Differences in longevity in Europe

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INTERVIEW

ESKO KIVISAARI NEW CHAIRPERSON

INTERVIEW BY **JENNIFER BAKER**

As the Actuarial Association of Europe appoints new senior management at the General Assembly in September 2018, TEA caught up with the new Chairperson, Esko Kivisaari to find out his vision for the future of AAE.

'It is well known that the AAE has three strategic objectives: to offer expert actuarial advice; to promote education requirements and professional standards; and to help build the actuarial community.'

In the first area, Kivisaari thinks the organization is already doing well. AAE is known as an expert source of information. However the new chair wants that to be more widely recognized. 'We need to identify the new areas where actuaries could play a role, and also to be better in our communication. We must not keep our good work hidden,' he explained.

In terms of education, he sees new challenges in the area of predictive analytics, while building a living community is primarily about having better communications, he added.

The AAE already has good relationships with key European institutions, and Kivisaari will build on this foundation. 'The institutions already appreciate our input, in particular the quality and independence of our input. We have good relationships with key institutions, but we cannot take them for granted, if we lose the quality, we will lose the relationships. So, they need to be nurtured well to maintain them,' he said.

BUT DO DIFFERENT INSTITUTIONS NEED TO BE TREATED DIFFERENTLY?

'It depends very much on the institution,' he continued. 'It might sound neutral in the main, but institutions consist of people and personalities, and one of the key things is to be able to differentiate people and keep them interested. Secondly, I would say that if you look at the Commission or EIOPA, they are doing the early preparation of different issues, and then you are talking about preliminary ideas. When something goes from the Commission to the Parliament or to the Council and they have a specific proposal already, you are in a bit of a different position in that the area and the issues are more political. They are more technical when it comes to the Commission.'

'My hope is to have fewer overlaps, and maybe even get rid of some things that do not bring very much value to the policy-holders, the consumers.'

ESKO KIVISAARI

Although there is not much new European legislation on the horizon, Kivisaari knows there is still work to be done on testing and improving the quality of implementation.

'My hope is to have fewer overlaps, and maybe even get rid of some things that do not bring very much value to the policy-holders, the consumers. What we do certainly have in the pipeline now is Solvency II reviews. And going forward we have the Pan European Pension Project in the pipeline as well, but generally I think I'd expect us to have more in the areas of consumer protection and sustainable finance. The EU is also preparing to endorse IFRS17 where I think the actuary should have a clear role in signing the accounts,' said Kivisaari.

The role of actuaries also warrants closer scrutiny according to Kivisaari: 'First I would like to mention the increased role of governance and what is the role of actuaries among chief risk officers. Then the second is evolving technology. I would say that actuaries can take a role in predictive analytics and ethical use of big data. This is not automatic and we need to be active in that area. Finally, sustainability – meaning the environment, society, governance – is certainly an issue where important things are happening.'

TAKE ACTION

'When it comes to climate change, we need to take action, Europe needs to take action, and the world needs to take action.
It is self-deception to say we are on our way in fulfilling the goals of the Paris Agreement, that we are achieving less than two degrees with current actions. I think actuaries have many competencies in that area that can be utilized in making the world more sustainable.
One could say that actuarial techniques in insurance are one of the very early forms of the sharing economy and the sharing economy could be an answer in many areas,' he continued.

> ***continuous professional development is more important than ever***

The role of the actuarial profession is changing. 'We have seen in a number of jurisdictions that the qualified actuary is no longer required by the legislation. But I think by supporting the role of the actuary, we can have a situation where fully qualified actuaries are automatically thought to be fit and proper for different positions in the actuarial and risk management functions,' said Kivisaari.

A key role of the AAE is to promote consistent standards of education and professionalism among actuaries in Europe. But, as Kivisaari points out, there is no 'one size fits all.'

'It's a different question for existing actuaries and for those coming into the profession,' he explained. 'Basic education is changing all the time, and the capabilities of people coming into the profession after university are changing. In many areas they are better than existing actuaries, for example in this predictive analytics and technological area. And in some areas, they might lack something that was taken for granted earlier. So we need to be aware how we adapt our core syllabus to take into account of what is happening with the basic education.'

'Then the second challenge is what to do with existing actuaries so that they can really fulfil their role – they certainly need to learn something like big data analytics that did not exist when they were undertaking their studies. What this means is that continuous professional development is more important than ever, to take into account that actuaries are capable of doing what is needed and what is required today,' added Kivisaari.

The new chair explained that he will be working to support the development and recognition of individual member associations. 'I have interviewed all available presidents of our members associations to gather experience of what the needs of different associations are,' he said. 'Now we have ideas and initiatives that are under discussion within the board. We will go through them in our annual meeting and then put them into action, so I think there will be better support for our member associations to interact and go forward with development.'

FINALLY, WHAT WILL BE THE BIGGEST CHALLENGE FOR KIVISAARI IN THIS NEW POSITION?

'Well especially as a person coming from a small member association the question is to understand the positions and challenges of different associations, to really make the AAE valuable for as many actuaries as possible in Europe. And then the role of the actuary in wider challenges in fields like sustainability, technological disruption and consumer protection,' he concluded.

INTERVIEW

CONTRIBUTING TO SOCIETY

INTERVIEW BY **JENNIFER BAKER**

Taking the reins alongside the new Chairperson, is incoming Vice-Chair, Falco Valkenburg. He spoke to TEA about how the AAE can achieve its key objectives.

'I think we are already doing a lot of good things that we should just continue doing. But my personal focus will be on one specific part of our vision and that is contributing to the wellbeing of society,' said Valkenburg. 'We already do that in a lot of papers that we produce and discussions and meetings that we have, but I would like to invite our committees to come up with concrete ideas for specific actions that we can show as European actuaries that we are contributing to the wellbeing of society.'

The AAE is already well regarded for providing expert advice and information, and Valkenburg believes that is down to the organization's autonomy. 'What I've experienced over the years is that our good relationships with the EU institutions are based on our independency and the value-added work that we deliver,' he explained.

'I think that is where we are different from the many lobby groups that are present in Brussels. So we should keep on being independent, not speaking for one industry or the other, but rather presenting an independent view as actuarial experts. It is also important in maintaining those good relationships that we identify what is key for those institutions – what is on their agenda. Then we can focus our contributions on what is relevant at this moment in time, given their discussions and deliberations,' he continued.

Right now Valkenburg is keeping his eye on the pan-European Personal Pension Product. 'I have noticed many press releases, with opposing views, so that could be an area where we can make some input on an independent basis. We have already done so in the discussion paper that we published earlier this year,' he said.

He also believes the area of ESG (environmental, social and governance) risk deserves special attention. 'I think that this is an important area,' said Valkenburg.

'It is about risk, and risk management. It is also about what is important for society. For example, how do we deal with the environment? We actuaries have no opinion exactly on what to do and how to do it, but we can deliver the material to access it, and how to measure things. And that is what is sometimes missing in discussions. There are a lot of views and opinions, but where are the facts?'

CLIMATE INDEX

Valkenburg would like to see a European Actuaries Climate Index developed similar to that in the United States and Canada. It that would measure extremes relative to a long time average: Extremes in temperature, high and low extremes in rain or storms, etc. 'I would like to see whether we can develop something to provide concrete, fact-based material,' explained Valkenburg. 'Then it will be for politicians and others to judge what to do with it.'

'I think it is very important to keep the standards we have in place up-to-date given the sometimes very rapid development'

FALCO VALKENBURG

As well as the EU institutions, the AAE also maintains good relations with other industry and consumer protection bodies. This is something Valkenburg expects to continue under his tenure.
'I think it is very important to know each other. We encounter the European supervisors quite frequently in all sorts of meetings for example on the occupational pension stakeholder group and the insurance stakeholder group. And it is good to know what they are thinking, what is on their agenda. But once again I would stress our independence. For me that means even if we agree with the view of certain lobby groups, we would not issue a joint statement. It will always be our own statement, using our own words,' he said.

BEST PRACTICES

One thing Valkenburg would like to see more of is the exchange of best practices. He wants to provide member associations with an opportunity to look at best practice in other members, and to consider whether or not they could use part of them in their own country.
'I think we as the AAE can fulfil a role here,' he said. 'For example, by further improving our own website to facilitate such an exchange of practices. That is one of the key things that I would like to focus on.'

Alongside best practice guidelines, there are many standards in place - how important are these?
'I think it is very important to keep the standards we have in place up-to-date given the sometimes very rapid development,' said Valkenburg. 'Our Education Committee does a lot of good work on this, and I will highly rely on their assessments and suggestions. I think it is one of the ways to find good actuarial practices that already exist and then to share those. On the other hand, I think we should be careful not to produce standards for everything. Sometimes it's wise to have a good discussion, but we could decide not to make a standard because we need to allow for expert actuarial judgement, and the standard could be too narrow to allow such judgements.'

The coming year will be a busy one for Valkenburg. With European Parliament elections coming up in May 2019, he says it will be the usual challenge to connect again with all the new people in European Parliament as well as a new Commission.

Another date in his calendar is 13 January 2019: 'I have a background in pensions, and the IORP Directive is coming into force on 13 January, which is very important for actuaries because there is a key actuarial function defined in this directive. It was already the case for insurance and Solvency II, but is now also the case for pension funds and that is very important for actuaries. There is also a risk management function defined as a key function, which could be combined with the actuarial function, so I think that is also a very interesting option.'

Finally of course the other big event in the AAE's diary is the European Congress of Actuaries on 6 and 7 June next year. Valkenburg says it will be 'a great opportunity to learn and engage in discussions on a variety of topics, and to meet other actuaries from all over Europe.'

REINSURANCE CAPTIVES, WHY LUXEMBOURG?

BY **YOHAN BOTBOL**

With around 200 reinsurance captives, Luxembourg is a preferred choice for setting up reinsurance captives for big industrial companies.

What is a reinsurance captive, and what is so special about Luxembourg that makes it so attractive here?

When I was an actuarial student, I do not recall having any university curricular mentioning captives, and even today when I ask current actuarial interns about captives, they look at me with complete bewilderment.

Actually, I discovered the world of reinsurance captives when I arrived in Luxembourg some years ago. If you are an actuarial consultant in the Grand Duchy of Luxembourg you cannot avoid the captives. They represent a material proportion of the financial landscape in Luxembourg. Like every insurance company, they not only require their annual accounts to be audited, but also engage in some consulting services. The demand for consulting services also increased recently when the Solvency 2 Directive came into force in 2016. Additionally,

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the captives also need recovery plans to have their solvency ratio accepted by the Supervisor (Commissariat Aux Assurances, CAA) or, it may happen that some multinational companies ask for advice to set up a reinsurance captive in Luxembourg.

A reinsurance captive is a risk management tool, which concretely takes the shape of a company belonging to a group, where optimization is primarily based on insurable risks of the group. As a result, it offers risk coverage capacity together with group treasury solutions. Furthermore, the efficient design, set up, and use of a captive turns the costs of insuring group risk into a profit generating entity. In other words, an industrial group pays premiums to its own reinsurance captive (through many possible mechanisms) to insure its own risks. Therefore, the money paid for premiums stays within the group.

In Europe, there are six main domiciles for captives: Guernsey, Isle of Man, Malta, Gibraltar, Dublin and Luxembourg. Each of these domiciles offers a specific legal framework for captives on top of the general legal framework of the country. The specific legal framework for captives is therefore a trigger to choose the location of the captive.

When stakeholders choose a location to set up a captive, they think about Luxembourg for many reasons, such as: a simple and stable tax system, specific and precursor legal framework for captives, great choice of captive managers, easy access to the ▶

Regulator that allows a "quick" set up or a quick recovery solution, and lastly the equalization provision. While all of these reasons are all very important to Luxembourg, the two main reasons are regulatory framework, and equalization provision.

