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ELICITING THE DEMAND FOR LONG TERM CARE INSURANCE: A DISCRETE CHOICE MODELLING APPROACH

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

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Abstract

In this paper we aim to estimate the willingness to pay (WTP) 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. To our knowledge, these techniques have been never used for studying the demand for LTC services. The adoption of a choice modelling approach allows for determining the relative importance of the characteristics which together compose the insurance programme. Then, we test for the effects of a series of socio-demographic variables and personal and household health status indicators.

An extended analysis by means of personal interviews was carried out, aimed at studying the attitude of the Emilia-Romagna population regarding the introduction of LTC insurance schemes. In addition to a wide set of questions related to health and socio-economic indicators of respondents and related household, each interview foresaw the implementation of a choice experiment for the elicitation of the WTP for LTC insurance programs. In particular, a basic scenario has been varied according to the levels of four main attributes which define 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.

Answers to the choice experiment have been studied through well established regression techniques for limited dependent variables such as nested logit models, aiming to analyse both the propensity to insurance coverage and the choice probability for different insurance prospects. Strong significance of selected attributes in determining the WTP is found, and the results harmonize with the economic intuition. Ceteris paribus, individuals assign an additional positive value to a public funded LTC insurance service. Also demographic and personal status indicators display clear significance, mainly when modelling the opt-out (i.e. choice of the status quo) stage by means of a "nested-logit" approach. Choice modelling seems to provide an important tool for designing and evaluating the structure of non-marketed health insurance programs.

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

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1. Introduction

In the last 15 years, both the social policy debate and public economics literature have experienced a growing attention to the issue of an adequate provision of long term care (LTC) services.[1] The effects of this debate are witnessed by the legislative interventions aimed at introducing public coverage programs, which date to 1994 in Germany, 1998 in Luxembourg, 2002-3 in the Italian autonomous provinces of Trento and Bolzano, to cite a few examples.[2]

The necessity to "care" about LTC risk is evident, given a few tendencies of most developed countries, namely the rapid ageing of the population, the increase in the cost of specialized care services, and the changing structure of households, which make more difficult the provision of informal care within the family. Lack of adequate coverage for the LTC risk is considered socially detrimental for several reasons, which include the fact that a solution based on intrafamily networks is often no longer feasible given the transformations occurred in the present societies, or is likely to have strong consequences on labour supply; and the fact that out-of-pocket expenditures from a long-lasting disability, although characterised by a moderate probability to occur, often have a "catastrophic" dimension, such that to strongly draw on individual and familiar wealth. The latter occurrence is usually perceived as inequitable since it affects these families in a very difficult period from a psychological point of view, and when allocation of time for labour and leisure is already constrained by the necessity to provide informal care. On the whole, economic problems are usually only a side-effect of the heavier burden represented by physical frailty. This explains why equity reasons should be considered with particular attention in this area and why they usually call for a substantial degree of socialisation of disability-related risk.

Difficulties in ensuring a widespread coverage for LTC costs by simply relying on completeness of existing markets (even when private health insurance is predominant like in the US, private policies for LTC risk are owned by no more than 5% of the population), suggest the need of policy interventions which may take different forms, ranging from an increase in private saving (Garber, 1996), to incentives for the development of private LTC insurance, or the introduction of specific programs for LTC, financed out earmarked social contribution or general taxes. The heterogeneity of the solutions proposed is influenced, on the one hand, by the features of the existing health and social care systems in the different countries, and reflects, on the other hand, different views on the most appropriate way to split the financial load for elderly care between individual and social responsibilities.

[1] Reference contributions for a survey of this debate are Fuchs (1996); EU Economic Policy Committee (2001). Reference to the debate in Italy include Beltrametti (1998, 2003) and Gori (2001, 2003).

[2] For the German solution, see Cuellar and Wiener (2000) and Geraedts, Heller and Harrington (2000).

Reflections and policy suggestions for the supply side of LTC risk coverage programs can not leave out of consideration the demand side of the issue, which is the main focus of this paper. However, evaluating the demand for LTC policy schemes from existing expenditure surveys or market data has usually been considered an unmanageable task, whether because of the lack of such specific information, or because of the market failures which hamper voluntary transactions between economic agents.

