics and tests						
Log likelihood function	-11625.3			-11603.3		
Pseudo R-squared	0.100			0.102		
Hausman test for IIA (*model without ASC*). (Excluded choice is "status quo"						
Chi Squared[4]	650.2					
Number of observations	11760			11760		
(Number of respondents)	*(1176)*			*(1176)*		

as determinants of the 'no insurance' choice. As pointed out for example by Train (2003), this implies that the associated coefficient represents the (negative of the) differential effect of the socio-demographic variables on the utility of extending insurance cover compared to maintaining the status quo.

A first important remark that can be drawn from the estimation is that the value of the IV parameter (0.549 and 0.566) and its high significance level indicate the statistical appropriateness of adopting the two level NL specification. In light of what we said in the previous section, we know that this value must lie between 0 and 1, where the latter value implies a MNL specification. If we limit the analysis to the restricted sample, the exclusion of households displaying no interest for coverage reduces the degree of dissimilarity between the status quo and the alternative insurance scheme, yet the value of the parameter indicates that they cannot be considered as equal substitutes.

Overall, it can be seen that a large proportion of the variables included in the regression display significant effects. The sign of the coefficients meets prior expectations in most cases. On the top of the table, we can see that the four attributes included in the insurance package are all highly significant, although the lower z-statistics indicate higher standard errors than in the MNL model. With respect to the latter, also remark that the coefficients display smaller aboslute values because of the different common scale parameter implied from the NL. The coefficients of the continuous variables (cost and degree of coverage) both have the expected sign. The same happens for the option to extend cover to additional residential care expenses (dummy equals 1 when the option is included). The financing scheme has been coded by setting the private insurance as a base, that is equal to zero, for the related dummy variable. We leave to the next subsection, where monetary equivalents of the estimates are

Table 3: Estimates results with the nested logit specification

Explanatory variables	***Nested Logit with main effects***			***Nested Logit with design interactions***		
	Coefficient	*z-stat.*	*Prob*	*Coefficient*	*z-stat.*	*Prob*
"Choice of alternatives" process						
Financing scheme (0 private, 1 public)	0.1930	9.80	0.000	0.2443	9.49	0.000
Extension to residential care	0.3413	12.88	0.000	0.3900	12.50	0.000
Degree of % coverage	0.0120	14.78	0.000	0.0116	12.77	0.000
Yearly cost of coverage	-0.0011	-14.50	0.000	-0.0011	-14.48	0.000
Interaction between "extension" and "low coverage"				-0.2176	-4.23	0.000
Interaction between financing scheme and "total coverage"				-0.1083	-2.59	0.010
ASC (0 for status quo)	-1.1563	-4.81	0.000	-1.1388	-4.71	0.000
"Insurance decision" process						
Age	0.0195	7.93	0.000	0.0195	7.93	0.000
Family Income in €	-0.0002	-6.43	0.000	-0.0002	-6.41	0.000
Sex (1 if male)	-0.1597	-3.63	0.000	-0.1601	-3.64	0.000
Household size	0.1903	7.86	0.000	0.1903	7.85	0.000
Spouse	-0.0050	-0.09	0.930	-0.0041	-0.07	0.943
Young children	-0.2302	-4.06	0.000	-0.2308	-4.07	0.000
Adult children	0.1119	1.33	0.185	0.1112	1.32	0.188
University degree education	-1.1502	-6.39	0.000	-1.1457	-6.36	0.000
Secondary school education	-0.6777	-4.00	0.000	-0.6742	-3.98	0.000
Compulsory education	-0.5778	-3.48	0.001	-0.5749	-3.46	0.001
Blue collar occupation	0.1049	1.42	0.154	0.1070	1.45	0.146
White collar occupation	-0.0270	-0.42	0.673	-0.0264	-0.41	0.680
Retired	-0.1988	-2.76	0.006	-0.1978	-2.74	0.006
Not working	0.0272	0.35	0.725	0.0290	0.38	0.707
Other employment status	0.4555	3.12	0.002	0.4578	3.13	0.002
Chronic disease	-0.0491	-0.90	0.368	-0.0502	-0.92	0.358
Self assessed health status (0 for good, 1 for bad)	0.3342	6.28	0.000	0.3351	6.29	0.000
Subscriber of a private health insurance	-0.4719	-8.11	0.000	-0.4714	-8.10	0.000
In hospital in the last year	0.0629	0.94	0.345	0.0631	0.95	0.344
Smoker	0.0782	1.66	0.097	0.0790	1.68	0.094
Preference for "cash" LTC coverage	-0.0203	-0.49	0.624	-0.0215	-0.52	0.602
Existence of a person with LTC disability in the family	-0.2535	-5.17	0.000	-0.2531	-5.16	0.000
Health in the first 3 priorities for new public expenditures	-0.3229	-6.25	0.000	-0.3224	-6.24	0.000
Negative opinion of the quality of NHS care services	-0.1724	-3.48	0.001	-0.1734	-3.50	0.001
Negative opinion of existing LTC services	-0.0710	-1.52	0.128	-0.0718	-1.54	0.124
State should pay basic LTC services to all	-0.4730	-9.20	0.000	-0.4745	-9.23	0.000
State should pay basic LTC services only to the poor	-0.1563	-2.84	0.005	-0.1569	-2.85	0.004
IV parameters						
No insurance	unidentified			unidentified		
Insurance	0.5487	14.545	0.000	0.566	14.535	0.000
Diagnostic statistics and tests	*Value*			*Value*		
Log likelihood function	-11117.7			-11102.1		
Pseudo R-squared	0.156			0.158		
Number of observations	11760 (1176)			11760 (1176)		

