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Martin Karlsson, Les Mayhew and Ben Rickayzen

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Cass Business School
106 Bunhill Row
London EC1Y 8TZ
T +44 (0)20 7040 8470
www.cass.city.ac.uk

Investigating the market potential for customised long term care insurance products

Martin Karlsson Les Mayhew   Ben Rickayzen[1]

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Abstract

Previous economic research into long-term care (LTC) has mainly been focussed on one issue: the reasons why the LTC insurance market has not been successful. In this contribution, we analyse the prospects for a new type of insurance policy, which offers a top-up on the resources already available to the individual.

We abstract from most problems inherent in LTC insurance markets and derive premium rates for various types of insurance policies. Generally, we find that the top-up option reduces premium rates considerably, to the point where it might be expected that a substantial number of people would take up policies, were they available.

Keywords: premium rates, long term care, insurance

JEL Classificartion: I11, H51

[1] Corresponding author: Martin Karlsson - p.m.karlsson@city.ac.uk. This research was supported by a grant from the UK Actuarial Profession.

1 Introduction

Most developed countries are on the brink of a massive demographic transition, which will have serious implications for public spending on pensions, long term care and health care. The British dependency ratio (i.e. the number of retired people per 100 persons at active ages), is projected to increase from 24 today to 38 in 2040. Although this is a substantial increase, in fact, the U.K. can expect a less drastic development than many other countries. In Japan, for instance, the ratio is projected to increase from 30 today to 65 in 2040 (United Nations, 2002).

The demographic changes are believed to have the strongest impact on the demand for long term care (LTC). Most consumers of LTC are over 80 years old – in England almost 80 per cent of care home inhabitants belong to this group (Bajekal, 2002) – and since increasing life expectancy causes this age group to grow even faster than the retired population in general, concerns have been aired that the demographic burden makes the current system of financing of LTC unsustainable. Indeed, there has already been a common trend towards concentrating on severe cases in many countries including the U.K. (Karlsson et al, 2004).

The ageing of the population not only has implications for the demand for LTC. The ageing process is also accompanied by at least two other trends which have implications for the financing of LTC. The first one is a trend towards ever higher income and wealth levels within the retired population. Between 1996 and 2002, the median income of U.K. pensioners grew by around 19 per cent (Goodman et al, 2003), and there is no reason to believe that this trend will cease in the future. Secondly, there is a trend towards the disintegration of families which might in the long run reduce the availability of informal carers: the latter play a particularly important role in the U.K.

Taken together, these developments might destabilise the current division of responsibilities between the family, the state and the private market. It seems likely that, in the future, the responsibility of the individual to pay for his or her care needs out of pocket will increase, and the responsibilities of the state and of families will decrease accordingly. There is, however, a scarcity of research to date on the possible implications of such a shift of responsibilities. From the point of view of the private market, there should be an interest in determining what kind of insurance products are required and by whom. From the point of view of the state, the focus of interest is probably on how to strike the right balance between efficiency, equity and cost containment. However, although the perspectives are quite different, the tools needed to analyse these issues are quite similar.

The total costs of formal care in the U.K. amounted to £14 billion in 2001 (1.4 per cent of GDP). Some two thirds of these costs are spent on care homes. The private sector accounts for £6.0 billion of the care home costs and the voluntary sector accounts for another £1.3 billion, the residual being public sector (Laing & Buisson, 2001). The total value of informal care is unknown, but has been estimated to be between £10 and £40 billion, depending on what wage level is imputed (Royal Commission, 1999). Private LTC insurance was introduced in 1991, but the market is far less vibrant than in the U.S.. Up to the end of 2000, fewer than 40,000 policies had been sold which corresponds to less than 0.5 per cent of the retired population (Werth, 2001). The need for LTC represents a significant risk in most individuals' lives, and hence the low demand for insurance is one of the main puzzles in the literature.

Research into LTC has mainly been focused on two issues: the first being theoretical micro-economic analyses of whether a market failure exists in the LTC insurance market and, if so, what the explanations for this are. There is a theoretical argument and some empirical evidence that the existence of public provision, even through a welfare program, dampens the market for private insurance (Pauly, 1989; Sloan & Norton, 1997), as well as a behavioural argument that parents deliberately do not purchase insurance as a strategy to ensure help from their children (Pauly, 1990). Cutler (1993) has suggested that the fixed or nominally adjusted benefits found in current LTC insurance products leave purchasers exposed to the risk of long-term cost increases, reducing the value placed on the coverage. The second focus of research has been to study the effects of ageing on demand for LTC and the implications for the public purse. Concerning the U.K., important contributions have come from the PSSRU model (Wittenberg et al, 2003), the Nuttall et al (1994) model and the authors' own model, based on dynamic simulations of the prevalence of disability in the U.K. population (Karlsson et al, 2005).

There have been, however, few attempts to bring the two perspectives together, i.e. to analyse the implications for private LTC insurance of population ageing and social change. One exception is Brown & Finkelstein (2003), who estimate the demand for private LTC insurance in the U.S.. The authors conclude that unless individuals are extremely risk averse, the demand for private LTC insurance should be negligible. Hence, there is a need to find, firstly, whether the same holds true of the U.K., and secondly, under what alterations of the means testing system a private market for LTC insurance could develop without adverse consequences for the least well off members of society.

This report is the first step in an attempt to investigate the relative merits of a new type of insurance product, which we have chosen to call "top-up insurance". Our eventual aim is to find out to what extent the low demand for LTC insurance has been due to existing policies not being sufficiently diversified in their design. Need for LTC cannot be solely derived from an individual's health (such as failing Activities of Daily Living (ADLs)) but also depends on the environment in which the individual lives. For instance, the need for formal care services depends crucially on whether there is an able (and willing) spouse present or not. Furthermore, if the purpose of purchasing LTC insurance is to avoid spending down assets once the need has materialised, the individual would not need to insure the entire cost connected with LTC, but only to top-up existing income to the level required to meet LTC costs. These two facts suggest that an insurance policy that conditions benefits on more contingencies than health might be more appropriate for the actual risk that individuals face and thus might, if introduced, lead to a surge in demand for LTC insurance.

For this paper, we consider the two most 'natural' characteristics to condition insurance benefits upon, apart from health, namely cohabitation status and income. Hence, 'top-up insurance' in this version is an insurance policy that jointly insures health risk, income risk, and the risk of not having a spouse who can provide care. A simplified representation of the idea is given in *Figures 1* and *2*. *Figure 1* sketches how the three risks evolve over a lifecycle. The full curve shows the probability of cohabitation for survivors. The dashed curve depicts prevalence of moderate disability among survivors, and the dotted curve shows prevalence of severe disability. *Figure 2* shows the top-up need once disability has materialised. The horizontal line represents the cost of nursing home care, and the curve sketches the average evolution of earnings over the life cycle. The difference between the two is the top-up need. Hence, the insurance premium would then need to be based on an assessment of the three risks involved and their interdependence.

One can think of the top-up product as being a type of joint life policy where an individual looks to top up their income to a particular level if they have a spouse and a higher level if they do not. It is generally accepted by reinsurers (Singh, 2006) that single people have a greater propensity to claim under existing LTC policies than married individuals. This seems to support the idea that cohabitation status is important. In the past, there has been a tendency for couples to 'over insure' by taking out two single policies. With our approach, policies will

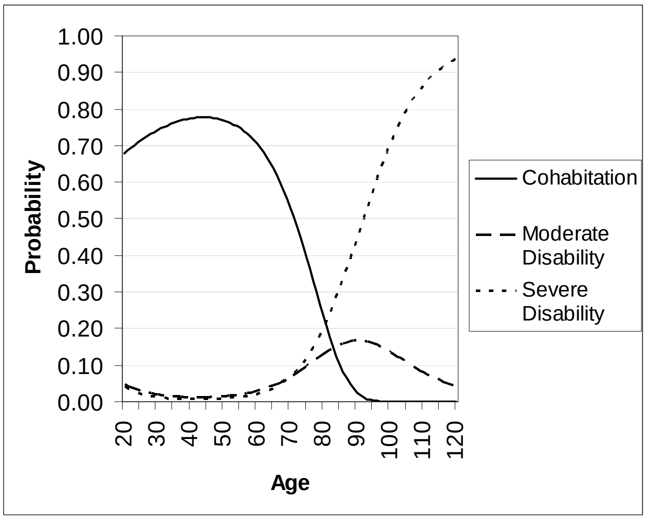

Figure 1. Example of evolution of various LTC relevant risks over the life cycle (survivors).

be cheaper and this should make the product more attractive to couples than currently existing products. Furthermore, if the reduced premium rates attract more consumers, it is also likely that the adverse selection problem would be reduced, which would allow a further reduction in premium rates. We will not analyse this possibility here, but rather leave the issue for future research.

In this paper we look at the pricing of top-up LTC insurance. Using simplified assumptions - most importantly: independence of the risks involved - we derive insurance premiums for LTC insurance. Our most important finding is that top-up insurance has the potential to reduce premium rates substantially, and might therefore be a way to increase demand for LTC insurance.