With respect to the last point, it has been pointed out, in the first place, that traditional market failures such as adverse selection and moral hazard affect LTC more strongly than health care financing. Since disability typically occurs in the old age, there is a lack of incentives for young people to purchase voluntary coverage, which keeps low risk agents out of the insured pool (Meier, 1999).[3] Secondly, there are peculiar features of LTC insurance that further limit the potential of a decentralised allocation mechanism to supply extensive coverage. Well known examples are the presence of non diversifiable risk due to aggregate changes in the expected costs of care (Cutler, 1993) and strategic behaviour that lead elderly people to limit LTC coverage in order to leave expenditure risk on their children's shoulder. In this way, younger generations have an incentive to provide informal care which is typically preferred to formal care by the elderly (Pauly, 1990).[4]

A "market" alternative to insurance is of course the purchase of caring services through out-of-pocket payments. A limited coverage in this case is a preference-driven choice and therefore is not attributable to market failures.[5] Yet, sub-optimal risk transfer may occur even here. A possibility of that is represented by myopic behaviour that leads individuals to underestimate the consequences of disability at earlier stage of life, and leave them exposed to an excessively high financial risk when they get older. Finally, scepticism about the optimality of revealed preferences can be related to the occurrence of situations in which consumers strategically choose sub-optimal level of coverage because they rely on last resort public intervention.

These various problems suggest that an unmet demand for this kind of services could be present without being "revealed" by market transactions. It turns out that an alternative approach based on "stated preference" information could be quite informative, in cases like that. In fact, this conjecture was at the base of a research project, which main result are presented in this paper. To estimate the willingness to pay (WTP) for long term care insurance prospects and its main determinants in a stated preference context, we adopt here a discrete choice modelling approach. In particular, an ad

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[3] Moreover, "insurance-covered" help in daily activities may be attractive for the insured even when health conditions do not strictly require it, raising monitoring costs in order to prevent demand abuse (Garber, 1996).

[4] A clear empirical validation of such conjectures has not been found (see Sloan, Picone and Hoerger, 1997; Mellor 2001)

[5] This low propensity is accentuated by the very nature of LTC services, which often require a modest expertise. This enables a high substitutability between professional assistance and informal care.

hoc choice experiment was carried out on a sample representative of the Emilia-Romagna population. To our knowledge, these techniques have been never used for studying the demand for LTC services. The adoption of a choice modelling approach allows for determining the relative importance of the characteristics which together compose the insurance programme. Then, we test for the effects of a series of socio-demographic variables and personal and household health status indicators, with particular attention to the modelling of the choice whether preferring one of the hypothetical policies proposed, or the existing situation.

We study the answers to the choice experiment by the respondents have been studied through well established regression techniques for this kind of limited dependent variables (see Louvière, Hensher and Swait, 2000, for a survey). In particular, theoretical reasons and hypotheses testing lead us to estimate a nested logit specification. 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 which harmonize with the 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. However, an important share of the sample always declared to be most satisfied with the present solution in Italy (i.e., loosely speaking, the lack of private or public widespread insurance schemes).

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 carried out

A survey on the attitudes towards LTC coverage was carried out by means of personal interviews between October and December 2002. A questionnaire, collecting information on socio-economic status, health conditions and household demographic composition was submitted to a representative sample of the population of the Italian region Emilia-Romagna. On the initial 1415 questionnaires, a check for the internal consistency of the answers was carried out (see below). This test nearly always passed. On the contrary, for the analyses carried out in this paper, 148 interviews (about the 15% percent of the sample) has not been used since the information on household income was missing. The regression analyses of section 4 have therefore been carried out on a subsample of 1191 observations.

As outlined in the introduction, the interview included the elicitation of WTP for LTC coverage programs by means of a discrete choice experiment,[6] whose main steps are described below.

The first problem to be addressed is the definition of the hypothetical scenario that serves as a framework for individual choices. This is typically a very critical operation and in this case difficulties are 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 care provision, to cash payment defined according to the severity or 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 level of care need for the case described 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. [7]

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. Had one allowed for that, he would have recorded WTPs for 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.[8]

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

[6] For an introductory level description of this technique, see the book on stated preference techniques by Bateman *et al.* (2002). For an in-depth overview of foundations and current applications of the method, see Louvière et al. (2000)

[7] The service proposed did not imply the lack of coverage for heavier or less serious syndromes, and respondents had been informed about that.

[8] The extension to household components is trivial in case of public coverage, when the service is extended to the whole population. In the case of private voluntary insurance, extension schemes are usually available in standard contracts.

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.[9] The following table describes the attributes and related levels which were used in the choice experiments.

