

ISSUES IN BRIEF

UK LIFE INSURANCE

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THE IMPLEMENTATION OF SOLVENCY II IS FAST APPROACHING, AND UPDATES ARE COMING THICK AND FAST. INSURERS ARE NOW WELL INTO THE FINAL STAGES OF PREPARING FOR THE NEW REGULATION, AND APPLICATIONS FOR APPROVAL OF INTERNAL MODELS, THE MATCHING ADJUSTMENT, THE VOLATILITY ADJUSTMENT AND TRANSITIONAL MEASURES ARE AT OR CLOSE TO COMPLETION. THE THIRD ARTICLE IN THIS EDITION OF ISSUES IN BRIEF DISCUSSES THE ROLES OF ACTUARIES UNDER SOLVENCY II, INCLUDING THE CONTROLLED FUNCTIONS ENVISAGED BY THE PRUDENTIAL REGULATION AUTHORITY (PRA).

IN THE LAST EDITION OF ISSUES IN BRIEF, WE LOOKED AT THE LIKELY EFFECTS OF REMOVING COMPULSORY ANNUITISATION BY ANALYSING INTERNATIONAL MARKETS WITH SIMILAR CHARACTERISTICS. NOW THAT THE PENSION REFORMS HAVE GONE LIVE, OUR FIRST ARTICLE DISCUSSES WHETHER THE INSURANCE INDUSTRY CAN DELIVER SOLUTIONS TO FUTURE UK RETIREES THAT CAN ADAPT TO THEIR CHANGING NEEDS AND RISK TOLERANCES.

NICK DUMBRECK
PRINCIPAL AND
CONSULTING
ACTUARY



Another popular current topic covered in this issue is risk culture. We explain how many regulators are introducing changes to require boards to diagnose and measure their risk culture, as well as looking at possible approaches and the results of a case study.

With the deadline for implementing central clearing requirements under EMIR now only a few months away, Milliman's most recent global survey of derivative usage by life insurers sought views on the likely consequences of the changes. The fourth article discusses the key findings from the survey.

Diversification benefits and associated correlation parameters are critical in determining risk-based capital requirements for insurers, and so we finish this edition of *Issues in Brief* with an article that examines suitable approaches for modelling and documenting dependencies.

I hope you will find something of interest to you in our Summer 2015 *Issues in Brief*.

—Nick Dumbreck

OPPORTUNITY KNOCKS FOR AMBITIOUS INSURERS



Since the pension reforms have gone live, future UK retirees now have a whole new set of choices at retirement, but sitting alongside them are significant risks. The question is, can insured solutions deliver to their varied objectives and add real lasting value in helping mitigate their risks?

The authors of a recent Milliman research paper¹ believe the answer is yes. Structures can be developed which provide individuals with guaranteed income for life, with flexibility to change income levels to reflect changing circumstances, with the ability to combat the risk posed by inflation and pass residual funds to their dependents. The priorities and measures of success will vary for different people and trade-offs are required – the building blocks to achieve this are already available.

Will insurers step up to the challenge or will the opportunity be allowed to slip away?

RETIREMENT GOALS

Recent research commissioned by the National Employment Savings Trust (NEST)² sought to determine retirees' main priorities with regard to their benefits during retirement. Exhibit 1 shows the top five objectives identified and aligns these against two of the most popular conventional solutions – the fixed lifetime annuity and pure income drawdown. Both solutions address some needs, but neither ticks all the boxes.

However, measuring success is complex. The dominance of the fixed annuity in recent decades makes it easy to be led into the trap of focusing solely on initial income levels received from conversion at retirement – the higher the income, the better the deal. This is short-sighted and overly simplistic, as a leading objective is to have an income stream capable of mitigating inflation.

Furthermore, it is clear that having lump sums available either on unexpected withdrawal or on death is also a key consideration, and so a measure that allows for the return to the retiree inclusive of these types of benefit is important.

ALTERNATIVE RETIREMENT SOLUTION

The Government's Freedom and Choice reforms that recently went live in April, have already had a significant impact:

Annuity sales have declined markedly and in response a number of insurers have sought to broaden their offering via drawdown products. In its conventional form, this solution requires retirees to tread a careful line between two significant risks:

- **Being too aggressive** - Investing drawdown funds in relatively high-risk assets in search of growth and protection from inflation also brings volatility and the risk of significant declines in fund value if investment markets fall – income levels may fail to be sustained and may cease altogether if funds are exhausted.
- **Being too cautious** - Investing too conservatively in search of fund stability provides low growth potential and little chance of mitigating inflation. In reality, whilst the ride may be less bumpy, the final destination can be the same as the 'too aggressive' scenario – income levels fail to be sustained and may cease altogether if funds are exhausted.

EXHIBIT 1: RETIREMENT OBJECTIVES VS. POPULAR INSURED SOLUTIONS

RANKED RETIREE OBJECTIVE	FIXED LIFETIME ANNUITY	PURE INCOME DRAWDOWN
#1 Income that grows in line with inflation	No	Possibly
#2 Security of a guaranteed fixed income until you die	Yes	No
#3 Protection from falls in the values of my fund	Yes	No
#4 Ability to access lump sums when I want	No	Yes
#5 Ability to pass money on to my dependents	Possibly	Yes

¹ Defined Ambition pensions: A review of some opportunities for insurers <http://uk.milliman.com/insight/2015/Defined-Ambition-pensions-A-review-of-some-opportunities-for-insurers/>.

² National Employment Savings Trust, The Future of Retirement: A consultation on investing for NEST's members in a new regulatory landscape, p. 45, Figure 2.3. Retrieved April 2, 2015, from <https://www.nestpensions.org.uk/schemeweb/NestWeb/includes/public/docs/The-future-of-retirement.pdf>.

