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Aging and longevity

With

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INDEX

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EDITO

As the main driver of contemporary ageing, under the dual impact of increasing life expectancy and the post-war baby boom, longevity has major socio-economic consequences. It obliges us to rethink what constitutes a life-time and to redesign public policies so as to take into account the capacity of both the younger generation and seniors to contribute to the economic system and finance social debt.

With unchanged financing rules, projections of social protection expenditure, in terms of retirement and health-care, reveal a funding requirement of 4.4% of GDP by 2050. Currently, in the absence of growth, we are obliged to find other sources of funding to cover our period of old age.

The family and the market are also play their part in the solidarity that will become all the more significant since public debt, including social debt, is likely to be limited. The financial innovations proposed here should allow insurers to take responsibility for longevity risk by dissociating interest risk from life expectancy risk. In regard to families, the valorization of assistance over time should make this increasingly "visible" and facilitate the implementation of appropriate public policy.

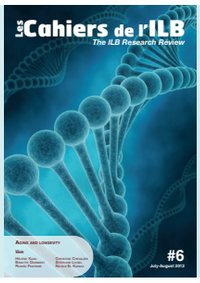
Considerable uncertainty remains as to the evolution of life expectancy, especially regarding the role of the professional and social environment and the impact of health and social protection expenditure. We know that working longer delays the onset of degenerative diseases, but we are still far from being able to specify the optimal level of health-care expenditure or the relevant organization of levels of solidarity (state, family and market).

Our chances of living to a hundred or more forces us to rethink society from the standpoint of intergenerational relations.

Hélène Xuan

Video

Find Hélène Xuan's interview video on www.finXchange.org



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Is longevity an asset?

HOW CAN INCREASES IN LONGEVITY BE CONSOLIDATED?

Based on an interview with Hélène Xuan and on her paper "La longévité : un atout ?".

Longer life expectancy leads on naturally to rethinking the existing system of redistribution. But how should we analyze the current mechanisms, taking into account demographic and societal prospects ? How should we view the existing issues ? For Hélène Xuan, it is necessary to study longevity as intergenerational system if we are to maintain the existing improvements. Any reform is global. It affects both seniors and the younger working population.

BIOGRAPHY

Hélène Xuan

Hélène Xuan is the Scientific Director of the Demographic Transitions, Economic Transitions Chair. She holds a PhD in Economics on population aging and growth. She collaborated with Yazid Sabeg under the Borloo plan in the Evaluation and Monitoring Committee of ANRU (Agence Nationale pour la Rénovation Urbaine) to desegregate neighbourhoods. She then worked at ACAM (Autorité de contrôle des assurances et des mutuelles) before joining the staff of Yazid Sabeg, who was appointed Commissioner for Diversity and Equal Opportunities in December 2008, as a consultant.

Seniors are becoming increasingly numerous – there will be two billion over-60s on the planet by 2050 – and it is within this population that financial and housing wealth will be concentrated. But as Hélène Xuan shows, this very broad perspective masks a number of issues. While the opening up of the economy has increased life expectancy, it has also accentuated the inequalities between social classes. Taxation and redistribution have an important role to play. For instance, setting up a social protection system would allow infant mortality rates to be reduced by 20 %.

The economic viewpoint : the cost of aging

Population aging will generate a loss of 0.5 point of growth per year between 2010 and 2060. This forecast should not lead to hasty conclusions, however. For comparison, study of a scenario without additional longevity suggests that the social security budget would gradually return to surplus but people would not be much wealthier. Other studies have shown that immigration would bring more to social security financing, particularly because the influx of labour increases the number of those working and reduces the proportion of retirees in the total population. In her paper, Hélène Xuan also recalls that emphasis is often placed on the average standard of living of all retirees, which is now higher than that of the working population. This fact become even more conspicuous if one includes income from assets and the ownership of

METHODOLOGY

"La longévité : un atout ?" derives from a synthesis of various scientific economics papers. The aim is to take an intergenerational view on issues of aging. This contribution refers extensively to the work of the researchers of the Demographic Transitions Chair, in particular Andre Masson, the Chair's associate researcher. For all the contributors of the study, economic transitions allow a better understanding of the mechanisms of aging and its socioeconomic impact. In her paper, Hélène Xuan also draws upon the debates organized at the last two annual forums: "Les sociétés vieillissantes sont-elles condamnées ?" (2010) and "Vieillissement et Perspectives de croissance" (2011).

housing. But how will our current working population live when they reach retirement age ? Hélène Xuan points out that the reform enacted in 1993 partially deprives retirees of the fruits of economic growth. And in the time frame 2030-50, it will be the mass unemployment generations entering the labour market in the 1980s and 2000s who will bear the brunt of this reform. They are all the more vulnerable since it has been difficult for them enter the property market in a context of increased socio-economic inequality.