Financing scheme:		*public* (general taxation/compulsory participation)
		private (insurance premium/voluntary participation)
Yearly cost of coverage: [10]	*(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*

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.[11] 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.[12]

As for the "option right", 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 ca be ascribed to the choice of the nursing home.

[9] The hypothetical scenario has been constructed following the indications emerged from a board 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 has suggested not to exceed the number of four attributes.

[10] The original values supplied to respondents were in ITL (200,000; 500,000; 750,000; 1,000,000; 1,500,000)

[11] The respondent was explicitly informed that in case of public provision the price indicated as "insurance cost" consisted in a tax price, and therefore citizens richer than him would have been asked to contribute more, and vice-versa for the poorer.

[12] Moreover, each subscriber of the same policy would pay the same premium independently of her or his income.

Starting from these varying attributes, a series of alternative insurance packages has been built, among which the respondents have been asked to choose in a series of one to one confrontations. The level of the attributes has been varied according to a "end-point fractional design", in order to allow for interactions between 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.[13] Figure 1 below presents as an example one of the choice sets submitted during the interviews.

Figure 1: *Example choice set*

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)	Low coverage (70% left to the patient)	
Option for covering additional costs	With 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)	❐	❐	❐

More in detail, each respondent is 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 11 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. In this case the choice turns out somewhat trivial, since, other things equal, any (risk averse) rational agent should prefer lower cost and copayment rate. Hence he should always opt for the dominant alternative. Following a standard strategy in the literature, we have excluded from the sample all respondents who choose the dominated solution, since their

[13] In this case the choice of the status quo implies that the respondents prefers not to extend his coverage for LTC, withdrawing the two proposed insurance packages.

comprehension of the proposed scenarios is questionable.[14] The sample used for the estimation also includes individuals who have always chosen the status quo.[15]

Starting from respondent 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.[16]

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 discrete choice multinomial logit models (henceforth, MNL).[17] Initially developed in the transportation and marketing literature, the technique has increasingly found applications in environmental and health economics in more recent years.[18] 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 $k_i = 1,2, \ldots K$ alternative observed choices taken by a sample of $h = 1,2, \ldots, H$ respondents can be described according to a random utility specification such as the following:

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

where the vector $\mathbf{x}_k^h$ may refer to both characteristics of the choice alternatives and of the respondent. The individual random components ε_k^h are assumed to be independently and identically

[14] The dominant card has been excluded from the estimation also for the respondents who made the "correct" choice, since the decision on that item could not be taken as informative on trade-off between attributes.

[15] The fraction of respondents who always prefer the status quo amounts to 23% of the sample.

[16] 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.

[17] This model is often known as the "conditional logit" (e.g. Greene, 2003). Here we follow the terminology adopted by Mc Fadden (1984) and Louvière *et al.* (2000).

[18] E.g., see the surveys by Hanley, Mourato, and Wright (2001), Mazzanti (2003), and by Ryan and Gerard (2003), referred respectively to environmental economics, evaluation of cultural goods, and health economics literature.

distributed[19] (IID) with an extreme value type 1 (Gumbel) distribution with mean $\eta+\gamma/\mu$ and variance $\pi^2/6\mu^2$.[20] Being π = 3.14159, it follows that in the MNL the equal unobserved 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*:

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

where y_h is an index of the choice made by household *h*, and μ is normalized to 1. The vector $\boldsymbol{\beta}$ is common to all choices, which 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 or attributes of 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 very strong because it is quite likely to have common unobserved factors within these subsets, 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 which imply different forms of coverage extension are confronted with a third solution characterised by no additional cover. This point can be better assessed by providing with some structure the nature of the decision process implied by our choice experiment. In particular, for any respondent, each repetition of the choice experiment can be interpreted as the outcome of two (simultaneous) decisions:

- whether extending the coverage against the risk of LTC expenses or opting for the present level of coverage;

[19] The IID hypothesis implies that $\text{cov}(\varepsilon_k^h, \varepsilon_l^h) = 0$ and $Var(\varepsilon_k) = \sigma^2 = \pi^2/6\mu^2, \forall k$, so that on the whole the variance –covariance matrix of the MNL simply is $\Sigma = \sigma^2 I$.

[20] The parameter η is the mode of the distribution, μ is a positive scale parameter, and γ =0.577 (the Euler's constant).