The first step to building a new solution is to devise an investment strategy that is specifically designed to support the delivery of a sustainable rate of retirement income. Milliman recently conducted some research³ that calculated sustainable withdrawal rates for various investment approaches. The sustainable withdrawal rate was determined as the income that could be taken (expressed as a percentage of initial fund value) over the expected lifetime of a retiree, allowing for inflationary increases with a suitably high probability of achievement. The results were as follows:

- **Pure equity investment** – Whilst delivering on long-term growth and inflation protection, this has the risk of significant short-term loss of capital, which limits a sustainable income to **3.6% per annum**.
- **Pure bond investment** – Whilst helping reduce the risk of short-term loss of capital, this asset class does not provide the growth to deliver inflation protection, and so a lower level of income is actually sustainable at **3.2% per annum**.
- **Fixed allocation mixed fund (65% equity, 35% bond)** – Traditional investment philosophy advises us to diversify investment, and indeed this approach – managed on a basis of fixed allocations to each asset class – does give a higher sustainable income of **4.1% per annum**.
- **Managed risk equity fund** – However, the adoption of a sophisticated, dynamic risk-managed approach can be demonstrated to significantly enhance the level of supportable income. Such an approach would invest heavily in equities to maximise return during periods of relative calm in the markets, but then limit exposure during periods of volatility. These are techniques that insurers have been using for a number of years to protect their own balance sheets, which with the latest technology can now be made available to the policyholder, too. Furthermore, a managed approach would only provide an inflationary

increase in withdrawal income in years where underlying fund growth is able to support this. The combination of these techniques can be shown to deliver a sustainable income of **6.0% per annum** in comparison. An example of this approach is the Milliman Managed Risk Strategy (MMRS).

Looking back to Exhibit 1, the adoption of a highly effective investment strategy provides an important enhancement to the drawdown solution – it improves the delivery against objective #1 and enables us also to address objective #3.

The remaining gap is objective #2, the security of a guaranteed income for life.

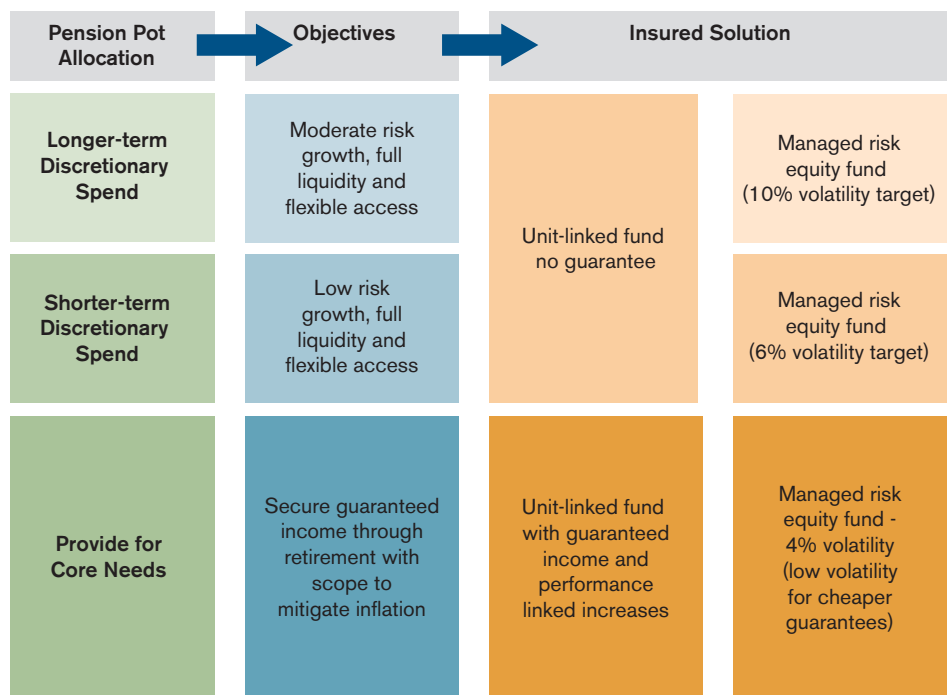
So for those for whom full security of income is a prime concern, the ability to secure a guaranteed income within the product structure will be key. Fortunately, the design, pricing and risk management of guarantees is a core competence of insurers, and products already exist in the marketplace that provide these. So it would appear we have all the required ingredients to hand for success.

The beauty of this approach is that the components can be combined to different extents, providing the flexibility to address the varying priorities of retirees across a broad span of objectives. Exhibits 2 and 3 provide a generic illustration.

EXHIBIT 2: THE RECIPE BOOK



EXHIBIT 3: APPLICATIONS



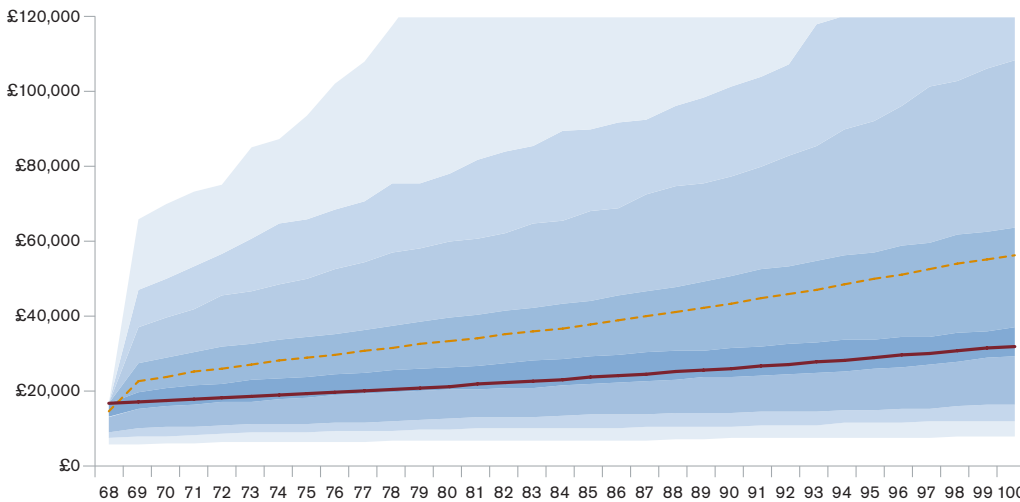
3 See Mungan, K., Fang, F. & Kaufman, M. (August 2014). The 6% Rule, Milliman white paper. Retrieved April 2, 2015, from <http://us.milliman.com/uploadedFiles/insight/2014/six-percent-rule-2.pdf>.

