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How much risk is mitigated by LTC Insurance? A case study of the public system in Spain

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Abstract

We present a methodology that allows to calculate the impact of a given Long-Term Care (LTC) insurance protection system on the risk of incurring extremely large individual lifetime costs. Our proposed methodology is illustrated with a case study. According to our risk measure, the current Spanish public LTC system mitigates individual risk by more than 30% compared to the situation where no public protection were available. We show that our method can be used to compare risk reduction of alternative LTC insurance plans.

1 Introduction and motivation

Long-Term Care (LTC) expenditures will rise greatly over the next several decades because of population ageing and cost of services increase. This is well known and for many years, economists have fueled a debate on whether a public system coverage versus an exclusively private LTC insurance compete or can efficiently be combined. Brown and Finkelstein (2009) argue that the Medicaid programme in the US crowds-out private insurance demand, while according to Kessler (2008), the

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market for LTCI is growing rapidly in countries which do have a public protection system such as Spain, Italy and South Korea, but stagnating elsewhere such as in Germany, the UK and the European Nordic countries.

Individual and family resources pay for a substantial proportion of long-term care costs, often out-of-pocket at the point of need. Public schemes are expensive and can only target a small population group, namely the poorer and/or those in clearly strong need of support. In many European countries LTC public systems exist, but they have not really been fully understood by most citizens because public LTC systems cost a lot to the states, but only benefit a few. In this context, unlike for most universal welfare protection rights such as education or health, LTC systems seem to be relegated to play a residual role (Mayhew et al, 2010).

Private or mandatory public LTC protection schemes should be presented to the society in such a way that it becomes transparently clear why they effectively mitigate the risk of incurring extremely large lifetime LTC costs. This could substantially improve risk perception compared to the present under-evaluation of the potential magnitude of the long-term care burden (Zhou et al., 2010).

The effectiveness of LTC insurance schemes as risk transfer instruments has not been discussed in the literature. Moreover, it is difficult to compare existing alternative LTC protection strategies, specially for elaborating international correspondences because each country has very specific regulations as seen in Taleyson (2003).

Our goal is to define possible risk measures and we will use them to compare the effectiveness of LTC protection systems as risk transfer instruments. Risk measurement is essentially aimed at evaluating both the likelihood that a loss occurs and the magnitude of this loss. We will propose a method to asses how much risk is mitigated by a LTC protection system that would otherwise be kept by individuals or their families. Quantitative risk measurement relies on statistical concepts and provides tools to obtain a numerical value that represents the risk level of a potential loss.

In general, risk mitigation finds ways to reduce risk and when addressing economic losses, the simplest way to mitigate risk is to transfer it to someone else, who would cover the cost if the loss occurs in exchange of a premium. Risk transfer is also easily achieved by sharing the risk with other individuals that also have the possibility that a loss occurs to them. Therefore, in our situation, the way to mitigate the risk that an individual has to spend an enormous amount of money during his or her lifetime is to subscribe to a LTC coverage protection scheme, that would share the expenditure among participants in the programme.

Formal definitions of risk measures are available and their mathematical properties have been studied in the literature on risk management and insurance (see, for instance, McNeil et al. 2005, Coles, 2001, Panjer, 2006, Panjer et al. 2008). Our contribution is to adapt these measures to the analysis and comparison of LTC insurance alternatives. When it comes to practice, it is assumed that the loss is a random variable and risk measurement requires that an estimate of the statistical distribution of the loss is available. Our random variable is the cost of LTC over lifetime.

2 Notation and basic concepts

We denote by X_0 the cost of lifetime LTC from a given age t to death assuming that there is no level of protection so that the individual has to pay for all costs of services aimed at his or her care. At age t the value of X_0 is unknown mainly due to the uncertainty about the duration of the need for care and the inflation of the cost of services. Note that there could also be innovations on therapies that would change the evolution on disability rates. So, we can assume that X_0 is a random variable which follows a probability distribution with a probability distribution function $F_0(x)$, for $x \geq 0$, defined as the probability that the lifetime cost of LTC from age t is not larger than x.

We will assume X_p is the cost of lifetime LTC for an individual at age t if he or she subscribes to a protection plan so that part (or all) of the cost of LTC in X_0 is covered by an insurance scheme, either private or public or both. Indeed the state can propose a universal coverage system, for instance. In that case the final value of X_p is also unknown to the person at age t, and it will only become known once the person dies. At age t, X_p is a random variable which follows a probability distribution function $F_p(x)$, $x \geq 0$ which is the probability that the lifetime cost of LTC not covered by the external protection is not larger than x.