presented, the analysis of the relative importance of the various attributes.[1]

Let us now comment on more specifically the coefficients in our NL regressions realted to the decision of whether or not to insure, by recalling that a positive sign indicates a higher probability to opt for the satus quo. First of all, the specification of the empirical model includes a group of socio-demographic variables such as family income (which refers to net monthly family income, that sums up respondent and, when present, spouse income), respondent's age, household size, presence of adult and yong children in the household. Income positively influences the probability of extending coverage (negatively affects the choice of the status quo). This result suggests that the price hurdle limits access to additional coverage especially at low income levels. Given the peculiar nature of LTC, achieving a substantially different degree of cover among citizens determined by income might be negatively evaluated. This has also important policy implications. If, besides meeting individual preferences, the policymaker objective function includes a specific egalitarian argument of this kind, the result for the income coefficient indicates that contributions to public programs should be designed in a rather progressive manner, possibly including exemptions for very low income groups. Contrariwise, tax allowance on private policies are effective in meeting individual preferences but they are also likely to widen the difference in the level of protection among different income groups.

The dummy variable that captures the presence of adult children at home was suggested by some theoretical models (e.g. Pauly, 1990) which have suggested that the presence of adult children discourage the purchase of LTC insurance because of intrafamily moral hazard. Since elderly people prefer to be assisted by their family members, they strategically choose not to insure, so that formal care is paid at full cost at the point of demand. This is expected to incentivate adult children to provide informal care to their parents, given that the entire amount of money spent in formal care reduce future bequests. Our estimates only partially support this congecture, as the presence of adult children at home decreases the likelihood of choosing a larger coverage, but the effect is not significant (the effect is more relevant when carrying out the regression without.

Also the result related to the age variable is of high policy relevance since it points out that younger generations are more favourably oriented towards a coverage extension. Often, a myopic attitude of young people has often been put forward as a possible explanation for the lack of demand of LTC insurance. Actually, since elderly people are more likely to be in need of LTC in the near future, one could have expected older respondents to be more willing to contribute to the program, an intuition contradicted by our empirical evidence. A possible explanation is that younger people face a larger uncertainty over the possibility to cover the risk of disability in the advanced age simply relying on current welfare programs. Ageing of the population and increasing restraints on the public budget may limit the possibility to provide an adequate level of coverage to future generations, who therefore are more interested in extending current programs.