> *“it is vital to reform the social protection system”*

The political viewpoint : the price of longevity

The inequality between seniors who have benefited from growth, retirement and accumulated wealth and the younger generation for whom everything turns on reforms yet to be implemented undermines the social protection system. It is therefore vital to reform it. The French system should be the outcome of a balancing act between family solidarity and public policy. However, the revolution in longevity has not yet transformed French society. Today, excluding their period of education, people spend a third of their lives retired and two-thirds working. It is the latter section of the population which finances retirement income. This time breakdown allows us to calculate the tax rate needed to maintain the same living standard through a person’s lifetime. In fact, greater longevity ought to lead to an increase in the contribution rate and a prolongation of the time spent working. In an ideal system, each person would “choose” to retire whenever he or she so desired, but would be encouraged to leave later, through a “premium-discount” system. Such a configuration would avoid imposing a uniform legal age of retirement.

Life annuities are another possible financial resource, given the concentration of wealth in the hands of seniors, that could be a solution for all those wishing to remain at home during their retirement and have an additional guaranteed income. Yet despite their advantages, annuities are proving difficult to develop. To facilitate these intergenerational negotiations, the state could provide a nudge in the right direction by encouraging the early handing on of inheritance or by taxing it heavily.

The importance of prevention

Investment in prevention could delay the onset of disease. Prevention would no longer be only a cost but also the means by which people improve their health and actively contribute to financing health insurance. We should therefore rethink the career system and take advantage of the time spent working to modify our behaviour (better diet, reduction of stress, etc.).

KEY POINTS

- Longevity should be analyzed from an overall, intergenerational standpoint.
- Older people’s retirement is in the hands of the young. It is the counterpart of investment in education, training, etc.
- The reform of 1993 weakened the new generations who will reach retirement age in the coming decades.
- Business is the ideal place to make employees aware of “aging better” and preventing the onset of chronic diseases.

Recommendations

- The ten additional years in good health are the result of over a century of increasing life expectancy, which it is a matter of consolidating for future generations by ensuring adequate living standards.
- Points-based retirement or the premium-discount system allows retirement to be “chosen” and the pitfall of imposing a fixed legal retirement age.
- The slow growth of the life annuity market calls for high taxation of inherited wealth or a tax incentive by the state to bequeath it early.
- Business should assume a role on behalf of social protection.

Further reading...

- “Vivre un siècle”, H. Xuan, Ed. Descartes, 2011.
- “Vivre et travailler plus longtemps”, J.-O. Hairault, Ed. Descartes, forthcoming 2012.
- “Rajeunissement et vieillissement de la France, une politique pour la jeunesse”, J.-H. Lorenzi, J. Pelletau and A. Villemeur, Ed. Descartes, 2012.
- “L’immigration coûte cher à la France, qu’en pensent les économistes ?”, X. Chojnicki and L. Ragot, Ed. Les Echos-Eyrolles, 2012
- “Des liens et des transferts entre générations”, A. Masson, Ed. EHESS, 2009

Find the Hélène Xuan’s article on www.finXchange.org

The growth of health-care spending : determinants and aims

HOW MUCH SHOULD BE SPENT ON HEALTH ?

Based on an interview with Brigitte Dormont and on her book "Les dépenses de santé. Une augmentation salutaire ?"

Expenditure on health is usually discussed in terms of funding, with the prospect of sacrifices to be made. Its growth is automatically considered to be unsustainable, and is implicitly viewed as a cost to be cut back. For Brigitte Dormont, this approach confuses two concerns that are, however, quite distinct : that of the effectiveness of health spending and that of its optimal level. The question of the optimal level of expenditure still remains unresolved : what proportion of national resources do we want to devote to health care ?

Since the mid-twentieth century, the developed economies have experienced two trends : a tremendous increase in longevity and a continuing increase in the share of GDP devoted to health spending.

The causes of growing health care expenditure

Contrary to popular belief, aging plays only a minor role in the growth of health spending. Admittedly, everyone sees their expenditure on health increase as they age. But the most important changes are due to the fact that individual health spending increases over time, for a given age or disease. For example, a 50-year-old man suffering from diabetes spent much more on his health in 2009 than he would have done in 2000. This change is unrelated to the aging population. It results from the dynamics of medical progress : new procedures are continuously developed, leading to changes in medical practices.

How can we evaluate the influence of these developments on the future growth of health spending ? We may assume growth in health spending 1 percentage point higher than growth in income, a rate consistent with that observed in recent decades, or accelerating advances in

METHODOLOGY

In collaboration with Helen Huber and Michel Grignon, Brigitte Dormont has shown, using a microsimulation analysis carried on representative samples of the French socially insured population, that changes in practices greatly influence the growth of health spending, while the aging of the population plays only a minor role, accounting for no more than one tenth of the growth in health expenditure over the period 1992-2000. With the support of the Institut Montparnasse, this study has been updated for the period 2000-2008. The results confirm the minor role played by aging : despite the impact of cohorts of aging baby boomers, it still accounts for only a fifth of the growth in health spending. Retrospective analysis carried out for the United States between 1965 and 2002 led to the same conclusion that technological change accounted for the large part of spending growth.