For any given random variable we can define risk measures that can be used to evaluates its level of risk. We aim at quantifying the risk transfered from X_0 to the external part, so from the individual to the insurance plan or the public protection programme. One simple way to do that is by comparing the distribution of X_0 and X_p or their respective risk measures.

3 The Value-at-Risk of LTC lifetime individual expenditure

Assume we fix a probability level α, $\alpha \in (0, 1)$. It means we are only considering the cost of LTC that is incurred by the $\alpha 100\%$ of the population that is going to spend more money on LTC. It means we are interested in the worst cases.

The notion *Value-at-Risk* with level α is related to the notion of quantile and is defined as follows:

$$VaR_\alpha\left(X_j\right) = \inf\left\{x, F_j\left(x\right) \geq \alpha\right\}. \; j = 0, p \tag{1}$$

The interpretation for the Value-at-Risk at level α of individual lifetime LTC cost under protection scheme j, $j = 0$ or $j = p$ is straightforward. There is $\alpha 100\%$ of the population aged t that will spend at least $VaR_\alpha\left(X_0\right)$ if there is no protection and at least $VaR_\alpha\left(X_p\right)$ if protection p is covers him or her. Another way to interpret Value-at-Risk is that a $(1-\alpha)100\%$ percent of the population aged t will spend less than $VaR_\alpha\left(X_0\right)$ if there is no protection but less than $VaR_\alpha\left(X_p\right)$ under protection p. All the previous interpretations do have to be considered in the context of a probability space. They have been widely used for assessing financial risk (Jorion, 2001, Klüppelberg et al., 1999).

We will define the amount of risk mitigation of policy p, with respect to the scenario where the whole burden is on the individual, based on the concept of Value-at-Risk as:

$$RM_1(\alpha; 0; p) = VaR_\alpha\left(X_0\right) - VaR_\alpha\left(X_p\right). \tag{2}$$

The main drawback of $RM_1(\alpha; 0; p)$ is that there must be a consensus on which is the α level that is going to be chosen for comparative purposes.

Once α is fixed, $RM_1(\alpha; 0; p)$ can be computed for several protection alternatives p and one can say that a policy is more effective than another if it has a larger risk mitigation.

4 Conditional tail expectation or Tail-Value-at-Risk of LTC lifetime individual expenditure

If we would like to average values at risk with respect to different α levels, then we can use the notion of *Tail Value at Risk* at level α_0. Let us assume that $\alpha_0 \in (0, 1)$ is a fixed confidence level. We would like to examine all Value-at-Risk at levels between α_0 and 1.

The definition of *Tail-Value-at-Risk* with a given level probability α_0 is:

$$TVaR_{\alpha_0}(X_j) = \frac{1}{(1-\alpha_0)} \int_{\alpha_0}^{1} VaR_{\alpha}(X_j)\, d\alpha \;\; j = 0, p.$$

The previous definition is mathematically equivalent, under adequate sufficient smoothness conditions for the distribution function of X_j, $j = 0, p$, to a conditional expectation:

$$TVaR_{\alpha_0}(X_j) = E(X_j | X_j > VaR_{\alpha_0}). \; j = 0, p \tag{3}$$

where E denotes the mathematical expectation as usual.

The Tail-Value-at-Risk can be interpreted as an average for all Value-at-Risk cases above a level α_0. In our case, it is the expected value of lifetime LTC costs with no protection (X_0) or with protection (X_p) for the $\alpha_0 100\%$ group of individuals aged t who will experience costs larger than VaR_{α_0}. So, it concentrates on the average cost for the group that will make alarger expenditure.

Note that there are many possible ways to fix the value of α_0. For instance, one may say that $\alpha_0 = 25\%$, and that would imply that $TVaR_{\alpha_0}(X_j)$ corresponds to the average cost incurred by the group that will pay more than the 75% percentile with respect to X_j.

An interesting way to fix the value of α_0 is somehow indirectly. Let us assume that we define α_0 as the level such that $1 - F_0(x_0) = \alpha_0$, given that x_0 is a fixed amount. In this case $\alpha_0 100\%$ is defined as the percent of individuals aged t that would pay lifetime LTC costs above x_0. We could fix the value of x_0 with respect to a yearly minimum income level. It can also be fixed in absolute terms. Then $TVaR_{\alpha_0}(X_0)$ would be interpreted as the average lifetime LTC cost incurred under for those who would pay a lifetime LTC cost greater than x_0.