This paper is part of a more extensive project, where the prospects for top-up LTC insurance will be analysed in more detail. One obvious extension of the simple model used in this paper is to relax the assumption of independence between risks and estimate models of the various risks jointly. Furthermore, the potential demand for top-up insurance should be assessed using

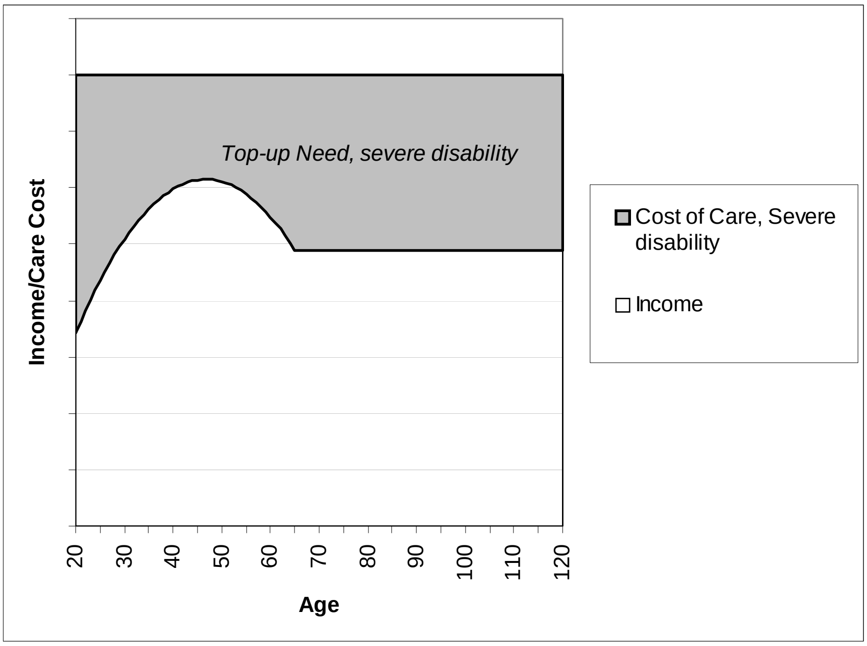

Figure 2. Top-up need for single person under various circumstances.

dynamic optimisation techniques similar to those used by Brown & Finkelstein (2003). Hence, the current paper provides a starting point for describing what a top-up insurance policy might look like in the future. The paper is organised as follows. In the next section, a literature review is provided. Section 3 presents the methodology used in the different steps of the analysis. Results are presented in section 4. Section 5 summarises, concludes and discusses open questions for future research.

2 Literature Review

If the market for private LTC insurance is to develop, it is necessary to understand the reasons why it has failed in the past. Generally, articles in this field are concerned either with explaining the limited size of the LTC insurance market, or analysing effects of state intervention such as mandatory social insurance. The two issues are closely related since one of the main factors used to explain the limited size of the LTC insurance market is the effect of crowding out from different public support systems.

One of the first contributions in the field is Pauly (1990). Pauly relies largely on intuitive reasoning to explain why a risk averse individual may rationally refrain from purchasing LTC insurance. Pauly is able to show that the public support at the lower end of the wealth distribution will crowd out LTC insurance demand completely. This observation is to be expected, since he assumes that there are no quality differences between different care homes. Pauly then considers various extensions of the basic model. One is the possibility that the demand for LTC is not completely inelastic, for instance if private LTC insurance gives access to care of a higher quality than the default Medicaid alternative. Under reasonable assumptions, however, this phenomenon cannot give rise to any significant demand for LTC insurance, since in most developed countries a policyholder must forfeit any public subsidy if insurance benefits are consumed. Thus, the individual will end up paying the whole cost of LTC, but only benefiting from the difference between the Medicaid quality level and the desired quality level. Logically, this decreases the relative advantages of LTC insurance.

Two other extensions considered by Pauly are, firstly, a bequest motive on the part of the individual and, secondly, a family bargaining process over the LTC provision. In the absence of perfect annuity markets, any individual facing uncertainty concerning time of death will have to leave a positive expected bequest (since savings have to be based on a worst case scenario). It is thus not obvious that a bequest motive will make a difference to the decision over whether or not to purchase LTC insurance; it might be that the expected bequest is already in excess of the desired level. Concerning intra-family bargaining, Pauly concludes that the parent might be better off without LTC insurance, since this should ensure that the child's incentives harmonise better with the interests of the parent. This is a line of thought that has subsequently been modelled explicitly by Zweifel and Strüwe (1996, 1998).

To sum up, Pauly delivers an array of reasons why rational individuals — even in the case of risk aversion — should not purchase LTC insurance. Pauly's approach is less useful in explaining the behaviour of those who actually do purchase LTC insurance, however. One of the most questionable assumptions that Pauly makes is that disabled individuals derive no utility from consumption at all. Meier (1999) uses a model that differs slightly from Pauly's to analyse the relative merits of savings and LTC insurance to provide for old age. As is customary in the literature, Meier models LTC costs as a necessary 'evil'. He considers three different regimes: firstly, a 'private funding' regime, where everybody is forced to hold the savings required to cover LTC costs; secondly, a 'social aid' regime in which the government tops up insufficient resources; finally, 'mandatory LTC insurance', with a minimum level of coverage.

Meier is able to show that in the 'social aid' regime, there will be a cut-off wage at which individuals start demanding LTC insurance instead of relying on public finance. Above that threshold, the behaviour of individuals is the same as in the private funding regime. Furthermore, if mandatory insurance is introduced, the existence of a minimum level of insurance may switch the individual from being a free-rider to buying an optimal level of insurance coverage (i.e. benefits in excess of the mandatory requirement). Indeed, the number of people doing this increases as the level of mandatory coverage is increased. This finding is due to the fact that when there are means tested benefits available, individuals on low incomes will find the premium for LTC insurance prohibitive when compared with the relatively small increase in benefits it offers to replace public benefits. Once there is a mandatory minimum level in place, insuring the residual not covered by the mandatory scheme seems more affordable, and hence ever more individuals will choose to do so.

Meier models individual behaviour in a parsimonious yet realistic way. His model offers a good starting point for analysing behavioural responses to different policy changes. In a more recent paper, Meier has analysed the optimal timing of the purchase of LTC insurance (in this case, non-purchase is not considered as an option). Again, individuals are assumed to maximise expected utility over two time periods. Individuals may choose to purchase LTC insurance at the beginning of the first period or at the beginning of the second period. In the benchmark case, with symmetric information between insurer and customers, homogenous individuals, perfect insurance markets and certainty concerning the risk of disability and the LTC costs, the two options will be completely equivalent. Meier then analyses which of these assumptions will, when relaxed, alter the situation in favour of an early or a late purchase of LTC insurance. He finds that the possibility of premature death does not alter the equivalence between early and late purchase. The individual simply purchases an annuity that leaves a person with zero expected bequests. Concerning the loading of insurance premiums (i.e. deviation from actuarial fairness) it is quite clear that additive loading (i.e. a constant loading factor on each policy each period) would work in favour of late purchase. A multiplicative loading factor, on the other hand, would not change the equivalence of early and late purchase. If there is uncertainty concerning the probability of disability, and therefore the need for LTC, but no asymmetric information, it is preferable to buy insurance in the first period. The reason is that this serves to eliminate income risk; as the individual is then insured against finding out that he or she is a high risk individual. This result is not changed by the introduction of asymmetric information. Even if only the consumer (and not the insurer) gets improved information concerning his or her risk profile later in life, it will still be beneficial to insure early against unfavourable realisations of the risk factor.

However, if disability before retirement is a possibility, and if individuals are different concerning this risk, it may, under some circumstances, be preferable for low risk individuals to postpone the purchase of insurance. The reason is that, if the difference between high and low risk groups is relatively large, the premiums in the first period will appear very expensive to low risk individuals. Once this loss outweighs the benefits from the reduced income risk, low risk individuals will prefer to wait. Hence, this scenario poses an adverse selection problem, potentially resulting in ever higher premium rates for early purchasers.

Finally, if the care costs are uncertain, rational individuals will prefer to buy insurance late, on the assumption that insurance benefits are not indexed to actual care costs (i.e. indemnity insurance). In such situations, individuals will postpone the purchase in order to avoid excessive coverage of the insurance.

To summarise, Meier singles out three factors that may explain why LTC insurance policyholders tend to acquire LTC policies at such a high age, namely: additive loading, uncertain LTC costs and heterogeneous risks. However, the question of the relative importance of these factors remains largely unresolved. One empirical study that analyses the decision to purchase LTC insurance is by Sloan & Norton (1997). Based on a large sample of the elderly American population, a probit regression was used to identify factors that influence the LTC insurance purchase. Among the main findings are that i) Medicaid crowds out LTC insurance demand for older (70+) individuals, ii) the self-assessment of poor health is correlated with the purchase of LTC insurance (which, in cases where those self-assessments are correct, reflects an adverse selection problem), iii) bequest motives do not influence LTC insurance demand, iv) neither the number of children nor the income of children influence the purchase decision, v) marital status influences the decision only in the younger group, vi) the better educated the individual, the more likely he/she is to purchase LTC insurance and vii) non-housing wealth but not income is correlated with demand for LTC insurance.

Thus, the study by Sloan & Norton (1997) indicates that the emphasis on bargaining situations between parents and children has been misplaced. Instead, it seems that the existence of public subsidies and potential adverse selection seems to be the most important explanatory factors behind low takeup.

3 Methodology

This section seeks to give a crude estimate of what premium rates would look like if a top-up LTC insurance were offered in the market. In deriving the premium rates, we make restrictive assumptions concerning the risks involved and concerning individual behaviour in response to various incentives. We also ignore expenses in our calculations.

3.1 General Assumptions

The assumptions used in this work are somewhat simplified. We therefore make them explicit below.

Assumption 1 *Individuals purchase LTC insurance in order to avoid spending down assets.*

For simplicity, we do not derive the demand for insurance from the individual's optimisation problem; this is an issue left for later research. Instead, we assume that individuals pursue the objective of protecting their assets - possibly due to a bequest motive. Hence, our approach assumes that a person wants to protect his/her assets and would not wish to sell his/her house to pay for long term care. Some people might be willing to give up a share of their house to pay for the first few years of care rather than purchase LTC insurance. This would imply purchasing a LTC policy which kicks in only after the money from the asset sale has been exhausted. In theory, one could have top-up insurance policies based on asset values as well, but in such a case it becomes unclear what it is the individual is actually trying to insure. Hence, we disregard such possibilities in this paper.

Assumption 2 *Individuals are not forward-looking in their decisions concerning work, retirement age and savings.*

The practical effect of this is that we treat the income stream that individuals enjoy as known and predictable; as well as the total amount of assets that they will have at any age, given their personal circumstances.

Assumption 3 *Disability, income and assets are independently distributed*

This assumption overlooks the interdependence between disability and socioeconomic status, which is well documented in the literature. It is unclear to what extent this assumption influences the results, and it will be a topic of future research to try to establish how the relevant risks correlate.