BIOGRAPHY

Brigitte Dormont

Brigitte Dormont is professor of economics at Paris Sciences Lettres (PSL) and Paris-Dauphine University and holder of the Health Chair of the Risk Foundation. She is also co-director of the Public Economics and Redistribution programme at CEPREMAP. Her research focuses on public policy in relation to regulation of the French healthcare system, with empirical assessments implemented on micro-economic data. Her publications have variously addressed the regulation of ambulatory medicine, the reform of hospital pricing, the role of demographic aging in the growth of health spending, and competition in health insurance. She has recently published "Les dépenses de santé. Une augmentation salutaire ?" with Editions Rue d'Ulm (2009)
http://www.cepremap.ens.fr/depot/opus/OPUS15.pdf
Brigitte Dormont also participates as a qualified expert on various scientific commissions and committees, including the Haut Conseil pour l'Avenir de l'Assurance Maladie, the Commission des Comptes de la Santé and the Comité d'experts de l'Institut des Données de Santé.
Personal web page :
http://www.brigitte-dormont.fr/
Health Chair website :
http://www.chairesante.dauphine.fr

medical techniques. In both cases, the proportion of gross domestic product spent on health care in is likely to grow significantly in the future.
We can therefore expect to devote an ever growing proportion of our wealth to health care. But is this such a bad thing ? A common mistake is to think that austerity necessarily results from it. This fear is unfounded. True, a greater proportion of GDP will be earmarked for health. But GDP is steadily growing. In any event, household consumption, excluding health spending, should at least double by 2050. There is little doubt, therefore, that the additional health spending will be sustainable.

Is this growth desirable ?

The fact that this expenditure can be funded does not mean that such a development is desirable. Some people may prefer to devote their resources to personal expenditure rather than pay into a common pool to fund better medical care. Others may agree to their resources being channelled into expenditure that is collectively decided, but prefer to focus on environmental protection or education rather than health.
In France, the financing of health expenditure is largely socialized : trade-offs are made by public authorities or joint bodies acting on behalf of the socially insured public. Asking whether the growth in health spending is desirable amounts to asking whether the decisions current being made are consistent with our preferences.

Do we spent too much or not enough on health care ?

According to a study by Kevin Murphy and Robert Topel, improvements in health and longevity in the USA, between 1970 and 2000, added a value each year of about 32 % of GDP to the nation's wealth. The annual contribution of health expenditure was much higher than its cost, which amounted 15 % of U.S. gross domestic product in 2000. This gap suggests that health spending in America is below its optimal value from the standpoint of the nation's preferences.
In Brigitte Dormont's approach, health is seen as a source of well-being and not as a productivity and growth factor. One can well put forward the argument that health is also a productive sector that creates jobs and is a source of growth. Yet while there are benefits involved in promoting health spending, they are insufficient to justify such expenditure. Regarding the economics of well-being, productive activity is justified not by the jobs it helps create, but by the fact that it meets a demand. The central point must not be obscured : the purpose of health spending is to increase longevity and improve the quality of life.
Thanks to medical advances, we are living longer and enjoy better health. Evaluated in monetary terms, the improvement in well-being obtained in return for this expenditure seems huge. Certainly, efficiency gains are desirable. But there is an urgent need to organize a democratic debate in France around the level of the outlay agreed to on behalf of people's health and well-being.

KEY POINTS

- Aging plays only a minor role in the growth of health expenditure.
- The spread of new types of treatment leads to a rise in health care costs.
- The concept used to measure improvement in health and longevity is termed "the statistical value of life".
- Health should not be viewed solely as a productivity and growth factor but also as a source of well-being.
- The purpose of health spending is to increase longevity and improve the quality of life.

Recommendations

- In analyzing the growth in health care expenditure, it is important not to confuse efficiency and the optimal level.
- We need to evaluate, in monetary terms, the value of the health obtained against the expenditure incurred.
- Viewing health care as a productive sector involves referring to characteristics that are not specific to it.
- There is an urgent need to organize a democratic debate in France around the level of the outlay agreed to for health care.

Further reading...

- "Les dépenses de santé. Une augmentation salutaire ?", B. Dormont, Ed. Rue d'Ulm, 2011.

  An electronic version of the book may be downloaded free of charge from : http://www.cepremap.ens.fr/depot/opus/OPUS15.pdf
- "Health expenditure growth : reassessing the threat of ageing", B. Dormont, M. Grignon and H. Huber, Health Economics, Vol. 15, # 9, 947-963, 2006.
- B. Dormont, J. Oliveira Martins, F. Pelgrin, M. Suhrcke, "Health expenditures, longevity and growth", in Ageing, Health and Productivity, Oxford University Press, 2010.
- Murphy, K. and R. H. Topel (2006), The value of Life and Longevity, Journal of Political Economy, 2006, Vol. 114, n°5, p. 871-904.