Note that if $\alpha_0 = 0$ then we would just have that the Tail-Value-at-Risk is the expected lifetime LT cost or the average of all individuals in the population.

We will define the amount of risk mitigation of policy p with respect to policy 0, $RM_2(\alpha; 0; p)$, using the concept of Tail-Value-at-Risk as:

$$RM_2(\alpha_0; 0; p) = TVaR_{\alpha_0}(X_0) - TVaR_{\alpha_0}(X_p). \tag{4}$$

In order to compute $RM_2(\alpha_0; 0; p)$ a decision has to be made upon which α_0 level is chosen. Once α_0 is fixed, $RM_2(\alpha_0; 0; p)$ can be calculated for several protection alternatives p and one can score alternatives with respect to the gain in risk mitigation.

The main drawback of the comparative capacity of $RM_2(\alpha_0; 0; p)$ for alternative p policies is that the comparison is made between the distribution of the largest cost incurred only. However, calculating $RM_2(\alpha_0; 0; p)$ is simple, once estimates of the distribution functions F_0 and F_p are available. Moreover, $RM_2(\alpha_0; 0; p)$ can be interpreted directly as the reduction on the expected cost of individual lifetime LTC cost for those that would incur lifetime LTC costs above a certain level without a risk transfer programme p.

It is interesting to note that $TVaR_{\alpha_0}(X_j)$ at a given level is a coherent risk measure that has been used in many areas. It has risen independently in a variety of fields and has been given names as *Conditional Value-at-risk*, *Conditional Tail Expectation* or *Expected Shortfall*. It satisfies the so-called axioms of coherence, namely translation invariance, subadditivity, positive homogeneity and monotonicity. In particular, subadditivity means that if lifetime LTC costs are calculated as the sum of types of costs, the Tail-Value-at-Risk with level α_0 of the total cost is smaller or equal than the sum of the Tail-Value-at-Risk with level α_0 of each type of cost.

5 Using Tail-Value-at-Risk to rank alternative social policies

Let us assume that X_0 is the cost of lifetime long term care (LTC) from a given age t to death assuming that there is no level of protection so that the individual has to pay for all costs aimed at his or her care. X_0 is a random variable which follows a probability distribution function $F_0(x)$, $x \geq 0$. This can be called the *reference cost distribution*. Let us also assume that there are programmes that aim at reducing the risk of incurring very large lifetime costs by means of a risk transfer. We will call the lifetime LTC costs that would be paid if each of these alternative programmes are implemented, X_p with $p = 1, 2, ..., P$, and their corresponding distribution functions are called F_p, $p = 1, 2, ..., P$. Assume that the Tail-Value-at-Risk at a given level α_0 for those distribution functions can be estimated.

We can define a percent reduction of the Tail-Value-at-Risk at level α_0, which we call the *relative risk mitigation index* as:

$$RM_3(\alpha_0; 0; p) = \left(1 - \frac{TVaR_{\alpha_0}(X_p)}{TVaR_{\alpha_0}(X_0)}\right) \cdot 100 \tag{5}$$

Assuming that costs incurred are always positive and that $X_p \leq X_0$ almost surely, which means that the probability that X_p is larger than X_0 is zero then it can be shown that $RM_3(\alpha_0; 0; p)$ is a score between zero and 100.

A technical difficulty in the comparison of X_0 and X_p is that there is no guarantee that that probability of X_0 equals 0 is the same as the probability that X_p equals 0. Individuals may incur cost if there is no protection programme, while they may have to pay nothing when p is implemented. The fact that X_0 and X_p, $p = 1, .., P$ have a positive probability mass on 0, possibly not constant across all these random variables poses a potential technical problem, because the portion of the population group that incurs strictly positive cost varies from one scheme to another.

The Gini coefficient is a measure of inequality and we do not recommend it here as it mainly measures dispersion. We are not so much interest in examining the range of possible lifetime LTC costs and its variability across a population age group. We think that the aim of an efficient protection programme is to transfer and share risk and in this sense we want to measure the ability to reduce the risk