Assumption 4 *Income, assets and cohabitation patterns are deterministic functions of age, gender and education level only.*

This assumption implies that individual behaviour can be modelled by using representative individuals. It follows that the simplified version of top-up insurance which is outlined in this paper, will be inappropriate for individuals who are not close to the averages of their respective groups. The model also disregards behavioural responses to the existence of various insurance policies, as well as the possibility of adverse selection.[2]

3.2 Estimating Incomes, Assets and Marital Status

To estimate the paths of earnings, income, assets and cohabitation status over the life cycle we partitioned the British Household Panel Survey (BHPS) by age, gender and level of education and estimated separate random effects models for each subsample. We used all waves that contain information on all the relevant variables (i.e. data in 1993 to 2001). All individuals with at least two observations (i.e. at two points in time) were kept; hence we did not impose

[2] It should be noted that if top-up LTC insurance does succeed in attracting more customers than traditional insurance, it will also to some extent mitigate the inherent adverse selection problem. This means that premium rates for top-up insurance would typically be lower than the equivalent conventional insurance premiums. We will analyse this issue in future research.

a balanced panel by excluding observations. This had the advantage that we could partition the sample into a large number of groups. The unbalanced nature of the panel is a minor concern since we are only estimating conditional means and not confidence intervals around the means.

Apart from gender as a basis for partitioning, we use educational attainment. This variable is convenient since it tends not to change above certain ages, and it is a good predictor of the overall socioeconomic status of an individual. We make use of three different education levels; the highest one (H) being equivalent to a university degree, the intermediate one (M) corresponds to some further education, and the lowest one (L) corresponds to no further education at all.

The working age subsamples include people between 25 and 64 years of age (younger individuals were excluded since they are not relevant for the research questions and, in addition, their education is incomplete). Within this sample, a random effects model was estimated with fixed year effects,[3] to account for the general economic development over the sample period, and the first four coefficients of a fourth degree polynomial of age, in order to capture the age effects on earnings, assets etc. Hence, the estimating equation is:

$$y_{jt}^i = \alpha_j + \beta_1^i x_{jt} + \beta_2^i x_{jt}^2 + \beta_3^i x_{jt}^3 + \beta_4^i x_{jt}^4 + \lambda_t^i + \varepsilon_{jt}^i$$

where y_{jt}^i is either the level of income or assets of individual j belonging to group i at time t. α_j is a random individual effect,[4] x_{jt} is the age of individual j at time t, λ_t^i is a fixed year effect and ε_{jt}^i an error term. Due to the panel structure of the data set, we are able to distinguish between age effects and year effects. All estimates are presented in 2001 prices. Since the

[3] The reason for choosing a fixed effects structure concerning time and a random effects structure concerning individual effects is that it is likely that the former are correlated with the other regressors (e.g. age, hence reflecting changes in the demographic structure of the population). Hence, for the sake of consistency of estimates, this assumption is necessary, cf. Greene (2003).

[4] The assumption of the random effects model is that the random individual effect is uncorrelated with the regressors, i.e. $E\left[\alpha_j \,|\, x_{jt}\right] = 0$.

cohabitation variable is binary, we estimated a random effects probit model, also with fixed year effects. Due to collinearity among higher terms, this specification only allowed age and age squared as arguments. Hence, the model we consider is:

$$\Pr\left(z_{it}^{j}=1\left|t,j,x_{it}\right.\right)=F\left(\delta_{j}+\gamma_{1}^{i}x_{it}+\gamma_{2}^{i}x_{it}^{2}+\upsilon_{it}^{i}\right)$$

where $z_{it}^{j}\in\{0,1\}$ is cohabitation status (with a one representing cohabitation), $F(\cdot)$ is the cumulative distribution function of the standard normal distribution, δ_j is an individual random effect and υ_{it}^{i} is an error term with a normal distribution.

3.3 Calculating Insurance Premiums

If we use the empirical results of the estimation outlined above, and impose the simplified assumptions presented in subsection 3.1 then what would the insurance premiums for top-up insurance be?

To answer this question, we will consider a wide variety of different policy types and health scenarios in order to try to ascertain the main factors determining the premium rates for different socioeconomic groups and ages. As regards public policy, we consider two different cases. These are denoted type 1 and type 2 in the descriptions below. 'Type 1' represents insurance policies where the public subsidy is paid only in the event that the individual has no insurance, whereas with 'Type 2' the insurance policy benefits are conditional on the individual not being eligible for public support. Hence, 'Type 1' is a replacement for public support, whereas 'Type 2' represents a type of public/private partnership. Regarding the terms and conditions of the insurance policies, we consider a variety of possibilities where we alter the assumptions concerning the way in which income is defined and whether the existence of a spouse is taken into account. In subsections 3.3.2 to 3.3.12, the different scenarios are described in more detail.

3.3.1 Data

Our disability data is based on work by Rickayzen & Walsh (2002). For convenience, a brief outline of the model is given below. The model requires 3 main pieces of data:

- Prevalence rate data are required as a starting point, which show the proportion of the UK population at each age with a particular level of disability.

- Transition rate data are required in order to project the current healthy and disabled population forward. Transitions include, for example, healthy people becoming disabled, disabled people becoming more severely disabled and people dying.

- Trend data are required to indicate how the transition rates might change over time. For example, general improvements in the health of the UK population might make it less likely that a healthy person of a certain age becomes disabled during the following year.

The data set used to provide the prevalence rate data comes from the OPCS survey of disability in Great Britain (Martin, 1988). This entailed the screening of representative samples of private households and communal establishments in 1985 and 1986, respectively. Although the survey took place nearly 20 years ago, it still represents the richest source of data for UK long term care models. It should be noted, however, that the published OPCS survey results, although they include the 80+ group, do not show disaggregated figures in smaller age bands, which means that the model is less robust at the oldest ages.

The published report on the survey allocated disabled people to one of ten categories of disability with Category 1 the lowest and Category 10 the highest levels of disability. Rickayzen & Walsh use a 12-state multiple state model comprising the healthy state ('category 0'), 10 states of disability and the dead state. The transition rate part of the model was developed from considering data available in respect of the different transition components: mortality rates, disability inception rates and recovery rates. The parameters were chosen such that the transition rate model generated the prevalence rates obtained from the OPCS survey.

Trends in healthy life expectancy data were then used to shape the assumptions made regarding changes in the transition rates over time. Due to the level of uncertainty in this part of the model, projections were made using 16 different sets of trend assumptions from the base year of 1996. Rickayzen & Walsh quote the results from the central ('Basis C'), the most optimistic ('Basis N') and most pessimistic ('Basis A') sets of assumptions. The results for all 16 sets of assumptions can be found in Walsh & Rickayzen (2000).

In this paper we have used Bases C, N and A in order to obtain central, optimistic and pessimistic results, but with an alteration made to the mortality rate assumption. The overall mortality assumed throughout this paper is the IL92 mortality table (males and females, as appropriate) rather than the Government Actuary's Department (GAD) central population projection for the period 1996 to 2036 (Government Actuary, 1998) which was assumed in Rickayzen & Walsh (2002). The reason for this is that using the IL92 tables will result in smoothed mortality rates being incorporated. This change has an insignificant effect on the results.

We conclude our summary of the long term care model by highlighting the differences between the 3 sets of assumptions used in this paper.

With Basis A (the most pessimistic assumptions), we assume no trends in the transition rates other than an improvement in overall mortality (which is implicit within both the IL92 tables and the GAD projections).

With Basis C (the central assumptions), in addition to the trend regarding overall mortality, we allow for the following improvement in disability rates: we assume that the probability that a healthy person aged x in year y becomes disabled in the following year is equal to the probability that a healthy person aged $x + 1$ in year $y + 10$ becomes disabled in the following year. This one year shift in age every 10 calendar years in relation to the probability of becoming disabled leads to this trend being described as '1 in 10'. Since it is assumed that the probability of becoming disabled in a year increases with age, this represents an improvement in disability rates over time.

Basis N (the most optimistic assumptions) is similar to Basis C except that we assume a '1 in 5' rather than '1 in 10' trend regarding disability probabilities. We also assume a slight reduction in the probability that a disabled person becomes more severely disabled in the following year.

The reason for choosing Basis C as our central scenario is that with these assumptions, there would be a gradual increase in healthy life expectancy as well as in the time spent disabled, just as the available national datasets suggest (National Statistics, 2004). Scenario N is approximately equivalent to the compression of morbidity hypothesis (Fries, 1980, i.e. that individuals live longer but with a reduced amount of time spent disabled) and scenario A to the expansion of morbidity hypothesis (Gruenberg, 1977, i.e. that individuals live longer, but spend a longer time disabled).

3.3.2 Common assumptions

Generally, we calculate insurance premiums using a prevalence rate approach, allowing for the benefits paid by the insurance company to depend not only on the severity of disability but also on personal characteristics that vary systematically by age, gender, and education level.

It should be noted, however, that the policies suggested here offer individuals poor mitigation of risk since it is assumed that variables such as marital status and income are completely non-random and mutually independent. In other words, the insurance policies considered here are deficient in the sense that they do not exploit the possibility of insuring the individuals against disability and loss of spouse jointly, which would be the most natural application of studying them jointly. This is a topic for future research. The following analysis offers some stylised figures on what top-up insurance policies could look like.

The basic equation for determining premium rates (ignoring expenses) is

$$P_x^i \cdot \sum_{k=x}^{120} v^{k-x} \frac{l_k}{l_x} = \sum_{k=x+1}^{120} v^{k-x} \left(\frac{l_k^1}{l_x} B^1 \left(w^i (k), m^i (k) \right) + \frac{l_k^2}{l_x} B^2 \left(w^i (k), m^i (k) \right) \right)$$

where P_x^i is the annual premium paid by an individual of group i if purchasing insurance at age x, v is the annual discount rate[5] (and $v = \frac{1}{1+i}$ where i is the assumed annual investment return), l_k is the number of healthy lives (OPCS level 0-4) at age k, l_k^1 is the number of lives who are moderately disabled at age k and l_k^2 is the number of lives that are severely disabled. $B^1 \left(w^i (k), m^i (k) \right)$ is the benefits function, defined differently for each policy type, which defines the insurance benefits accruing of a person of moderate disability (OPCS level 5-7) with income $w^i (k)$ and marital status $m^i (k)$. Strictly speaking, benefits are a function of the group (i) and the age (k) of the individual only, but since all characteristics of an individual are assumed to be completely deterministic and independently distributed, the two different approaches amount to the same thing. Similarly, $B^2 \left(w^i (k), m^i (k) \right)$ is the level of benefits paid to an individual with severe disability (OPCS level 8-10). It should be noted that we assume that individuals pay contributions to the insurance only as long as they are healthy (i.e. OPCS level 0-4). Furthermore, all benefits are in cash and not in kind; hence, individuals are not insured against cost inflation in the LTC sector.