Objectives and priorities will vary between individuals but also critically for the same individual as retirement experience unfolds over what is likely to be a 25- to 30-year horizon. The solution must be agile and able to respond to change. For example, our individual may have underestimated core needs or simply become more risk averse – in this case funds can be reallocated from the non-guaranteed to the guaranteed pot to increase the income underpin. Alternatively, our individual may have been too cautious initially and over-purchased the guaranteed component: Here a first step would be to switch off the guarantee on a portion of the fund. The retiree can then consider if the newly non-guaranteed element should be invested differently, for example adopting a less conservative strategy. In both cases, the key is the flexibility of the framework to adapt and provide a suitable solution tailored to the revised objectives.

Exhibit 4 below illustrates how different income profiles can be achieved from the same product chassis, to meet alternative pension income priorities.

EXHIBIT 4: STOCHASTIC DISTRIBUTION OF INCOME PROFILES FOR ALTERNATIVE OBJECTIVES

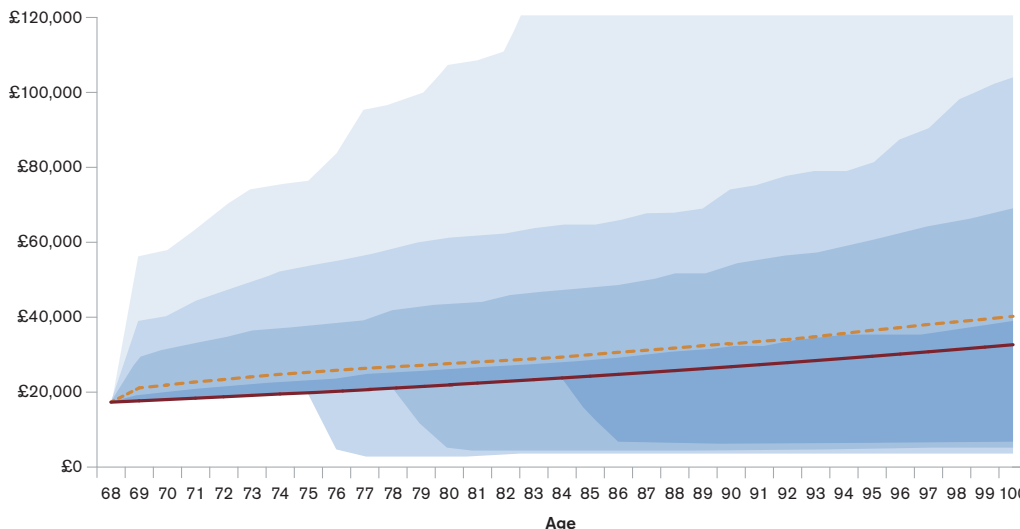
Actual Total Retirement Income*
(Guaranteed Income Product - Profile A)



Profile A – Provides a *high likelihood* of meeting the set target pension *throughout retirement*. There is some risk of falling below the target but this is limited and there is also considerable potential for income increases to meet inflation.

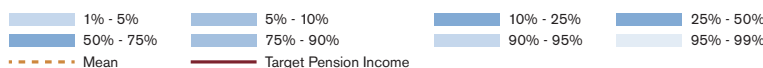
Solution – Investment in managed risk equity funds with 100% of funds applied to the purchase of guarantees in the run up to retirement.

(Guaranteed Income Product - Profile B)



Profile B – Provides *certainty* of meeting the set target pension *in the early stage of retirement*. The trade-off is increased risk of income levels falling below the target later in retirement and a reduced scope for income increases to mitigate inflation.

Solution – Investment in managed risk equity funds with 60% of funds applied to the purchase of guarantees, residual funds provide capacity for non-guaranteed drawdown.



* The distribution of retirement income has been modelled for a pension scheme member commencing contributions at age 25 with starting salary of £15,000, and contributing 8% of his salary during his working life. The stochastic range of outcomes reflects variation in fund performance, both during the pension accumulation phase and the pension decumulation phase, as well as variation in retirement income guarantee pricing. For more detail on assumptions and methodology, please request a copy of the research report.

CONCLUSION – THE PROOF OF THE PUDDING

We return now to where we started, with the stated objectives of individuals entering retirement, and consider how well our recipe book meets their requirements. Exhibit 5 provides a summary.

In our view, the alternative solution provides an attractive overall proposition to retirees delivering considerable freedom to balance growth, liquidity and security and to adjust that balance over time as circumstances change. This, to us, seems eminently suited to the direction of travel of the retirement market and the challenges and opportunities presented by both the government's 'Freedom & Choice' and 'Defined Ambition' reforms.

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EXHIBIT 5: RETIREMENT OBJECTIVES VS. ALTERNATIVE SOLUTION

RANKED RETIREE OBJECTIVE	UNIT LINKED LIFETIME INCOME GUARANTEE
#1 Income that grows in line with inflation	Possibly
#2 Security of a guaranteed fixed income until you die	Yes
#3 Protection from falls in the values of my fund	Yes
#4 Ability to access lump sums when I want	Yes
#5 Ability to pass money on to my dependents	Yes

ONE MEASURE OF CULTURE, PLEASE



Regulators across the world are increasingly focused on risk culture within organisations. Many regulators are introducing changes to require boards to establish, shape and monitor the culture within their organisation. At the heart of this is risk culture. In Australia, the regulator has issued new prudential standards that require boards to ensure that there is a sound risk management culture which is maintained throughout the organisation.

