Milliman

SUMMER**2013**

ISSUES**IN**BRIEF
UK LIFE INSURANCE

As we issue our latest update, inspired by the recent heat wave and a series of British sporting successes, there is at least a glimmer of hope that Solvency II may get back on track in the foreseeable future. EiOPA's recommendations based on the results of the Long-Term Guarantees Assessment include pragmatic transitional arrangements aimed at easing the introduction of more onerous liability values and capital requirements. While not all of EiOPA's proposals have found favour with industry bodies, and low interest rates continue to create problems for many insurers within and beyond Europe, things now seem to be moving in the right direction.

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This issue begins with an article on the modelling of dynamic policyholder behaviour which, in addition to being required for Solvency II compliance, will be an important element of any insurer's strategic and risk management frameworks. Feedback at our most recent forum indicated that half the attendees considered policyholder behaviour risk to be one of the top three risks faced by their company. By combining expert opinion with current and historical data, Bayesian network models provide a powerful tool for analysing this risk.

Keeping the forward-looking assessment of an undertaking's own risks and systems of governance in mind, we study risk culture and the quantification and setting of risk appetite. We have gathered some valuable insights from the work of anthropologists, and we hope you find the implications for risk culture interesting.

The next article highlights potential pitfalls in re-expressing a risk appetite based on a specified VaR measure as a minimum level of cover for the required solvency capital, and proposes an alternative approach which takes into account expert judgement.

To improve our understanding of the potential effects of the measures investigated in the LTGA, we have back-tested the impact of the proposals on balance sheet volatility over three recent six-month periods. For these investigations, we used Milliman's cloud-based modelling software, ECSight™, which allowed us to carry out daily calculations of a notional life insurer's Own Funds and Solvency Capital Requirement.

Finally, we provide an update on developments affecting the clearing and reporting of over-the-counter derivatives, namely the European Market Infrastructure Regulations and the Dodd-Frank Wall Street reforms.

I hope you enjoy the rest of the summer, and look forward to seeing you at one of our events over the coming months.

GAINING INSIGHT ON POLICYHOLDER BEHAVIOUR RISK

The risk posed by adverse policyholder behaviour, in particular the risk of a positive correlation between adverse policyholder behaviour and other risk factors, is a long-term strategic risk, the impact of which can persist far into the future. Failing to recognise the long-term impact can lead to inadequate capital levels or missed opportunities of strategic importance. Understanding the way policyholders might behave in different circumstances will inform many aspects of management of an insurance company, such as how to market insurance and investment products, what options and guarantees will be perceived as valuable by customers, and how to price products and measure their profitability. It will affect investment management as it can affect the duration and valuation of liabilities as well as the capital set against risks. Monitoring emerging trends in policyholder behaviour should be an important part of a life insurer's risk management system.

In this article we will provide an overview of the methods which can be used for understanding and modelling policyholder behaviour.

RISK OVERVIEW

Adverse policyholder behaviour is a complex risk which is particularly characterised by its interactions with other risks. Examples include:

- An increase in the premium rate on reviewable protection policies due to unexpected mortality experience can lead to an increase in lapses.

- Poor investment performance can lead to higher surrenders on unit-linked and with-profits business.

- Adverse media coverage, whether justified or not, can lead to the loss of business (new and in-force).

- A potentially negative correlation between the behaviour of policyholders holding savings and protection products: Better economic conditions can lead to lower lapses for savings products due to rising fund values and increased customer wealth, whereas worse economic conditions may lead to lower lapses for protection products as customers will value these products more in such circumstances.

Policyholder behaviour is driven by many factors at the macro- and the micro-level: It is influenced by macroeconomic parameters and company-specific parameters, such as reputation, quality of management, distribution methods, as well as product-specific parameters, e.g., presence of guarantees and surrender penalties. Finally, the personal preference of individual policyholders will affect their attitude to products, e.g., their level of risk aversion and rationality.

Levels of persistency and new business volumes are also influenced by the practices of competitors, as for developed markets the level of 'genuine' new business is not very significant—one company's new business is often another company's lost existing business (an effect known as 'churning').

TRADITIONAL METHODS

Traditional methods within the insurance industry use historical data to measure past surrender rates, often with policy duration as the only driver. In this traditional analysis, decrement rates are assumed to follow a stationary distribution, which hints at the major drawback of this traditional method. Decrement rates are derived from time series which span different economic conditions, different products and changing marketing strategies, which makes it difficult to understand whether fluctuations in experience arise as a result of a genuine movement in the best estimate because of the changing conditions or just because of natural fluctuations in policyholder behaviour.

However, bringing more drivers into the analysis will lead to an inevitable loss of credibility, as splitting the data into more granular categories means that the exposure bases available to analyse a given relationship become smaller.

These traditional methods provide little understanding of policyholders' decision-making processes in extreme scenarios and therefore of the amount of capital to hold against the risk of adverse experience.

DYNAMIC POLICYHOLDER BEHAVIOUR

Modelling policyholder behaviour dynamically is required by the draft Solvency II rules. It usually captures expected changes in customers' behaviour for a given level of interest rate movements, as for significant numbers of insurance products, changes in interest rates will affect the value of guarantees embedded in the product. A linear function is the most popular form of modelled relationship between the driver and the assumed surrender rate. Whilst a linear relationship can be considered reasonable in moderate conditions, in extreme conditions (which could drive high levels of surrenders) a different type of relationship may be required. When deciding on the form of relationship between the driver and policyholder behaviour, the level of policyholder rationality can be taken into account, as policyholders may not realise the value of the option. Also, the level of rationality of policyholders may depend on the in-the-moneyness of the option and can therefore increase in extreme conditions as this value can become clearer.