We do not at this stage allow for conditioning the annual premium on cohabitation status.

[5] We work with the assumption of an annual discount rate of 3 per cent.

Hence, premiums are paid according to the expected cohabitation status given age, gender and socioeconomic status, and benefits are derived in the same way. Of course, in practice, the future probability of cohabitation will certainly depend on current cohabitation status. Hence, the premium rates derived here must necessarily be seen as a crude average across single and cohabiting people. We will allow for diversified premiums in future research. For the moment, however, this assumption is convenient and it also implies that insurers do not reassess premiums after one spouse dies.

3.3.3 Policy 1A: No public subsidy, no top-up

This policy is a conventional insurance product where benefits are constant and independent of level of incomes and the other characteristics of the individual. 'No public subsidy' means that the existence of any insurance benefits preclude funding on the part of the public sector; in other words, insurance benefits have precedence over public transfer. We have made the following assumptions:

$$B^1(\cdot) = 10,000$$
$$B^2(\cdot) = 20,000$$

which could be interpreted as roughly corresponding to the annual cost of relatively intense home care and institutional care, respectively.

3.3.4 Policy 1B: No public subsidy, narrow income definition, spouse disregarded

As with policy 1A, policy 1B assumes that the public support system is residual to insurance benefits. A further assumption is that the insurance benefit tops up average income levels in the group. Investment income is disregarded. Hence:

$$B^1\left(w^i(k), m^i(k)\right) = \max\left\{10,000 - w^i(k), 0\right\}$$
$$B^2\left(w^i(k), m^i(k)\right) = \max\left\{20,000 - w^i(k), 0\right\}$$

which means that the insurance benefit is at most the difference between care costs and the income of the individual (i.e. provided this amount is non-negative).

3.3.5 Policy 1C: No public subsidy, narrow income definition, spouse included

In this case we allow for the insurance benefit to depend on the (average) availability of a spouse. Hence, it is assumed that a severely disabled individual will only need intense home care if a spouse is available,[6] and a moderately disabled individual will need no formal care at all in this case.

$$B^1\left(w^i(k), m^i(k)\right) = \begin{cases} \max\left\{10,000 - w^i(k), 0\right\} \text{ if } m^i(k) = 0 \\ 0 \text{ otherwise} \end{cases}$$
$$B^2\left(w^i(k), m^i(k)\right) = \begin{cases} \max\left\{20,000 - w^i(k), 0\right\} \text{ if } m^i(k) = 0 \\ \max\left\{10,000 - w^i(k), 0\right\} \text{ otherwise} \end{cases}$$

3.3.6 Policy 1D: No public subsidy, wide income definition, spouse disregarded

This policy assumes that the individual derives an income from his/her assets and properties other than his/her own home. Hence, the equations involved are identical to those of policy 1B above, with the difference that $w^i(k)$ now also includes investment income.

3.3.7 Policy 1E: No public subsidy, wide income definition, spouse included

Again, we allow for the income path, $w^i(k)$, to include investment income. Apart from that, the equations are identical to those of policy 1C above.

[6] This assumption is of course dubious as far as really severe disability is concerned.

3.3.8 Policy 2A: Public subsidy, no top-up

In this case, we assume that the insurance provides benefits only when the individual does not qualify for public benefits, or if the public benefits would come at the cost of spending down assets. Hence, the individual will receive insurance benefits only if two conditions are fulfilled: one is that his/her assets are above the threshold for capital disregard (because in that range the public subsidy would work exactly as top-up insurance) and the second one is that the individual's income falls short of the actual cost of care. This policy corresponds to policy 1A in that we assume that benefits are flat-rate and do not top up the income and/or any care provided by the spouse of the individual. Hence,

$$B^1\left(w^i(k), m^i(k)\right) = \begin{cases} 10,000 \text{ if } w^i(k) < 10,000 \wedge c^i\left(k, m^i(k)\right) > 11,750 \\ \text{0 otherwise} \end{cases}$$
$$B^2\left(w^i(k), m^i(k)\right) = \begin{cases} 20,000 \text{ if } w^i(k) < 20,000 \wedge c^i\left(k, m^i(k)\right) > 11,750 \\ \text{0 otherwise} \end{cases}$$

where $c^i\left(k, m^i(k)\right)$ is the level of assets, the amount of which depends on whether the individual is cohabiting (value of home excluded) or living alone (value of home included). The amount £11,750 is the current threshold for capital disregard in the means testing formula in the U.K., i.e. the level below which the individual's assets will be disregarded when the public subsidy is determined.

3.3.9 Policy 2B: Public subsidy, narrow income definition, spouse disregarded

This policy corresponds to 1B with the addition that the insurance pays benefits only when there is no public support available that does not require spend down on assets. Hence, the benefit functions are:

$$B^1\left(w^i(k), m^i(k)\right) = \begin{cases} 10,000 - w^i(k) \text{ if } w^i(k) < 10,000 \wedge c^i\left(k, m^i(k)\right) > 11,750 \\ 0 \text{ otherwise} \end{cases}$$

$$B^2\left(w^i(k), m^i(k)\right) = \begin{cases} 20,000 - w^i(k) \text{ if } w^i(k) < 20,000 \wedge c^i\left(k, m^i(k)\right) > 11,750 \\ 0 \text{ otherwise} \end{cases}$$

where again the income function $w^i(k)$ is narrowly defined, i.e. it excludes investment income.

3.3.10 Policy 2C: Public subsidy, narrow income definition, spouse included

This policy corresponds to 1C with the addition that the insurance pays benefits only when there is no public support available that does not require spend down on assets. Hence, the benefit functions are:

$$B^1\left(w^i(k), m^i(k)\right) = \begin{cases} 10,000 - w^i(k) \text{ if } w^i(k) < 10,000 \wedge c^i\left(k, m^i(k)\right) > 11,750 \wedge m^i(k) = 0 \\ 0 \text{ otherwise} \end{cases}$$

$$B^2\left(w^i(k), m^i(k)\right) = \begin{cases} 20,000 - w^i(k) \text{ if } w^i(k) < 20,000 \wedge c^i\left(k, m^i(k)\right) > 11,750 \wedge m^i(k) = 0 \\ 10,000 - w^i(k) \text{ if } w^i(k) < 10,000 \wedge c^i\left(k, m^i(k)\right) > 11,750 \wedge m^i(k) = 1 \\ 0 \text{ otherwise} \end{cases}$$

3.3.11 Policy 2D: Public subsidy, wide income definition, spouse disregarded

This policy assumes that the individual derives an income from his/her assets and properties other than his/her own home. Hence, the equations involved are identical to those of policy 2B above, with the difference that $w^i(k)$ now also includes investment income.

3.3.12 Policy 2E: No public subsidy, wide income definition, spouse included

Again, we allow for the income path, $w^i(k)$, to include investment income. Apart from that, the equations are identical to those of policy 2C above.

3.4 Discussion

The reader will have noticed that the methodology and assumptions presented here are not in complete agreement with what a real world top-up LTC insurance product would require. For example, we ignore interesting practical challenges which an insurer would face in designing such an insurance policy (e.g. moral hazard and adverse selection). Nevertheless, by considering a hypothetical top-up insurance product, we gain valuable insights into the extent to which individuals might take their personal circumstances into account when considering the funding of their future LTC requirements.

In the next section we present some preliminary findings concerning the potential demand for top-up LTC insurance.

4 Preliminary Findings

4.1 Income, Asset and Cohabitation Trajectories

Results for labour income are presented in *Figure 3*. In this figure, the conventions are as follows: *Male Low* = males with no further education, *Male Medium* = males with some further education, *Male High* = males with university education. In the same manner, *Female Low* refers to females with no further education, and so forth.

Quite expectedly, earnings increase in the first part of the working life, and reach a peak around the age 45-50. The peak occurs later the higher the level of education. It is notable that the peak occurs a little earlier than is normally perceived as the peak of the wage curve, and this is due to the fact that the figure has had the effects of inflation and general productivity increases removed.[7]

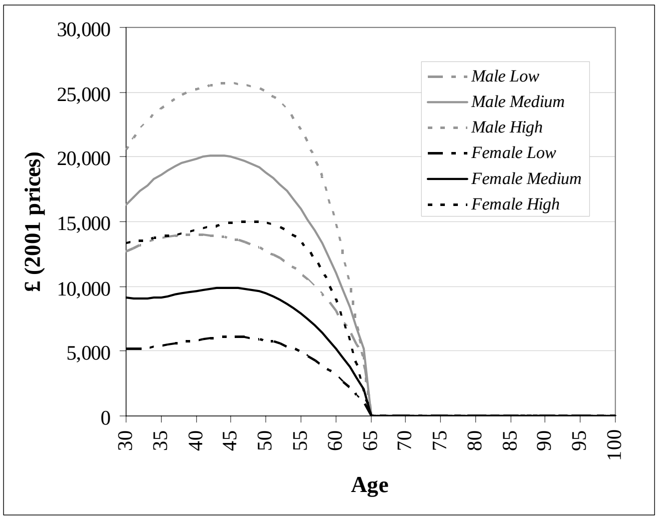

Figure 3. Labour income by age, gender and education level..

As expected, we find that labour income is positively correlated with education level. Hence,

[7] This was done using the Consumer Price Index.

men with university degrees reach a peak at around age 45 with annual earnings of more than £ 25,000 per year, whereas females with no further education do not earn more than £ 7,000 on average.

Adding non-labour income, such as transfers from the government (including state pension), to the equation, we arrive at the values presented in *Figure 4*. In this figure, we see that total income follows a path similar to that of labour income, but with a less sharp decline when people retire (as we would expect). It should also be noted that the income curve for low education males follows the curve of females with university degrees quite closely, hence there is quite considerable gender inequality (which, however, is partly attributable to differences in labour market participation, number of hours worked etc).