In Europe, the architecture of Solvency II has been specifically designed to require a risk management function which has been integrated into the insurer's DNA. To ensure that the appropriate behaviours and practices are followed and are in line with the risk management framework, the firm will need to have the 'right' risk culture in place to support the framework.

At the Institute and Faculty of Actuaries (IFoAs) General Insurance Conference in September 2014, the governor of the Bank of England, Mark Carney, reiterated the Parliamentary Commission on Banking Standards' view that a new regime for senior managers at banks was a necessity to ensure accountability. In shaping the Prudential Regulation Authority's (PRA's) response to strengthening the level of individual accountability and responsibility for the company's performance (good as well as bad), the PRA has issued several consultation papers. For the banking industry, the proposed 'prescribed responsibilities' include:

- Responsibility for leading the development of the firm's culture and standards in relation to the carrying on of its business and the behaviours of its staff
- Responsibility for embedding the firm's culture and standards in relation to the carrying on of its business and the behaviours of its staff in the day-to-day management of the firm

The PRA has also issued CP26/14 'Senior Insurance Manager Regime', which introduces similar cultural responsibilities for the insurance industry, as well as incorporating specific changes driven by Solvency II.

The topic of culture has also become more predominant outside the financial industry. The Financial Reporting Council (FRC) in the UK, which issues guidelines and codes that companies with a premium listing on the FTSE are encouraged to conform to, has also increased its focus on culture. The FRC has stated that, during 2015, it will focus on how companies have fared at assessing and embedding good culture within their organisations.

EXISTING SOLUTIONS

There are many competing academic theories that aim to provide a means of diagnosing and measuring the culture (and more specifically the risk culture) within organisations. However, many appear to base their assessment on a limited number of dimensions which then results in the organisation being rigidly allocated

amongst a narrow set of categories. Other methods see the unit of measurement aimed at summing up the traits of individuals in the firm. This, however, ignores how people interact within groups, how this differs depending upon the group of people they are with and how they differ, further again, by business activity. These issues and difficulties arise because culture cannot be directly observed; instead, it can only be inferred from the observed behaviours and practices.

OUR SOLUTION

Our approach to this cultural challenge is based upon a more comprehensive way of measuring the risk culture of an organisation. It utilises proven academic theory to assess the risk culture within an organisation across several dimensions. These dimensions represent the natural way that risk management activities can be carried out – for example, whether the behaviour and practices followed with respect to the identification of risks follow well-established set processes, or if the time spent identifying risks is instead governed by focusing on identifying those risks that are deemed to put the organisation at greatest risk of failure, if they were to materialise. Furthermore, this framework pitches the question in a non-pejorative manner, such that the individual is asked to give his/her opinion on what are the behaviours and practices observed. This avoids unintended bias and manipulation. It is important to note that there is no 'right' or 'wrong' risk culture. Instead, there is the need to determine the most 'appropriate' risk

culture that will give rise to the behaviours and practices being observed that fit with the organisation's risk framework and risk appetite the best. Hence, a key first step is to determine the most appropriate risk culture across the risk management activities. This serves as a bespoke internal benchmark that can provide richer insight for a firm to assess its performance and the extent of any discrepancy between the risk culture that it espouses and the risk culture that it currently has.

The questions are designed to elicit opinions into the behaviours and practices observed across risk identification, risk analysis, risk mitigation and risk review. Some initial demographic questions help to cut the analysis at a granular level which can be particularly useful in helping to pinpoint issues (i.e., contrast different departments' risk cultures and the extent of consistency in approaches across risk activities).

CASE STUDY

Below we discuss some insights gleaned from an example involving a multinational insurer which was undergoing a transformation of its risk framework.

The survey was issued to the global risk community.

Figure 1 shows a sample of the results covering three of the risk activities (identification, analysis and mitigation). There are some common positions across the risk management activities but also some stark differences. The size and direction of the bars denote the strength of which end of a given dimension behaviour is more closely associated.

The activity of risk identification and analysis is very much geared towards following established practices, whereas this contrasts sharply with the process of risk mitigation. This perhaps suggested that there were distinct groups within the organisation carrying out risk mitigation activities in their own way in a manner that was outcome driven.

The view is held that within risk identification there is greater affiliation with the organisation, and hence trust that the organisation will carry out this task, whereas mitigation is seen as an activity for professionals, with strong individual identification to the role of risk mitigation.

The three risk activities share a consistent view across the last dimension, which indicates that the behaviours and practices are in line with established company policies. This is indicative of an industry that is heavily regulated.