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

To be consistent with this framework, the error term in (1) can be shaped according to the following additive error structure:

(3) $$\varepsilon_{k|j,i}^{h} = u_{i}^{h} + u_{k|j,i}^{h},$$

where the index *j* relates to the choice between the alternatives A and B and the index *i* relates to the choice of whether to extend coverage against LTC risk or not. Hence, the random term affecting final choices is the sum of two 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, in which the variance (and the scale parameter μ_i) is allowed to differ across groups of choices (coverage extension vs. status quo), while the IIA property is retained within groups. Namely, the unobservable terms related to final choices now have a Gumbel distribution with variance

(4) $$Var\left(\varepsilon_{k|j,i}^{h}\right) = \frac{\pi^2}{6\mu_i^2}, \ \forall i, j.$$

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

(5) $$Var\left(u_i^h\right) = \frac{\pi^2}{6\lambda^2}.$$

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 by Hunt (2000), in a NL model the alternatives are organised in clusters (or partitions) reflecting a supposed similarity, 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).

In fact, in our model a rejection of the IIA assumption indicates that a significantly larger correlation is observed in the choice between alternative A and B, with respect to what happens for the status quo vs. coverage extension decision. The latter is in fact a "non participation" alternative, which is intuitively different from a choice among alternatives.[21]

By framing the above mentioned 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 to buy 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 the status quo otherwise.

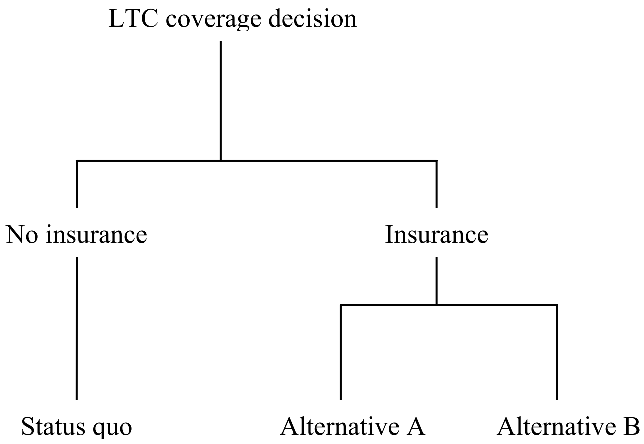
Overall, a partially degenerate NL seems a first appropriate solution, in order to predict the probability of choosing the two alternative insurance schemes, conditional on having chosen to ensure against LTC. We discuss now the structure of this estimation model.

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 allows for a more rigorous analysis of cases like ours. The application to our case implies a first nest or cluster in which the respondent chooses to buy or not to buy an LTC insurance. In the second nest, he or she selects the preferred alternative conditional on having chosen to insure, or the status quo otherwise (see figure 2).

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

[21] The use of NL models in the presence of a "non participation" alternative is for example advocated by Morey (1999).



To make easier the interpretation of the discussion below, let us now introduce the following symbols:

i= not insure, insure (upper level index)

j= insurance A, insurance B, status quo (lower level index)

I= total number of possible upper level choices (2)

J = total number of possible elemental choices (3)

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

k = choice made among the j alternatives

l = choice made among the i alternatives

Let us first better define the random utility structure. For a generic elemental choice *l,k,* household *h*'s utility takes the form:

(6) $$U_{lk}^h = U_l^h + U_{k|l}^h,$$

which we can also write as follows:

(7) $$U_{lk}^h = V_{lk}^h + \varepsilon_{lk}^h,$$

where the V_{lk}^h indicate the non stochastic utility components, $\varepsilon_{lk}^h = u_l^h + u_{k|l}^h$ is the stochastic utility component.

In order to formally define our case, we distinguish between observables which influence the choice at the *j* level ($\mathbf{x}_j$), and observables which affect the choice to insure or not to insure ($\mathbf{z}_i$). The non stochastic part of the indirect utility function is hypothesised additively separable:

(8) $$\begin{aligned} V_{lk}^h &= V_l^h + V_{k!l}^h \\ &= \boldsymbol{\gamma}'\mathbf{z}_{lk}^h + \boldsymbol{\beta}'\mathbf{x}_{kl}^h \end{aligned}$$

By using (3), this leads to:

(9) $$U_{lk}^h = \boldsymbol{\gamma}'\mathbf{z}_{lk}^h + \boldsymbol{\beta}'\mathbf{x}_{kl}^h + u_l^h + u_{k|l}^h$$