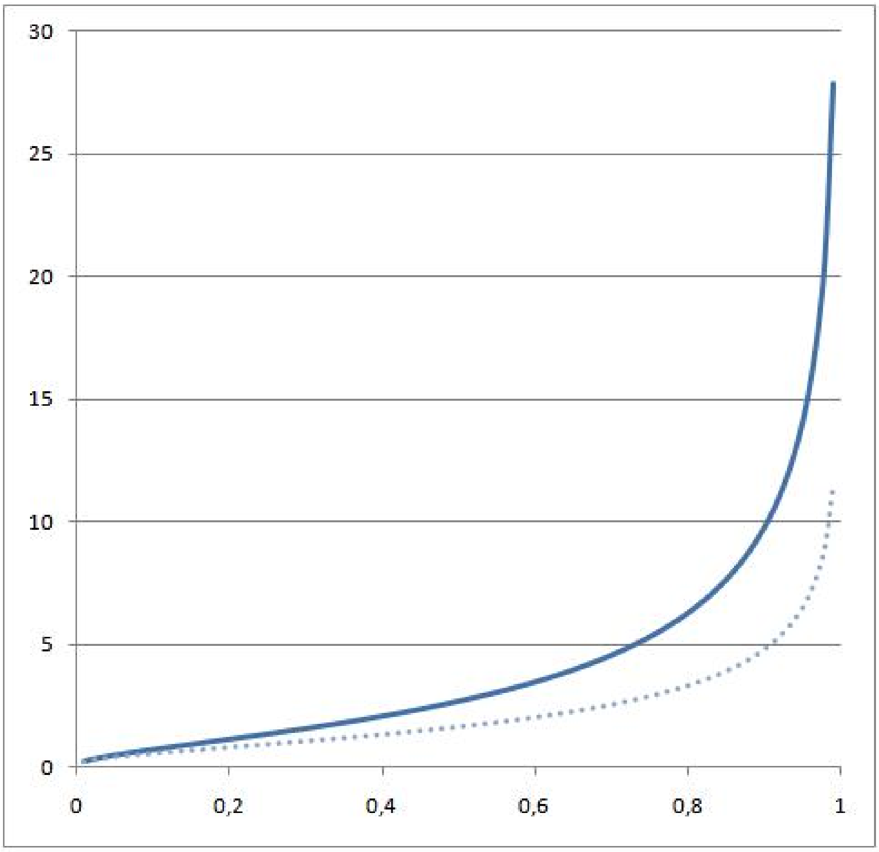

Figure 1: Value-at-risk for X_0 (solid) and X_1 (dotted), horizontal axis is α, simulated lognormal data

born by citizens.

6 An example and computing tools

Let us compare two random variables X_0 and X_1 whose probability distribution functions are known.

We have simulated lognormal data to have a shape similar to the one we would expect in an application to lifetime LTC costs. This is an example that helps to introduce the application of the *relative risk mitigation index* which has been introduced in the previous section.

Table 1: Risk measures and risk mitigation measures for simulated data (X_0 and X_1)

	Value-at-Risk and Tail-Value-at-Risk				
Level (α_0)	$VaR_{\alpha_0}(X_0)$	$VaR_{\alpha_0}(X_1)$	$TVaR_{\alpha_0}(X_0)$	$TVaR_{\alpha_0}(X_1)$	
15%	7.44	3.82	13.11	6.06	
10%	9.37	4.62	15.42	6.96	
5%	12.99	6.07	19.51	8.50	
	$RM_1(\alpha_0;0;1)$		$RM_2(\alpha_0;0;1)$		$RM_3(\alpha_0;0;1)$
15%	3.62		7.05		54%
10%	4.75		8.46		55%
5%	6.92		11.01		56%

$RM_1(\alpha_0;0;1)$ indicates the difference in Value-at-Risk, $RM_2(\alpha_0;0;1)$ is the difference in Tail-Value-at-Risk and $RM_3(\alpha_0;0;1)$ is the relative difference in Tail-Value-at-Risk

Figure 1 shows the Value-at-Risk plot, i.e. $VaR_\alpha(X_j)$ for $\alpha \in (0,1)$ and $j = 0, p$. This is also known as the quantile plot. One can see from the shapes in Figure 1 that for all levels of α, $VaR_\alpha(X_1)$ is lower than $VaR_\alpha(X_0)$.

Table 1 presents the Value-at-Risk in the simulated data for three α levels. We have chosen $\alpha = 0.15, 0.10$ and 0.05. Tail-Value-at-Risk at those same levels is also shown.

Table 1 shows that the larger the α level, the higher the risk. This means Value-at-Risk increases when the confidence parameter decreases, as expected. The same happens as Tail-Value-at-Risk increases when α decreases as the measure concentrates on the more extreme cases.

Using both Value-at-Risk and Tail-Value-at-Risk we see that risk mitigation occurs when comparing X_0 versus X_1. For all three levels chosen, the risk of X_1 is lower than the risk of X_0, consequently $RM_1(\alpha_0;0;1)$ and $RM_2(\alpha_0;0;1)$ are positive for all values of α_0.