PREDICTIVE MODELLING

Predictive modelling uses statistical techniques to understand interactions between factors influencing policyholder decisions. It has the advantage that it can capture a greater number of risk factors that might drive policyholder behaviour and can account for correlations between them. For example, predictive modelling can help insurers determine the interaction between income and age, and the impact it has on lapse rates. Predictive modelling makes optimal use of available data, by avoiding segmenting and grouping, which can result in a loss of credibility. Notwithstanding that it produces better results than traditional methods, it can still fail to capture the rich structure of causal influences and non-quantitative factors (e.g., emotional and social

factors) that influence policyholder decision making. Furthermore, predictive modelling relies on historical experience to predict future experience. Consequently, it is not very reliable in predicting future experience when there is a fundamental change in the environment which is not seen in the historical data.

COMPLEXITY SCIENCE

Complexity science studies how relationships between parts give rise to the collective behaviours of a system and how the system interacts and forms relationships with its environment.

Complexity science uses a holistic approach to understanding the emergence of a risk and can account for non-linearity and complexity of the system from which it emerges. It can better take into account human bias when expert judgement is expressed and can help understand how future experience might change when there is a fundamental change in the environment.

Bayesian networks are a powerful tool of complexity science, which can be very useful when it is necessary to combine 'prior knowledge' with the new data to get updated model estimates—for example, when a new product is launched and an estimate of future lapse rates is needed. Bayesian networks are a useful tool when some data exists, but not enough for a complete model, or when it is necessary to incorporate some judgement/background information into a model.

Building a Bayesian network model will, in itself, help to better understand the policyholder behaviour risk and its main drivers. It also can provide better understanding of tails of the distribution, that is, how policyholders might change their decision-making process in extreme conditions. These behaviours in extreme scenarios will be the main drivers for capital required to be held against this risk, but companies usually do not have data on this and therefore models calibrated using historical data can be misleading.

Bayesian network models can incorporate both macro parameters, e.g., how macroeconomic conditions influence policyholders, and micro-level parameters,

as well as making use of behavioural economics and insight into how human bias can affect the decision-making process.

Reverse stress testing of the model can give insight to the likely state of model drivers in a '1-in-200' event. In the model of lapse behaviour we built for a notional product (regular premium unit-linked savings), a 1-in-200 event was a significant deterioration in lapse rates, but this was driven by relatively small changes in a number of drivers rather than a large change in one, say investment performance. This shows the non-linearity of the relationship between the drivers of lapse behaviour; slight simultaneous changes in, say, economic conditions and the quality of sales processes can lead to disproportionately large increases in lapse rates. This is because customers who have been sold policies they did not really need (and the number of such customers increases due to poorer sales processes) are more likely to lapse their policies if investment performance is poor or they are more likely to become unemployed (both are consequences of unfavourable changes in economic conditions).

Bayesian network models can also help companies identify the drivers to which policyholder behaviour is most sensitive and therefore understand where to focus their efforts to improve lapse rates—e.g., in our model, even a small improvement in investment performance compared with competitors led to a relatively large decrease in lapse rates.

CONCLUSION

The risk of adverse policyholder behaviour is complex, is highly correlated with many other risks and affects many areas of life insurers' day-to-day and strategic management. There are many different ways to understand, model and monitor this risk, which vary in their complexity and predictive power.

If you have any questions about approaches to understanding and modelling policyholder behaviour risk, please contact Tatyana Egoshina at tatyana.egoshina@milliman.com, Robert Bugg at robert.bugg@milliman.com or your usual Milliman consultant.

A NEW PERSPECTIVE ON RISK CULTURE

In recent weeks, the subject of risk culture has been the topic on everyone's lips. How to measure it, how to improve it, how to control it! But while it is easy to make broad brush statements about the need for a 'good' risk culture, few people can define quite what they mean, let alone root their ideas back to a sound theoretical underpin.

When people talk of risk culture, what they typically appear to be referring to is the behaviour of the people in their organisation—maybe at the top of their organisation—towards risk taking.

DEFINITION OF CULTURE

The definition of culture is the obvious place to start. Rather than make up a definition, we look to the discipline that concerns itself with the study of culture: anthropology.

One early definition of culture was given in 1897 by Sir Edward Taylor:

Culture or civilisation taken in its broad ethnographic sense, is that complex whole which includes knowledge, belief, art, morals, law, custom and any other capabilities and habits acquired by man as a member of society.

Of course, this definition of culture is arguably much wider than many of us

mean when we use the term *culture*. We are often more concerned with the status and relationships between humans in our working environment and how this contributes to decision making. While the wider society (civilisation even) that we inhabit will doubtless have an impact on the culture of our workplace, it feels beyond the scope of what even the most ardent CEO could hope to change.

There is, however, a sub-group of the social anthropology community that talks more to the types of issues that concern us in the risk management of insurance companies. It is their focus on the diversity of positions and perspectives within a social group that makes their skill set useful to us in understanding our organisations.

RISK MANAGEMENT SYSTEM

Insurance chief risk officers (CROs) often come to think about risk culture as they design the risk management system. Risk culture is often portrayed as a coloured box to be found in a multi-coloured schematic from a consultant providing a (their) particular flavour of risk management framework.