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

(10) $$U_l^h = \boldsymbol{\gamma}'\mathbf{z}_{lk}^h + u_l^h$$

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

(11) $$\mathrm{P}[y_h = k, i, j] = \mathrm{P}[w_h = l] \times \mathrm{P}[y_h = k \mid i]$$

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 to 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 a λ scale parameter associated with the upper level, and to μ_i parameters for the elemental alternatives level.[22]

At the level of each generic branch level choice *i*, the conditional choice probability for the elemental alternatives can be written in the following way:

(12) $$\mathrm{Prob}[y_h = k \mid i] = \frac{\exp(\mu_i \boldsymbol{\beta}'\mathbf{x}_{k|i})}{\sum_{j=1}^{J_i} \exp(\mu_i \boldsymbol{\beta}'\mathbf{x}_{k|i})} = \frac{\exp(\mu_i \boldsymbol{\beta}'\mathbf{x}_{k|i})}{\exp(IV_i)}.$$

[22] As we said before, the NL structure imposes a common scale parameter across the alternatives within each partition of the same level. Caution must however be paid in the interpretation of the results when using this assumption with a degenerate branch (see Hunt, 2000, for details).

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

(13)
$$\text{Prob}\left[w_h = l\right] = \frac{\exp\left[\lambda \boldsymbol{\gamma}' \mathbf{z}_l + \frac{\lambda}{\mu_i} IV_i\right]}{\sum_{i=1}^{I} \exp\left[\lambda \boldsymbol{\gamma}' \mathbf{z}_l + \frac{\lambda}{\mu_i} IV_i\right]},$$

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

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

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

(15)
$$\text{P}\left[y_h = k, i, j\right] = \frac{\exp\left[\lambda \boldsymbol{\gamma}' \mathbf{z}_l + \frac{\lambda}{\mu_i} IV_i\right]}{\sum_{i=1}^{I} \exp\left[\lambda \boldsymbol{\gamma}' \mathbf{z}_l + \frac{\lambda_i}{\mu_i} IV_i\right]} \cdot \frac{\exp\left(\mu_i \boldsymbol{\beta}' \mathbf{x}_k^h\right)}{\sum_{l=1}^{K_i} \exp\left(\mu_l \boldsymbol{\beta}' \mathbf{x}_l^h\right)}$$

Two considerations are usually reported in the literature about the role of the scale parameters and their ratio λ/μ, known as the "inclusive value coefficient (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 $u_i + u_{j|i}$) shares part of its unobservables with the higher level (with has error component u_i^h), then the variance at the lower level must be the highest. Given the proportionality between the scale parameters of the assumed Gumbel distribution and the standard deviation of unobservable terms, this entails that, if the NL specification is correct, the estimated inclusive value coefficient λ/μ must lie in the interval (0,1).[23]
The second consideration refers to the identification issues which the presence of the scale parameters entails (see Ben-Akiva and Lerman, 1985). 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

[23] 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 $\rho = 1 - (\lambda/\mu)^2$, which is clearly zero for λ/μ = 1. Hence, to reflect plausibly the preferences of utility-maximizing individuals, the IV coefficient must lie in the interval (0,1). The closer the coefficient is to unity (zero), the less (more) the degree of perceived similarity of the alternatives considered.

the case for the utility index $\boldsymbol{\gamma}'\mathbf{z}_l$, since its value is multiplied by the (unidentified) scale parameter λ. A similar consideration applies for the lower level utility index $\boldsymbol{\beta}'\mathbf{x}_{k|i}$, 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. 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 (λ=1) rather than to the lower level scale parameter (μ_i=1). The same authors report that most empirical studies normalise the branch level utility index by setting λ =1. From a practical point of view, it is remarked that this kind of normalization enables the researcher to carry out a direct confrontation of NL estimates with the parameters obtained with a MNL model, relates normalization to total variance, and leads to a simpler PCS.[24]

In the next section, we follow this convention, also in light of some invariance results by Hunt (2000).[25] We therefore report below the expressions of the PCS for the case λ=1.[26]

a) conditional choice probability for the elemental alternatives:

(16) $$\text{Prob}\left[y_h = k \mid i\right] = \frac{\exp\left(\mu_i \boldsymbol{\beta}'\mathbf{x}_{k|i}\right)}{\sum_{j=1}^{J_i} \exp\left(\mu_i \boldsymbol{\beta}'\mathbf{x}_{k|i}\right)} = \frac{\exp\left(\mu_i \boldsymbol{\beta}'\mathbf{x}_{k|i}\right)}{\exp\left(IV_i\right)},$$

b) marginal probability at the "branch" level:

(17) $$\text{Prob}\left[w_h = l\right] = \frac{\exp\left[\boldsymbol{\gamma}'\mathbf{z}_l + \frac{1}{\mu_i} IV_i\right]}{\sum_{i=1}^{I} \exp\left[\boldsymbol{\gamma}'\mathbf{z}_l + \frac{1}{\mu_i} IV_i\right]},$$

c) "inclusive value":

(18) $$IV_i = \ln \sum_{J=1}^{J_i} \exp\left(\mu_i \boldsymbol{\beta}'\mathbf{x}_{k|i}\right)$$

As it can be seen, the change is in the marginal probability, where the utility index is directly computable, and the IV parameter reduces to $\frac{1}{\mu_i}$. By using the estimate of the latter, it follows that

[24] See Cherchi (2003) and Carrasco and Ortùzar (2002).

[25] Invariance results are quite general in case of NL estimates with nondegenerate branches. In the presence of a degenerate branch, invariance holds at a more general level (see Hunt, 2000).

[26] In a few works (eg. Louvière *et al*., 2000; Hensher and Greene, 2002) this normalisation is labelled as "random utility model 2" (RU2).

also the lower level utility index can be identified.[27] Notice that, given the theoretical condition $\lambda/\mu < 1$, in this case the estimated lower scale parameter is expected to be larger than one.[28]

4. Main results from the estimation of the NL model

In this section we present the results of our estimates. Following most of the literature, we have first run a MNL estimation with the attributes as regressors, whose results are reported in table 1. The parameters of the attributes are highly significant. However, the McFadden-Hausmann test indicates, with a very high value (649), a strong violation of the IIA hypothesis.
As a consequence, we move to the estimate of the NL model described in the previous section.
The NL estimates are reported in table 2. As anticipated above, they have been carried out by normalising on λ=1. In particular, this allows a direct comparison of the values of the parameter of the attributes. By making explicit the two decision processes faced by the respondent, it is of particular interest to model the decision whether or not to opt for an insurance coverage, i.e. the index $\boldsymbol{\gamma}'\mathbf{z}$. As can be seen, a quite long series of variables suggested by theory have been successfully used.

Table 1: *Multinomial logit estimation and McFadden-Hausmann IIA test*

Variable	***MNL model with attributes only***		
	Coefficient	*t-value.*	*Prob*
Financing scheme (0 private, 1 public)	0.29806	-25.796	0.000
Extension to residential care expenses	0.55004	11.425	0.000
Degree of percentage coverage	0.01781	21.229	0.000
Yearly cost of coverage	-0.00162	31.429	0.000
Alternative specific constant (0=status quo)	-1.38213	-26.185	0.000
Diagnostic statistics and tests	*Value*		*Prob*
Log likelihood function	-12138.3		
Pseudo R-squared	0.072		
Hausman test for IIA. (Excluded choice is "status quo" Chi Squared[4]	649.436		
Number of observations	11910		

[27] With the normalisation $\lambda = 1$ at the upper level, it is sometimes imposed a common scale) factor at the lower level $\mu_i = \mu$ for all *i*. However, this is impossible in the presence of a degenerate branch as in our case (e.g. Hensher and Greene, 2002).
[28] Remark that the software NLogit that we use in the estimation, under the normalization $\lambda = 1$, differently from what appears in the estimation output, presents an estimate of μ_i, that is of the IV parameter.

Table 2 is divided in two parts. In fact, in order to test for the robustness of the results obtained with the estimate of the “main effects”, the design of the experiment was framed in a way suitable for checking the possible variation of consumer preferences when faced with the extreme levels of the attributes. In practical terms, starting from the base model, we have subsequently inserted the interaction variables between the qualitative attributes and the extreme values of the quantitative ones. The results reported on the right side of table 2 refer to a regression which contains only those interactions which were significant at the 5% level.

Let us now move to the comment of the results in the table. A first important remark is that the value of the IV parameter (0.547) and its high significance level indicate the statistical appropriateness of the two level NL specification adopted. In light of what we said in the previous section, we know that this value must be between 0 and 1, being the latter one the value implied by the MNL specification.