Find the Brigitte Dormont's article on www.finXchange.org

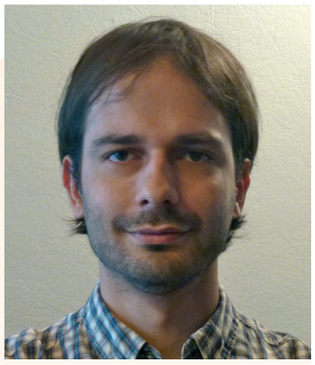
Family support for dependent elderly people

HOW CAN THE IMPLICIT COSTS BE TAKEN INTO ACCOUNT ?

Based on an interview with Roméo Fontaine and on his paper “Soutenir ses parents, jusqu’où ?”, (2012), Project, n°326, p. 36-42.

The debate around the organization and financing of care for dependent elderly people has enriched the analysis of the current system and of the challenges facing it as a result of demographic changes and has allowed ways of reforming to be envisaged. But while the public outlay is easily quantified, how can we put a value on family support ? What are its consequences for the economy ? Roméo Fontaine goes beyond the financial aspect and emphasizes the indirect costs of such aid, which are essential, in his view, for designing a social security system that judiciously links collective and family solidarity.

BIOGRAPHY



Roméo Fontaine

Roméo Fontaine holds a Ph. D in Economics from Paris-Dauphine University. He is project manager in the Economics and Finance department of the Mederic Alzheimer Foundation. He is also researcher in the Health Chair and associate researcher at Institute for research and information in health economics (IRDES). His research interests are in health economics and family economics. His work focuses on long-term care, and in particular family support for disabled elderly people and private long-term care insurance.

The aging population and socio-demographic changes affecting family structures form a cocktail that raises questions about the division of private and public solidarity and, more specifically, about the role our society wishes to entrust to families in caring for very elderly people. Estimated at 24 billion euros in 2010, or 1.4 % of French GDP, the public outlay for elderly dependent people amounted to – depending on the designation conventions used – between 68 % and 77 % of the overall financial costs of caring for elderly dependents. This approach, however, by not taking into account the economic value of the informal help given to frail elderly people, considerably underestimates the resources used at a family level in the production of care and support and by the same token overestimates public involvement.

Family care, a low-cost system ?

Compared to the amount of assistance provided by professional workers, informal support, which mainly takes the form of a transfer of services (such as help with household tasks or personal care), emerges as a major resource, making the family the real backbone of the present system. Such family support can be presented as inexpensive for society. There is then a strong temptation to make families responsible for the bulk of the care, especially when constraints on government finances make it difficult to increase public coverage.
But fact remains that doing so in-

METHODOLOGY

The work carried out within the “Modelling of support for dependent elderly people” project of the Health Chair seeks to encourage thinking about the division between collective and family solidarity, through the study of family support mechanisms. In this context, Roméo Fontaine adopts a micro-econometric approach, based on survey data. This data enabled him to gain a clear impression of how families make arrangements to help elderly dependents. He was thus able to highlight the more diffuse and difficult-to-observe impacts of a system of support that makes family solidarity the main safety net mechanism.

volves indirect costs that Romeo Fontaine highlights in his work, following various lines of research.

Family support and professional activity

One line of research aims in particular to study the adverse effects on professional activity of support given to an elderly dependent parent. Roméo Fontaine shows that at a European level, beyond a certain amount, care provided to a family member tends to reduce the labour supply and wage rates. Carers are encouraged to give up some job opportunities or to accept lower-paying jobs if these provide greater geographical proximity to the home of the person assisted or if they allow more flexible hours. However, these adjustments of working life very rarely result in leaving the labour market. Most care providers express a strong commitment to carrying out a professional activity : working is a source of respite for them, freeing them from their caring role. Work can also be a form of "protection", enabling them not to be completely taken over by the caring function.

> *"informal support involves indirect costs"*

Impact on care providers' state of health

Numerous epidemiological studies also highlight the consequences on the state of health of caregiving spouses and children, Roméo Fontaine emphasizes. Supporting an aging parent increases symptoms related to depression, especially when the caregiver has other family responsibilities. Providing help also has effects on physical health, for example, heart disease.

Social inequalities

The indirect costs in terms of social inequality have also been highlighted. Making support depend on family solidarity tends first of all, in practice, to accentuate socio-economic inequalities between men and women. More generally, basing dependency risk on private solidarity is probably accompanied by anti-redistributive effects between families. Roméo Fontaine also points out – although this has yet to be proven – that it is reasonable to assume that families with lower living standards are more frequently made use of in this respect. As well as social inequalities between families, there could also eventually be additional social inequalities within families. The potentially negative effects of caregiving – reduction of working time, deteriorating health – could then fall largely on the most vulnerable.

Are collective and family support at odds with each other ?

Faced with such findings, it is important, Roméo Fontaine concludes, not to reduce the question of the relationship between public and private solidarity to a confrontation between costly collective support on the one hand and free family support on the other.

Recommendations

- It is necessary to go beyond the strictly financial question of support for the elderly.
- Informal care emerges as a major resource, making the family the backbone of the current support system.
- It should not be forgotten that domestic care provision is accompanied by economic costs. Although not easily observable and quantifiable in monetary terms, it is important to take account of the risks associated with excessive family-based care of elderly dependents.