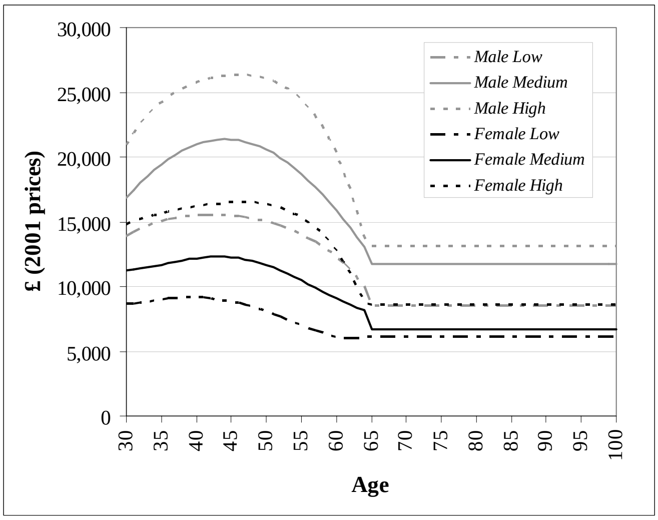

Figure 4. Total non-investment income by age, gender and education level..

It can also be seen from *Figure 4* that individuals with higher income experience a greater decline in income at retirement. Hence, males with some further education, have a peak in their incomes at around £ 22,000, and have an income of just £ 12,000 after retirement (i.e. a 45 per cent reduction), whereas females with no further education experience a decrease of only 30 per cent.

Turning to assets, we work with two different concepts, defined more or less in accordance with the rules applied by the means testing procedure for institutional care. As a narrow definition of assets, we consider the sum of savings/capital (as derived from the investment income data according to the BHPS) and the net value of any property other than the home of the individual. In cases where this property is owned jointly by the individual and another person, it has been assumed that their respective shares in the property equal 50 per cent. The estimated curves are provided in *Figure 5*.

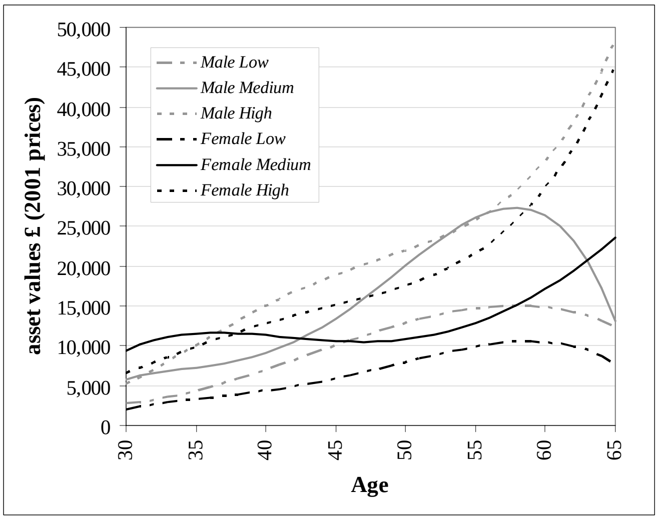

Figure 5. Assets (narrow definition) by age, gender and education level..

According to *Figure 5*, people with university degrees keep accumulating assets throughout their working life. As regards individuals with a lower level of education, the asset accumulation path tends to reach a peak just before the age of 60, after which it declines slightly and then stays constant during retirement. Regarding the third education group, the middle one, the asset accumulation paths exhibit some irregularities that are persistent across definitions of the variable assets, which makes it more difficult to interpret the behaviour.

It should be noted that the gender differences in assets are less marked than the gender differences in income. On the other hand, the differences according to education level are greater in the case of assets than income.

Next, we consider asset levels including the home of the individual (i.e. in cases where the home is owned by the individual) in *Figure 6*. The patterns that emerge are largely similar to those in *Figure 5*, only at higher levels. Again, assets remain fairly constant after retirement.

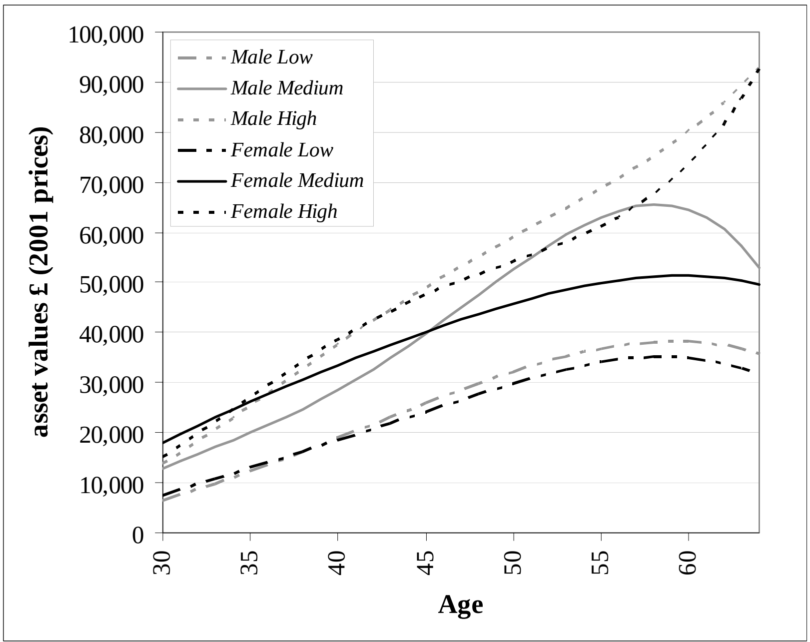

Figure 6. Assets (wide definition) by age, gender and education level..

When analysing the ratio of assets to income, we find that the higher the education level achieved, the higher the ratio. In addition, the ratio increases with age. The narrow ratio (i.e. excluding housing wealth) also tends to be higher for women than for men. Figures for the retired population are provided in *Table 1*.

Hence, according to *Table 1*, women tend to hold more assets (in relative terms) than men according to the narrow definition of assets, but less according to the wide definition. In other

Table 1. The ratio between assets and income in the retired (65+) population. 2001 pounds.

Gender	**Education**	**Assets/Income** *(narrow definiton)*	**Assets/Income** *(wide definition)*
Male	*Low*	1.60	2.17
	Medium	2.56	4.97
	High	2.81	5.86
Female	*Low*	1.26	1.24
	Medium	3.04	2.97
	High	3.73	4.68

words, men are more likely to be homeowners than women.

Finally, we show the estimates for the cohabitation variable in *Figure 7*. There is some irregularity concerning the low education group, but in general, the patterns are clear: In the retirement years, men have a higher probability of cohabitation than females (since men tend to predecease their spouses). Furthermore, the probability of cohabitation does not monotonically increase with educational level. On the contrary, it is rather the middle education group that tends to have the highest probability of cohabitation at older ages. We can only speculate on the reason for this. That the middle education group has a higher probability than the lowest group could be attributable to the well-known relationship between socioeconomic status and life expectancy. It is more puzzling that the middle education group has higher probabilities than the highest education group. This might be due to, for example, a higher divorce or never married rate in the latter group.

4.2 Insurance Premiums

Since we are considering 10 different types of insurance policies, three different health scenarios and six different population groups, we have a total of 180 different insurance premium functions calculated. It is, of course, not possible to present all combinations here; so instead,

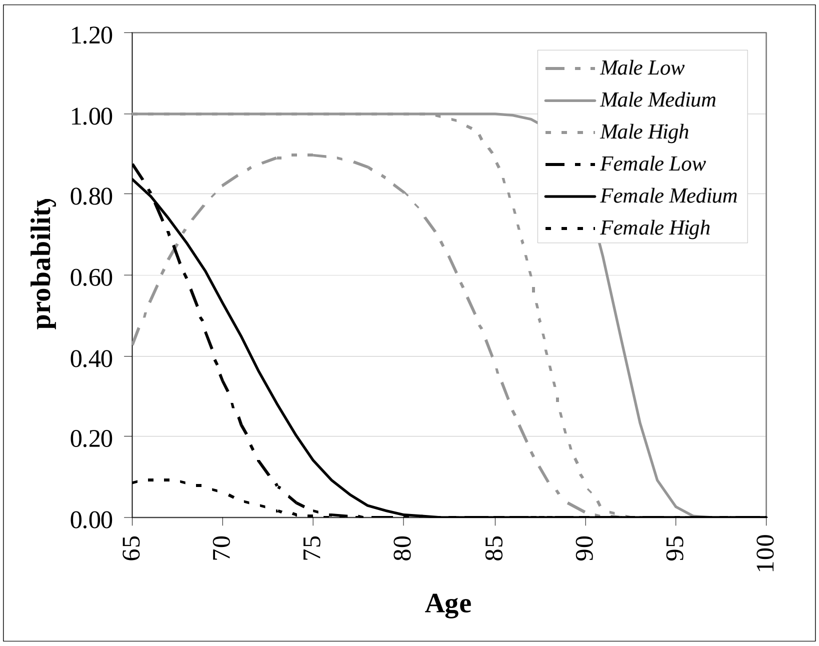

Figure 7. Predicted probability of cohabitation by age, education level and gender.

we will focus on the effects of altering some assumptions at a time. Before turning to the premium rates, however, we consider the insurance benefits accruing under different policies. A summary of the types of policies available is given in *Table 2*.[8]

4.2.1 Insurance Benefits

We will illustrate the effects of allowing for insurance to top up income and the care provided by a spouse by looking at the effects on insurance benefits for a male with some further education. The benefit functions for policies 1A-E, i.e. the policy types where public support is secondary, are provided in *Figure 8*. The horizontal line (Type 1A) corresponds to conventional insurance: as benefits in this case only condition on disability they are constant over time. The two thinner

[8] The first row in the table - ’Primary source’ - refers to whether holding an insurance policy precludes public subsidies (’Ins’) or not (’Publ’). The second row - ’Income top-up’ - refers to whether income risk is insured along with disability. The third row - ’Investment income included’ - refers to whether the income concept is narrow (only earnings and transfers) or wide (also capital returns). The final row - ’Spouse included’ - refers to whether the cohabitation risk is insured along with the two other risks.