But these graphical representations can be misleading and can often almost seem to suggest that risk culture can be *done* to an insurer. *Done* in the sense that, as

long as a work-stream is kicked off with a project manager, a Gantt chart, some milestones and a small army of contractors or consultants, risk culture will *happen.*

From our experience of working with anthropologists to understand the nature of culture, we don't agree that an effective risk culture will be created using this type of framework.

There are two misconceptions around risk culture that we would like to address in this article before we move onto discuss some of the practical things that you can actually do as a risk manager in an insurance company.

CULTURE AS THE INDIVIDUAL OR THE COLLECTIVE

The first misconception we would like to take up is the idea that the individual is in some way the central unit of study in a culture. This misconception is reinforced by some papers and presentations on risk culture that, in our view, make this mistake.

The definition we shared above from Sir Edward Taylor talks to the complexity of the interactions between individuals, and it is from this *complexity* of interconnections, and the flow of information along those interconnections, that an overall culture emerges.

Of course, most individuals will propagate the culture through their actions whilst some will directly affect the culture more than others—and in return the culture will impact the individual. So what we end up with is a complex symbiotic relationship between the individual and the culture in which he or she is embedded.

What we have in essence is a complex system—technically a complex adaptive network. One thing science knows about these networks is that you cannot understand them just by looking at the behaviour of the individual elements—you need to look at the emergent behaviour of the *system* as a whole.

HOW MANY CULTURES ARE THERE?

The next misconception we would like to address is that there is only one culture within an organisation. The consultant presentation risk culture box can suggest that there is just one of these and that it can be uniquely identified—somehow—maybe even using a highly subjective real number disguised as a *risk culture* index.

In reality, we find, our clients find, and social anthropologists find, that there are multiple diverse cultures within an organisation.

We know this in reality of course if we reflect on our own experience. Some parts of organisations feel hierarchical, some more entrepreneurial. On the more negative side, we have probably also all seen cliques developing in organisations, or some people or groups suffering alienation—and not just in our work organisations.

The pervasiveness of patterns such as hierarchy, entrepreneurship and cliques throughout the social structure of humankind means that this has been very well studied, and we find that social anthropologists already have well-developed theories for explaining these patterns and their inter-relationships.

We make the point, therefore, that there is not one homogenous culture to the organisation (especially a sizeable organisation) and that an organisation will—inevitably—be a collection of sub-cultures. Understanding the organisational culture—let alone doing anything about it—therefore requires a recognition that this diversity exists and a way of recognising the recurring patterns that have been identified by the social anthropologists.

IS THERE EVEN SUCH A THING AS RISK CULTURE?

We've discussed culture so far, but before we move on it is worth pausing to think carefully about whether there is such a thing as *risk culture* at all, as distinct from *culture* per se.

We note that senior managers often refer to their *organisational culture* and struggle to separate out a risk culture from the organisational culture. But there are other types of culture we can identify too that have equal validity and may also struggle to be seen separately from *organisational culture.*

There are parts of our organisations where innovation and creativity is the most valuable commodity—product design, strategy, marketing are the obvious examples. Professionals and academics concerned with the generation of new ideas and products are prone to refer to the *innovation culture* within an organisation. By this they mean the ability of organisations to innovate new products and come up with new ideas. We could describe this as 'the ability of an innovation narrative to operate and influence the decision-making process of the organisation.'

In this framing, we can think of risk culture as the risk (or uncertainty) awareness within the organisation. Using a description analogous to the one above, we could define risk culture as 'the ability of a risk and uncertainty narrative to operate and influence the decision-making process of the organisation.'

We therefore argue that risk culture and innovation culture are two emergent properties of the overall organisational culture.

RIGHT CULTURE IN THE RIGHT PLACE

Picking up on the concept of these two quite separate sub-cultures, we could consider the idea that the organisation culture is a portfolio of sub-cultures. We don't just note this in a passive way (a fact of organisational life); in fact, we argue that this portfolio of sub-cultures is actually essential to the well-being of the enterprise.

From a naïve point of view, one might suspect that risk managers should see their objective as ensuring everyone in the organisation is thinking about risk in everything they do. Surely then they can truly be said to have *done* risk culture to their organisations.

But we would argue that this path of good intentions could also lead to an adverse outcome if the avoidance of risk becomes an objective in its own right. Such an outcome might take the form of slow decline in run-off or acquisition by a consolidator, rather than the loud pop of a high-profile corporate insolvency.

Let us take the example of the product design team. Having a team of over-cautious risk managers as your creative epicentre is likely to result in a distinct lack of creativity. An area such as product design will want to promote creativity and will necessarily be less focused on risk and downside. They will focus on upside potential, opportunity and how to move *real options* into the money.

However, the risk function most certainly does need to uncover all the risks in the product design and express its view on what could go wrong.

There are other parts of our organisations where an *innovation culture* can be quite destructive. The finance team at Enron were infamously creative—operating as a highly innovative profit centre and applying their creativity to financial accounting. An *internal control culture* is more likely to be desirable for an accounting team.

Having said this, an *innovation culture* directed at more efficient systems and processes is clearly to be encouraged within a finance function—which rather underlines the difficulty we have in neatly packaging up what is *good* culture and *bad* culture.

BALANCING CULTURES

But how do these different cultures interact when it comes to decision making? We argue that the *risk culture vs. innovation* culture dialogue needs to take place in the debating chamber of the boardroom where the opportunities for innovation can be compared and contrasted with the risks and dangers of such innovation. The important point is not what the decision is—as this is subjective and will depend on the risk appetite of the board and of the executive. The important point is that the facts as they are known are laid out and uncertainties are also laid out for the board and executive to see and understand.