Further reading...

- Fontaine R. (2011), "Le soutien familial aux personnes âgées dépendantes : analyses micro-économétrique des comportements individuels et familiaux de prise en charge", Doctoral Thesis in Economics, Université Paris-Dauphine.
- Fontaine R., Gramain A. and Wittwer J. (2010) "Providing care for an elderly parent : interactions among siblings ?", Health Chair Cahier, n°3 (also published in Health Economics 18(9): 1011-1029).
- Gramain A. and Wittwer J. (2010) "Prise en charge des personnes âgées dépendantes : quels enjeux économiques ?", Regards sur l'actualité, Ed. La Documentation française.

KEY POINTS

- The monetary value of informal caregiving is undervalued relative to public coverage.
- There is a considerable economic cost from family support for elderly dependents.
- Providing help for a family member may have adverse consequences for the carer's professional activity and state of health.
- Basing support on family solidarity accentuates social inequalities between and within families.

Find the Roméo Fontaine's article on www.finXchange.org

Determinants of the uninsurability of longevity risk and the life annuity market

HOW CAN LONGEVITY RISK BE COVERED ?

Based on an interview with Christine Chevallier on the subject of her paper "Déterminants de l'inassurabilité du risque de longévité et marché de la rente viagère" (Revue Française d'Economie, April 2012), in collaboration with Hélène Xuan and François-Xavier Albouy.

With rising life expectancy, the management of longevity risk has become a major issue. Why do life annuities not appeal either to the insured or to insurers ? How can the system be changed ? What role could the state play ? The analysis of the determinants of the uninsurability of longevity risk, carried out by Christine Chevallier, provides food for thought on how to improve the insurability of this risk.

BIOGRAPHY

Christine Chevallier

Following her initial training in mathematics, Christine Chevallier turned to finance and then to the economics of risk. After a number of years of teaching and research, particularly at Paris-Dauphine University where she obtained her doctorate, she joined the Groupe Sup de Co La Rochelle as a teacher-researcher, while remaining an active member of the Risk Foundation's Demographic Transitions, Economic Transitions Chair at the Paris-Dauphine University. Her research focuses mainly on the financing of the systemic risk management, particularly disaster risks and, currently, longevity risk.

The study focuses on longevity risk, which has two components. The first, specific to the individual, stems from the fact that a person's life expectancy deviates from its expected value at a given age and time horizon. The second, systemic, component follows from the principle that the aggregate mortality of a population deviates in the long term from its expected value, at a given age and time horizon. For the individual, longevity risk can be covered by building long-term savings generating a life annuity.

A risk and form of coverage not conducive to its insurability

The systemic component of longevity risk cannot be diversified and, furthermore, is of high magnitude. Thus the insurer only agrees to cover the risk if it is priced above its actuarial value, forcing the policyholder to acquire partial insurance. In addition, the ambiguity around longevity risk, i.e. the uncertainty of its probabilities, leads insurers to overestimate people's life expectancy. Policyholders, in turn, underestimate their life expectancy as a result of this ambiguity, accentuating their refusal to agree to higher pricing.
Christine Chevallier also makes clear that the wish to build up savings to cope with the unexpected is the

METHODOLOGY

The paper is based on a synthesis of different theoretical and empirical results, taken from an extensive review of the literature. The aim is to establish which ways of thinking about the management and funding of longevity risk are the most effective. To identify the determinants of the uninsurability of longevity risk, Christine Chevallier draws on a wide variety of frameworks. She starts from a critique of the theory of risk sharing, commonly used in the analysis of uninsurability, and goes through to the latest developments in decision theory. At the same time, she constructs her analysis by addressing anomalies in savings behaviour in relation to the predictions of the life-cycle theory. On the basis of the synthesis made, the paper discusses appropriate ways of managing and financing longevity risk, while steering clear of the idea of a unique solution.

main reason for saving. Furthermore, faced with uncertainties in relation to income and expenditure, people have an incentive to accumulate sufficiently liquid savings, leading them to opt for savings strategies that are suboptimal but reversible. From this standpoint, a life annuity is unsuitable. Finally, an annuity tends to be viewed as a savings product rather than an insurance product. People often seem to forget that an annuity provides a hedge against longevity risk. Even if the person takes this into account, the ambiguity of survival probabilities, explaining the difference in longevity risk perceptions between the insured and the insurer, may be enough for the insured not view the annuity as cost-effective compared to other financial investments available.

Estimation of longevity risk on the basis of an average probability induces adverse selection, since "economic agents whose risk is lowest, and fail to find coverage at an acceptable premium rate, are not encouraged to ensure, in contrast to agents whose risk is highest", Christine Chevallier says. An annuity therefore applies only to people for whom a supplementary pension would be more financially viable and therefore more costly for the insurer. In addition, there rather disadvantageous tax conditions for changing long-term savings into a life annuity. Finally, the existence of transaction costs also reduces the demand for insurance coverage. "At the extreme, these factors can lead to a complete lack of supply of insurance coverage, with insurers abandoning the market", Christine Chevallier adds.