Table 2. Characterisation of different insurance policies.

Policy	1A	1B	1C	1D	1E	2A	2B	2C	2D	2E
Primary source	Ins	Ins	Ins	Ins	Ins	Publ	Publ	Publ	Publ	Publ
Income top-up	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Investment income included	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Spouse included	No	No	Yes	No	Yes	No	No	Yes	No	Yes

curves, Type 1B and 1D, portray insurance benefits that top-up income but disregard the availability of a spouse. For these, for most of the working life there is no need for cover since high earnings means that the individual has enough income to pay for care. However, in retirement, some top-up is needed in order to avoid the spending down of assets. The thicker dashed and dotted curves (Type 1C and 1E) also take the existence of a spouse into account, hence benefits are needed only at relatively high ages.

Clearly, there is a considerable reduction of the insurance benefits required as soon as personal characteristics are taken into account. The income of the individual typically covers around 50 per cent of actual costs, and at the ages where labour income reaches its peak, no benefit at all is needed in the event of disability. Furthermore, with the policies where the availability of a spouse is taken into account (policies 1C and 1E) the individual needs virtually no top-up before very high ages have been reached (e.g. age 85).

Next, we turn to the policies where the insurance product only tops up in cases where the first source of funding is the public sector, and the private insurance only tops up in cases where relying on the public system would imply spending down assets. Figures are presented in *Figure 9*.

Clearly, this alteration only has implications for younger ages, that is, before the individual

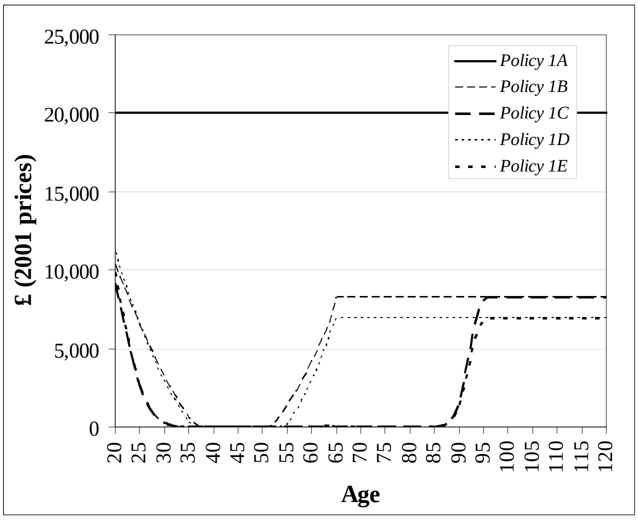

Figure 8. Annual insurance benefits in the event of severe disability, male medium earner.

has accumulated capital above the capital disregard threshold.

4.2.2 The Annual Insurance Premium

We now turn to calculating the annual insurance premium which the purchasers of insurance would need to pay for the various types of policies. As before, we consider individuals with the medium education level, and in this part we restrict our attention to the baseline health scenario. In *Figure 10*, we present annual premium rates for males under the various policy types.

As expected, the top-up option leads to a considerable reduction in the annual insurance premium. Accordingly, with a conventional insurance policy, the annual premium is more than £ 1,000 for policies taken out after the age of 54. With the narrowest type of top-up insurance (i.e. 1B: narrow income definition and spouse not taken into account) it is only at the age of 78 that this level of initial premium is reached. For the most extensive form of coverage (i.e. 1E: wide income definition and spouse taken into account) the annual premium is less than £ 1,000 unless insurance is taken up after the age of 86.

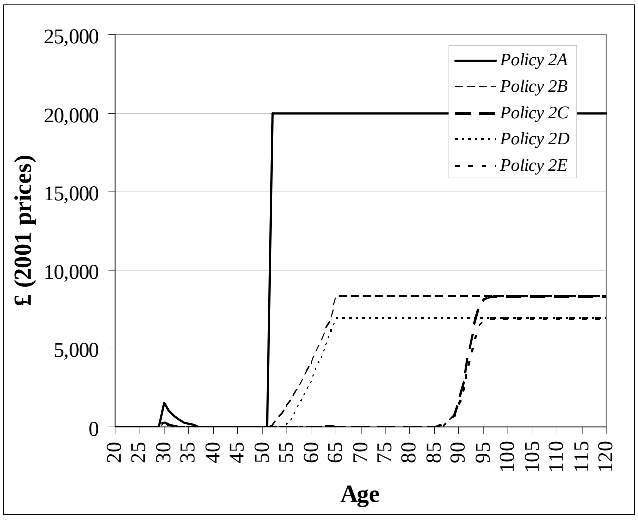

Figure 9. Annual insurance benefits in the event of severe disability, male medium earner, first source of funding is public sector.

For cases where the public sector is the primary source of funding, we present some results in *Figure 11*.

As expected, this alteration has only a small effect on premium rates. The only premium rate that is largely affected by the existence of public sector funding is the one for conventional insurance: now the level of £ 1,000 is reached only at a takeup age of 63. Hence, allowing for private insurance to complement public sector benefits is already a way to reduce premium rates significantly.

Turning to female medium earners, we show the premium rates (for the non-public policies) in *Figure 12*.

The picture is largely similar to that for male individuals, but with the notable difference that taking the spouse into account does not make a big difference. Males are likely to pre-decease their wives and therefore they are not likely to provide much informal care. In addition, the premium rates are generally higher, reflecting the higher disability rates of women. Accord-

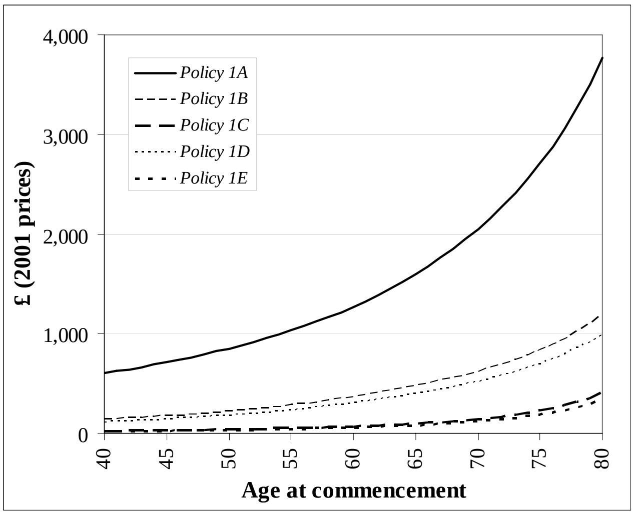

Figure 10. Annual insurance premiums for different insurance policies, male medium earner, public subsidy secondary. Baseline health scenario (C)

ingly, in this case, the £ 1,000 p.a. premium threshold is reached at the age of 46 in the case of conventional insurance, compared to age 65 for the least extensive top-up policy, and age 68 for the most extensive one.

The corresponding premium rates for policies including public involvement are presented in *Figure 13*.

The results are, again, similar to those where there is no public intervention. The age for conventional insurance where the £ 1,000 p.a. premium threshold is reached now increases to 56, whereas the other premium rates are largely unaffected.

4.2.3 Different Health Scenarios

We now analyse the effects of different health scenarios on the premium rates. For convenience, we summarise the three different scenarios under consideration in *Table 3*.

In *Figure 14*, we present premium rates for male medium earners under the three different health scenarios and under three different insurance policies.

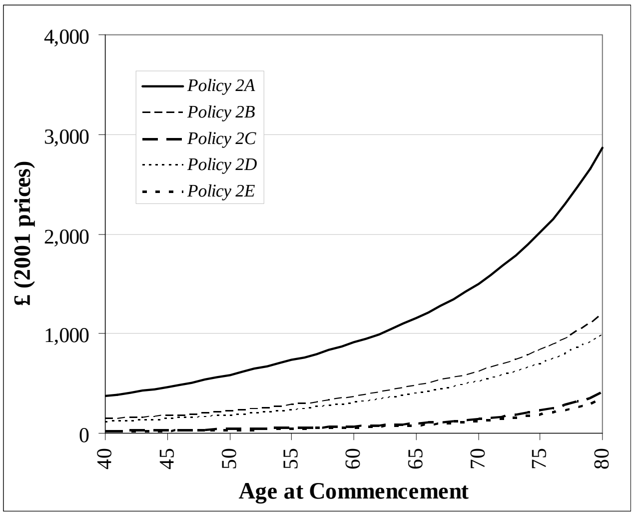

Figure 11. Annual insurance premiums for different insurance policies, male medium earner. Public subsidy primary. Baseline health scenario (C)

In the figure, black curves refer to the baseline scenario of a moderate improvement in health over time (scenario C). Similarly, dark grey curves refer to the pessimistic scenario (A) of no health improvement whereas the light grey curves refer to the optimistic health scenario (N). Full lines represent the benchmark scenario of no top-up, whereas dotted curves represent the case of income top-up and the dashed curves represent income and spouse top-up.

Two observations can be made about *Figure 14*. Firstly, the impact of introducing top-up insurance on premium rates is of the same order of magnitude as altering the health scenarios. Secondly, the reduction in premium rates due to top-up is greater in the more pessimistic scenario than in the more optimistic one - and the baseline scenario is, as expected an intermediate case. Concerning the £ 1,000 p.a. premium threshold, with the pessimistic scenario it occurs at age 37 (scenario 1A: no public subsidy, no top-up), 63 years (1B: no public subsidy, income top-up) and 80 years (1C: no public subsidy, income and spouse top-up) respectively. In the optimistic scenario, the corresponding ages are 74 years (scenario 1A) and 95 years for scenarios

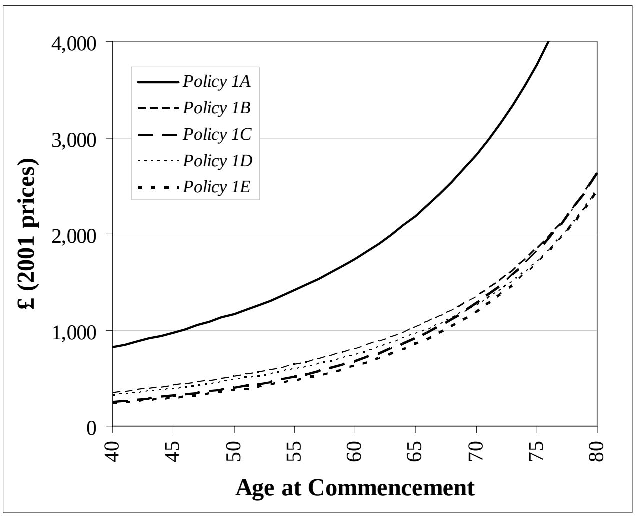

Figure 12. Annual insurance premiums for different insurance policies, female medium earner. Public subsidy secondary. Baseline health scenario (C)

1B and 1C.