Age is a good proxy for health status and consequently the positive sign of the age coefficient displays analogies with the additional result according to which individuals with poor self rated health state are more likely to opt for the status quo. In fact, we can see that not only elder, but also less healthy people should get a larger expected utility from insurance, but still they prefer not to top up the present level of LTC coverage. Whereas

[1] We also carried out estimates on a subsample of 'interested people' selected by ad additional question as described in section 2. Our goal here was to check if the inclusion of respondents who always opted for the status quo significantly affected the results. From these additional regressions, which we do not report here, we found that the quality of the results is unaffected by the exclusion of these non interested respondents.

generic bad health conditions do not increase the demand for coverage, chronic conditions and hospitalisation in the year prior the survey both have a positive influence on the probability of opting for a larger coverage. A possible explanation is that people who suffer of a generic bad health state may presume to qualify for free social care already under current legislation. On the contrary, chronic diseases and previous hospitalisation can be taken as more precise evidence of physical frailty which is also often directly associated with a direct experience of disability. People who are personally going through these experiences are more likely to be aware of the high (monetary and non-monetary) burden that's currently left to individual responsibility. They probably already receive some kind of help (either informal or publicly provided) or they perceive as particularly high the risk of needing assistance in the near future and in both cases the benefits from larger coverage tend to be highly evaluated.

Another group of variables included in the regression refers to respondent's educational and employment status. Differences in education produce relatively larger influences than those in working position. For the former variable the base case is represented by non educated respondents, all the coefficients are significant and their absolute value increases with the level of education attained. Hence, the empirical evidence suggests a positive association between education and propensity to cover which is probably due to a higher awareness of the difficulties to ensure the financial sustainability of LTC programs because of expected increase in demand of formal care. The result is consistent with empirical evidence provided by the revealed preferences literature that studies the demand for both long term care (Mellor, 2001) and supplementary medical insurance (see Besley, Hall and Preston, 1999) where most educated households are more likely to purchase coverage. On the contrary, the working position plays a minor role in the decision. White and blue collar workers do not present any significant difference with respect to the self employed, assumed as base case. Such result is not totally surprising if one considers that, differently from standard health insurance policies, LTC coverage acquires increasing importance as long as the policyholder gets older. Therefore the argument of larger opportunity costs of illness for self employed individuals is weakened for the kind of coverage we are considering here, since it is likely that most individuals will experience disabilities after retiring. Still, the coefficients for the retired and non occupied condition, although including a limited number of respondents, are significant with the former group more likely and the latter group less likely to choose the status quo.

It is also interesting to note that a negative opinion on the quality of care currently provided by the National Health Service favours an extension of coverage. Citizens do not seem to respond to unsatisfactory quality of public health care by relying on out of pocket expenditures. Contrariwise, the reaction is that of requiring additional financial support for ancillary programs such as the one proposed here concerning disability in the old age. Our dataset also contains an indicator of respondent's opinion on existing LTC services. This indicator did not show any significant role when considering the whole sample, whereas a positive effect on the propensity to choose a cover alternative is found in the subsample.

Finally, being a subscriber to a private health insurance policy has a positive impact on the probability of willing to contribute to LTC coverage. The result is consistent with prior expectations since policy holders are expected to be more risk averse and to perceive the insurance mechanism as an effective tool for facing health related risks.

4.1 Evaluation of attributes and welfare analysis:

This section focuses on the second objective of our study, that is the analysis of marginal WTP (and more in general of welfare effects) related to the introduction of coverage against

LTC risk. The issue of deriving welfare measures from discrete choice experiments has been recently largely debated in the health economics literature (Lancsar and Savage, 2004; Ryan, 2004; Santos Silva, 2004). Following Ryan's (2004) definition, we are essentially interested in obtaining the estimation of welfare effects related to a "state-of-the-world-model", i.e. a situation where it is known with certainty the kind of good or service which will be chosen by an individual. In this case the welfare measure for a change in the characteristics of an available alternative is the following

$$WTP = -\frac{1}{\beta_p}\left(V_0^h - V_1^h\right), \tag{19}$$

where the subscripts (0,1) define indirect utility functions before and after the policy change, and β_p is an approximation of the inverse of marginal utility of income, which in this kind of models is recovered from the estimated coefficient of a variable expressed in monetary terms. If only one attribute is changing, then we obtain an "implicit price".