> *"an annuity provides a hedge against longevity risk"*

Adaptations can improve the insurability of longevity risk

To remedy this insurability problem, it seems necessary to better adapt the product to the investor. Limitation of the risks associated with annuities, by indexing products to inflation and incorporating options on insurance contracts in the event of adverse events, would increase interest in life annuities. In addition, the development of its market is one of the French state's public policy objectives. The state may well intervene by imposing certain changes, particularly in relation to pricing. It could also take on responsibility for distributing systemic longevity risk between generations, focussing on economic agents who most able to bear it, and therefore are less risk averse and better capitalized. State intervention in the capital markets, through "survivor bonds" or "longevity bonds", the coupons of which are based on the survival rate of a cohort of the population, would be an opportunity to take on this risk in the form of a private right contract. It would be therefore a matter of transferring longevity risk to the state, which is inherently in a position to manage long-term risks. Historically, it was the development of insurance techniques, coupled with increasing state intervention, that helped limit the impact of the determinants of uninsurability, including longevity risk, Christine Chevallier points out in conclusion.

Recommendations

- Products should be adapted to savers by simplifying and limiting the risks they bear. Indexing to inflation and the introduction of termination options are solutions for meeting the precautionary needs of policyholders.
- The imperfections of the market should be mitigated by legislative intervention and by introducing a tax to encourage people to take out annuities.
- The state should distribute systemic longevity risk between generations by intervening in financial markets as an insurer.

Further reading...

- Xuan Hélène, Vivre un siècle, Descartes et Cie, Chaire transitions démographiques-transitions économiques collection, September 2011
- Gollier Christian, The Economics of Risk and Time, MIT Press, Cambridge, 2001
- Gollier Christian, Vers une théorie économique des limites de l'assurabilité, Revue d'économie financière, (37), pp. 59-79, 1996
- Masson André, La vie pour l'épargnant ne se réduit pas à un exercice de calcul.1. Les impasses des approches du cycle de vie standard et psycho-économique, Revue française d'économie, XXV (1), pp.117-173, 2010.

KEY POINTS

- Longer life expectancy increases the proportion of the population likely to outlast their resources.
- Insurance against longevity risk insurance takes the form of a long-term savings that enlarge the number and complexity of the determinants of its uninsurability.
- Life annuities are the only form of long-term savings that provide coverage against longevity risk.

Find the Christine Chevallier's article on www.finXchange.org

Taking on longevity risk : models and issues

WHO CAN TAKE ON INCREASING LONGEVITY RISK ?

Based on an interview with Stéphane Loisel and on his paper "Assumer le risque de longévité : modèles et enjeux", co-authored with Pauline Barrieu, Harry Bensusan, Nicole El Karoui, Caroline Hillairet, Claudia Ravanelli and Yahia Salhi.

Life expectancy is an area where uncertainty reigns supreme – uncertainty that those who bear financial risk, such as insurers, reinsurers and pension funds, need to combat. Huge financial stakes are dependent on the development of forecasting models. Nevertheless, merely anticipating longevity is insufficient for the good management of policyholder portfolios. The time has come for risk transfer, an exercise that is still in its infancy.

An estimation error on a single year can be very costly to a pension fund. But how is the exact life expectancy of those insured to be assessed ? This question becomes even more crucial with the increase in longevity in recent years, thereby resulting in an increase in the annuities paid out. Control of longevity risk, that is to say, of uncertainty concerning the age of death, more than ever represents a major financial challenge. This issue is particularly complex to manage for the actors concerned, because we know that the smaller the population sample, the greater the margin of error.

Use of models

Assessment of the life expectancy of a cohort of the population is not a new exercise. What is new, however, is how to proceed in the face of mortality tables that have flaws and weaknesses, especially when it is a matter of to evaluating a policyholder portfolio. Researchers Harry Bensusan and Nicole El Karoui took models derived from population dynamics as their working basis, in order to develop a more precise forecasting method than those typically used by insurers, which are often limited solely to health and medical history criteria. A much broader spectrum of data needs to be studied, as these researchers show. Factors specific to each individual, such as educational level, occupational category or marital status, strongly influence longevity. Insurers, pension funds and all other actors confronted by longevity risk can thus no longer simply replicate the forecasts made on the basis of a nationwide population.

BIOGRAPHY

Stéphane Loisel

Stéphane Loisel holds a PhD in applied mathematics from University of Lyon, a MSc in actuarial science and finance, and is a fellow and member of the board of the Institut des Actuaires. He is now full professor at ISFA, Université Lyon 1, and associate researcher at CMAP, Ecole Polytechnique.
Associate Editor of IME, MCAP, BFA, AJAC and co-editor of EAJ, Stéphane's main research interests include ruin theory with dependent risks, Solvency II and ERM, as well as longevity risk and customer behaviour in insurance. He obtained the SCOR PhD award in 2005, and the Lloyd's Science of Risk runner-up prize (insurance and financial markets category) in 2011. Stéphane also serves on the CERA review panel.