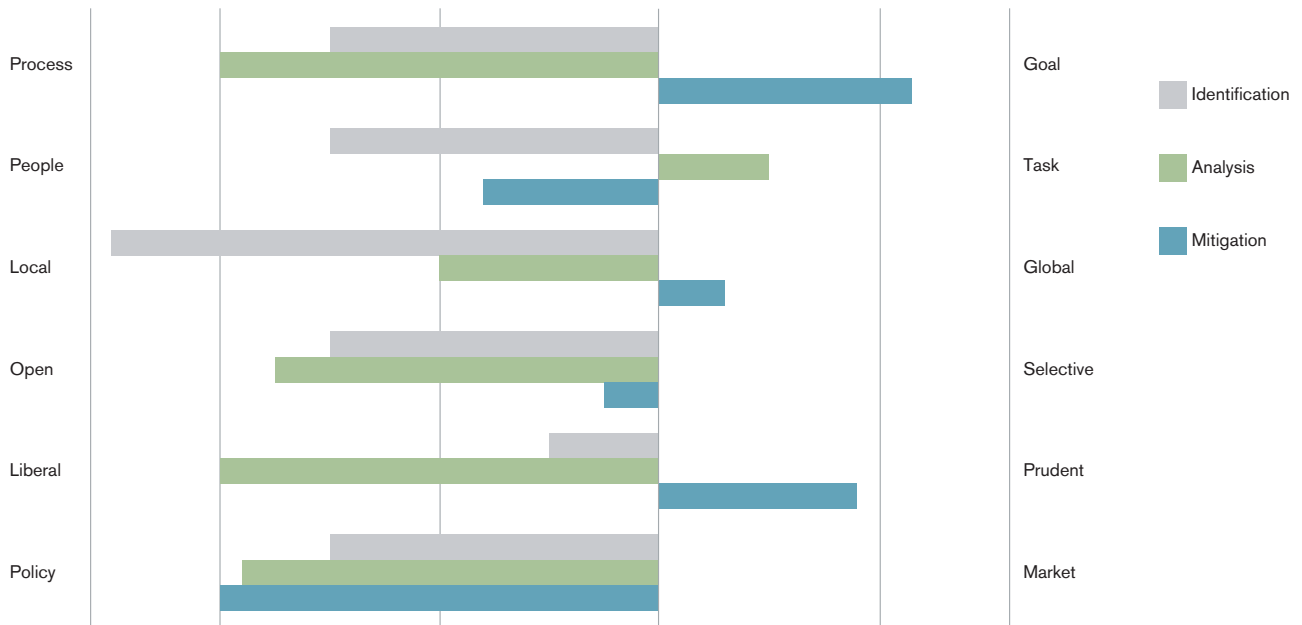
Clear differences can be seen across the risk activities. An internal benchmark profile can be overlaid across the measured position to see the areas where there are discrepancies between the observed culture and that which was expected for that business activity. When we compared the views of senior management with those of the rest of the staff, this identified several areas where there was distinct misalignment. This helped to diagnose the tensions that existed between how the staff were being asked to do risk management activities and the way they liked to carry out those activities. As a result, a tailored program of cultural change could be specifically designed to address the root cause of the differences.

The challenges that exist for companies in measuring and diagnosing the risk culture within their organisation, together with the regulatory cultural push for boards to actively demonstrate that they have the culture that they want embedded, means that firms must select an approach that truly provides the means to get beneath the skin of their organisation's risk culture.

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FIGURE 1: IDENTIFICATION, ANALYSIS, AND MITIGATION OF RISKS



ACTUARIES UNDER SOLVENCY II

The introduction of the new European insurance regulation regime, Solvency II, will fundamentally change the regulatory roles of actuaries working in both life insurance and non-life insurance. This note considers roles where actuaries, under Solvency II, can add value and where they are specifically required, or are natural candidates, to fulfil the updated controlled functions envisaged by the Prudential Regulation Authority (PRA).

The future role of actuaries under Solvency II represents a hot topic in the insurance industry today. The actuarial function, as introduced by the Level 1 Framework Directive, is a natural role for actuaries to fill. However, the exact structure of this function, the level of overlap permitted between it and other key functions and activities of a firm, and the specific requirements of the individuals who perform it are not yet entirely clear.

In the UK, as part of its transposition of the Solvency II Directive into national law, the PRA has proposed a number of controlled functions, appointments to which must be pre-approved. These include the chief actuary function, amongst others, which would have responsibility for the actuarial function.

While it is not expected that the Solvency II actuarial function will introduce unfamiliar tasks for actuaries, there are a number of differences to be observed when comparing against the current UK actuarial function holder role under Solvency I, most notably:

- Rather than being limited to a single individual, the Solvency II actuarial function may be structured in a range of ways, e.g., a group of people.
- There is no explicit requirement for the Solvency II actuarial function to be conducted by qualified actuaries (although proposed changes to the PRA Rulebook seem to suggest this is required where the function is outsourced).

In practice, however, obstacles exist in relation to non-actuaries being appointed to perform the actuarial function or to fulfil the role of chief actuary. First, demonstration of fit and proper criteria as set out in the Solvency II Directive, in particular the required knowledge and relevant expertise, would be difficult for an individual who is not a suitably qualified and experienced actuary and a fellow of a relevant professional body such as the Institute and Faculty of Actuaries (IFoA) in the UK. Furthermore, the IFoA is likely to introduce a compulsory practising certificate (PC) for any IFoA member appointed to fulfil the chief actuary function, and this would further strengthen the eligibility argument that fellows of the IFoA are appropriate candidates to head the function.

The Solvency II risk management function is another area of potential future actuarial employment, and the PRA has proposed that, in the UK, this will be the responsibility of the chief risk officer (CRO) controlled function. Earlier this year the IFoA consulted its members regarding the appropriateness of introducing a voluntary PC for those fellows appointed to the role of CRO within firms, and the outcome of this process is awaited.

Where firms outsource the actuarial function, the risk management function or both to an external service provider, further clarification is needed from the PRA as to who will hold the chief actuary and CRO titles. This clarification would then inform who will need to hold the relevant PCs. EIOPA has indicated, in its Level 3 Guidelines, the need for two pre-approvals by supervisory authorities, in relation to both:

- The person within the firm with responsibility for the outsourced key function, and
- The person in charge of the outsourced key function at the service provider

Conflicts of interest will need to be managed and avoided, for example where:

- An individual is appointed to more than one controlled function
- The actuarial function and risk function are combined
- Operating (or 'doing') and controlling (or 'reviewing') tasks are conducted by the same function

In assessing an appropriate level of overlap, the PRA has indicated that it will apply the principle of proportionality and may permit some level of integration of functions, so long as independence can be demonstrated.