As is explained, for example, in Louvière *et al.* (2000, p. 337), with an expression like (19) we get the compensating variation in the case a particular alternative (policy scheme) should be chosen by the individual with certainty. Alternatively, it can be seen as an appropriate measure for those cases where a quality variation applies to all the alternatives of the choice set (Haab and McConnell, 2002).

As long as WTP is determined as a difference between utility functions, it follows that in our model only the attributes determine the welfare measure, and that the utility index at the status quo can be set to zero.

Let first analyse the implicit prices of the single attributes. These values are derived from the parameter estimates reported on the top of Table 2 and 3 by dividing the estimated coefficients of the non monetary attributes by the negative of the coefficient of the "cost of coverage" attribute. Confidence intervals (at 95%) have been computed with the Krinsky-Robb procedure in order to assess the robustness of the results.

The value of the degree of coverage is probably the most interesting indicator for the evaluation of the marginal WTP in the case of a service sold in the market. In the base model, the estimated value is of 11.04 Euros per 1% increase in coverage, and this value is not affected by the choice of the estimation model. However, the MNL estimate is relatively more affectd by the inclusions of the significant interactions between low copayment rate and extention of the policy to residential care, and between total coverage and public provision of the policy.

A relatively unexpected result is the high value attached to the extension of the coverage to residential care expenditures (315 and 345 Euros in NL and MNL base specifications; nearly 20% more when considering the endpoint design), which are apparently perceived as a very worrying risk. More in general, the difference between MNL and NL estimates in this case is wider. Given that one additional percentage point of coverage is evaluated up to 11 euros, the option for residential care is evaluated as much as 28.5% percent point of coverage (from the NL estimates with the main effects design), up to 40% with the MNL estimates with the end point design). Indeed, with the estimation of the interaction effect, we can see that respondents (in a quite rational way) evaluate less the extention of coverage to residential care mainly for high copayment rates.

Finally, the preference for the public solution highlighted by the positive sign of the "financing scheme" coefficient amounts to 178 euros (which amounts to about 16 percentage point of coverage) of additional WTP with the NL estimates for the base model. For this

Table 4: *Estimates of monetary values of the attributes defining the policy and mean WTP*

	MNL estimations				NL estimations			
	Base Model		Model with interactions		Base Model		Model with interactions	
Attributes of the coverage programme	*Implicit prices in Euros*	*K-R 95% confiden interval*	*Implicit prices in Euros*	*K-R 95% confiden interval*	*Implicit prices in Euros*	*K-R 95% confiden interval*	*implicit prices in Euros*	*K-R 95% confiden interval*
1% Degree of coverage	11.04	*10.03 12.18*	9.56	*8.27 10.97*	11.03	*8.49 12. 80*	10.50	*8.49 12.8*
Option to cover residential costs	345.0	*305.1 387.7*	383.9	*341.2 431.4*	314.9	*256.1-384.1*	351.7	*284.9 430.4*
Option to cover residential costs if 30% coverage			110.3	*14.2 208.2*			155.4	51.8 267.9
Difference between private insurance and public cover	183.6	*149.2 219.2*	211.2	*169.5 255.5*	178.1	*137.2-226.1*	220.3	*168.5 281.1*
Difference between private and public cover if 100% cover			166.5	*86.8 248.1*			122.7	*35.9 213.3*
ASC (*0 for status quo*)	-864.0	*-775.6 -961.0*	-756.2	*-651.7 -864.3*	-1066.8	*-619.4 -1541.0*	-1027.1	*-589.5 -1505.9*
Scenario	***Mean WTP***	*K-R 95% confiden interval*	***Mean WTP***	*K-R 95% confiden interval*	***Mean WTP***	*K-R 95% confiden interval*	***Mean WTP***	*K-R 95% confiden interval*
75% of public cover and option to cover residential costs	492.8	*392.9 596.1*	555.6	*418.1 701.2*	253.2	*-191.9 711.9*	329.8	*-119.4 792.3*

attribute, the percentual difference between main effects and end point design estimates are even larger than for the cover extension option.