The corresponding premium functions are presented for female medium earners in *Figure 15*.

As usual, women generally have higher premium rates than men. The changes in premiums due to top-up seem to be slightly greater than the reductions due to changing health scenarios. For the pessimistic scenario (A), the age at which takeup premium rates reach £ 1,000 is 30 years (scenario 1A), 49 years (scenario 1B) and 53 years (scenario 1C) respectively. For the optimistic scenario (N), the corresponding ages are 68, 85 and 85, respectively. Hence, the availability of top-up insurance can make private LTC insurance attractive even at relatively high ages.

4.2.4 Comparing socioeconomic groups

Finally, we look at how the premiums would differ for different socioeconomic groups. We focus on the baseline health scenario (C) and examine the same top-up scenarios as before, i.e.

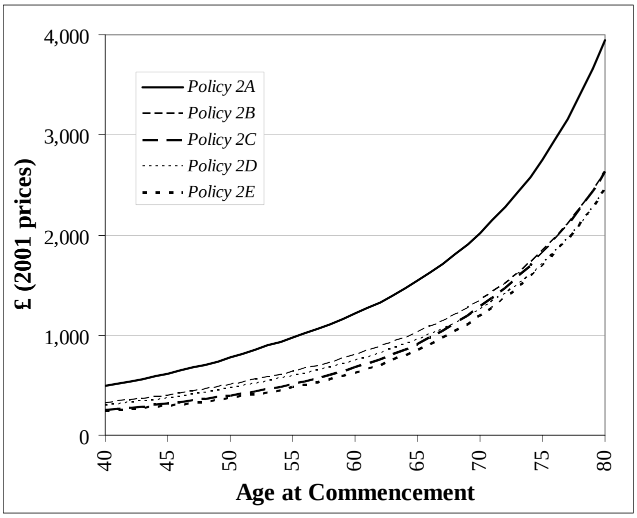

Figure 13. Annual insurance premiums for different scenarios, female medium earner. Public subsidy primary. Baseline Health Scenario

1 A, B and C. Results for men are provided in *Figure 16*.

In the figure, black curves correspond to the medium education group, whereas dark grey curves correspond to the low education group and light grey curves correspond to the high education group. Interestingly, it is not only differences in income which account for the differences in premium rates between the different education level groups. As mentioned previously, individuals in the medium income group are more likely to have a spouse which leads to this group having the lowest premium rate of all once income and spouse are taken into account. In terms of where the policies hit the £ 1,000 p.a. premium threshold, the highest premium curve is the one for low education men when the spouse is not taken into account (73), whereas the corresponding ages for medium and high education men are 78 and 81 respectively. For income and spouse top-up, the low education group reaches £ 1,000 p.a. at the age of 78, compared to 86 and 84 for the medium and high education groups, respectively.

We make the same comparison for women in *Figure 17*.

Table 3. Characterisation of different disability scenarios.

Scenario	Name	Assumption
A	*Pessimistic*	No further health improvements
C	*Baseline*	‘1 in 10’
N	*Optimistic*	‘1 in 5’ plus reduced probability of deterioration

The differences between the socioeconomic groups in terms of insurance premiums are much smaller for females than for males. As before, looking at the age at which a £ 1,000 p.a. takeup premium is reached, it varies only between 64 years of age and 68 years of age. This result is to be expected since females have smaller differences in their earnings due to education and tend to be widowed at the point when long term care is needed.

4.3 Group sizes

The previous exposition has shown that changing the terms of insurance products could potentially reduce premium rates a great deal. This finding suggests that provided the motive for taking up LTC insurance is the one we have assumed in this report, there might be a larger demand for tailor-made products than for the products already available on the market. We will not be able to give an assessment of the actual demand for LTC insurance, since the assumptions we have made of individual behaviour are rather simplistic. But, to give the reader some indication of the likely size of the market, we will partition the 2001 UK population into the groups we have been considering here. Figures are provided in *Table 4*.

In order to give a crude estimate of how market size and premium income would change if new products were to be introduced, we have made a rough estimate of the number of policy holders and total premium income under various scenarios. These estimates are clearly crude and marred by several methodological shortcomings; hence they will need to be complemented by future research using more rigorous economic modelling techniques.

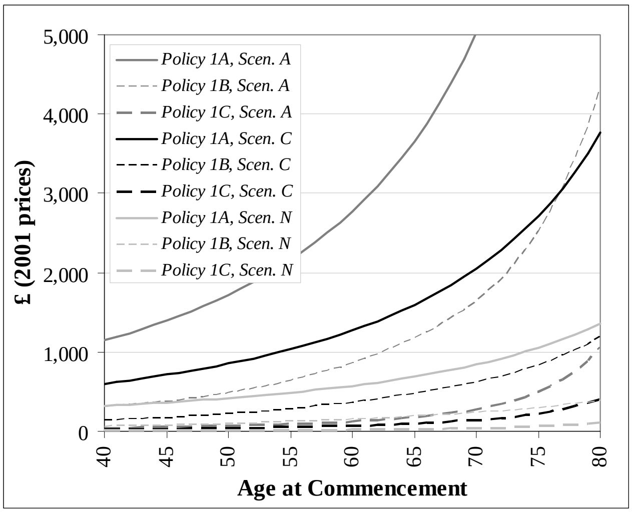

Figure 14. Annual insurance premiums for different policies and health scenarios, male medium earner. Public subsidy secondary

In order to arrive at something similar to a demand curve, we have made a number of simplifying assumptions. Firstly, we now abandon the assumption that all individuals of a certain subgroup are identical, and assume instead that they respond in different ways to the changes in price that the introduction of a top-up policy produces (nevertheless we keep the assumption that there is no information asymmetry between the customers and the insurance company). Furthermore, we assume that the concept of price elasticity of demand is well defined in a shift from conventional to top-up insurance, despite the facts that a) top-up insurance represents a different product – not only compared with conventional insurance, but also a qualitatively different product for each subgroup of the population and b) all products considered are assumed to be actuarially priced and hence it does not make sense to talk about one being 'cheaper' than the other.

Our method to assess potential "demand" is based on the following considerations:

• The number of current policy holders is 40,000

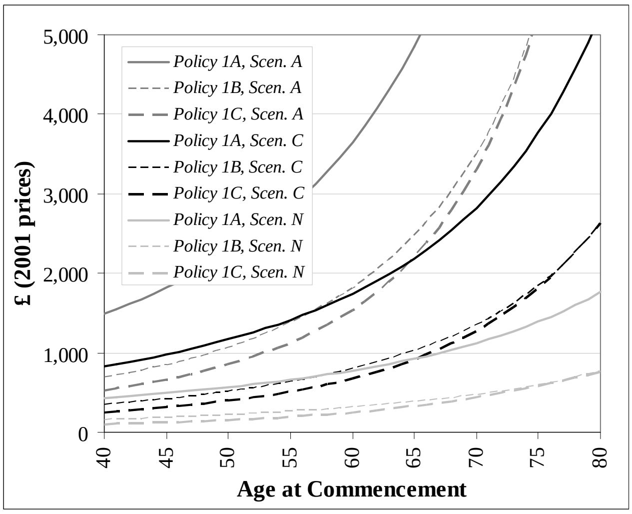

Figure 15. Annual insurance premiums for different policies and health scenarios, female medium earner. Public subsidy secondary

- The ‘demand function’ is assumed to have constant ‘price elasticity’, hence $q = kp^{-r}$ where p is the premium rate, q the quantity demanded, r a parameter representing ‘price elasticity’[9], and k a constant.

- Parameters are chosen so as to replicate the current 40,000 demand for LTC insurance

- We undertake sensitivity analysis with respect to ‘price elasticity’ and the typical age at takeup

- Econometric studies from the U.S. have estimated price elasticity for conventional LTC insurance at around -1.2 (Cohen & Weinrobe, 2000). As the ‘elasticity’ we are utilising must necessarily be much lower (in absolute value), we choose this figure as the upper bound for our estimates

- Since the two types of policies are equivalent from an actuarial point of view (i.e. neither of them is over- or underpriced), the case of zero ‘price elasticity’ is a natural lower bound

[9] The reader should note that we are using the concepts of ’demand’ and ’price elasticity’ outside their domains, and in a context where they are not well defined. Hence the quotation marks.

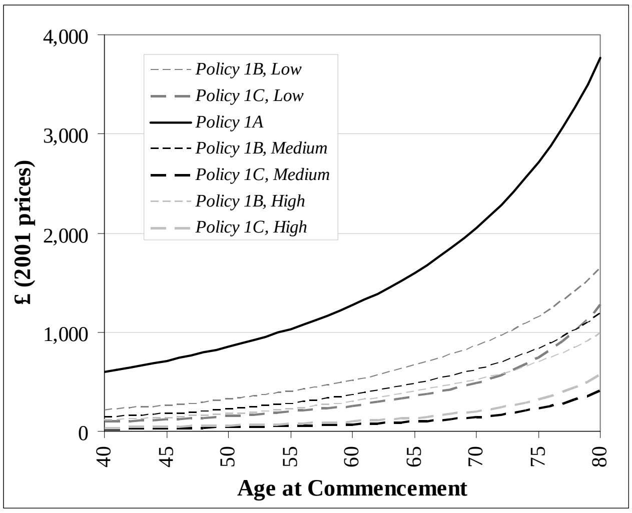

Figure 16. Annual insurance premiums for different policies and socioeconomic groups, males. Public subsidy secondary. Baseline Health Scenario

Hence, if the 'conventional insurance' premium rates[10] are denoted p_x^m and p_x^w for men and women aged x, respectively, and the demand schedule for each group is $q^i = k(p_x^i)^{-r}$, $i = m, w$, then we derive the parameter $k\,(r, x)$ for different 'elasticities' and takeup ages by solving the following:

$$k\,(r, x)\left[(p_x^m)^{-r} + (p_x^w)^{-r}\right] = 40,000 \tag{1}$$

Hence, for each possible age of takeup, we derive the coefficients $k\,(r, x)$ that are needed to get the current demand for LTC insurance under the assumption that *every* policyholder took up insurance at age x. Using the values of $k\,(r, x)$ derived this way, we may then calculate the 'demand' for top-up LTC by the formula

$$q_x^i = k\,(r, x)\,(\widetilde{p}_x^i)^{-r},\ i = m, w \tag{2}$$

[10] The premiums for 'conventional' insurance are calculated according to the model above (i.e. Policy 1A), as given in Figure 12.