Overall, it can be seen that a large proportion of the variables included in the regression display significant effects. In the following of the section we comment the coefficients for the decision of whether or not to insure. We leave to the next subsection the analysis of the role of the four attributes (all highly significant) included in the insurance package.

At the first node of the decision tree, respondents are faced with the alternatives of extending coverage against LTC risk or of maintaining unchanged the level of protection that emerges from current public support for disable elderly people. For the decision to insure, we have inserted a series of socio-demographic indicators. As pointed out for example by Train (2002), this implies that the associated coefficient do represent the differential effect of the socio-demographic variable on the utility of extending insurance cover vis à vis that of maintaining the status quo.

More in detail, the specification includes three quantitative variables, family income,[29] respondent age and family size, and a series of dichotomous indicators that capture several aspects of the socio-economic and health status of the respondent. As can be seen from inspection of table 2, most of the variables have a significant impact on respondent choice. Moreover, the sign of the coefficients meets our prior expectations, which we are now briefly explaining

Income positively influences the probability of extending coverage, whereas age presents the opposite sign. The former result suggests that the price hurdle limits access to additional coverage especially at low income levels. Given the peculiar nature of LTC, one might negatively evaluate the achievement of substantially different degrees of cover among citizens determined by income. 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

[29] This variable refers to net monthly family income, that sums up respondent and (when present) spouse income.

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.

Also the result for the age variable is of high policy relevance since it points out that younger generations are more favourably oriented towards a coverage extension, whereas 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, which therefore are more interested in extending current programs. Moreover, age is a good proxy for health status and consequently the negative sign of the age coefficient displays analogies with the indication according to which individuals with poor self rated health state are more likely to opt for the status quo.

Table 2: *Nested logit estimations*

Explanatory variables	***Base model***			***Model with interactions***		
	Coefficient	*t-value.*	*Prob*	*Coefficient*	*t-value.*	*Prob*
Stage 2: choice of alternatives						
Financing scheme (0 private, 1 public)	0.19302	9.929	0.000	0.24284	9.587	0.000
Extension to residential care	0.3352	12.931	0.000	0.38271	12.543	0.000
Degree of % coverage	0.01185	14.912	0.000	0.01148	12.859	0.000
Yearly cost of coverage	-0.00108	-14.630	0.000	-0.00110	-14.598	0.000
Interaction between "extension" and "low coverage"				-0.21532	-4.250	0.000
Interaction between financing scheme and "total coverage"				-0.10498	-2.544	0.011
Stage 1: Insurance decision						
Age	-0.01698	-9.963	0.000	-0.01696	-9.953	0.000
Family Income in €	0.00032	12.314	0.000	0.00032	12.300	0.000
Sex (1 if male)	0.19253	4.783	0.000	0.19270	4.787	0.000
Household size	-0.15746	-8.638	0.000	-0.15757	-8.643	0.000
Property of the living house	0.03190	0.632	0.528	0.03218	0.637	0.524
University degree education	0.65248	4.314	0.000	0.65214	4.315	0.000
Secondary school education	0.47616	3.334	0.001	0.47559	3.332	0.001
Compulsory education	0.30513	2.184	0.029	0.30490	2.184	0.029
Blue collar occupation	0.05994	0.837	0.403	0.05991	0.836	0.403
White collar occupation	-0.02344	-0.384	0.701	-0.02378	-0.389	0.697
Retired	0.15106	2.492	0.013	0.15036	2.479	0.013
Not working	-0.16299	-2.264	0.024	-0.16447	-2.285	0.022
Other employment status	0.25651	1.901	0.057	0.25675	1.902	0.057
Chronic disease	0.28476	5.547	0.000	0.28468	5.544	0.000

Self assessed health status (0 for good, 1 for bad)	-0.37262	-7.674	0.000	-0.37306	-7.683	0.000
Subscriber of a private health insurance	0.18002	3.433	0.001	0.18003	3.431	0.001
In hospital in the last year	0.21931	3.371	0.001	0.21891	3.365	0.001
Smoker	-0.00927	-0.202	0.840	-0.00765	-0.166	0.868
Preference for “cash” LTC coverage	0.07434	1.828	0.068	0.07473	1.837	0.066
Health in the first 3 priorities for new public expenditures	0.32081	6.469	0.000	0.32026	6.459	0.000
Negative opinion of the quality of NHS care services	0.22614	4.781	0.000	0.22696	4.798	0.000
ASC (0 for status quo)	-1.01108	-4.914	0.000	-0.99427	-4.802	0.000
IV parameters						
No insurance	unidentified			unidentified		
Insurance	0.54709	14.694	0.000	0.56302	14.666	0.000
Diagnostic statistics and tests	*Value*			*Value*		
Log likelihood function	-11393.7			-11378.2		
Pseudo R-squared	0.14857			0.14973		
Number of observations	11910			11910		

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 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 have not necessarily a clear perception of all the consequences of incurring in severe disabilities and they presume to qualify for free social care 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 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 receive some kind of help already (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.