In addition to the calculation of the implicit prices of the attributes, we have applied equation (19) in order to come to an estimate of the overall mean WTP. This mean WTP needs to be estimated also considering the negative value of the alternative specific constant in order to adequately represent the share of respondents who always opted for the status quo option. If the policy would be introduced in a compulsory way, for some individuals this would be an 'utility loss'. And this needs to be considered.

The results are reported in the bottom part of Table 4 for a degree of coverage of 75%. In this case the difference between the MNL and the NL estimates is quite large. This is mainly due to the ASC value, since with the NL model we have been able to consider a series of individual specific regressors which the basic MNL could not take into account. An "undesired effect" of our nested logit approach to explicitly model the status quo option is that of getting a lower significance level of the constant. In turn, this clearly leads to much larger confidence intervals for the mean WTP estimates.

5 Discussion and conclusions

This paper has presented the intermediate results aroused from the analysis of the answer to a discrete choice experiment carried out on a representative sample of the population of the Emilia-Romagna region. The choice experiment was aimed at inferring the characteristics of the potential demand for LTC risk insurance services and eliciting the WTP for some basic policy prospects.

A basic scenario was varied according to the levels of four main attributes which defined the LTC coverage: the yearly cost of the insurance premium, the form of payment (whether through a voluntary subscription to a private company or compulsory personal income taxation), the option right to access different forms of care services, the co-payment rate.

As was remarked in the introduction, an analysis based on a stated preference approach may certainly prove useful for policy decisions, given the scarcity of information from real data and the need to evaluate a potential demand which tends to vanish because of agent's strategic behaviour.

In light of the results of the previous section, where the variables which defined the hypothetical policies were all highly significant, it seems us that choice modelling approaches can provide an important tool for designing and evaluating the structure of non-marketed health insurance programs. In particular, we think that it may be useful to model the insurance decision (thanks to specifications such as the nested logit we have proposed) arising from a "laboratory experiment", given that it permits to analyse *pure* demand effects which are often difficult to detect in real markets (when real markets exist!).

The welfare estimations derived from the regression results display a fairly high mean WTP, with a value of 10-11 euros per each percentage point of co-payment rate, although when thinking about the political feasibility of an actual introduction of coverage schemes it should also be kept in mind that one forth of the sample always preferred the current solution.

At this point of our research, we still find unsatisfactory that a large part of overall WTP is not captured by the characteristics of our hypothetical cover scheme or the individual-specific variables inserted in the regressions. Also a more extensive detailed analysis which would look to the differences of the estimated values for some specific quantiles of income and age variables could be interesting in future stages of this research.

References

[1] Adamowicz, W., Boxall, P., Williams, M., Louviere, J. (1998), "Stated preference approaches for measuring passive use values: Choice experiments and contingent valuation", *American Journal of Agricultural Economics*, 80, 64-75.

[2] Bateman. I.J., Carson, R.T *et al.* (2002), *Economic valuation with stated preference techniques,* Edward Elgar, Cheltenham, UK.

[3] Ben-Akiva, M.E. and Lerman, S. (1985), *Discrete choice analysis: theory and application to travel demand,* MIT press, Cambridge, Mass., USA.

[4] Besley, T., Hall, J., Preston, I. (1999), The demand for private health insurance: Do waiting lists matter?, *Journal of Public Economics*, VOL, 155-181.

[5] Carrasco, J.A. and Ortùzar, J. de D. (2002), "A review and assessment of the nested logit model", *Transport Reviews*, 22, 197-218.

[6] Cuellar, A. E., Wiener, J.M. (2000), Can social insurance for long term care work? The experience of Germany, *Health Affairs*, 19, 8-25.

[7] Economic Policy Committee (2001), Budgetary challenges posed by ageing populations, Working Group on Ageing Population, Brussels.

[8] Eisen R., Sloan, F.A. (1997). *Long-Term Care: Economic Issues and Policy Solutions.* Kluwer Academic Publishers, Boston

[9] Fuchs, V. R. (1996), *Individual and social responsibility: child care, education, medical care, and long-term care in America*, University of Chicago Press, Chicago.

[10] Garber, A. (1996), To comfort always: the prospects of expanded social responsibility for long-term care, in V. R. Fuchs (eds), *Individual and social responsibility: child care, education, medical care, and long-term care in America*, Chicago, University of Chicago Press, pp. 143-169.