The calculation of $RM_3(\alpha_0;0;1)$ for $\alpha_0 = 0.15, 0.10$ and 0.05 is also presented in the last column of the bottom part of Table 1. The relative decrease in Tail-Value-at-Risk for X_1 compared to X_0 is about 55% for all confidence levels.

7 A case study: The public LTC system in Spain

In December 2006 the Spanish parliament approved the so called Law of Dependence, which was enforced in 2007. The law established a public long-term care (LTC) system and granted new rights to citizens in need of personal assistance. The law was recognized as a fourth pillar to the Spanish welfare system. Since then, the Spanish general budged has assigned increasing levels of funds for citizens needing LTC, and those funds have been set independently of public health funds.

The Law of Dependence in Spain provides support for all individuals from age 6, but elderly citizens are in fact much more prone to need some form of long term care. The natural demographic evolution in Spain will cause a great increase in the number of individuals above age 65 in the next decades and therefore this will lead to an enormous potential increase in the number of people in need of care and support. Wittenberg et al. (2002), Guillén et al. (2007) and many others argue whether living longer necessarily means that individuals will have a longer active life or whether, on the average, elderly people will need support for a longer period of time in the near future. Bolance et al. (2010) found that for the Spanish case demand for LTC starts at a later age, but may last longer on average than in the past. The prospects of an increase in unit cost of service necessarily implies an increase in lifetime LTC cost for individuals. In addition, there are contributions to the discussion on the role of public and private LTC insurance by Brown and Finkelstein (2008, 2009), de Crasties (2009), Gleckman (2007) and Comas-Herrera et al. (2011).

The demographic situation in Spain imposes an alert if the demand for long-term care services increases sharply. In the absence of a well structured public network for formal care in Spain, plus the economic frailty of the current public LTC system, preserving the essence of the public scheme and promoting private LTC insurance may be the best possible strategy.

Before the law has been passed, several forms of social protection have already existed in Spain. Citizens with little economic resources, living alone and in need of LTC were a priority, but there was no specific subsidy linked to the need of LTC for which citizens could apply. In fact, the public health system was effectively providing assistance to people in need of LTC who had scarce resources, but this created a burden for medical facilities and implied an inefficient use of hospitals.

The Spanish public system recognizes the right to receive support in case of dependence. Emphasis is out on need of support, not on disability or handicap, while budged allocated to social protection in Spain is among the very small in Europe. However, a strong advertisement campaign when the law was enforced did not create awareness, but reinforced the belief that the state is a strong safety net.

In 2010, the number of people receiving some form of allocation was 614,750. In fact the form of service may be multiple, so 7,468 got a prevention plan; 74,775 got tele-assistance; care at home was supplied to 78,968; a care at day or night centre unit was assigned to 39,312 users; residential care was provided to 114,263; supplementary service allocation was given to 50,803 and supplementary cash allocation for family care was allowed to 357,599 Spanish citizen. Allocation for family care is by far the most popular form of support from the public system.

The current Spanish LTC system is universal and funded by taxes. Entitlements are based on the severity of dependence and not on the individual's wealth and income.

Bolancé, et al (2010) estimated the distribution function of lifetime LTC cost for men aged 65 who would be classified as dependent by the Spanish public system, using a large survey by the Spanish Statistical Institute in 2008. Respondents were classified as elligible or non-elligible in terms of people that would be entitled to receive a public allocation. They were also rated in the official scale levels of severity. The same authors compared the distribution of lifetime LTC costs if no public entitlements were available and the distribution of lifetime LTC costs if the entitlements that are established by the Spanish regulation were applied, so that cost would be partially covered by the state. More details can be found in their report.

Table 2 presents the Value-at-Risk and the Tail-Value at Risk for three levels of risk $\alpha_0 = 0.10, 0.05$ and 0.01 for the distribution of lifetime LTC cost of those aged