Other areas where actuaries are either natural candidates or where they can add value following the implementation of Solvency II include:

- The role of the with-profits actuary in the UK
- First-line activities such as underwriting, pricing, reinsurance management or asset management
- Independent and external reviews of the output submitted to the regulator and public

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MILLIMAN GLOBAL DERIVATIVES SURVEY

The life insurance industry across the globe is undergoing a major transformation in the face of a rapidly changing economic and regulatory landscape. In Europe, with Solvency II almost upon us, the technical details of the forthcoming regulations have already been driving changes in risk management and derivative usage, but many uncertainties concerning the treatment of different approaches still remain unresolved. The EMIR central clearing obligations are closer to becoming live, and with them the increasing collateralisation requirements for interest rate swap portfolios, which may also be driving changes in risk management strategy. Furthermore, with the pension reforms underway in the UK, there is an increasing need for modern sophisticated risk-managed fund and product strategies in the retirement decumulation space, many of which are reliant on derivatives.

To explore trends in risk management practices and derivative usage within the insurance industry, Milliman has been conducting an annual global survey of life insurance companies. The 2014 survey report has recently been released and gives an overview of current usage and practices, as well as a perspective on how derivative usage is likely to change in the future. This year's survey received responses from 66 insurance companies, with a spread of responses from North America, Europe, Asia and other territories, including many of the largest companies in the industry.

The two dominant market risk factors faced by respondents of the survey are interest rate risk and equity risk, with 98% and 85% respectively of survey respondents having exposures to these risk factors. Currency, credit and longevity were also important risk factors, with at least two-thirds of respondents exposed to each of these risk factors. Inflation risk was less prevalent among survey respondents globally, with only 39% materially exposed to this risk factor.

Some of the key findings of the survey results include:

- The split between static hedging and dynamic hedging among survey respondents is fairly even, with 70% of global respondents using some form of static hedging and 68% using some form of dynamic hedging. Many respondents use both forms combined.
- Managing economic profit and loss (P&L) volatility is the top reason chosen by our respondents for using derivatives in all territories except the UK, where managing regulatory capital was considered slightly more important.
- With Dodd-Frank now implemented and EMIR central clearing expected to go live later this year, as may be expected, we are seeing a sharp reduction in the number of insurers relying solely on non-cleared interest rate swaps. In North America, only a quarter of respondents do not use cleared swaps, compared with two-thirds last year. In the UK 43%, and in Europe (excluding UK) two-thirds of respondents do not use cleared swaps. However, in Japan – where it is expected that some of the largest insurers may be subject to mandatory central clearing of swaps in the near future – not a single survey respondent stated that it currently uses cleared interest rate swaps.
- In response to the increased use of risk management within funds, we now see 24% of North American, 42% of European, and 11% of UK respondents indicating some use of a target, capped or managed volatility strategy within funds.
- Despite market convention dictating overnight indexed swap (OIS) discounting for the pricing and valuation of most interest rate swaps, we see that only 37% of insurers currently adopt OIS discounting for their interest rate swap valuations.¹ A further 27% are planning to switch to this basis in the near future. For those companies that responded last year, there is a slight increase in the adoption of OIS discounting.

- For liability valuations, an overwhelming 80% of respondents do not plan to use OIS discounting, reflecting a widespread reluctance in accepting OIS as the equivalent of a risk-free curve for long-term liability valuation.
- Very few respondents choose to hedge LIBOR-OIS spread basis risk exposures, with only 8% of those that use interest rate swaps choosing to hedge this risk factor.

Finally, when asked about their views on the impact of central counterparty clearing on general derivative usage, there were more with a negative view than a positive view, with 24% seeing a reduction in usage compared with 9% seeing an overall increase. Another 27% said they thought there would be no significant impact, and 40% did not offer a definitive view, reflecting the complex and uncertain implications of central clearing and how they may interact with the various other capital and regulatory changes under way. This also suggests that we may expect derivative usage to continue to evolve in the industry, as many companies are still evaluating the impact of these regulatory changes. Among those companies that responded to this question last year, fewer are seeing an overall increase and more are seeing either a reduction or no significant impact on derivatives usage.

If you would like a copy of the summary report of the 2014 survey results or have any questions, please contact:

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¹ In valuations used for risk management purposes.

CORRELATION FROM CAUSE

Diversification benefits, and the associated correlation parameters, are critical in determining risk-based capital requirements for many companies. Under Solvency II, firms will be required to justify the use of the standard formula parameters, or else derive their own if those prescribed are deemed to be inappropriate. However, setting and validating correlation parameters can be challenging, with reliance often placed upon high-level discussions and expert judgment.

This being the case, it is easy to see why greater focus is now being placed on developing a suitable approach to modelling and documenting dependencies.

TYPICAL APPROACH

Historically, the degree of dependency between risks has always been difficult to quantify. Where data is reliable and plentiful, regression analysis can be carried out between risks, and results can be derived and validated. However for risks with insufficient or flawed data (operational risks for example), it is very difficult to derive any meaningful correlations. Consequently, models are often built with the end result already in mind, influenced by the expert's view of the correlations, with little justification as to how the estimate was derived. This can lead to an incomplete view of how the risks behave, and can be difficult to justify and validate.

Another consequence of traditional approaches is that correlations are often derived based on a certain state of the business or the external environment. It may be the case, that in a stable market, a pair of risks has a very low level of correlation; however in a stressed environment, unusual dynamics can surface, and those same risks may suddenly be highly dependent on the same drivers.

An ideal solution would be to treat the degree of correlation between two risks as another variable in the model, which could change in response to the movement in other drivers. This would allow the

correlations to adapt to changes in the business and financial environment, enabling the risk owners to develop a more thorough understanding of how the interactions between risks change over time.