Regulatory Framework

Here in Luxembourg, the regulator is pragmatic and close to the industry, and the golden rule is that activity must remain in line with the business plan. Regulatory reporting is reasonably designed by the regulator, whereby part of the reporting is now standardized at the European level. Financial investments of the captives are not constrained by law, but the regulator monitors the investment policy of reinsurance captives and can enforce ad hoc investment rules if needed. Capitalization rules are determined by solvency capital requirements (application of Solvency 2), whereby the minimum capital requirement is €1,225,000.

Equalization Provision Mechanism

The equalization provision is intended to cover exceptional claims and the allocation to this provision is tax deductible. The reinsurance captive must allocate the technical result[1] and the financial result[2] to the equalization provision respecting different thresholds. This provision has a risk ceiling, beyond which the result cannot be allocated to the provision. Above this ceiling the result becomes taxable. Hence, *it is common to see a profit of 0 in the accounts of a reinsurance captive because all the result has been allocated to the equalization provision.*

The risk ceiling is the average net premium earned during the last five years multiplied by a factor approved by the Supervisor. This factor is also based on risk, but also on information about the volatility; its calculation is detailed in government regulations. On top of this risk ceiling, there is also another "overall ceiling" to the equalization provision which corresponds to 17.5 times the average net premium earned during the last five years.

A very simple tool is provided by the supervisor to calculate the ceilings and the final amount of the allocation to the equalization provision. In the Solvency 2 environment, the equalization provision does not exist, it goes to the reconciliation reserve.

What this means in practice is that this mechanism allows for more available capital to cover the Solvency Capital Requirement. *It is not rare to see reinsurance captives with a Solvency ratio above 300%.*

Luxembourg - a full range of service providers

Service providers in Luxembourg are very experienced in dealing with worldwide issues and challenges due to the multinational and multicultural aspects of the business in the country. Luxembourg is a major domicile for reinsurance captives due to a long track record in reinsurance structures, the reactiveness of the regulator to changes in the business environment, the diversity of captive managers, and well-organized associations such as the Association for Insurance Companies (Association des Compagnies d'Assurance et de Réassurance, ACA), and the Luxembourgish Institute of Actuaries (Institut Luxembourgeois des Actuaires, ILAC).

Links

www.ilac.lu/
www.aca.lu/en
www.caa.lu/

[1] **TECHNICAL RESULT =**
Net earned premium
+ Other technical income
– Claims incurred, net of reinsurance
– Change in other provisions
– Net operating expenses
– Other technical charges

[2] **FINANCIAL RESULT =**
Financial income
– Financial charges
+/- (Un)Realised gain/ loss on intercompany transactions

CREATING BESPOKE MORTALITY TABLES FOR POPULATION SUBSETS

BY **CATHY LOVE SOPER**

Often there are very different patterns in longevity between subsets of a population. In such cases, different mortality tables should be constructed and used for modelling different populations. This is not only because various population subsets can experience materially different levels of mortality (tables can be rated up or down to address this) but also because the shape of their mortality curves can be very different and this is not so easy to address with a straightforward adjustment.

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Insurance regulators and social security schemes may use national population mortality tables – or even tables from other countries – at an early stage in a market's development, rather than building their own bespoke mortality tables. Although it's not an easy task to build bespoke tables, as it requires a rather specialised actuarial skillset, it may bring considerable value.

KEY BENEFITS

A key benefit of robust local tables for the life insurance sector is that they will reduce the

need for risk loadings included in premium pricing, thereby improving the affordability of insurance and enhancing product development. As Solvency II style regimes are being rolled into more territories, the need for up-to-date best estimate tables is becoming more pressing.

Building bespoke local mortality tables, compared to using national population tables, could also help social security schemes in countries where only a subset of the population (e.g. the formally employed) are in such schemes. Tailored mortality tables will enable schemes to better estimate, and budget for, their future liabilities, and will help to ensure that "black holes" are less likely to develop in the pension system's future finances.

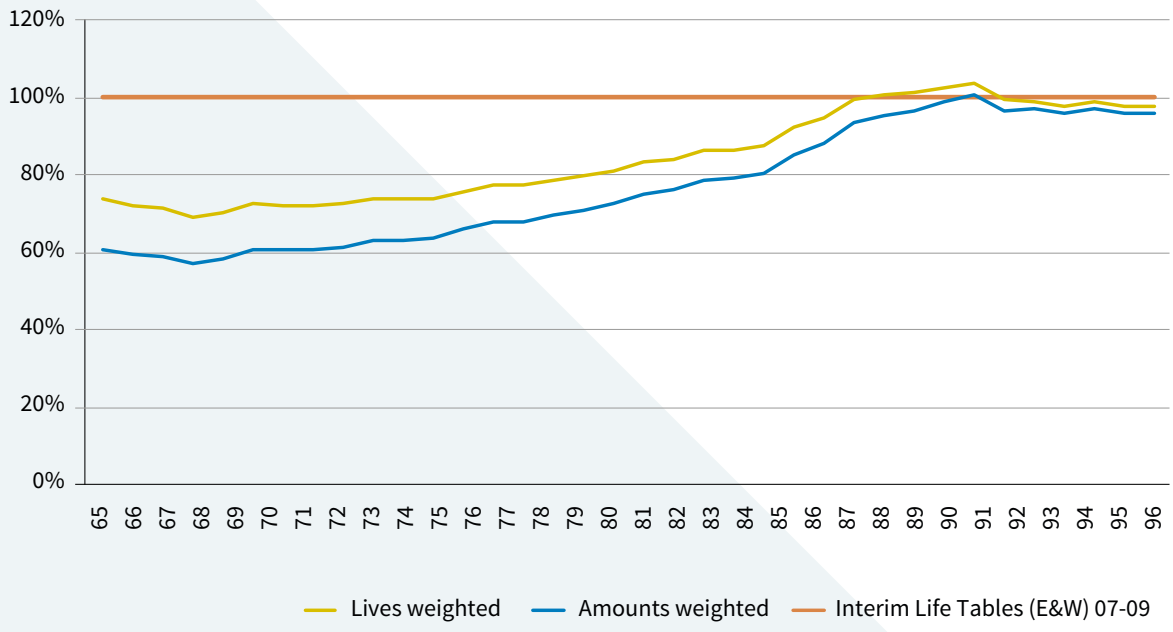
THE DRAWBACKS OF USING NATIONAL POPULATION TABLES

But are national population tables really not good enough? If we turn to the experience in England and Wales, we can see quite how inappropriate they can be.

Figure 1 shows mortality for insured male annuitants, compared to the male national population of England and Wales.

"Lives weighted" is where each individual life contributes the same weighting as all other lives. "Amounts weighted" is where experience is weighted by annuity amounts, attributing more weight to those with greater liabilities (the latter are more useful for actuarial purposes).

FIGURE 1: MALE ANNUITANT MORTALITY RELATIVE TO THE GENERAL POPULATION



Source: Author's calculations using the PML08 and PMA08 tables published by the CMI and the Interim Life tables for England & Wales 2007-2009, published by the ONS. All tables are applicable in 2008.

Male annuitant experience is materially lighter (i.e. longer life expectancies) at most ages shown than national population experience. In particular, the red line (lives-weighted mortality) shows at age 68 experience is as low as 69.2% of that of the national population with the difference generally becoming smaller at higher ages. For female annuitants the picture is similar.

This highlights the first of the drawbacks. Not only is the level of annuitants' mortality experience different from that of the national population, but the difference reduces with age and so it is hard to simply adjust the national tables. In other words, neither the level nor the shape of the national curve is reflective of annuitant mortality.

This picture is similar in other countries I have researched and indeed is more pronounced in developing countries, with often greater levels of inequality. It is not hard to imagine why: people who are able to afford annuities are likely to be wealthier overall, and wealth is very often correlated with lighter mortality for a host of reasons. However, this correlation tends to diminish with increasing age.

The second of the drawbacks is that national tables can only be based on lives data. The above graph shows that amounts-weighted mortality differs from the national population by more than lives-weighted mortality.

The last major drawback of using national tables is a lack of precision. In the UK a census (which collects data on numbers of people alive) is only performed every ten years. Whilst the national deaths data may be collected annually, annual estimates on numbers of people alive at each age need to be made in the interim period. In some countries, tables are even grouped into five-year age bands, which further reduces their precision, and therefore relevance for our purposes as actuaries.

HOW TO DEAL WITH A LACK OF DATA?

But what if traditional datasets are so small that confidence intervals would be too large for any clear picture to emerge? There are still options available:

- It may be possible to get hold of additional data using more innovative sources, for example, through national ID card systems or banks. This may be easier in countries which have more fully embraced new technology.

- One could reference tables in other, similar, countries with more data, and indeed this is how we dealt with the lack of data at older ages when we recently built the first ever set of bespoke mortality tables in Rwanda. The Rwandan social security scheme was one of the first in Africa to build its own tailored mortality tables. Many others (particularly in Southern and Eastern Africa) are now considering similar projects.

- The newer technique 'co-graduation' may also be helpful when building tables for subsets of the population, e.g. blue or white-collar annuitants, where the all lives annuitants' tables are reliable. Co-graduation makes it possible to produce more credible mortality tables for small subsets by effectively drawing value from larger datasets giving more power to your fit for smaller datasets. The technique involves graduating families of curves together, which ensures they move sensibly in relation to each other, fewer parameters are used for each graduation and in general is a better use of limited data.

FUTURE MORTALITY IMPROVEMENTS

Of course, building bespoke base mortality tables is only the first step in producing more accurate mortality assumptions. Without an allowance for future improvements (or changes) in longevity, the implicit assumption is effectively that there will be no further changes in mortality rates, which doesn't seem sensible. However good quality base mortality tables, which are tailored to the underlying population being modelled, are a pretty good place to start!

SOLVING LONGEVITY

FROM RUSSIA WITH LOVE

BY **SERVAAS HOUBEN**

The day before the start of this year's world cup, Russia announced that it would increase its retirement age for men from 60 to 65, and for women from 55 to 63. This raised some concerns as life expectancy is only 66 for men and 77 for women, implying that many Russian men in particular won't live long enough to even claim their pension.

The idea of working until death may not be very popular in society but is from a longevity perspective an interesting one as several research papers (Dr Hinohara, Oregon State University and others)[1] show that working longer results in lower mortality rates and higher life expectancy.

The SOA 2000 mortality study even showed that death rates for men aged 50-70 was only half for working men compared to those retired or not able to work. Is working until death a good solution for increasing our life expectancy while reducing pension benefit payments at the same time?