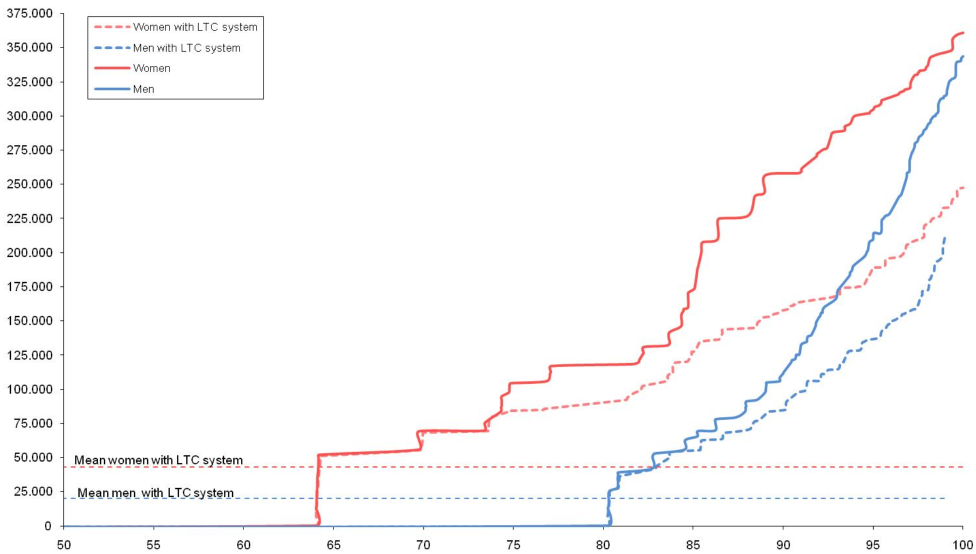

Figure 2: Value-at-risk of LTC costs of dependence in Spain for those aged 65 in 2008 with and without LTC public system, by gender

Table 2: Risk measures for lifetime LTC costs of dependence in Spain (2008)

Men aged 65					
	Value-at Risk		Tail-Value-at Risk		$RM_3(\alpha_0; 0; p)$
Level (α_0)	X_0	X_p	X_0	X_p	
10%	111.8	84.9	220.1	141.8	36%
5%	210.9	136.9	277.7	175.4	37%
1%	314.6	211.8	330.6	229.4	31%
Women aged 65					
	Value-at Risk		Tail-Value-at Risk		
Level	Without	With	Without	With	RM_3
10%	251.2	157.8	302.4	192.0	37%
5%	304.7	189.0	331.2	214.5	35%
1%	346.5	232.6	353.3	330.6	31%

Cost is expressed in thousand Euros. X_0 indicates all costs are payed by individuals or their families and X_p indicates that the individual is covered by the public LTC system.

65 in 2008 in Spain. Two possibilities are considered, those the estimated lifetime LTC cost distribution if individuals pay all services, i.e, without any public system coverage or X_0, and the distribution when the current public system covers some of the LTC cost, which is what we called X_p in the previous sections

Our results show evidence that risk mitigation as defined in (5) exceeds 30% both for men and women at any risk level. The interpretation then suggests that the public system reduces the extremes on the lifetime LTC cost. The implementation of the LTC public system guarantees that the highest or maximum possible cost incurred by the majority of the population (i.e. 90% or more) is reduced by more than 30% under the public LTC system.

By looking at the most extreme cases, the Tail-Value at Risk is also substantially reduced under the current public LTC system. In other words, the average cost for those people that would incur more expenses, especially if we look at the highest decile. Average lifetime cost would also be much reduced for the 10% of the population spending more on lifetime LTC costs.

However, when looking into the details of Table 2 we conclude that the Spanish system still needs to consider that there is a risk of about 1% that a man will have to spend about 229.4 thousand Euros and a risk of about 1% that a women will have to spend about 330.6 thousand Euros to cover lifetime LTC costs. Unfortunately risk mitigation may still seem too low for that small group, and policy makers should perhaps consider to introduce some modifications. For instance, an individual that has been dependent for a long period of time, even if his or her condition is not too severe, may be exposed to an escalating accumulation of expenditures. This means that duration in the state of dependency and not only severity needs to be taken into consideration and introducing such a change would probably help to suggest a different conclusion on the effectiveness of the public system when risk mitigation would be assessed. We believe that our relative risk mitigation index $RM_3(\alpha_0; 0; p)$ should be inversely related to α_0 instead of the other way round as it is now.

8 Discussion

Long-term care insurance either public mandatory or private plays a central role in financing long-term care (Feder et al., 2007). It is also a more efficient approach to covering lifetime expenditure than private savings, as it substantially reduces the need for every single individual or family to save up to the maximum possible lifetime cost of their care Insurance redistributes costs from those with lesser to those with greater care needs. By pooling risks and reducing the uncertainty risk averse individuals would prefer an actuarially fair insurance policy rather than the possibility of a substantial loss (see, for instance Barr, 2010, Browne, 2006, and Rivlin and Wiener, 1988).