A successful *risk culture* could therefore be seen as the ability of the risk and uncertainty narrative to be given equal prominence at the boardroom table to other perspectives such as the innovation and opportunity narrative.

WHAT CAN YOU DO?

So what can you do as a risk manager to influence the risk culture of the organisation?

We will look at two things you can (and in our view should) be doing to get some handle on the culture in your organisation, how it treats the risk and uncertainty narrative and how you might start to think about shifting the risk culture—should that be the appropriate course of action.

We will look at:

• Measurement of risk culture

• Changing the (risk) culture

CASE STUDIES

But first an aside on case studies. We are told by some CROs that examples of what has worked in other places before—case studies—are what can help most. We certainly don't deny that case studies are instructive, but we note that case studies show what worked (or didn't work) for a particular organisation in a particular situation at a particular time. While there are common themes emerging from case studies which are useful, we don't believe you should start *operating* until the physiology of the particular patient in question has been studied and diagnosed.

Complex adaptive systems (as we argue cultures are) have a knack for kicking back with unintended consequences—so we argue that the more information the CRO has about the cultural map of his or her organisation, the better armed the CRO will be to make or propose changes that could influence the culture in the desired way.

MEASUREMENT AND DIAGNOSIS

The first thing to do is to try and measure or diagnose the culture of the organisation. This sounds incredibly hard and time intensive—and indeed it could be made so. But it is in fact possible to get useful insights into the cultural map of an organisation from an online questionnaire using very little of employees' time—if, of course, one knows the right questions to ask and how to interpret those answers.

One way to make rapid progress is to sample staff's perceptions of the way different activities are carried out in their part of the company. This can be achieved by asking people to indicate whether activity tends towards either of two statements, such as 'there is a well-established process which is used to regularly identify risks' vs. 'the time that is spent identifying risks is governed by the nature of our work and the timescales for completing it.' Framing the questions in this manner enables you to elicit an understanding of the emergent behaviour of

groups and sub-groups within the company rather than the inherent individual motives, and to diagnose the cultural behaviours rather than simply judging them. This type of granular approach helps to uncover cultures within sub-groups which are somewhat different to the norm, and can help CROs (and indeed has helped some of our CRO clients) to diagnose particular areas, or sub-groups, where there is a clash between the way people like to work and the things they are being asked to do.

CHANGING RISK CULTURE

The next thing that a CRO might want to undertake would be to change the culture in some way, to make it better reflect the risk and uncertainty narrative.

We argue that the CRO should use his or her cultural map to identify areas of concern where the risk and uncertainty narrative is struggling to be developed—or struggling to be heard in the decision-making process of the organisation.

We also argue that the *culture*—as enacted through the behaviours of the staff in an organisation—has a symbiotic relationship to the processes within the organisation.

In other words, the processes that are followed by the staff influence the observed culture, and the culture also feeds back to influence the processes that the staff will follow.

The solutions to changing the culture will therefore be multi-faceted and depend on both:

• The existing culture of the organisation as manifested through the observed behaviours of the staff

• The processes that the staff are following

Possible changes could be:

• Training of staff

• Amended governance procedures

- Enforcement of existing governance procedures

- Amended processes

- Enforcement of existing processes

- Recruitment of new skills to the organisation

Which of these are appropriate to try will depend on the culture diagnosis of the organisation and the (current) understanding that the CRO has of the organisational culture and processes.

We used the word *current* deliberately because we are dealing with a complex adaptive system. We would suggest that the CRO should try one change first and then re-profile the culture to determine how it had (or had not) been shifted.

The feedback loops and complexity can lead to the culture changing in some unforeseen ways. This will help the CRO better understand how the organisation operates and evolve the culture in a more gradual way that doesn't throw up too many unintended consequences.

The difficulty in executing each change will also depend on the task—and the culture of the organisation.

At the easier end of the spectrum, it may involve time investment from different parts of the organisation not currently bought into the risk and uncertainty narrative. In this case, the winning of hearts and minds will be important, and this will mean helping other parts of the business see value in a risk and uncertainty narrative.

At the harder end of the spectrum, personnel changes or recruitment in other areas may be the obvious solution. Such difficult decisions require a broader consensus of agreement at senior management level and a CEO who is seeing value in the risk and uncertainty narrative enough to make some hard choices or release budget to recruit new skills to the organisation.

So to summarise, we argue that culture is split into two dimensions:

- The behaviours of the staff

- The processes they follow

In order to change the culture, we need to consider which of these needs to be (or indeed can be) changed to best effect the desired change in culture.

Where behaviours are deeply rooted and would take a great deal of effort to change— or indeed a change in personnel is required to change behaviours—then a change in the process is a way forward. Practically, this means setting different tasks and altering the process that the staff member(s) follow.

Where processes are more fixed—perhaps due to regulation or the wider organisation— then the behaviours are a more natural area of focus and techniques to help staff members reflect and take a new perspective will be useful.

There will be some extreme instances where behaviours and processes are both rigid, and in these cases more drastic action will be needed, such as changes in personnel (changing behaviours) or winning over stakeholders in the wider business/ government (changing processes)—both of which will be disruptive. Then the question will become whether the desire to change the culture outweighs the disruption.

However, often both processes and behaviours will have some degree of variability and in these cases some relatively easy adjustment can influence the culture in the desired direction.

It is quite common, for example, to find sub-groups within organisations who culturally tend to shy away from rapid disclosure of *problems*. It is also common to have others who disclose concerns quickly, possibly too quickly. A risk framework relying on front-line disclosures will be inconsistently applied where these cultures exist.