[1] www.express.co.uk/life-style/health/889730/how-to-live-longer-longevity-working-what-is-the-retirement-age

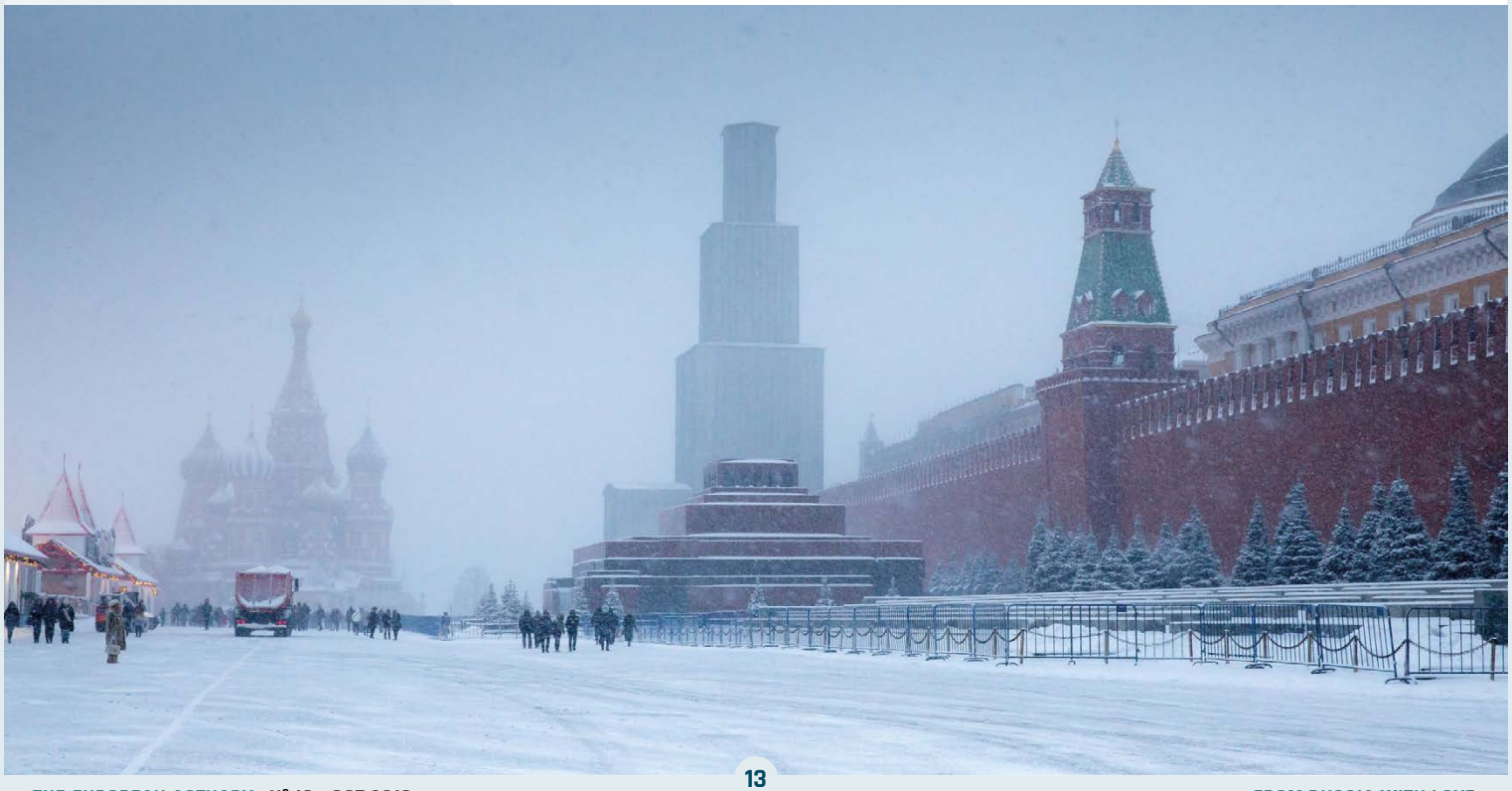
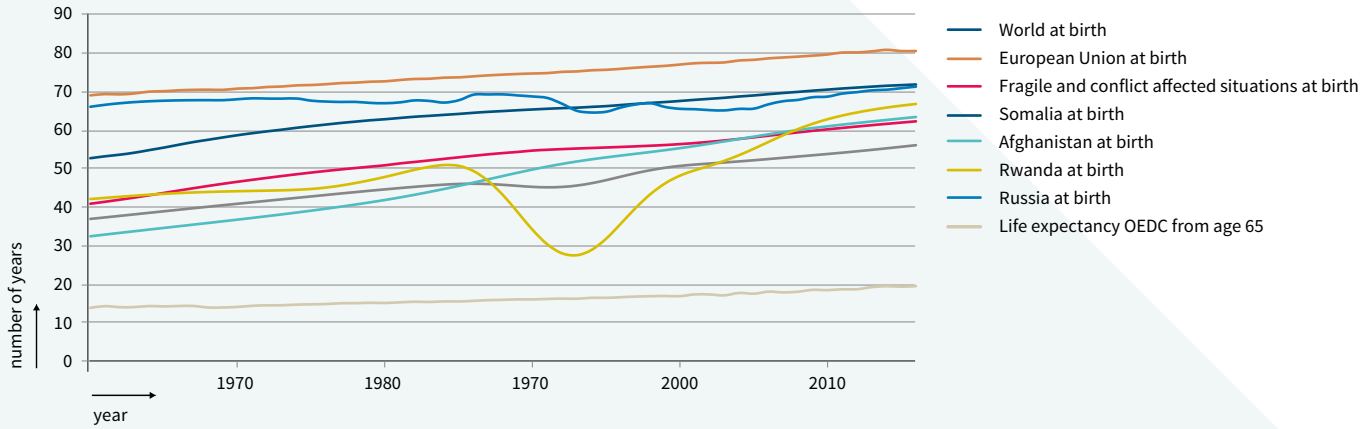


FIGURE 1: LIFE EXPECTANCY AT BIRTH AND 65



WORLDWIDE DEVELOPMENTS IN LONGEVITY

Despite regional differences, the overall worldwide trend in life expectancy over the past 50 years is very impressive. Even in areas that are known as unstable (Somalia) or shaken by wars (Afghanistan), a steady improvement has taken place: even for the 1990-1993 war damaged country of Rwanda, life expectancy continued its pre-war trend in the 2000s (Worldbank, OECD) **(Figure 1)**

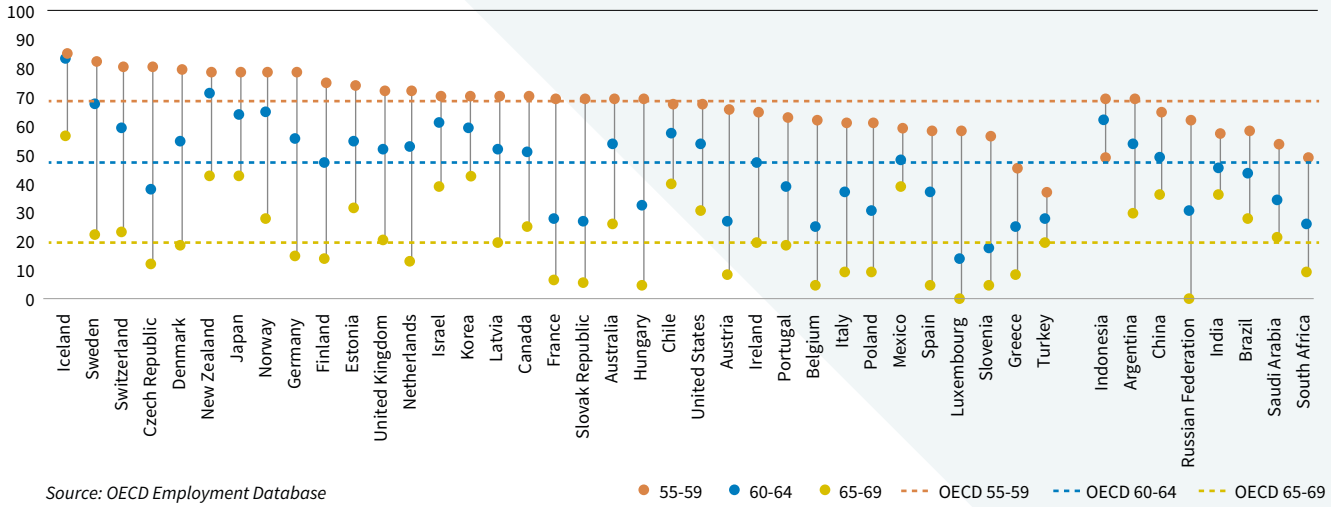
The increase in life expectancy at birth, mainly due to a decrease in child mortality, has been accompanied by a steady trend in an increase in life expectancy from age 65 as well: starting at 13.7 in 1960 to 19.5 in 2016 for the OECD countries. Many countries have already responded to these changes by increasing their retirement age and some countries have linked life expectancy and retirement age to ensure a healthy balance between working age population and retirees.

PARTICIPATION RATES BY AGE

As people live longer and longer, it therefore seems logical to be working longer as well, as they are able for a longer period to contribute. However, participation rates decline sharply by age from an average of 69.6% for ages 55-59, to 46.3% for ages 60-64 to 20.9% for ages 65-69 (OECD). **(Figure 2)**

So it seems that living longer, does not always imply being able to work longer as well. Governments have implemented measures to

FIGURE 2: EMPLOYMENT RATES FALL SHARPLY WITH AGE
EMPLOYMENT RATES OF WORKERS AGED 55 TO 59, 60 TO 64 AND 65 TO 69 IN 2016



Source: OECD Employment Database

increase the pension age, but there are not always such clear policies for the participation rates for older employees. What needs to be done to ensure people can if they are able to participate at a later stage of their lives?

THE RUSSIAN SOLUTION

Increasing the retirement age close to life expectancy like done in Russia, might be a solution for solving the longevity problem while increasing life expectancy in the process. However it seems that even more developed countries seem to struggle to enable older workers to work longer. What can be done for increasing older worker participation?

- Flexible working arrangements: working from home, part time work, or flexible working hours, all contribute to find the best fit and circumstances for older workers to continue to contribute in their working environment. Furthermore, older employees have to become comfortable with accepting a reduction in pay or responsibilities when their productivity decreases over time.

- Life-long learning: as the speed of technological changes has increased, keeping up-to-date with new technology and business practices is becoming more and more relevant. Skills therefore become outdated quicker and employees need to improve their skills continuously or need to consider changing career tracks altogether when physical limitations due to old age, or changing market demands, require different skills. Governments can stimulate life-long learning programs by providing tax incentives and ensuring schooling is available for all age groups.

- Mentoring/teaching: more experienced employees can fulfill the role of a mentor by advising younger employees. Also sharing knowledge of past events via teaching provides valuable life lessons for younger people.

- Healthy life style programs: employers can ensure the wellbeing of their employees by providing incentives for a healthy life style: unpaid leave, sabbatical options, cycling to work, or discounted gym memberships can stimulate employees to choose a certain lifestyle. Governments can use tax incentives to make these beneficial for both employees and employers.

CONCLUSION

From an economic and actuarial perspective the Russian solution is a start: retirement benefits are reduced while life expectancy increases. However, increasing the retirement age is one thing, ensuring older workers can find suitable jobs is quite another. Therefore the challenge with longevity is not just an economic and actuarial problem but a social challenge as well. Flexible working arrangement such as part time work, and working from home, and lifelong-learning can ensure working longer will become more attractive for both employees and employers, as the latter can benefit from the experience and life lessons older workers can bring to the table. Governments have already implemented policies for increasing the retirement age: should they also set policies and create facilities for social partners, employees and home workers that stimulate people to work longer?

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LONGEVITY IMPACT
ON LIFE INSURERS IN LOW INTEREST RATE ENVIRONMENT

BY **ANNA RITA BACINELLO, PIETRO MILLOSSOVICH** AND **AN CHEN**

AN CHEN

Over the last few decades, one of the major societal challenges has been the changing demographics due to our aging society. While birth rates remain low, life expectancy has increased continuously for many years. Apart from this, one of the main consequences of the credit crunch crisis in 2007/2008 has been the transition to a long-lasting phase of extremely low interest rate regimes in many developed countries. These two aspects have brought some trouble on life insurers all over the world, particularly on those providing long-term investment guarantees or lifelong benefits, as these have put a severe strain on life insurers' balance sheets by perceptibly inflating the market values of the liabilities.

The adoption of fair value based accounting standards for insurers, e.g. the full implementation of the Solvency II framework in the European Union in 2016, has enhanced the transparency of their balance sheets by tying assets' and liabilities' values to the actual (or hypothetical) prices they could be exchanged for in a liquid market. On the other hand, the application of these accounting standards has stressed the exposure of life insurers' balance sheets to a variety of financial and biometric factors, with a consequent effect on capital requirements. This is again particularly relevant for providers of long-term investment guarantees or lifelong benefits.