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. Still, the coefficients for the retired and non occupied condition, actually including a limited number of respondents, are significant and both have the expected sign, 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 encourages 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 supporting additional financial support for ancillary programs such as the one proposed here concerning disability in the old age.[30]

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 we expect 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 focus the main objective of our study, that is the analysis of willingness to pay (and more in general of welfare effects) related to introduction of coverage against LTC risk. In particular we tackle here the issue of deriving welfare measures from discrete choice experiments that has been recently largely debated. The discussion that follows draws on some recent insights by the literature (Lancsar and Savage, 2004a,; Ryan, 2004; Santos Silva, 2004).

Following Ryan's (2004) approach, we are interested in the first place in obtaining the estimation of a "state-of-the-world-model", i.e. a model suited for evaluating the welfare variation once a new service has been granted to individuals with certainty.

In this case, welfare effects are measured as follows:

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

[30] Our dataset also contains an indicator of respondent's opinion on existing LTC services. This indicator did not show any significant role, and was consequently eliminated from the regression analyses we are commenting here.

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 (in practice the estimated coefficient of a variable expressed in monetary terms). As long as WTP is determined as a difference, it follows that in our model only the attributes and the covariates interacted with the decision to cover determine the welfare measure, and that the utility index at the status quo can be set to zero.

Let first analyse the monetary values of the attributes only. These values are derived from the parameter estimates reported on the top of table 2. As it can be seen, also in the NL specification all the design variables are highly significant. 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.

Table 3: *Estimates of monetary values of the attributes defining the policy and mean WTP*

	Base Model	*Model with interactions*
Characteristics of the coverage	*Value in Euros*	*Value in Euros*
Degree of coverage	10.99**	10.43*
Option to cover residential costs	311	348 (152**)
Switch from private insurance to public cover	179	221 (125.22***)
Mean WTP (*at the mean of the explanatory variables*)		
Scenario A: 75% of public coverage and option to cover residential cost	652	716
Scenario B: 50% of public coverage without option	341	368

Note: ** Value in Euros of 1 additional percentage point of coverage*
*** In case of 30% coverage*
**** in case of 100% coverage*

The monetary values, reported in table 3, are obtained by dividing the estimated coefficients of the non monetary attributes by the negative of the coefficient of the "cost of coverage" attribute. The value of the degree of coverage is probably the most interesting for the evaluation of the WTP in the case of a service sold in the market.

In the base model, the estimated value is of 10.99 euros per 1% reduction in the copayment rate, that corresponds to an increase in coverage. A relatively unexpected result is the high value attached to the extension of the coverage to residential care expenditures, which are apparently perceived as a very worrying risk. Given that one additional percentage point of coverage is evaluated about 11 euros, the option for residential care is evaluated as much as 28 percent point of coverage. A similar reasoning translates the 179 euro of additional WTP for the public solution in about 16 percentage point of coverage.

The estimates from the model which exploits the end point design of our choice experiment provide some additional interesting insights. In particular, the figure in brackets refer to the value of the two qualitative attributes in the case of the lowest (for the option to cover residential costs) and highest (for public cover) level of coverage. Specially for the value of the option for extending the coverage to residential care, the change is remarkable. People does seem to assign a much lower value to it when only 30% of expenses are financed by the insurance scheme, probably realizing that in the case of the higher cost related to residential assistance, the option is offering a lower monetary support in absolute terms.

We have then applied equation (19) in order to come to an estimate of the mean WTP. The results are reported in the bottom part of table 3. For a degree of coverage of 75%, the estimated values are certainly conspicuous. However, 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.

Standard errors for the estimated mean WTP are being computed by means of “bootstrap” techniques. Then a more extensive sensitive analysis which will look to the differences of the estimated values for some specific quantiles of income and age variables is left for future stages of this research.

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.
The welfare estimations derived from the regression results display a fairly high mean WTP, with a value of 10.5 euros per each percentage point of co-payment rate.

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