A CRO who is aware of this can make small modifications to the framework, such as moving to more evidence-based

reporting compared with self-certification, in areas where disclosure is difficult. The important result from assessing culture is to reach an understanding of which processes and which behaviours fit together so the CRO can finesse the framework design to have the best chance of achieving the desired outcome. We argue that it is dangerous to simply 'benchmark' against a mythical gold standard which assumes people all behaving the same way will achieve the best outcome.

SUMMARY

In this article we hope we have convinced you that understanding and changing the risk culture of an insurer needs a different perspective from that we are used to in traditional actuarial work. We hope you share our view that tools and lessons from anthropology are appropriate places to start in understanding culture.

We explained our view that organisational culture is a portfolio of sub-cultures of which risk culture is just one—if an important one. We argued that a successful risk culture was one where the risk and uncertainty narrative had an equal voice at the boardroom table with other important sub-cultures, such as the innovation sub-culture.

We shared some ideas for how we have successfully helped some of our CRO clients to understand the risk culture in their organisations using some short questionnaires that their staff members have found easy and quick to complete.

Finally, we shared some ideas for how the risk culture can be altered and how the process needs to follow a step-by-step approach with a focus on one, or both, of the processes and the staff behaviours. We argued that care needs to be taken to attempt cultural change in a step-by-step way, due to the complex interactions that can lead to unforeseen consequences.

If you have any questions on risk culture, please contact Elliot Varnell at elliot.varnell@milliman.com, Neil Cantle at neil.cantle@milliman.com or your usual Milliman consultant.

SETTING AND MONITORING RISK APPETITES

A company's risk appetite is an expression of the level of uncertainty which the board is willing to accept in the pursuit of its strategic objectives. Increasingly, companies are considering the degree of uncertainty in the context of each of the key goals of the business—its capital position (an 'inventory' measure), its stability of earnings (a 'flow' measure) and its reputation.

Under Solvency II, this may take the form of a set of statements along the lines of:

- Surplus capital must be sufficient such that, following a 1-in-10 year shock, the company is still able to cover its Solvency Capital Requirement (SCR).

- Following a 1-in-5-year shock, Market Consistent Embedded Value operating profit remains at 50% of plan or better.

- The company has no appetite for regulatory censure.

This article focuses on the solvency-based objective and more specifically the challenge associated with identifying the level of capital needed to remain within the board's agreed risk appetite. Similar ideas can also be applied to profit-based objectives.

We can restate the problem as needing to calculate the multiple of the SCR

HOW MUCH CAPITAL?

Suppose the random variable L is the loss (or profit) the company suffers over 1 year. Suppose that L governs both the shock in the risk appetite and the SCR.

We seek a shock and the SCR post-shock (SCR*) such that:

1) $P(L>shock) = 1/10$

2) $P(L>SCR*+shock \mid L>shock) = 1/200$

The first equation states that the shock is a 1 in 10 year event. We can use these two equations to show that:

$$P(L>SCR*+shock) = P(L>SCR*+shock \mid L>shock) * P(L>shock)$$

$$= 1/200 * 1/10 = 1/2{,}000$$

Hence the multiple of the SCR that the company should hold to meet its risk appetite is the ratio of the 1-in-2,000 VaR (i.e. "SCR*+ shock") to the SCR.

that the insurer should hold to meet the solvency-based risk appetite objective. This represents a key reference point with respect to the company's regular monitoring to ensure it remains within appetite. It is therefore critical to establish a robust approach that acknowledges the uncertainty underlying the SCR calculation.

Under the proposed requirements of Solvency II and the Individual Capital Assessment (ICA) in the UK's current solvency regime,

risk capital (i.e., the SCR or the ICA) is based on a 1-in-200 one-year Value at Risk (VaR). That is, it is the loss faced by the insurer over one year which will only be exceeded with a probability of 1-in-200 (0.5%).

The example risk appetite statement provided above refers to a 1-in-10 one-year shock, which can also be understood in terms of VaR. Under some weak assumptions, it is then possible to show that the level of capital the company will

require to satisfy this statement is the 1-in-2,000 level one-year VaR. See the side box 'How much capital?' for technical details.

In practice, the level of loss to which the insurer is exposed consistent with a 1-in-2,000 one-year VaR will be very difficult to model robustly (if at all). We will demonstrate that the 1-in-2,000 one-year VaR can vary significantly depending on the distribution selected to capture the full range of outcomes. For the remainder of this article, we have nevertheless assumed that the insurer's capital model is capable of outputting loss amounts at this level, and we ignore issues around interpreting what a 1-in-2,000 one-year loss actually means.

We also ignore the possibility of error in the calculation of the SCR and assume it has been calculated correctly. However, it is important to acknowledge this as an additional source of uncertainty associated with specifying the risk appetite, which arises from:

- Model risk: The probability distributions underpinning the individual components of the SCR may not reflect the company's true risk profile. There may be approximations in the model (for example, if proxy modelling is used) and these approximations themselves may be inappropriate.

- Parameter risk: The parameters underpinning the loss distributions, and used in the calculation of the liabilities, may have been mis-estimated.

- Sampling error. The SCR may have been calculated through a stochastic Monte Carlo projection, and the SCR estimated through this process will typically not equal the 'true' SCR.

As discussed above, if the same loss distribution underpins the SCR and the 1-in-10 year shock in the risk appetite, then the ratio of the 1-in-2,000 year VaR to the 1-in-200 year VaR gives the multiple of the SCR the insurer must hold. Since we cannot know this exact distribution with certainty, a key question is then how the 1-in-2,000 one-year VaR compares with the 1-in-200 one-year VaR given the assumption we make about the probability distribution.