Traditional life insurance products offering fixed life contingencies have been replaced long ago by more competitive contract structures, with-profits in the UK and participating policies with guarantees in Europe and the US, where insurers share part of their returns with the policyholders. Usually, the policyholders are promised to receive

a minimum return even when market performance is poor. This minimum rate of return is set at issuance on a very conservative basis, so that the implicit value of such a guarantee is small. However, given the long-term nature of the contract, guarantees that are initially far out of the money may become highly valuable due to adverse movements in market rates of return and/or an unexpected rise in the length of life. The increasing costs of these guarantees could become unsustainable and eventually compromise the financial stability of the insurance companies. A notable example is given by Equitable Life, the world's oldest life insurer. Therefore, an accurate contract design and careful assessment of all the risks involved, along with the interactions between them, are crucial.

LONGEVITY RISK AS EXPLICIT MODEL COMPONENT

Our approach aims at shedding some light on the interplay between two key risk factors affecting most life insurance products, namely the biometric and the investment risks. In our examinations, longevity risk is explicitly incorporated on a portfolio level in the stylized contingent claim model of a life insurance company issuing participating contracts and being subject to default risk. So far, most of the related literature has focused on financial risks only, as it is implicitly assumed that diversifiable biometric risk can be completely eliminated by pooling a large portfolio and systematic biometric risk, that is longevity risk, is absent. Longevity risk has been emphasized as a main factor influencing life insurance portfolios only in relatively recent years. Stochastic mortality models have been developed to explicitly allow for the uncertainty surrounding future survival rates. In our stylized framework, a stochastic force of mortality is introduced that is obtained by randomly rescaling a deterministic intensity. By this simple modelling, the mortality risk can be split into two components. The first component is given by the unsystematic risk that can be diversified away through pooling. In other words, this risk component tends to disappear for large enough portfolios. The second component is instead given by a systematic part that hits all policies in the same direction. In our case, this second component can be identified in the so-called longevity risk that is the risk of an overall unanticipated decline in mortality rates. When it is present, even with a large portfolio, there is a residual part of risk that cannot be eliminated.

SIGNIFICANT IMPACT OF LONGEVITY RISK

Our thorough analysis of contract components and fair participation rates explores in detail the interplay of guarantees, market regimes, mortality assumptions and portfolio sizes. Overall, our results stress the predominance of systematic over diversifiable risk in determining fair participation rates. The main findings can be summarized as follows: First, idiosyncratic biometric risk vanishes even in small portfolios. In other words, when homogeneous contracts are pooled together, diversification becomes fully effective with relatively small portfolio sizes. Second, longevity risk has a very substantial impact on the market values of the participating life insurance liabilities. The relative size of this impact on the fair participation coefficients is particularly relevant when systematic biometric risk is paired with a low interest rate environment, and is preserved when the solvency capital or the pricing rule is adjusted to reflect the portfolio size. Specifically, our results are quite worrying as they show that, under low interest rate levels, yet not even close to those currently experienced, the costs of offering guarantees may be hardly sustainable. Finally, our detailed analysis provides some useful guidance on the possible actions a life insurer could take in order to mitigate the effect of longevity risk. The insurance company can either increase the volatility of the assets or decrease the magnitude of the surpluses distributed to the policyholders to maintain the fairness of the contracts. In other words, continued improvement in life expectation will make currently offered surplus participation rates unsustainable.

It is high time for life insurers to fully perceive the important role of longevity risk!

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Table 1: *Fair participation rate δ for different values of $E[\Delta]$ and the case with deferred whole life annuities guaranteeing each survivor the continuous payment ρ per year starting a fixed maturity date T for a large portfolio.*

	$E[\Delta]=0.4$				$E[\Delta]=0.8$				$E[\Delta]=1.2$			
ρ	$\delta\%$	V_0^{g}	V_0^{b}	V_0^{d}	$\delta\%$	V_0^{g}	V_0^{b}	V_0^{d}	$\delta\%$	V_0^{g}	V_0^{b}	V_0^{d}
5.0	90.28	43	48	3	95.69	33	57	1	97.65	28	63	1
7.5	69.16	65	33	11	85.11	50	42	5	91.33	42	49	3
10.0	32.76	87	23	22	66.14	67	31	11	79.64	56	38	7
12.5	—	108	17	36	37.33	84	24	20	61.63	70	30	13
15.0	—	130	12	52	—	100	18	30	36.41	84	24	20

V_0^{g} is the initial market value of the guaranteed payments, V_0^{b} the initial market value of the bonus payment, and V_0^{d} the initial market value of the default option.

Table 2: *Fair participation rate δ for different values of $E[\Delta]$ and risk free interest rate r for the case with deferred whole life annuities guaranteeing each survivor the continuous payment $\rho = 10$ per year starting a fixed maturity date T for a large portfolio.*

	$E[\Delta]=0.4$				$E[\Delta]=0.8$				$E[\Delta]=1.2$			
$r\%$	$\delta\%$	V_0^{g}	V_0^{b}	V_0^{d}	$\delta\%$	V_0^{g}	V_0^{b}	V_0^{d}	$\delta\%$	V_0^{g}	V_0^{b}	V_0^{d}
1	—	196	6	108	—	140	10	59	—	113	15	39
2	—	129	13	52	8.17	97	19	28	45.47	79	25	17
3	32.76	87	23	22	66.14	67	31	11	79.64	56	38	7
4	76.54	59	36	8	87.93	47	45	4	92.75	40	51	2
5	92.21	40	50	3	95.96	33	57	1	97.60	28	62	1

V_0^{g} is the initial market value of the guaranteed payments, V_0^{b} the initial market value of the bonus payment, and V_0^{d} the initial market value of the default option.

For the numerical results we have used the parameters:

- m Gompertz law of mortality, fitted to the survival probabilities ${}_tp_{40}^{*}$ implied by the projected life table IPS55 currently used in the Italian annuities market
$$m(t) = \lambda c^{x+t}$$
with $x = 40, \lambda = 2.6743 \cdot 10^{-5}, c = 1.098$.
- Δ Gamma distributed with $\mathrm{Var}[\Delta] = 0.1$ and the following scenarios:
  - $E[\Delta] = 0.4$ extreme longevity improvement scenario
  - $E[\Delta] = 0.8$ moderate longevity improvement scenario
  - $E[\Delta] = 1.2$ slight mortality worsening scenario
- instantaneous assets return normally distributed with mean $r = 0.03$ and $\sigma = 0.15$
- maturity $T = 25$;
- initial individual assets per contract $w_0 = 100$;
- initial contribution ratio $\alpha = 0.7$;

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DEVELOPMENT OF LIFE EXPECTANCY IN HUNGARY AFTER WWII

BY **GYULA HORVÁTH**

MORTALITY DEVELOPMENT IN EUROPE

The constant improvement of the mortality in the developed (and not so developed) world is one the greatest achievement of modern medicine and changing human behaviour. If we pick up some Western European countries from the HMDB database, the pictures are very similar. In **Figure 1** there are 5 randomly selected countries from the EU 15. The trends are almost the same, although the speeds are diverse.

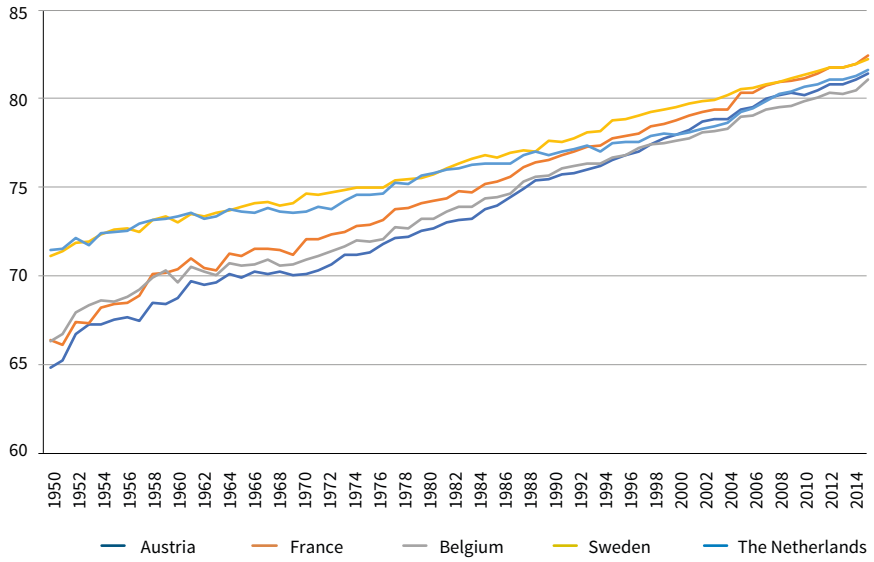
However, if we select some countries from the former communist block (the Visegrád countries) the development trends are different. **(See Figure 2)**

We can distinguish three periods: a rapid development until the mid-60s, a stagnation or very slow increase until the beginning of the 90s, then a faster growth up until now. For those who are familiar with the political history of these countries there is an easy explanation: until the 60s the communist block strengthened (post war reconstruction, healthcare for (almost) everybody etc.), then a long stagnation started with the Brezhnev-era gerontocracy, and after the changing of the system a new development period has been started. The real world is naturally more complicated. Let's see this in the Hungarian example.

HUNGARY VERSUS AUSTRIA

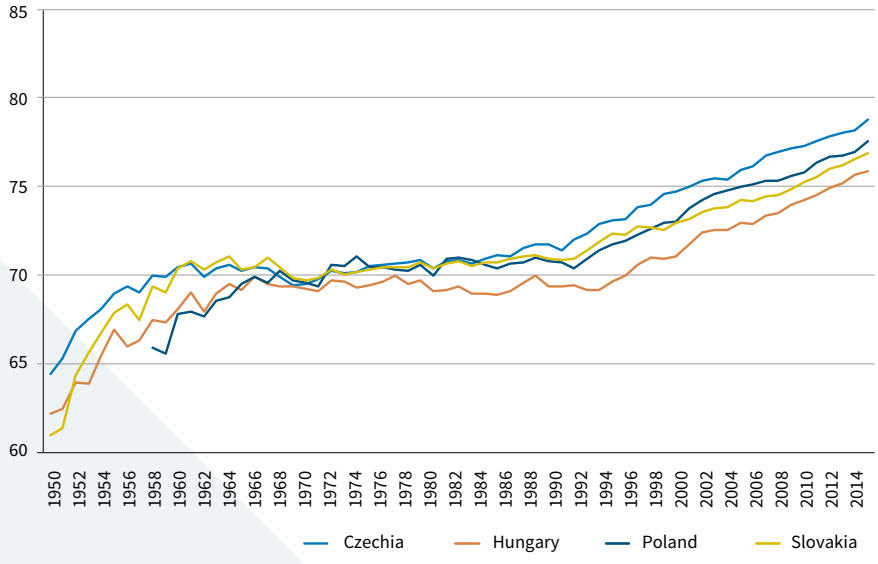
After the post-war reconstruction period the Hungarian mortality situation was not too far from our neighbours. As we tend to compare ourselves with the more developed part of the former Austro-Hungarian Empire, let's see the Austrian example. In 1950 the male and female life expectancy in our country was 96% and 95% of the corresponding Austrian data.