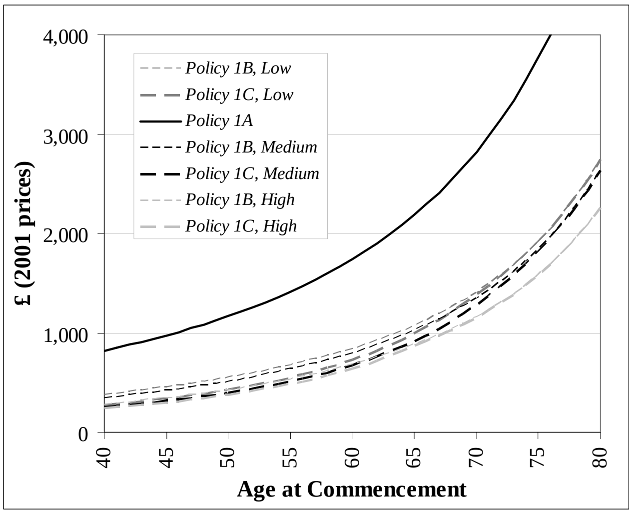

Figure 17. Annual insurance premiums for different scenarios and socioeconomic groups, females. Public subsidy secondary. Baseline Health Scenario

where $\widetilde{p}_x^i$ is the premium for top-up insurance for a person of age x and gender i, and premium income, t_x^i, is then

$$t_x^i = k\,(r, x)\,(\widetilde{p}_x^i)^{1-r},\ i = m, w \tag{3}$$

We present the results concerning the number of policies in *Table 5*, and concerning total premium income in *Table 6*. As follows from the assumptions, the top-up LTC insurance would be demanded to a greater extent than conventional insurance. This surge in demand does not necessarily, however, translate into an increase in yearly premium income. For the most "optimistic" scenario, demand would increase at least threefold (and in some cases tenfold if policy type 1C were to be introduced). This does, however, translate into a rather modest increase in premium income (typically 15-23 per cent for 1B and 27-43 per cent for 1C).

As there are more appropriate techniques to undertake this analysis (e.g. dynamic optimisation models where the problem can be analysed in all its complexity), these results need

Table 4. The UK population by subgroup.

Gender	Male			Female			
Education	*Low*	*Medium*	*High*	*Low*	*Medium*	*High*	**Total**
40-44	1,164,812	655,386	360,605	1,355,781	568,553	314,344	4,419,482
45-49	1,035,513	575,932	305,418	1,116,272	555,413	253,203	3,841,751
50-54	1,120,940	576,999	246,426	1,338,533	380,947	213,957	3,877,802
55-59	1,176,610	509,758	163,507	1,333,402	362,223	120,741	3,666,242
60-64	988,865	339,640	138,261	1,105,272	237,777	65,323	2,875,139
65-69	1,026,990	241,829	75,375	947,752	235,723	58,323	2,585,993
70-74	996,866	214,949	49,843	892,259	139,139	24,294	2,317,351
75-79	897,621	159,656	53,219	690,132	96,470	18,552	1,915,649
Total	8,408,217	3,274,148	1,392,655	8,779,404	2,576,247	1,068,738	25,499,409

to be interpreted with some caution. We conclude by establishing that *if* the introduction of LTCI leads to a substantial surge in demand, this corresponds to an increase in yearly premium income at an order of magnitude of millions of pounds. Future research will employ more standard economic analysis in order to get a more rigorous estimate of the potential market under various scenarios.

Table 5. Potential demand under various scenarios. Thousands

Policy type	Conv	Type 1B					Type 1C				
Elasticity		*0.0*	*-0.5*	*-1.0*	*-1.1*	*-1.2*	*0.0*	*-0.5*	*-1.0*	*-1.1*	*-1.2*
Purchase age											
40-44	40.0	40.0	72.5	137.5	157.2	179.9	40.0	113.3	396.4	519.5	684.6
45-49	40.0	40.0	71.2	132.2	150.3	171.3	40.0	110.5	376.6	491.1	643.8
50-54	40.0	40.0	69.7	126.4	143.0	162.1	40.0	107.3	355.3	460.5	600.0
55-59	40.0	40.0	68.2	120.4	135.5	152.6	40.0	103.8	331.8	427.1	552.6
60-64	40.0	40.0	66.7	114.9	128.6	144.0	40.0	99.7	305.4	389.8	500.0
65-69	40.0	40.0	66.0	112.2	125.2	139.9	40.0	95.2	276.8	349.3	443.2
70-74	40.0	40.0	65.5	110.5	123.2	137.5	40.0	90.0	243.7	302.8	378.2
75-79	40.0	40.0	64.8	108.4	120.6	134.4	40.0	83.5	204.1	248.1	302.9

Table 6. Potential turnover under various scenarios. Million pounds

Policy type	Conv	Type 1B					Type 1C				
Elasticity		*0.0*	*-0.5*	*-1.0*	*-1.1*	*-1.2*	*0.0*	*-0.5*	*-1.0*	*-1.1*	*-1.2*
Purchase age											
40-44	30.5	10.6	17.4	29.8	33.3	37.4	6.8	13.2	29.8	35.9	43.7
45-49	36.3	12.9	21.0	35.4	39.5	44.2	8.5	16.1	35.4	42.5	51.5
50-54	43.7	16.1	25.7	42.6	47.3	52.7	10.8	19.9	42.6	50.8	61.2
55-59	53.2	20.2	31.9	51.9	57.4	63.7	14.0	25.0	51.9	61.6	73.6
60-64	66.0	25.9	40.3	64.4	71.0	78.3	18.7	32.2	64.4	75.7	89.9
65-69	83.7	33.5	51.6	81.7	89.8	98.9	25.6	42.5	81.7	95.2	112.0
70-74	109.2	44.5	67.9	106.5	116.9	128.5	35.7	57.6	106.5	123.0	143.1
75-79	147.8	61.6	92.8	143.8	157.5	172.8	51.7	81.4	143.8	164.0	188.2

5 Conclusion

This paper has presented a simple model to give some rough estimates of what premium rates (excluding expense and profit loadings) would look like if insurance companies were to provide tailor-made products for different subgroups of the U.K. population. In particular, we have considered a ”top-up” option whereby individuals consider the amount of benefit they would require from an insurer to top up the care provided by the state and their spouse (if any) to a level appropriate to meet their care needs. Clearly, there would be practical difficulties in designing such policies; however, it is useful to consider the effect on premium rates and potential demand if such products existed. We have made several important observations. Firstly, we find that a top-up option reduces the annual premium required considerably. For instance, males with some further education would need to pay annual premiums of more than £ 1,000 p.a. if a non ”top-up” policy is purchased after the age of 54. With top-up insurance, this threshold is reached only in the late seventies or eighties. Hence, taken at face value, it seems that offering top-up options could potentially generate a surge in demand for long term care insurance.

Furthermore, we have found that taking the care which a spouse might provide into account may reduce the insurance premiums for males further, whereas the effect on female premium rates is negligible. This is due to the fact that the vast majority of women reaching the age when LTC is required tend to be widowed already.

Given the restrictive assumptions of the model used here, however, the findings must be seen as very preliminary. For example, we have ignored the interdependence between the various risks involved. Furthermore, we have assumed that there are no behavioural responses to the different policies offered. More importantly, the policies we have designed here offer poor insurance as benefits are based on group means of variables such as marital status and income. Of course, such an ”insurance” would not be deemed very satisfactory for real world individuals, who are concerned with the realised, and not the average, values of these variables.

Nevertheless, our analysis is useful in pointing out directions for future research. For example, it would be useful to have a better understanding of the empirical correlation between health, socioeconomic status and cohabitation status. The latter two are important in two ways: firstly, because they have a substantial impact on health, and secondly, since they determine the needs of an individual once disability has materialised. Hence, an extension of the disability model that takes these variables into account would be very useful.

Another important extension of this work would be to assess the potential market for LTC insurance. This would require a model that specifies individual behaviour and makes explicit assumptions on risk aversion and the rate at which individuals discount future benefits. A methodology has already been developed by Brown and Finkelstein (2003). The Brown and Finkelstein (2003) approach could be extended to allow for moral hazard in various decisions (e.g. retirement age, marital status, etc) and to allow for systematic differences between individuals, such as socioeconomic differences, interdependence between different risks and unobserved heterogeneity.

Looking more widely, it would be desirable to undertake a general equilibrium analysis of the implications of different LTC funding regimes. There is an extensive literature on the effects of pension reform but hardly anything has been written to date on LTC. Since formal LTC services currently work out at between 1 and 3 per cent of GDP (Karlsson et al, 2004), it might seem that the impact on the economy is insignificant. However, the impact of LTC should be greater than that. Firstly, because all LTC services (i.e. including informal care) comprise some five per cent of GDP today, and this is bound to increase in the future. Secondly, the public system for LTC, and the private insurance products complementing it, will have important implications for people's saving decisions and the equilibrium on the labour market. Hence, there should be scope for a thorough analysis of the macroeconomic issues involved.

Finally, the political economy perspective should not be neglected. Older people will, over the following decades, represent an ever larger share of the electorate. This will have important implications for the kinds of reforms which are undertaken in the political arena, and these decisions will, in turn, influence the demand for insurance. There is growing literature on the political equilibria in the presence of a supplementary private insurance market, but no model to date has analysed the case of long term care.

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