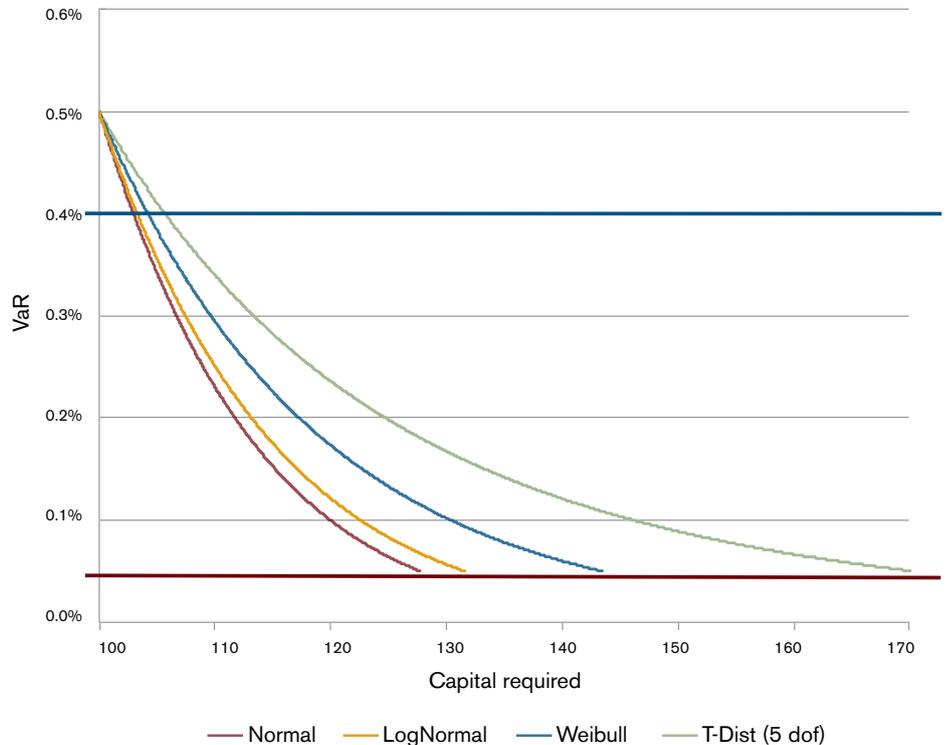FIGURE 1: TAILS OF VARIOUS DISTRIBUTIONS, GIVEN THE 1-IN-200 LEVEL OF CAPITAL

Figure 1 shows how the required level of surplus capital varies using different underlying distributions.

All the distributions considered have been set to have a mean loss of zero and a 1-in-200 percentile equal to the SCR, set to £100 million in our example. The blue horizontal line shows the 1-in-250 one-year VaR and the red horizontal line shows the 1-in-2,000 one-year VaR.

We see that, for the distributions considered, the multiple of the SCR which must be held to meet the risk appetite varies between 128% of the SCR for a normal distribution to 170% of the SCR for a t-distribution with five degrees of freedom. The key difference is how fat the tails of the distributions are—the five-degree-of-freedom t-distribution has a particularly fat tail, and so if losses follow this distribution, a higher multiple of capital is required than if losses follow a normal distribution.

This raises a question around how the company should monitor its position against risk appetite. The company

will typically assume a certain form of loss distribution to calculate the SCR. However, this distribution may be quite complex for a typical company and difficult to express analytically. A reasonably common approach in practice is to assume losses are normal and to base the multiple held on this distribution.

As Figure 1 shows, a normal distribution may understate the multiple required, particularly if losses are fat-tailed and the potential disparity only increases if the shock specified in the risk appetite is higher than the example we have used. For example, suppose that instead of covering a 1-in-10 year shock, the insurer wished to cover a 1-in-50 year shock. Then the range of multiples under the distributions above is between 144% for a normal distribution to 240% for a t-distribution with five degrees of freedom. It is also worth noting that the 144% cover derived from the normal distribution is insufficient to cover shocks at the 1-in-10 level if the loss distribution is actually a t-distribution with five degrees of freedom, since the t-distribution requires a 170% multiple at the 1-in-10 level of shock.

Even at the 1-in-250 level, we see that there is also a relatively wide range of possible outcomes. As shown in Figure 2, the capital required under a normal distribution is 3.0% higher than the 1-in-200 level of capital, whereas the capital under a t-distribution with five degrees of freedom is 5.7% higher than the 1-in-200 level of capital.

However, in contrast with extreme losses further out in the tail, the behaviour of expected losses at the 1-in-250 level (with respect to the corresponding 1-in-200 level VaR) should be something that key stakeholders and business experts have an intuitive understanding of and thus can estimate. Our suggested approach to monitoring risk appetite is therefore as follows:

- Ascertain from experts in the business their view of the likely range of 1-in-250 VaR outcomes, given the 1-in-200 VaR.

- Ask the same experts to assign likelihoods to the probability distributions consistent with each estimate of the 1-in-250 VaR.

- Create a model such as a Bayesian network or an evidence-theory-based model, which takes into account the likelihoods as judged by the experts to derive a mixture distribution for the aggregate one-year loss. The 1-in-2,000 level VaR under this distribution then provides the level of capital which should be held to remain within the agreed risk appetite.