FIGURE 1: LIFE EXPECTANCY AT BIRTH IN SOME WESTERN EUROPEAN COUNTRIES



Source: Human Mortality Database

FIGURE 2: LIFE EXPECTANCY AT BIRTH V4 COUNTRIES



Source: Human Mortality Database

In 1960 they were 101% and 99% (respectively). By 1990 these ratios had decreased to 90% and 94%. What happened over those years in between? Male life expectancy shows an especially miserable trend, or as the Hungarian demographers call it a demographic catastrophe. **(See Figure 3)**

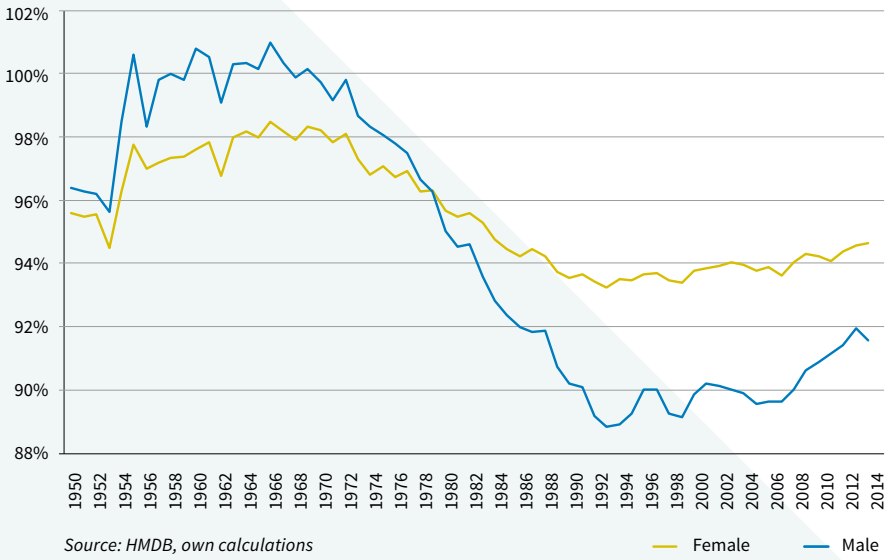
The next section looks at the more radical male case.

FACTORS BEHIND THE CHANGES

One of the most important factors behind increasing life expectancy was a rapid and constant decrease of deaths at younger ages in every European country. As we can see in **figure 4** the development of the infant and childhood mortality was parallel in the two countries, although the starting point was better in Austria. If we fit exponential trends, one can see that the development coefficients were also close to each other, but slightly better in the case of our Austrian neighbours: 5% versus 4.6% annual decrease in the case of infant rates, and 4% versus 3.4% between ages 1 and 14. However, these factors did not cause serious differences in life expectancy: if we substitute the first 14 years of Hungarian mortality rates with the Austrian ones in 2014, the life expectancy would increase from 72.3 to 72.4 (it would be 72.6 years in case of substitution with the first 40 years). This effect is of little surprise if we look at the corresponding data in **figure 5**. This chart shows the sad development of Hungarian male mortality for the period from age 40-65.

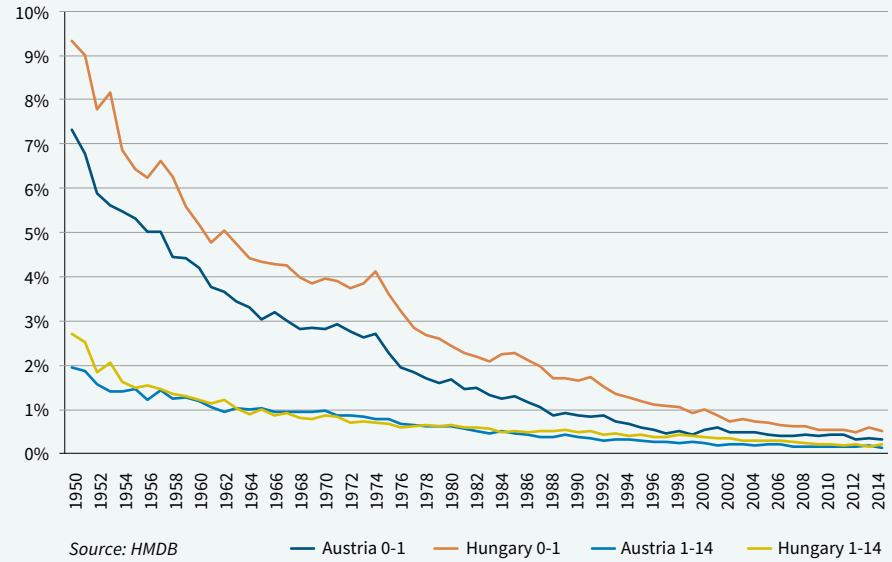
In 1971 the survivorship of Austrian men from 40-65 was practically the same as the Hungarian one, around 73%. In 1993 this was 60% for the Hungarians and 80% for the Austrians.

FIGURE 3: HUNGARIAN LIFE EXPECTANCY AUSTRIA =100%



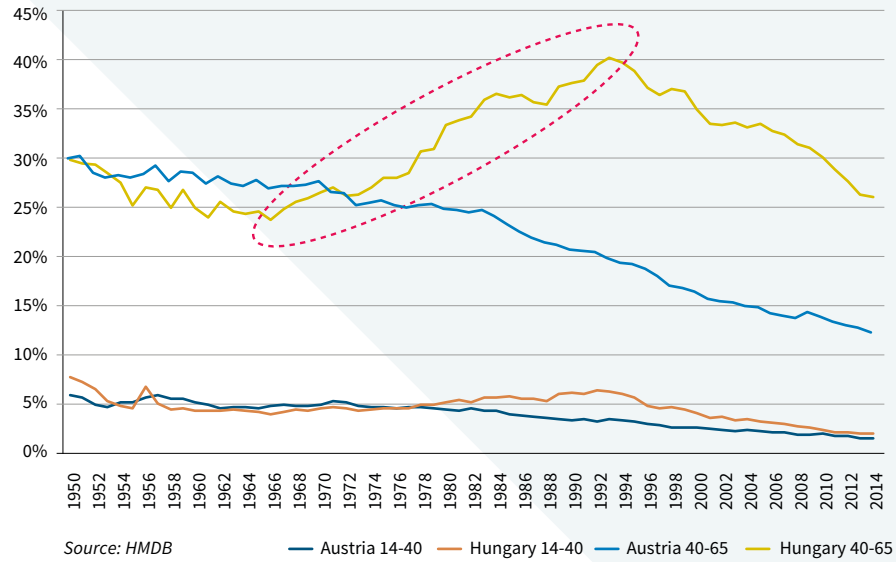
Source: HMDB, own calculations

FIGURE 4: INFANT AND CHILDHOOD MALE DEATH RATE AUSTRIA AND HUNGARY



Source: HMDB

FIGURE 5: ADULT DEATH RATES: AGES 14-40 AND 40-65 AUSTRIA AND HUNGARY



Source: HMDB

We can observe this trends in every 5-year age cohort **(Figure 6).** What is the background of this demographic catastrophe? The Hungarian demographers had different answers.

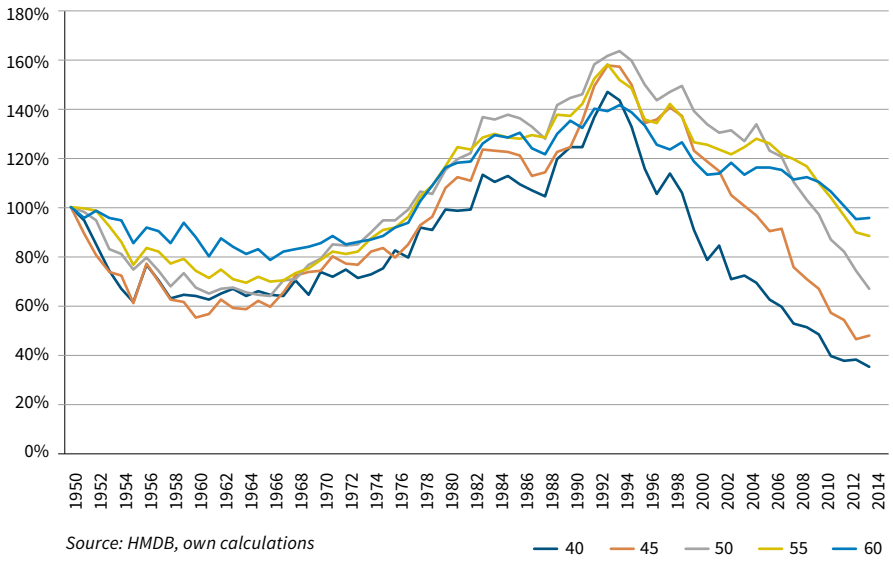
One is the excessive use of alcohol: Out of the total male mortality, in 1966 only 1.2% was the result of the chronic liver disease and liver cirrhosis, the same figure in 1994 had reached 8% *(Valkovics p22).* According to Péter Józan, one third of the male deaths in the period were caused by tobacco and one fourth by alcohol *(Józan 2008 p60).* Other causes can be put down to stress levels and disruption of family ties, especially in the period of forced industrialisation.

In order to finalise the picture, in **figure 7** we show the development of life expectancy in the two countries at age 65. Until the middle 70s this did not change and was almost the same in both cases. In case of Austria a definite improvement had begun, mainly due to new medical methods. In 40 years the improvement was 6 years, 1.5 years per decade. The Hungarian health care system was not able to follow this under the previous regime, so the improvement started 20 years later and the tempo was also a little more moderate at 1.2 years per decade.

SUMMARY

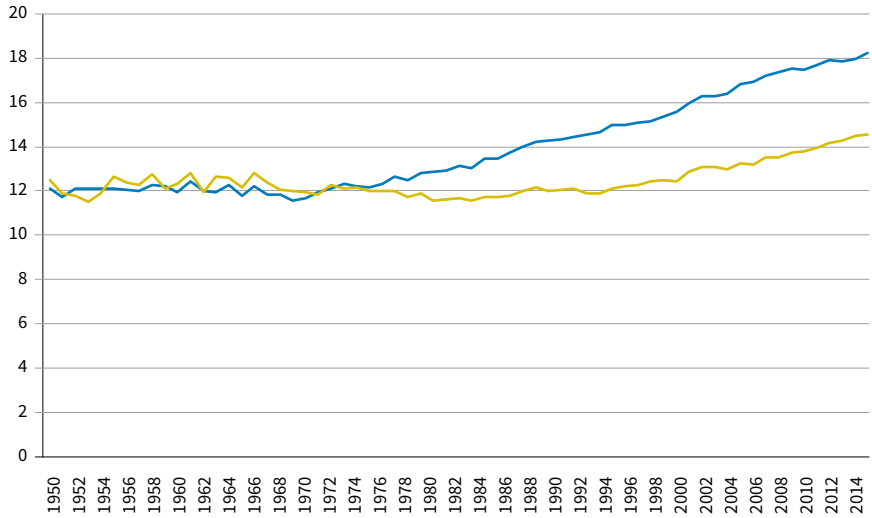
The historical mortality patterns of the former Eastern bloc countries were (and are) quite different compared with Western Europe. The divergent process was caused by the lack of the most up-to-date medical cures in the East and also some behavioural differences: probably stress and lack of freedom, and most surely the excessive use of alcohol and tobacco.

FIGURE 6: HUNGARIAN DEATH RATE BY 5-YEAR COHORTS 1950=150%



Source: HMDB, own calculations

FIGURE 7: LIFE EXPECTANCY AT AGE 65 AUSTRIA AND HUNGARY



Source: HMDB

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LONGEVITY RISK AND PENSION FUNDS

BY **RAJISH SAGOENIE AND GERT MAARSEN**

When looking at risk management at Dutch pension funds, interest and market risks often receive most attention. Attention to longevity risk is lower. Mortality seems to be less impactful and longevity cannot be influenced by the fund. A proper approach to this risk can avoid unexpected longevity losses. This article describes how pension funds in the Netherlands deal with this risk and looks into current developments.

RAJISH SAGOENIE is (equity) principal in the Amsterdam office of Milliman.