Private long-term care insurance is always conditioned by the characteristics of public sector coverage for long-term care the specific country where an individual resides (Foubister et al., 2006, de Castries, 2009). In some countries like England or the United States, the public social policies aim at people who cannot afford to pay for their own care (Comas-Herrera et al., 2010, Miller et al., 2009). However, those purchasing private insurance in those countries suffer the absence of a public safety net and protect their own assets for a catastrophic event, i.e. the costs involved in requiring a very long duration of care (Finkelstein and McGarry, 2006, Pauly, 1990). In some other countries where the public LTC system is universal, all individuals are covered, or may be some means-tested benefits are introduced for those who cannot cover their cost of LTC. This is the case of Germany, France and Spain, where private LTC insurance complements the public system (Comas-Hererra et al., 2011, Courbage and Roudaut, 2008, Guillén and Pinquet, 2008).

There is a strong debate in Spain about the sustainability of the public long-term care system. Concerns are rising about the equity of decisions in all the Autonomous Communities about who is and who is not eligible. This poses many problems to the political and social success of the Law, and there is a lot of criticism in the media. Inequality is possible if people living in different areas would benefit from different allocations and services simply because his or her Autonomous Community dedicates a lot more budged to social programmes. And this is indeed the case, because the development of social care networks and institutions has been much different from one Community to another and has thus created room for perverse comparisons between Spanish citizens, who would in principal claim equal rights. The *relative risk mitigation index* that we have proposed in the previous sections can be used to address regional inequalities, because the LTC systems can be ranked according to this score.

Many experts recommend, health and social services must reinforce prevention to extend duration of active life among the elderly. In previous analysis we have seen that three factors influence the increase of lifetime LTC cost in the last decade, namely the increase of longevity, a longer duration in the state of dependence and price of care services. Social policies should be devoted to reduce the length of time spent in a state of dependence by promoting active life and they should also dictate rules for the market to provide efficient services with a price evolution in line with inflation.

Social protection should not set priority on moderate dependence and non-eligible who still need care. The very extreme cases of lifetime LTC cost exist, which makes it reasonable to focus on the most severe situation and some form of compulsory insurance be imposed. Establishing public LTC systems such as the Spanish case aimed at severe cases and make people understand that it can only been an efficient risk mitigating tool if targeting the large costs is a good strategy. The welfare system and pensions should take care of more frequent and with relative low cost cases.

There are features of the Spanish case reform that have remained beyond the scope of our case study. One of them is who more control on the assessment scores given to applicants of the public system can be put in place, so that medical and social teams should be homogeneously qualified and evaluations peer reviewed. There is an urgent need for monitoring existing deviations in some regions between the expected number of eligible and the final number of allocations given. Clarifying vague concepts in the severity scale is necessary, as well as understanding how, why and when should the official score weights be changed. There are opinions in favour of removing the current three severity levels score for dependents, so that every point given in the measurement scale is linked to some kind of proportional allocation. The main drawback for this proposal is that some services, unlike cash, cannot be assigned proportionally. Indeed, one person either gets one form of service care or not, for instance, a residence. Another disadvantage is that not having a limited number of severity levels makes it more difficult to design public policies because it is difficult to identify worst classes. Another suggestion which has been made in the past is the introduction of means-tested copayments, but then this can lead to moral hazard because wealth can be transferred to third-parties in order to obtain public subsidies. In fact this can have a deterrence effect towards extending private insurance, similar to the phenomenon observed in the United States with the existence of Medicare, where the market for private LTC coverage has remained small.

The LTC insurance market in Spain is still very immature. The possibility to deduct LTC insurance premiums from taxes in conjunction with pension plans has been pointed out as a key driver and it has already been permitted to a very limited extend. Currently, market premiums are still expensive. For instance, a 1,000 monthly annuity in the event of full dependence is priced at about 265 euros for a man and 492 euros for a woman aged 50. The market tends to reject this sort of product and would prefer some alternative where at least part of the cumulated insurance premium could be passed on to heirs if no dependence annuity has been received. Otherwise, consumers feel that money going into LTC insurance premiums is lost savings.

Economic recession periods do not favour the development of LTC insurance. Buying private long-term care insurance is not an easy task as the policyholder sees that coverage aims at uncertain losses too far in the future. Generally a young person knows little about the future of public LTC coverage and is very poorly informed about his or her own risk of incurring lifetime LTC cost that exceed their assets. Barr (2010) points out that a too generous public system can the collide with private insure and produce unnecessary over-insurance.

Our contribution presents a new way to communicate about the risk of high lifetime LTC costs and its sensitivity to alterantive forms of insurance coverage.