One key advantage of this framework is that it is possible to update the model to reflect past experience and any change to the experts' views to ensure that the risk appetite multiple remains relevant in changing circumstances. For example, events such as the recent global financial crisis might increase the likelihood associated with more fat-tailed distributions.

As an example, suppose that the company considers the two probability distributions, a normal distribution and a t-distribution, as appropriate to describing the behaviour of its one-year aggregate loss under different circumstances. By assigning weights to each distribution specified by the experts, we can then use a simple Bayesian network to calculate an aggregate loss distribution. As shown in the table below, the resulting distribution has properties somewhere between the fat-tailed t-distribution and a normal distribution. To meet its risk appetite, the company would seek to hold 141% of the SCR.

In conclusion, monitoring a company's position against its risk appetite is a difficult task. One reason for the difficulty is the uncertainty associated with reliably estimating 'tail event' losses. It is possible to use the techniques explained in this article to create a robust framework to carry out this monitoring, which takes into account the views of the experts around the company and can easily be updated in line with changes to circumstances.

If you have any questions about setting and monitoring risk appetites or require any further information, please contact Matthew Cocke at matthew.cocke@milliman.com, Fred Vosvenieks at fred.vosvenieks@milliman.com or your usual Milliman consultant.

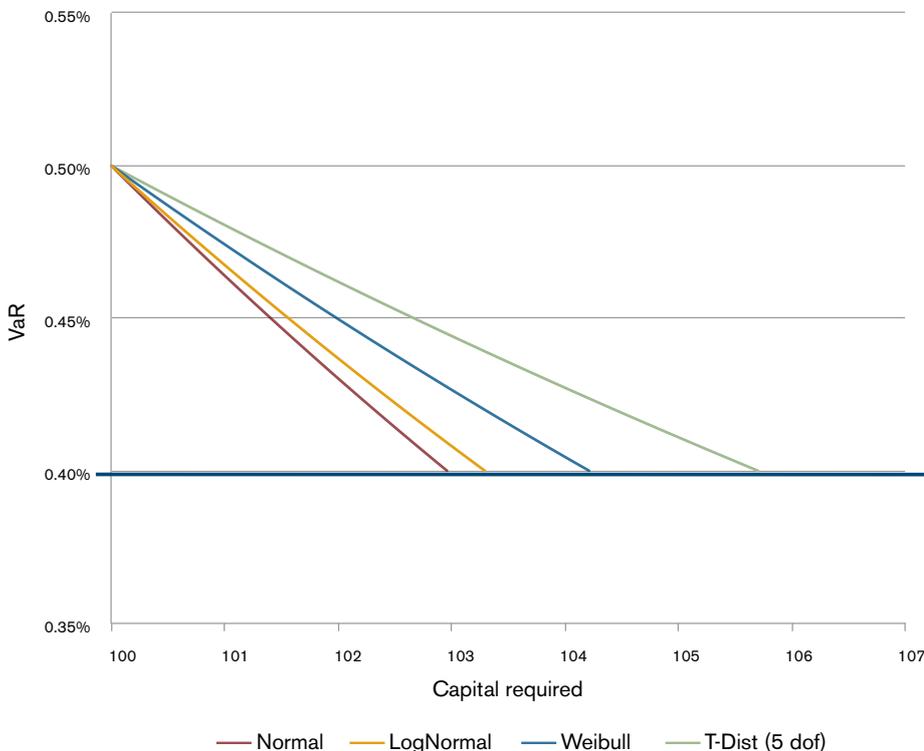FIGURE 2: 1-IN-250 VaR FOR VARIOUS DISTRIBUTIONS, GIVEN THE 1-IN-200 VaR

FIGURE 3: CAPITAL REQUIREMENTS USING A MIXTURE DISTRIBUTION

Distribution	1-in-200 VaR	1-in-250 VaR	1-in-2,000 VaR	Weighting
Normal	100	103	128	75%
T (fives degrees of freedom)	100	106	170	25%
Combined	100	104	141	n/a

LIVING WITH SOLVENCY II: AN ECONOMIC CAPITAL PERSPECTIVE FROM RECENT HISTORY

This article summarises the extensive analysis of our white paper, Living with Solvency II: An economic capital perspective from recent history, where further details can also be found about how the underlying technology of ECSight™ can expand the body of actionable knowledge to support management decision making.

INTRODUCTION

Much has been written about the impact of Solvency II (SII) on the future operation of insurance companies. We can expect more to come from the evolving nature of the regulatory regime following the publication of EIOPA's recommendations based on the results of the Long Term Guarantees Assessment (LTGA) and the phased introduction of preparatory guidelines for elements of Pillars 2 and 3 is expected to begin on 1 January 2014.

To investigate some of the implications of SII, we carried out an extensive analysis combining modelling techniques refined in other industries with the computing capabilities of Milliman's software system, ECSight. We generated a simple but realistic UK 'model life company' (MLC) and explored its operation, assuming SII had already been implemented, in a world beset by the recent global financial crisis (GFC).

The MLC we created is a relatively uncomplicated operation with a single life fund. Its focus has historically been on non-profit business, in particular fixed annuities in payment, inflation-linked annuities in payment (RPI, LPI types), deferred annuities, and unit-linked pensions business with minimal guarantees.

MLC's approach to asset management was to match liabilities using a diverse portfolio of bonds, money market instruments and derivatives. Duration is monitored and matched through a combination of conventional and indexed-linked gilts, corporate bonds with both fixed and floating coupons across a wide range of credit grades, and interest rates swaps. Slightly long, the portfolio's duration remains within its target range. Inflation risk is addressed through UK index-linked gilts and zero-coupon inflation swaps.