METHODOLOGY

This article is the result of a collective effort, spearheaded by Pauline Barrieu, Harry Bensusan, Nicole El Karoui, Caroline Hillairet, Stéphane Loisel, Claudia Ravanelli and Yahia Salhi, all members of the future Derivatives Chair. Their varied specialities include financial mathematics, risk transfer and insurance. The team based its work on numerous interviews, conducted with the professions concerned with longevity risk, such as insurers, reinsurers, pension funds and consultants. The researchers then met once a month with a view to developing their study.

The study, conducted by seven researchers, goes further, however, than the considerations of forecasting models. Stéphane Loisel, one of its authors, raises a broader question, as to the economic, social and political consequences. In what state of health will aging occur ? In his view, the issue of longevity risk cannot be understood without linking it to the question of dependency risk. This topic reveals the limitations of the forecasting models developed so far, because the considerable financial stakes entailed by dependency risk are often ignored. Yet a single year of dependency costs four times as much as a year of retirement of a non-dependent individual.

> *“the current financial crisis complicates the task of risk transfer”*

A matter of urgency

Two separate phenomena lend urgency to the issue of longevity. On the one hand, life expectancy has enjoyed a period of rapid increase since the 1960s. And on the other, regulatory changes, particularly with the introduction of Solvency II and Basel III at the end of this year, mean that insurers and other bearers of financial risk need to quantify their risk margin much more accurately. The new prudential rules will require larger amounts to be provisioned.
Apart from the calculation of solvency margins, the issue of the price of products still needs to be defined. Product prices remain difficult to determine, both because the duration of contracts is increasing, due the longevity of the people insured, and because the evolution of interest rates is difficult to grasp, at a time when the crisis has driven these to the very low levels. The performance of products is therefore becoming more uncertain.

Transferring risk

Faced with a growing number of uncertainties and financial amounts that are increasingly difficult for actors managing longevity risk to take on, risk transfer has emerged as a necessity. Who then is to take it on ? Two solutions are set to emerge, though the phenomenon is still in its infancy. On the one hand, reinsurers seem prime candidates to assume some of this risk. On the other, a transfer to capital markets, in the form of securitization, may also be envisaged. These products are commonly known as Insurance-Linked Securities or ILS. Stéphane Loisel is nonetheless concerned about their limitations. “How does one determine a fair price ? In what exchange context should they be placed ? It remains an opaque and illiquid market.” The few operations implemented since 2004 have remained secret. Outlines of solutions are under way, and some major banking institutions, led by JP Morgan, have created mortality indices and standard mortality rate swap products.
The current financial crisis complicates the task of risk transfer, with the failure of securities issuers now being a conceivable prospect, especially in the long term. But the authors believe that the urgency of the current situation and the scale of the stakes in relation to longevity – extending beyond the financial sector to impact the real economy, and social and political life – will force the actors concerned to speed up their search for solutions.

Recommendations

- The aging of the population includes a health and medical component that should not be neglected. To get a better grasp of the real world, it is important to work closely with the medical profession.
- Trying to understand longevity risk without linking it to dependency risk would be a mistake. In what ways and under what conditions life expectancy will be extended are important factors to be taken into account, as much from a financial as from a medical and social standpoint.

Further reading...

- *Modelling and Management of Mortality risk : a Review. Cairns, A.J.G. and Blake, D. and Dowd, K. Scandinavian Actuarial Journal, 2008, 108(2-3) : 79-113.*
- *A Two-Factor Model for Stochastic Mortality with Parameter Uncertainty : Theory and Calibration. Cairns, A.J.G. and Blake, D. and Dowd, K. Journal of Risk and Insurance, 2006, 73(4) : 687-718*
- *The handbook of insurance-linked securities. Barrieu, P. and Albertini, L. 2010, Wiley*

Find the Stéphane Loisel’s article on www.finXchange.org

KEY POINTS

- The theme of the aging of the population calls for an interdisciplinary approach.
- Longevity risk is both a long-term risk and one that is linked to changing trends, for example, the possibility that life expectancy could increase more rapidly than forecast.
- It is difficult to identify quickly enough a long-term change in trend given the current variability, which raises the question of the speed of response to this issue.

An innovative product for transferring insurers' financial risks

HOW CAN THE FINANCIAL RISKS ASSOCIATED WITH AN AGING POPULATION BE DISTRIBUTED ?

Based on an interview with Nicole El Karoui in relation to her paper "Partial Splitting of Longevity and Financial Risks : the Life Nominal Choosing Swaptions" (Université Pierre et Marie Curie), co-authored with Harry Bensusan, Stéphane Loisel and Yahia Sahli.

The recent economic and financial crises and upcoming new prudential rules (Solvability II), together with people's increasing life expectancy, is forcing life insurance companies and pension funds to adopt ever more effective risk cover strategies.
How can they separate longevity risk and financial risk in their annuity portfolios ? The authors have addressed this issue by introducing a new financial product.