MILLIMAN'S SOLUTION

One possible solution to the above problem is to use knowledge from business experts to build up a complete picture of each risk, and then build a causal model to derive correlations between them. This approach allows information already within the business to be extracted and provides a multitude of options for sensitivity analysis and stress testing. Furthermore, by documenting the initial discussions and model build, the process provides a clear audit trail for validation.

The process begins with a workshop with the relevant business experts. This is an in-depth discussion between key stakeholders of the risk about how the risk could occur, and helps to provide a clear picture of how the various areas of the business interact with one another.

The discussions from the workshop are converted into a cognitive map, which provides a visual display of the drivers, impacts and links within the risks.

Figure 1 shows how mathematical analysis is carried out on the map (which could potentially contain hundreds of concepts) to derive a minimally complex view, showing the key concepts which drive the risk in the business. The business experts are kept involved at all stages of the process, to ensure that the map remains true to the behaviour of the system. This allows the stakeholders to challenge the results and engage in the whole process, providing a robust validation framework.

The reduced map in Figure 2, provides the basis for creating a causal model, which can be calibrated using data, where available, and the knowledge of the business experts. Unlike more traditional structural models, a causal model can allow for any uncertainty in the relationships and dynamics of the model, so any ambiguity in the calibrations or structure uncovered during the workshops can be captured.

FIGURE 1: THE BIG PICTURE

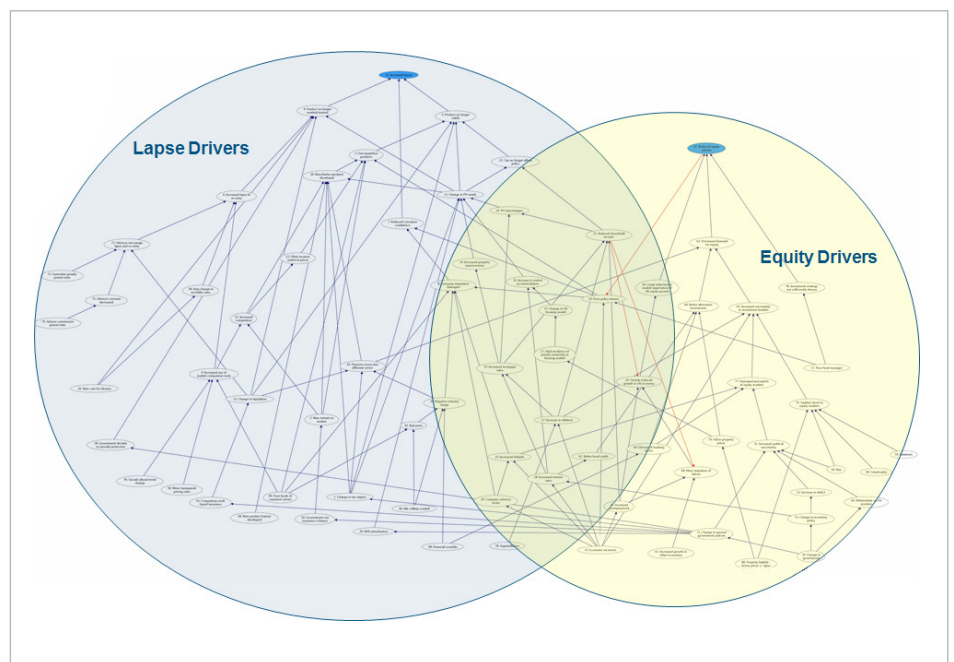
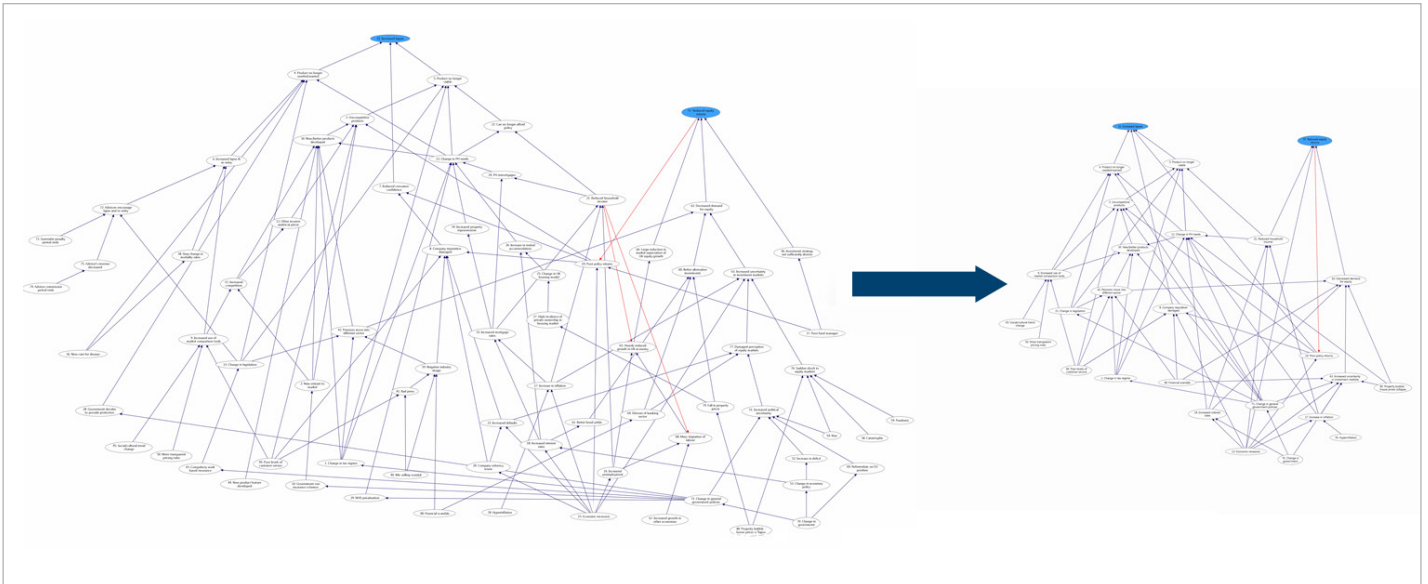


FIGURE 2: THE WOOD FOR THE TREES



Once built, the model can then be used to run a variety of interesting scenarios:

- Sensitivity tests highlight the drivers of the risk that should be monitored to minimise the impact of future risk events.
- Stress tests will show how the correlations change in extreme scenarios.
- Reverse stress tests can be used to view the levels that risk drivers would need to reach in order for a certain correlation to occur.
- What-if analyses can show how correlations change under specified conditions.