LEGAL TREATMENT OF LONGEVITY RISK IN THE NETHERLANDS

Pension funds keep buffers for longevity risk. These buffers are part of the required reserves. In order to determine these reserves, the fund considers various risk categories and their interdependencies. Reserves should be such, that the overall likelihood of underfunding after one year is less than 2.5%. Mortality is one of the risk categories. In the Netherlands we distinguish three elements:

- **Process risk**
  Process risk originates from abnormal adverse variation in insurance results during one year. This risk depends on the number of participants in the fund and the exposure of the fund to death risks.

- **Trend mortality uncertainty**
  Trend mortality uncertainty covers the uncertainty regarding the longevity trend. The lower the average age in the fund, the higher the trend mortality uncertainty.

- **Negative Stochastic Deviation**
  Negative stochastic deviation covers the risk that the estimated mortality rates differ from the actual mortality rates. The estimate of the actual rates is based on experience.

The impact of the trend mortality uncertainty is relatively large, because a good estimate requires a large amount of data. Furthermore, small changes in the trend can have large effects.

MORTALITY TREND

Once every two years the Dutch Royal Actuarial Association publishes updated mortality rates, including an updated mortality trend. The most recent mortality table is "Prognosetafel-AG2016". Almost all pension funds in the Netherlands use this table. The Royal Actuarial Society's mortality tables experienced strong developments since the introduction of the Pension law in 2007. Research indicates that the mortality trend for most countries with a comparable per capita income in Europe show strong correlation. **(figure 1)**

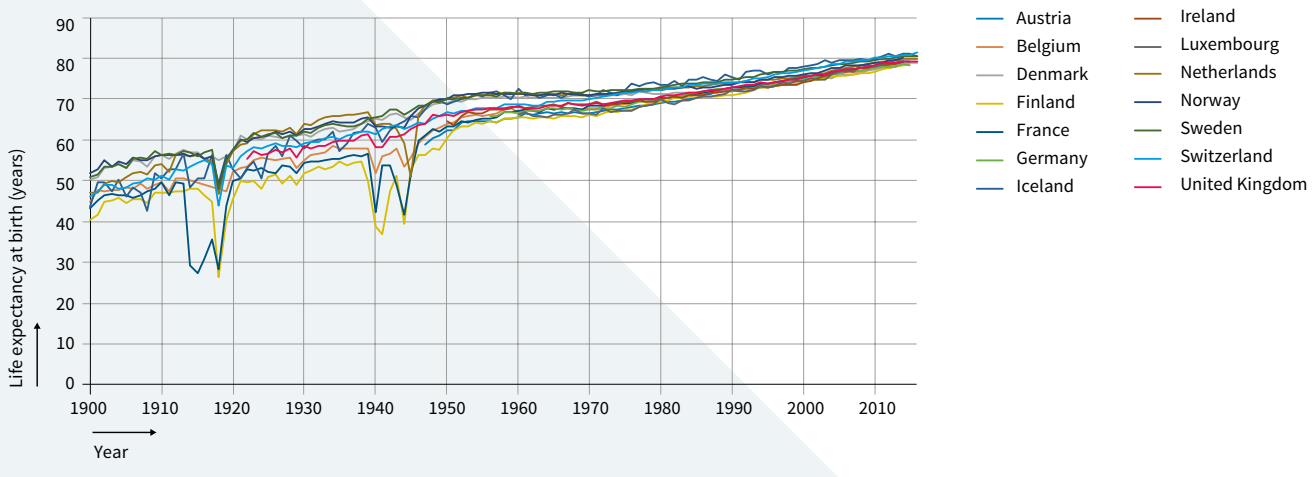
For that reason, the Association included the following elements in the latest AG2016-table:

- Mortality rates in countries with similar per capita income as in the Netherlands: The adopted table is now partly based on mortality rates in these countries and partly based on mortality rates in the Netherlands;
- Correlation between the mortality trend of men and the mortality trend of women;
- Application of Kannistö's method of extrapolation for mortality rates after age 90.

MORTALITY EXPERIENCE RATES

As mentioned above, the AG2016-table is based on the development of mortality rates for the whole Dutch population and on rates in selected European countries. Research shows that the mortality of insured populations and pension fund participants is lower than the mortality of the total population. The socio-economic status of a person significantly determines his/her mortality. In general, the mortality of high income and/or higher educated persons is significantly lower than the mortality of low income and/or lower educated persons.

FIGURE 1: CONVERGENCE OF PERIOD LIFE EXPECTANCY AT BIRTH FOR MALES IN WEST-EUROPEAN COUNTRIES



Source: Human Mortality Database

GERT MAARSEN is senior consultant in the Amsterdam office of Milliman.

Example: Relative effect of education on mortality rates. **(figure 2)**

The Dutch keep looking for better methods to deal with data on mortality in order to obtain better pension fund specific mortality estimates.

RECENT DEVELOPMENTS IN ASSESSING MORTALITY EXPERIENCE RATES

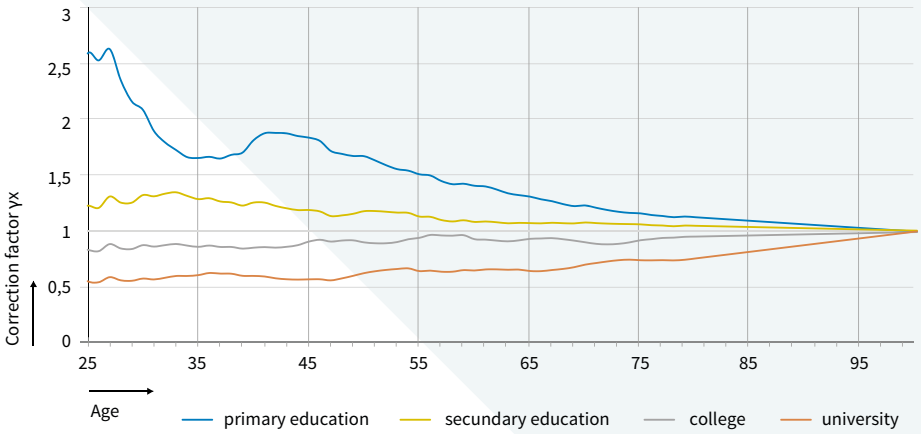
On March 8th 2018, the Royal Actuarial Society organized a meeting on mortality experience rates. During this meeting, several actuarial firms and large pension fund administrators shared and compared their experience rate models. It turns out that education and household income are good parameters to estimate experience rates. In practice however, income from most recent employment and pension income at the current pension fund is used for this purpose. The reason is that reliable information about total household income and about education levels is lacking.

Whereas for active participants pensionable income still provides a more or less reasonable estimate for mortality, this is not the case for inactive participants (former employees and retirees). Due to the relative increase of the number of inactive participants in pension funds, it becomes even more important gather data on education levels.

CONCLUSION

Innovations and new developments increasingly enable Dutch pension funds to get more grip on longevity risks. They can do so by considering the specific characteristics of the pension fund population. In current times of low coverage ratios and potential benefit cuts, the quality of "best estimates" of the provisions are crucial. We are on the right track, but more innovation remains necessary. The publication of the next "prognose table AG2018" (expected on September 12, 2018) will be the next step.

FIGURE 2: MILLIMAN EXPERIANCE RATING MODEL 2017: CORRECTION FACTORS MALES, PER EDUCATION LEVEL



WELFARE CHALLENGES IN ITALY

AN INTERVIEW WITH **LAURA CRESCENTINI**, ACTUARY, TECHNICAL COORDINATOR OF ASSOPREVIDENZA

INTERVIEW BY **GIAMPAOLO CRENCA**

What are the main welfare challenges that you have to face in Italy ?

'Italian welfare structures show (as in many other EU member states) the signs of the time. Conceived in the 19th century, it presents the classical structure of the Bismarck model, with an organization by so-called "silos", following the single kind of benefits (pensions, health, disability, unemployment, etc) focused on people that have a definite employment.

Unfortunately this model is not able to face new needs coming from changes in demography (long term care), job market (new atypical jobs, job instability), jointly with economic crises that present obstacles to an increase of means dedicated to welfare.

So it is time now (and even urgent) to undertake the way of so called "Social innovation". Social innovation concerns not only new benefits, but also processes, in order to adopt a logic of "welfare life-cycle", that is a focus on the life route of a person considering it as a continuum, without fixing in a rigid way steps between different phases (to which correspond different needs). And even more, also in order to create new social relationships and partnerships between actors belonging to different areas, typically public and private welfare.'

Are there any particular fields in which the need of innovation is more evident?

'There is no doubt that long term care is one of the principal argument of the debate,

considering that Italy is one of the oldest countries in EU and that the traditional Italian family model is by now deeply in crisis: the increase in the employment rate of women, a decrease in the number of children, frequently high distance separating parents and children.

Faced with new needs of elderly people, answers given by public and private sector are sharply inadequate under quantitative but above all qualitative profile. Public benefits are provided by different institutions at national and local level with a lack of coordination even concerning criteria of evaluation of disability. Moreover they are mainly focused on cash benefits without control about their effectiveness. The same problems can also be found in private benefits, that are anyway not so widespread especially on a collective basis.'

Is the State and private offer adequate to face the welfare demand?

'If the situation concerning long term care is probably the most inadequate, even in other fields answers for our welfare system show a need for change, particularly protection against unemployment and for new kind of jobs.

So we try to find a solution allowing under certain conditions an early retirement, particularly using second pillar pensions.'

Which are the main news in Italian welfare organization?

'In the last five years a new phenomenon has spread, the so called "corporate welfare".

The law gives fiscal incentives for employees to "buy" welfare benefits, also financing supplementary pensions, health care funds, long term care benefits.

Corporate welfare has seen a large degree of success: many new collective agreements contain welfare clauses and welfare has recently been included in the national framework agreement concerning collective bargaining.

Reasons for this success should be found in the feeling of nearness of this kind of welfare and the ease of use. In most cases, in fact companies gives their employees the possibility of "spending" their awards choosing benefits from a platform provided by specialized companies.'

Are there any risks in the implementation of this new welfare model?

'If corporate welfare has the merit of valorizing and helping the provision of welfare, we can't ignore the risk that under the label "welfare" will put also appear benefits that belong rather to the area of employee benefits, like culture/leisure (books, movies, museums) tourism (travel, hotels), sport (gyms, swimming pools), etc.

In fact many actors, even platform providers, are now conscious that to insert this kind of benefits under welfare label risks may delegitimize the idea of welfare itself, leading eventually to abolition of fiscal incentives because of benefit inappropriateness from a social point of view.'

What is now and above all in the near future the role of the actuary in the welfare world?

'Actuaries could play a key role in a process of social innovation of welfare systems in more than one way. First: In a period of shortages of financial means, it is crucial to optimize their utilization in order to avoid a decrease in the level of social protection, also in partnership of public and private resources. Second: In a process of social innovation it is particularly needful to know the technical way of functioning of different systems already adopted: it is not possible to innovate without knowing what you have to innovate. And third: Any kind of evaluation should be made not only with reference to the near term but considering the long term. Reforms concerning welfare, especially when you speak about pension or long term care, will make their effect felt for many years.

For all this reasons actuaries, because of their specific competence as risk evaluation specialists and welfare specialists, are in the best position to become a reference point for policy makers in order to support any project of social innovation of our welfare systems, particularly in the framework of the welfare life-cycle.'

CUTTING-EDGE LONGEVITY RESEARCH

FOCUSES ON RISK MODELLING, MONITORING AND TRANSFER SOLUTIONS

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BY **STÉPHANE LOISEL, ANDREW CAIRNS** AND **DAVID BLAKE**

There is a growing amount of work on both two population and multi-population models. Two population modelling typically aims to model a small population (e.g. a pension plan) alongside a national population. Multi-population modelling typically treats individual populations as having equal weight. Models need to be kept relatively simple to ensure robustness. Practical applications include "simply" assessing exposure to longevity risk (including e.g. Solvency II) and diversification benefits from having several portfolios with different mortality characteristics, through to having the capacity to assess properly the benefits of longevity hedges, especially index-based hedges.