The aging of the population and its financing requirements weigh heavily on the annuity products offered by professionals in this sector. They are faced with two types of risk. The first – longevity risk – concerns uncertainty as to how people's life expectancy will change. The second – interest rate risk – affects the investments and long-term assets (mostly bonds) held by insurance companies and pension funds, which depend on upward or downward changes in interest rates. This latter risk is usually the most dangerous for pension providers. If interest rates are not high enough, insurers may have trouble financing their customers' pensions. And if interest rates are too high, some bond issuers may fail and thus affect insurers' balance sheets and liquid assets.
"In the longevity market, there are numerous long-term risks that affect annuity products. This is a real problem for insurers, supplementary pension organizations

BIOGRAPHY

Nicole El Karoui

Nicole El Karoui is a researcher at the Ecole Polytechnique's Center of Applied Mathematics (CMAP) and a mathematics professor at the University of Paris VI's (Univ. Pierre & Marie Curie) Laboratory of Probabilities and Random Models (PMA).
She is in charge of the latter institution's Master's 2 program, "Probabilities and Finance", a joint degree with the Ecole Polytechnique. She is vice-president of the scientific steering committee of the Institut Louis Bachelier, and scientific director of the financial risk research chairs for the Fondation du Risque (FdR) as well as of the future derivatives research chairs for the Europlace Institute of Finance (EIF).

METHODOLOGY

Nicole El Karoui and her co-authors have developed a new financial product, Life Nominal Choosing Swaptions (LNCS). Its purpose is to transfer the financial risks associated with the annuity portfolios of insurance companies and pension funds to financial markets, using interest rate swaps and swaptions.

After recalling the financial concepts linked to interest rate swaps and swaptions, the authors first presented the financial characteristics of LNCS. Then, drawing on the dynamic longevity model (introduced in 2010 by Harry Bensusan) and on a two-factor interest rate model (developed in 1992 by Heath, Jarrow and Morton), they were able to determine the price of LNCS. Finally, they tested this new financial product with a quantitative analysis based on real data provided by INSEE.

and Anglo-Saxon pension funds because of the very large sums at stake. It is in their interest therefore to reduce interest rates", Nicole El Karoui points out.

A longevity market in the making

Even though the longevity of the population is steadily increasing, mainly because of scientific advances and improved living standards, the longevity market remains embryonic. Apart from private transactions entered into between financiers and insurers, longevity swaps and bonds indexed on longevity, there exist very few products for managing this type of risk. "There are currently few universal products covering longevity risk, due to the considerable disparity between countries. Investors are wary of long-term exposure, and the asymmetry of information between insurers and banks does not allow longevity hedging products to be developed", says Nicole El Karoui.

> *"few universal products cover longevity risk"*

LNCS cover insurers' financial risks…

Because of the great need to ensure longevity risk and the search by banks for new market niches, the introduction of products hedging financial risks is becoming necessary.

The authors therefore developed a structured product intended to transfer insurers' interest rate risks to banks : Life Nominal Choosing Swaptions (LNCS). This product is based on a combination of interest rates swaps of different maturities and swaptions (options on the conclusion of one or more swaps). Put plainly, the insurer exchanges a fixed interest rate against a floating interest rate, depending on its expectations regarding changes in the future mortality of its policyholders and in interest rates. Thereafter, the insurer may enter into an interest rate swap with the bank and thus transfer its interest rate risk, in order to focus solely on longevity risk. "Because the contract is agreed today and starts ten years later, the bank obviously makes the insurer pay for the worst case scenario. The bank needs to have an idea as to what the worst case scenario could cost it", Nicole El Karoui explains.

…at an affordable cost

Quantitative analysis on real data to simulate different LNCS prices has proved to be conclusive. With today's low interest rates, it is financially advantageous for insurers to use this type of hedging instrument.

Recommendations

- The adoption of a dynamic model of the population's longevity with a micro-macro approach is very useful for simulating in more detail the life expectancy of policyholders. The confidence interval chosen by the insurer must be wide enough to provide real protection. However, to avoid overly high insurance costs, this band should not be very wide, since the bank sets the price of the product according to the worst case scenario.
- Counterparty risk remains the greatest obstacle to the transfer of risk from annuity providers to the financial markets. The introduction of collateral as security is a way of mitigating the risk of default, though this is still insufficient.

Further reading...

- Bensusan, H. 2010. "Risques de taux et de longévité : Modélisation dynamique et applications aux produits dérivés et à l'assurance vie". Ph.D. thesis, École Polytechnique.

Find the Nicole El Karoui's article on www.finXchange.org

KEY POINTS

- Life Nominal Choosing Swaptions (LNCS) enable insurers to manage interest rate risks associated with their annuities portfolios by transferring them to the financial markets through swap contracts.
- LNCS provide insurers with cover against low interest rates.
- The correlation of interest rates plays an important role in pricing LNCS. The higher the correlation, the lower the LNCS price, and vice versa.

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