References

[1] Barr N. (2010) Long-term care: A suitable case for social insurance. Social Policy and Administration 44(4): 359-374.

[2] Brown, J.R. and Finkelstein, A. (2008) The interaction of public and private insurance: Medicaid and the long-term care insurance market. American Economic Review 98, 1083-1102.

[3] Brown J.R. and Finkelstein A. (2009) The private market for long-term care insurance in the United States: A review. The Journal of Risk and Insurance 76 (1): 5-29.

[4] Browne M. (2006) Adverse selection in the long-term care insurance market. In P.-A.Chiappori and C.Gollie, eds. Competitive Failures in Insurance Markets. IT Press, Cambridge MA, 97-112.

[5] Castries de H. (2009). Ageing and long-term care: Key challenges in long-term care coverage for public and private systems. The Geneva Papers on Risk and Insurance 34: 24-34.

[6] Coles S.G. (2001) Introduction to statistical modelling of extreme values. Springer-Verlag, Berlin.

[7] Comas-Herrera A., Wittenberg R., and Pickard L. (2010) The long road to universalism? Recent developments in the financing of long-term care in England. Social Policy and Administration, 44, (2): 375-391.

[8] Comas-Herrera A., Butterfield R., Fernández J.-L., Wittenberg R. and Wiener J.M. (2011) Barriers and opportunities for private long-term care insurance in England: what can we learn from other countries?. PSSRU Discussion Paper 2780.

[9] Courbage C. and Roudaut N. (2008) Empirical evidence on long-term care insurance purchase in France. The Geneva Papers on Risk and Insurance 33: 645-658.

[10] Feder J., Komisar H.L. and Friedland R.B. (2007) Long-term care financing: Policy options for the future, A comparative assessment of strategies. Long-Term Care Financing Project, Georgetown University.

[11] Finkelstein A. and McGarry K. (2006) Multiple dimensions of private information: Evidence from the long-term Care insurance market. American Economic Review 96(4): 938-958.

[12] Foubister T., Thomson S, Mossialos E. and McGuire A. (2006) Private medical insurance in the United Kingdom. European Observatory on Health Systems and Policies.

[13] Gleckman H. (2007) Financing long-term care: Lessons from abroad (June 1, 2007). Available at SSRN: http://ssrn.com/abstract=1116370

[14] Guillén M. and Pinquet, J. (2008) Long-term care: risk description of a Spanish portfolio and economic analysis of the timing of insurance purchase. Geneva Papers on Risk and Insurance-Issues and Practice 33: 659-672.

[15] Jorion P. (2001) Value at risk: The new benchmark for managing financial risk. McGraw & Hill, New York.

[16] Kessler D. (2008) The long-term care insurance market. The Geneva Papers on Risk and Insurance, 33: 33-40.

[17] Klüppelberg C., Embrechts P. and Mikosch T. (1999) Modeling extremal events for insurance and finance. Springer-Verlag, Berlin.

[18] Mayhew L., Karlsson M. and Rickayzen B. (2010) The role of private finance in paying for long-term care. The Economic Journal, 120: F, 478-504.

[19] Miller E.A., Mor V. and Clark M. (2009) Reforming long-term care in the United States: Findings from a national survey of specialists. The Gerontologist 50 (2): 238-252.

[20] McNeil A.J., Frey R. and Embrechts P. (2005) Quantitative Risk Management. Princeton Series in Finance. Princeton University Press.

[21] Panjer H.H. (2006) Operational risk: modeling analytics. John Wiley & Sons, Inc, New York.

[22] Panjer H.H., Klugman, S.A. and Willmot G.E. (2008) Loss models: From data to decisions. John Wiley & Sons, Inc, New York.

[23] Pauly M. V. (1990) The rational nonpurchase of long-term-care insurance. Journal of Political Economy 98: 153-168.

[24] Rivlin A.M. and Wiener J. (1988) Caring for the disabled elderly. Brookings Institute Pr.

[25] Taleyson L. (2003) Private long-term care insurance - International comparisons. Health and Ageing No. 08. The Geneva Association.

[26] Wittenberg, R, Sandhu, B. and Knapp, M. (2002) Funding long-term care: the public and private options. Chapter 10. Funding Health Care: Options for Europe edited by Elias Mosialos et al. 226-249.

[27] Zhou-Richter T., Browne M.J. and Gründl H. (2010) Don't they care? Or, are they just unaware? Risk perception and the demand for long-term care insurance. Journal of Risk and Insurance 77(4): 715-747.

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