Socio-economic modelling is an example of multi-population modelling where the groups being modelled have different socio-economic characteristics and often span the whole of a national population. Examples include: income or affluence (e.g. Denmark, US), pension amounts (Canada), educational attainment (Denmark, US and other countries), measures of deprivation (England), marital status and educational level (France). Modelling work requires these subgroups to be substantial in size to avoid sampling

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variation in the data (noise) obscuring the underlying mortality trends (signal). Population dynamics models enable one to take into account random transitions for one subgroup to another.

A number of researchers are looking at cause of death data (at varying levels of detail) and how these have changed over time. Some datasets use broad cause of death groupings (e.g. cancers, cardiovascular), while others that are emerging (US, Denmark and England) that use much more detailed causes of death (e.g. lung cancer, ischaemic heart disease). Greater detail allows us to separate out significant causes of death that have significant levels of social inequality, often linked to controllable risk factors such as smoking. Other more specific causes of death have minimal levels of inequality (e.g. breast cancer). In some recent research projects, actuaries, medical doctors and public health researchers teem up to study hospital data in order to refine causes of death and of disability and to manage jointly longevity and long term care risks.

Many of the examples above would not be possible without researchers having some level of access to very detailed national datasets. In many cases access is strictly controlled in order to comply with data privacy legislation, but it allows researchers to extract datasets in an aggregated form that have certain characteristics. Perhaps because of this limited access, we are some way from moving from big data to true data science (in terms of methods that are used to analyse data).

Insurers, pension funds, hedge providers and regulators must regularly check that actuarial assumptions are not contradicted by recent data. Optimal risk monitoring strategies have been recently identified for a large class of birth-death processes. Some more work is needed to adapt this to a big data setting with several policyholder groups and to design relevant key risk indicators combining online change-point detection and monitoring of advances in biotechnology and medical science.

Pension plans and annuity providers often see longevity as a risk that they would prefer to transfer. Risk transfer activity has been mainly in the UK, Netherlands and the US with a variety of formats. UK hedgers have tended to favour customised longevity swaps and related reinsurance deals. Dutch insurers (as hedgers) have favoured index-based hedges with option

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characteristics (e.g. the recent NN Life deal in December 2017). Current research seeks to develop methods that can be used to provide a fair assessment (including regulatory capital relief) of the different types of longevity hedge.

There is insufficient capital in the global insurance and reinsurance industries to remove all the $41tn of longevity-linked risks embodied in the pension liabilities of the world's corporations. To date, less than $400bn has been transferred, mainly in the UK, US and Canada. Each year, around $40bn is transferred and there is currently sufficient financial capital to deal with this flow rate. However, there is a different constraint that is impeding the ability of the market to grow faster and that is a human capital constraint. There is currently an insufficient supply of skilled actuaries and lawyers to meet demand.

Recently, reinsurers have begun to tap the capital markets for new sources of finance. One vehicle for doing this is the reinsurance sidecar – which is a way to share risks with new investors when the latter are concerned about the ceding reinsurer having an informational advantage.

Formally, a reinsurance sidecar is a financial structure established to allow external investors to take on the risk and benefit from the return of specific books of insurance or reinsurance business. It is typically set up by existing (re)insurers that are looking to either partner with another source of capital or set up an entity to enable them to accept capital from third-party investors.

It is established as a Special Purpose Vehicle (SPV), with a maturity of 2-3 years. It is capitalized by specialist insurance funds, usually by preference shares, though sometimes in the form of debt instruments. It reinsures a defined pre-agreed book of business or categories of risk. Liability is limited to assets of the SPV and the vehicle is unrated.

The benefit to insurers is that sidecars can provide protection against exposure to peak longevity risks, help with capital management by providing additional capacity without the need for permanent capital, and can provide an additional source of income by leveraging underwriting expertise. The benefit to investors is that they enjoy targeted non-correlated returns relating to specific short-horizon risks and have an agreed procedure for exiting; investors can also take advantage of temporary price hikes, but without facing legacy issues that could affect an investment in a typical insurer.

DIFFERENCES IN LONGEVITY IN EUROPE

BY **FANNY JANSSEN**

LONGEVITY LEVELS AND TRENDS IN EUROPE

In Europe, individuals nowadays experience longer lives than ever before. Whereas Europeans born at the beginning of the 20th century, could expect to live on average around 50 years, life expectancy at birth (e0) is currently around 78 years in Europe. This European average is 6 years higher than the current world average of life expectancy at birth, which amounts to 72 years.

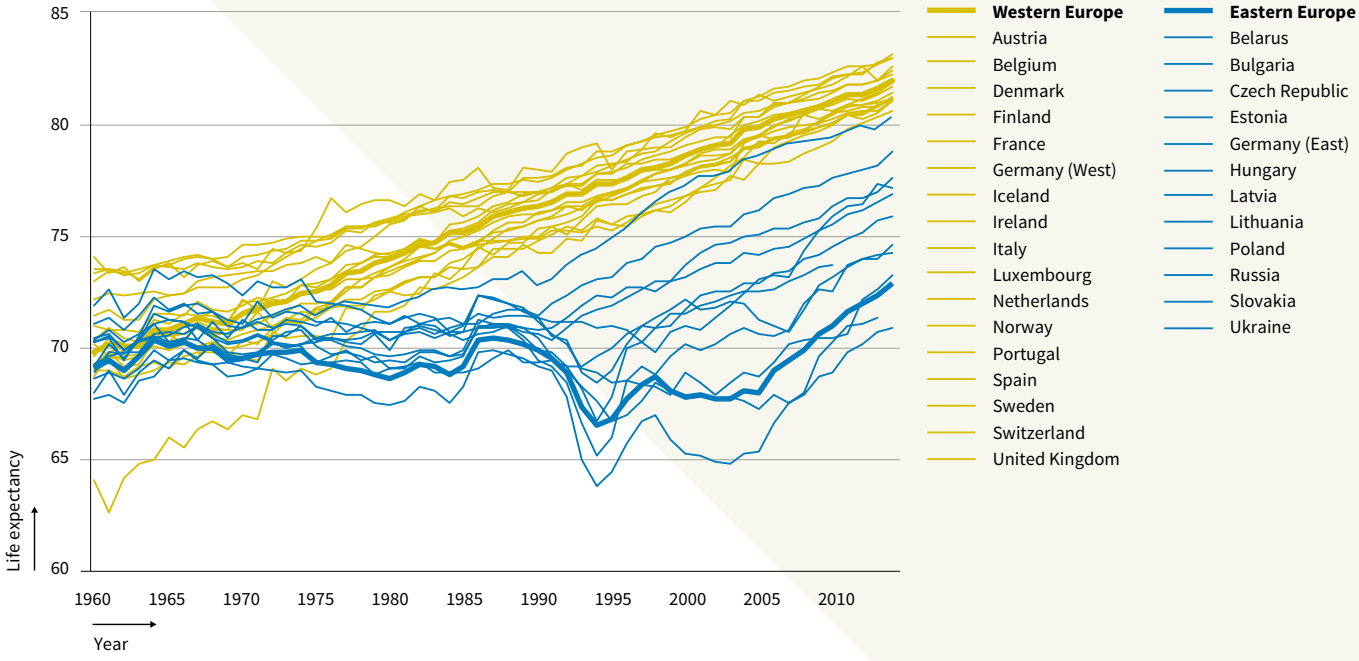
The gradual increase in life expectancy in the 20the century for Europe as a whole can be related mainly to socio-economic development and related medical progress. However, important differences within Europe exist in the speed of the increase in life expectancy , and – as a result – in current levels of life expectancy.

EAST-WEST DIVIDE

Whereas, in 1960, life expectancy levels across Europe were quite similar (with the exception of Portugal) and ranged (after excluding Portugal) from 67.8 (Poland) to 74.1 (Iceland), this picture quickly changed in the decades thereafter **(see Figure 1)**.

That is, from 1960 onwards the trends in e0 in North, West and Southern Europe clearly increased, whereas in Eastern Europe life expectancy did not improve. From 1975 onwards even declines in life expectancy occurred in

FIGURE 1: PAST TRENDS IN LIFE EXPECTANCY AT BIRTH, 1960-2014, EASTERN EUROPE AND WESTERN EUROPE COMPARED



Source data: Human Mortality Database, accessed 26/8/2018

Bold lines illustrate the weighted averages for Eastern and Western Europe. Up until 2010 this includes all the above mentioned countries for the two regions. Because of data unavailability, Bulgaria is excluded in the calculation of the weighted averages from 2011 onwards and Ukraine for 2014.

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FANNY JANSSEN
photo: Gerhard Taatgen

Eastern Europe as a result of the health crisis. From 1990 onwards e0 again improved for Central European countries, but for the former Soviet Republics the situation aggravated, and especially for Russia, Ukraine and Belarus it was not until 2005 that e0 increased again. As a result a clear divergence in life expectancy levels within Europe occurred from 1960 to 2005. In 1994 the range in e0 within Europe even amounted to 15.4 years, with Iceland still experiencing the highest level (79.2) and Russia the lowest level (63.8). From 2005 onwards, the difference diminished to 12.2 years in 2014 (70.9 years in Russia; 83.1 years in Switzerland).

Important differences in life expectancy also exist across countries within the two European regions. Especially important, and already referred to, is the difference within Eastern Europe where Central Eastern European countries are doing best, followed by the Baltic states, and with Russia, Ukraine and Belarus experiencing the lowest e0 values. Within Western Europe, in 1960 North-western European countries (Iceland, Norway, Netherlands, Sweden, Denmark) generally experienced the highest levels, whereas Southern European countries experienced the lowest levels. In 2014 however, Italy and Spain ranked 2nd and 3rd, whereas the Northwestern European

countries lost their advantaged position, as a result of stagnating trends around the 1960s among men, and around the 1980s among women.

SEX DIFFERENCES

But within Europe also important differences in longevity levels and trends between men and women exist. Women generally have an advantage in life expectancy over men. In Europe nowadays, life expectancy at birth (e0) is 6 years higher for women (81) as compared to men (75), which is higher than what is observed worldwide, where women's advantage in e0 amounts to 4 years.

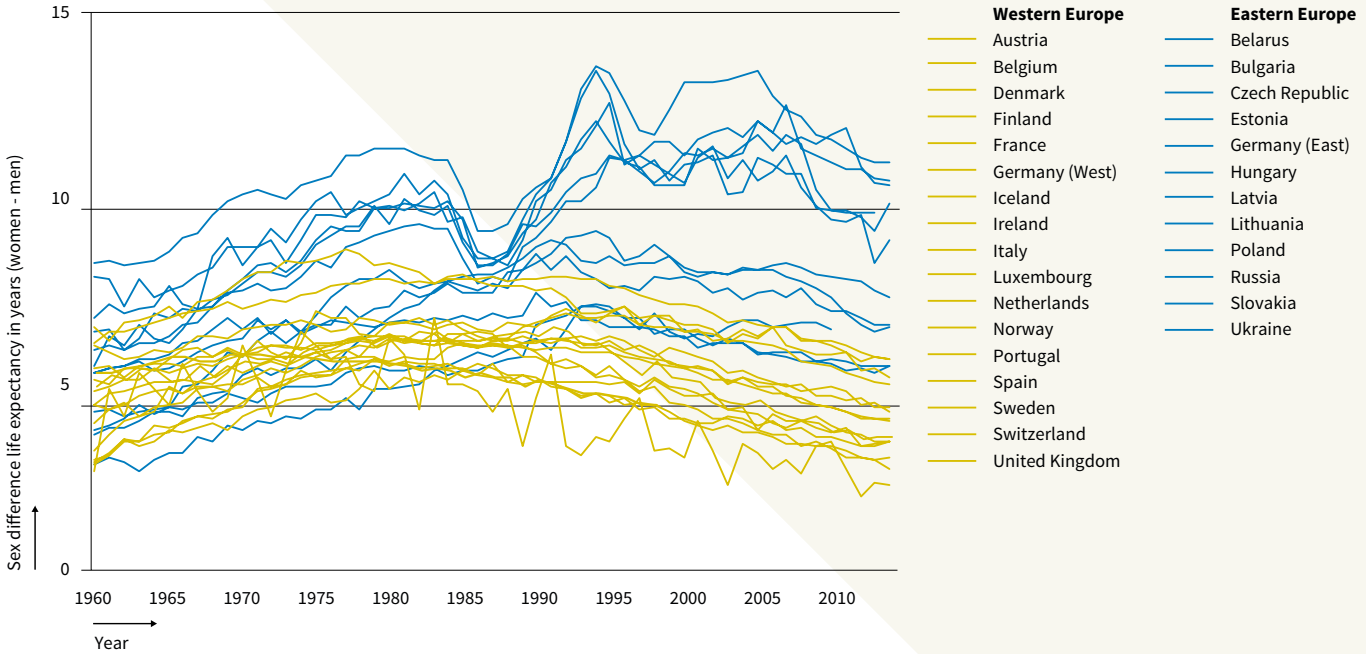
However, differences between European regions and countries exist in this sex gap in life expectancy **(see Figure 2)**.