[11] Geraedts, M., Heller, G. H., Harrington, C. H. (2000), Germany's long term care insurance: putting a social's insurance model into practice, *The Milbank Quarterly*, 78 (3), pp. 375-401.

[12] Greene, W. (2003), *Econometric Analysis, fifth edition*, McGraw Hill, New York.

[13] Haab, T.C. and McConnell, K.E. (2002). *Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation*, Edward Elgar, Cheltenham, UK.

[14] Hanley N., Mourato, S. and Wright, R. (2001), 'Choice Modelling: A Superior Alternative for Environmental Valuation?' *Journal of Economic Surveys,* 15, 435–462.

[15] Hensher, D.A., and Greene, W.H. (2002), Specification and estimation of the nested logit model: alternative specifications, *Transportation Research part B*, 36, 1-17.

[16] Hunt, G.L. (2000), "Alternative nested logit model structures and the special case of partial degeneracy", *Journal of Regional Science*, 40, 89-113.

[17] Lakdawalla, D. and Philipson T. (2002). "The rise in old-age longevity and the market for Long-Term Care", *American Economic Review,* 92, 295-306.

[18] Lancsar, E. and Savage, E. (2004), "Deriving welfare measures from discrete choice experiments: inconsistency between current methods and random utility and welfare theory", *Health Economics,* 13, 901-907.

[19] Louvière, J., Hensher, D.A. , Swait, J.D. (2000), *Stated choice methods*, Cambridge University Press, Cambridge.

[20] Mazzanti, M., 2003, "Discrete Choice Models and Valuation Experiments", *Journal of*

Economic Studies, 30, 584-604.
[21] McFadden, D. (1984), "Econometric analysis of qualitative response models, in Griliches, Z. and Intriligator, M.D. (eds.), *Handbook of Econometrics,* II, Amsterdam, Elsevier Science, 1395-1457.
[22] Meier, V. (1999), Why the young do not buy long-term care insurance?, *Journal of Risk and Uncertainty*, 8, 83-98.
[23] Mellor, J. M. (2001), "Long-term care and nursing home coverage: are adult children substitutes for insurance policies?" *Journal of Health Economics*, 20, 527-47.
[24] Mitchell, O.S., Piggott, J., Shimizutami, S. (2004), Aged-care support in Japan: Perspectives and challenges, NBER Working Paper 10882.
[25] Morey E.R (1999), Two RUMs unCKOAKED: Nested-Logit Models of Participation and Site Choice, in Herriges, J.A. and Kling, C.L., *Valuing Recreation and the Environment: Revealed Preference Methods in Theory and Practice*, Edwar Elgar, Northampton, USA.
[26] Pauly, M.V. (1990), "The Rational non-purchase of long-term insurance", *Journal of Political Economy*, 98, 153-168.
[27] Propper, C. (1990), Contingent valuation of time spent on NHS waiting lists, *Economic Journal,* 100, 193-200.
[28] Propper, C. (1995), "The Disutility of time spent on the United Kingdom's National Health Service waiting lists", *The Journal of Human Resources*, 30, 677-701.
[29] Ryan, M. (2004), "Deriving welfare measures in discrete choice experiments: a comment on Lancsar and Savage (1)", *Health Economics,* 13, 909-912.
[30] Ryan M, and Gerard K. (2003), "Using discrete choice experiments to value health care programmes: current practice and future research reflections", *Applied Health Economics & Health Policy*; 2: 55-64.
[31] Ryan, M, and Skatun, D. (2004), *Health Economics*, 13, 397-402.
[32] Santos Silva, J.M.C. (2004), "Deriving welfare measures in discrete choice experiments: a comment on Lancsar and Savage" (2), *Health Economics,* 13, 913-918.
[33] Sloan, F.A. , Picone, G., Hoerger, T.J. (1997), The supply of children's time to disabled elderly parents, *Economic Inquiry*, 35 (2), pp. 295-308.
[34] Train, K.E. (2003), *Discrete choice methods with simulation,* Cambridge University Press.