BENEFITS OF THE APPROACH

A causal approach means that it is possible to derive correlations based on the underlying structural similarities between the risks. This helps to explain why dependence is present and provides a method of generating interesting scenarios which relate dependence to drivers, under a variety of conditions.

The mapping and calibration exercises act as a clear audit trail, which sets out from start to finish how a given correlation parameter has been derived. This is useful not only for validation purposes but also as a tool for reconciling the model with backing data.

Finally, the approach can help firms to satisfy the use test, which is a particularly challenging requirement for those intending to use an internal model. The information contained within the model can help to identify the drivers and signals that would lead to a change in the correlation between risks. These can be monitored and used in the day-to-day decision-making process of the firm. This will lead to enhanced communication among the risk owners, board members and staff working in the business and is a big step towards satisfying some of the modelling requirements of Solvency II.

If you have any questions or require any further information, please contact:

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THOUGHT LEADERSHIP

MILLIMAN OFFERS UNBIASED, EXPERT ADVICE BASED ON FIRST-HAND EXPERIENCE IN MARKETS AROUND THE WORLD. OUR INSIGHT INTO INDUSTRY ISSUES SUCH AS THOSE DETAILED BELOW CAN HELP YOU NAVIGATE TODAY'S SHIFTING BUSINESS ENVIRONMENT AND FIND PRACTICAL, IMPLEMENTABLE SOLUTIONS.



CATCHING EARLY CASH FLOWS

Christopher Lewis, Scott Mitchell
14 April 2015

Solvency II allows recognition of expected future profits on insurers' balance sheets, and, as a consequence, some may expect a reduction in value in force (VIF) monetisation transactions. This article discusses why VIF monetisation is likely to remain a viable option to help optimise an insurer's capital, liquidity and risk positions.

Read the full article: <http://tinyurl.com/m7rn28l>



CALCULATING PENSION INCOME

Russell Ward, Colette Dunn
13 April 2015

The key to creating a sustainable retirement income and overcoming the fear of running out of money is rooted in the effective management of market risk and inflation risk. In light of the recent pension freedoms, this article discusses the results of a stochastic model used to consider sustainable levels of drawdown rates.

Read the full article: <http://tinyurl.com/k97ug9j>



THE FINAL COUNTDOWN

Neil Cantle
12 February 2015

The Own Risk and Solvency Assessment (ORSA) is at the heart of Solvency II and provides the central context for managing risk. That risk relates to the uncertainties associated with delivering company goals and ensuring that they are understood and managed with the right resources. One especially important feature of the ORSA is that companies are being asked to look ahead. In this article, Neil Cantle explains how insurers can prepare for the ORSA.

Read the full article: <http://tinyurl.com/k9wmfue>

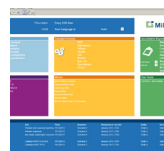


UNIT-LINKED MATCHING CONSIDERATIONS UNDER SOLVENCY II

Eamonn Phelan, Kevin Manning, Scott Mitchell
28 January 2015

With Solvency II, life insurers are finding the asset-liability matching requirements for unit-linked portfolios to be more important. The Solvency II regulation has created an opportunity for life insurers to enhance the capital position of unit-linked portfolios while simultaneously stabilising balance sheets. But these benefits come at a price. Insurers will have to determine whether the capital savings are enough to offset the operational complexities and a more volatile solvency coverage ratio. This article explores the opportunity for significant capital benefits for unit-linked portfolios under Solvency II.

Read the full article: <http://tinyurl.com/n5md4qh>



MILLIMAN'S VEGA SOLUTION

Ger Bradley
2 December 2014

In this short film, Ger Bradley, head of the Non-life practice in Ireland, discusses Milliman's VEGA solution, which helps to address the Solvency II directive. VEGA has numerous advantages, including the fact that it is ready to go and can be implemented very quickly. Developed by actuaries and IT professionals, VEGA has excellent functionality and tremendous flexibility.

See the video at: <http://tinyurl.com/kyuazdz>

EVENTS TO COME

MILLIMAN CONSULTANTS ARE SPEAKING AT A NUMBER OF FORTHCOMING EVENTS. IF YOU HAVE NOT SIGNED UP ALREADY, IT MAY BE POSSIBLE TO GET A DISCOUNT BY MENTIONING THAT YOU ARE A MILLIMAN CLIENT.

DATE	ORGANISER	EVENT
11 September 2015	The Pensions Network	Pensions Freedom & Choice – so far so good?
22/24 September 2015	The Financial Adviser	Financial Adviser Event
6 October 2015	Milliman	Milliman Forum / Milliman Technical Forum
13/20 October 2015	The Financial Adviser	Financial Adviser Event
18 - 20 November 2015	Institute and Faculty of Actuaries	Life Conference and Exhibition 2015

ABOUT MILLIMAN

Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in healthcare, property & casualty insurance, life insurance and financial services, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

MILLIMAN IN EUROPE

Milliman maintains a strong and growing presence in Europe with 250 professional consultants serving clients from offices in Amsterdam, Brussels, Bucharest, Dublin, Dusseldorf, London, Madrid, Milan, Munich, Paris, Stockholm, Warsaw and Zurich.



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