In Western Europe, the female advantage in e0 is currently around 3-6 years. In Eastern Europe, however, the female advantage is much higher, and for former USSR countries still close to 10 years. The sex difference in e0 has, over time, turned from an increase towards a decline in all European countries. The timing of this turnover however differed between countries, and occurred first in the UK (around 1970), followed by the Nordic countries (around 1980), remaining western European countries (around 1985), Southern European countries and Central European countries (1995) and former USSR countries (2005).

IMPORTANT ROLE OF LIFESTYLE FACTORS

Lifestyle factors play an important role in explaining the variations in mortality levels and trends within Europe. In the Europe Union, smoking, excessive alcohol consumption, and overweight/obesity are respectively the first, third and fourth most significant preventable risk factors (second = blood pressure). *Smoking* not only has a strong effect on mortality levels, but also on mortality trends, because of the subsequent increase and decline in smoking prevalence followed 30 years later by a similar non-linear pattern in smoking-attributable mortality.

FIGURE 2: SEX DIFFERENCES IN LIFE EXPECTANCY AT BIRTH, 1960-2014, EASTERN EUROPE AND WESTERN EUROPE COMPARED



Source data: Human Mortality Database, accessed 26/8/2018

The effects are particularly large among those who took up smoking first: men in Anglo-Saxon countries and north-westernEurope. Women, in general, started smoking some decades later than men, and less excessive. *Excessive alcohol consumption* is especially prevalent among adult men in Eastern Europe, resulting in substantial alcohol-related mortality with a high impact on mortality. *Obesity's* prevalence has tripled in the last 20 years, and currently more than half of the adult EU population are overweight or obese. Obesity foremost has an effect on morbidity, but with the further proceeding of the obesity epidemic its effect on mortality levels and trends is growing.

Own research on the East-West difference in e0 showed that in 2012/13 alcohol-attributable mortality contributed on average around 20% to life expectancy differences between Central and Eastern European (CEE) countries and Western Europe, for both men and women. Among men, the contribution of smoking is estimated to be even slightly higher, whereas among women a small negative contribution of smoking is shown. Obesity contributes around 0.4 years for men and around 0.3 years for women to the East-West difference.

The stagnation of the increase in life expectancy among men in Northwestern European countries in the 1950s/1960s can largely be explained by high lifetime smoking prevalence among these early adopters of smoking. When smoking is excluded from the trends in life expectancy they are not only more linear, but also more parallel between men and women.

This latter finding relates to smoking contributing on average around one third to the sex difference in e0 in Europe. This makes smoking even more important than biological factors whose contribution has been estimated by Marc Luy at 25%. The contribution of alcohol to the gender gap is largest in Central Eastern Europe, where it contributes at least 15% in 2012/2013. Also obesity is affecting life expectancy of men more than women, albeit to a much smaller extent.

FANNY JANSSEN currently leads the research project "Smoking, alcohol and obesity – ingredients for improved and robust mortality projections" funded by the Netherlands Organisation for Scientific Research (NWO) (grant no. 452-13-001). In this project, the role of smoking, alcohol and obesity 'epidemics' on past mortality trends is assessed, and subsequently this knowledge is integrated into a novel methodology to forecast mortality. Key to the methodology is distinguishing between the general gradual long-term mortality decline, and the smoking, alcohol, and obesity 'epidemics' which cause deviations from and variations in the general mortality decline. See www.futuremortality.com for further information.

The life expectancy numbers for Europe and the World are taken from the World Population Data Sheet 2018 by the Population Reference Bureau.

The data behind the two figures stem from the Human Mortality Database (www.mortality.org) (accessed 26/8/2018).
The age-specific mortality data from the HMD has been aggregated for those aged 100 and above, after which lifetable techniques have been applied. We excluded Greece and Slovenia because for them no data is available from 1960 onwards.

BETTER OUTCOMES FOR DC RETIREES

BY COLM FAGAN

At retirement, members of Defined Contribution (DC) pension schemes face difficult choices when converting their DC pots into an income for life. In a presentation to the Society of Actuaries in Ireland on February 7 last, I addressed the key challenges they face of: (i) high charges; (ii) low investment returns; and (iii) no security of income.

High charges are a consequence of members being forced to leave the security of the DC scheme on retirement, of losing the benefit of the trustees' duty of care, to enter the fraught world of personal financial advice. In Ireland, experts estimate that charges on insurance-based individual pension products equate to a yield reduction of 1.5% to 2% a year.

Low investment returns, the second of the challenges, are caused primarily by risk aversion by both retirees and their advisers.

Risk aversion is understandable. Someone saving through equities risks losing a sizeable portion of their pension pot, either in one fell swoop, like in October 1987 when markets fell by over a fifth in just two days, or through slow torture, as happened in the UK between 2000 and 2005, when the market remained below its starting level for a full five years. Other markets have suffered even more prolonged torpors: Japan's lasted for more than two decades at the turn of the millennium. Such history lessons help us to understand why many DC retirees keep a high proportion of their assets in low-yielding cash and short-term bonds.

Advisers sometimes amplify rather than alleviate their clients' risk aversion. Nobel Prize-winning behavioural psychologist Daniel Kahneman observed that "decision makers who expect to have their decisions scrutinised with hindsight are driven …. to extreme reluctance to take risks". Financial advisers' recommendations are regularly scrutinised with hindsight. This makes them reluctant to advise clients to risk committing a significant portion of their savings to equities.

Nevertheless, the incontrovertible truth is that equities have delivered vastly superior returns in the long-term. DC retirees can expect to live another 20 to 25 years on average, so they should be able at least at first to invest for the long-term. The Equity Risk Premium (ERP) - the additional expected return on equities over bonds – is generally agreed to be of the order of 3% to 6% a year. Currently, high quality Eurozone bonds yield under 0.5% a year; equities are expected to deliver approximately **ten times** that - on average. That's a prize worth fighting for.

But it is part of human nature to fear losses more than to celebrate gains: some anthropologists assert that risk aversion is hard-wired into us by evolution. Studies have shown that the pain of a 10% loss wipes out the joy of a 20% gain. This changes the calculus. It also chimes with our gut instinct that someone in their seventies or eighties should not be exposed to the risk of an October 1987 type collapse in the value of their savings, whatever theories of *homo economicus* tell us.

How do we square the circle?

My proposal to address the challenges of high charges and low investment returns, whilst also recognising the reality of loss aversion, was to allow members to remain in the group scheme post retirement. This spares them the expense of cashing their scheme investments and having to take out higher cost

individual arrangements. The related proposal was that they could transfer their funds to a separate pooled account invested entirely in equities and other real assets (except for a small cash float to meet short-term liquidity needs). The returns on this pooled account would be smoothed, to even out the humps and hollows of short-term fluctuations in market values.

I set out the criteria that the proposed smoothing formula must satisfy: it should be transparent, objective and easy to apply; it should reflect long-term trends while damping short-term fluctuations in market values; it should be capable of being applied across different markets and in different time periods; it should also minimise the risk of astute investors exploiting the system by investing when smoothed values are below market values and withdrawing large amounts when smoothed values are above market values.

The proposed smoothing formula gave just 1.5% weighting to the current market value and 98.5% weighting to the previous month's smoothed value increased by one month's return at the assumed long-term rate and adjusting for cash flows in the month. The assumed long-term rate is a function of: prevailing bond yields, the assumed Equity Risk Premium, and the extent to which the smoothed value of the fund at the calculation date is above or below market value.

The resulting formula succeeds in mitigating short-term fluctuations. Back-testing against the UK and US markets for the 32 years from 1986 to 2017, the smoothed quarterly return would have been positive over the entire period. Approximate calculations indicated similar results for the last 100 years. (It wasn't possible to apply the formula exactly for the entire period because of lack of monthly data).

Rules would be required to prevent sophisticated investors from playing the system, but they would not be onerous. For example, members would only be allowed to join the smoothed fund at retirement: they could not choose their joining date to coincide with when market values were above smoothed values; similarly, withdrawals would have to follow a regular pattern to prevent people from withdrawing more when market values were below smoothed values and less when they were above smoothed values. "It's a pension, not a piggy-bank" is the mantra.

The presentation addressed the third challenge of the first paragraph by proposing a new approach to converting the lump sum into an income for life, which wouldn't require the member to cede control of their money to an insurance company or to lose the benefit of the accumulated fund on death.

The result is an expected income for life more than double that payable under a life annuity, with the added benefit that undrawn funds, plus investment returns to date, are refunded on death.

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is an independent Non-Executive Director and a former President of the Society of Actuaries in Ireland. He is an active private investor and writes prolifically on his investing adventures.

ACTUARIAL OVERSIGHT

As you may know the AAE develops European Standards of Actuarial Practice (ESAPs) which are model standards of practice. It is important to note that ESAPs are model standards of actuarial practice and, as such, are not binding on any actuary. The AAE encourages its member associations and other actuarial standard-setters to have in place standards of practice that are substantially consistent with the ESAPs issued by the AAE, to the extent that the content of these ESAPs is appropriate for actuaries in their jurisdiction. All standards issued can be found on the AAE website.

The AAE's biggest Member Association, the Institute and Faculty of Actuaries (IFoA), has a special arrangement in place. For over a decade, the Financial Reporting Council (FRC) has provided independent regulatory oversight of the UK Actuarial profession and the independent setting of technical actuarial standards. The FRC and the IFoA have laid down their respective responsibilities in a Memorandum of Understanding (MOU).

The AAE's Professionalism Committee has overall responsibility for the activity of the AAE with regard to Actuarial Standards. The FRC observer status in that committee enables the AAE to stay informed of developments in that area.

In June 2018, The UK government launched an independent review of the FRC, the so called "Kingman review", which will also consider questions around the arrangements for actuarial regulation in the UK.

In the meantime the IFoA has responded to this "Call for Evidence". The response is available on the IFoA website.

Although these arrangements agreed in the UK are quite unique, I would recommend the "Call for Evidence" and the response of the IFoA as interesting reading material for all European actuaries.

Ad A.M. Kok AAG Hon FIA
Chief Executive
Actuarial Association of Europe

COLOPHON

The European Actuary (TEA) is the triannual magazine about international actuarial developments. TEA is written for European actuaries, financial specialists and board members. It will be released primarily as e-mail newsletter.
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Suggestions can be e-mailed to info@theeuropeanactuary.org

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