For investigative purposes, MLC has been designed to implement an internal model. On 30 December 2011, the value of liabilities was £8.6 billion with Own Funds of £1.0 billion. The Solvency Capital Requirement (SCR) was calculated to be £0.6 billion using thousands of multivariate risk scenarios to generate a distribution of capital results from which the SCR (99.5% Value at Risk [VaR]) can be derived. Compared to the current Solvency I position, MLC has found its solvency position

squeezed from both sides–reduced Own Funds and increased capital requirements.
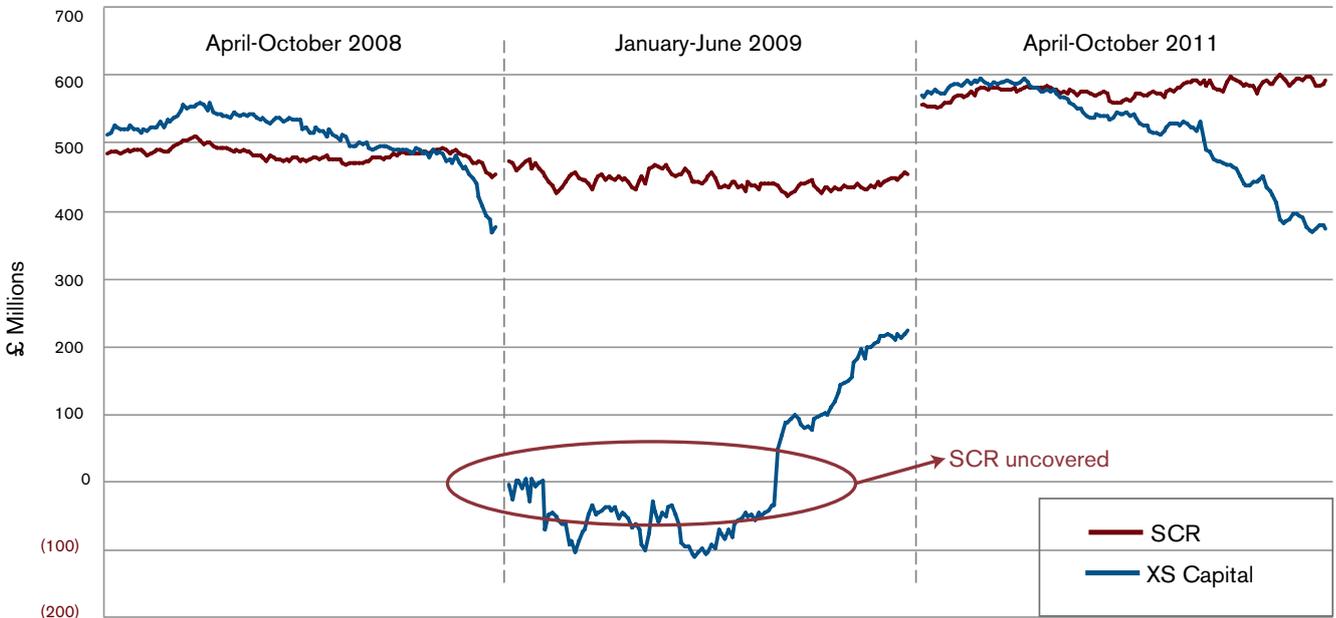
To get a broad perspective and understanding, we wanted to examine the potential volatility of our MLC's SII balance sheet through changing market conditions and financial cycles. This additional information is crucial in order to set appropriate capital buffer targets and to develop a course of action to manage the volatility.

INVESTIGATION 1: HOW WOULD THE CAPITAL REQUIREMENTS OF OUR COMPANY HAVE EVOLVED DURING THE TURBULENT MARKET CONDITIONS OF THE GFC, AND WOULD WE HAVE REMAINED SOLVENT?

To generate scenarios based on realistic market situations, we can look to recent history which provided sufficiently interesting experience without the need to invent challenging scenarios.

We undertook a *daily* calculation of our Own Funds and the SCR, looking back at three historical periods, each spanning two quarters, when markets were under significant stress:

FIGURE 1: DAILY HISTORICAL SCR AND EXCESS CAPITAL POSITION

Month	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
2y Swap	5.24	5.61	6.21	5.88	5.45	5.34	2.26	2.17	2.21	2.18	2.00	2.27	1.78	1.54	1.42	1.36	1.22	1.22
10y Swap	5.11	5.26	5.60	5.46	5.13	5.05	3.62	3.72	3.62	3.74	3.90	4.18	3.77	3.51	3.41	3.33	2.89	2.62
30y Swap	4.71	4.71	4.83	4.72	4.54	4.46	3.62	3.77	3.77	3.87	4.04	4.23	4.12	3.99	3.98	3.94	3.67	3.42
15y Inflation	3.51	3.66	3.83	3.94	3.87	3.85	3.35	3.48	3.66	3.56	3.48	3.66	3.57	3.50	3.55	3.56	3.45	3.34
A Spread	2.23	1.98	2.05	2.24	2.34	2.67	5.28	4.99	5.11	5.06	4.27	3.57	1.77	1.80	1.99	2.08	2.39	2.85
B Spread	7.36	6.58	6.90	8.19	8.67	9.25	17.63	17.79	19.43	17.53	14.73	13.27	4.82	4.92	5.34	5.72	7.54	8.85

April to October 2008, January to June 2009 and April to October 2011.

In the market value world, balance sheet volatility can be acute and can lead to highly material changes in solvency position over a short ti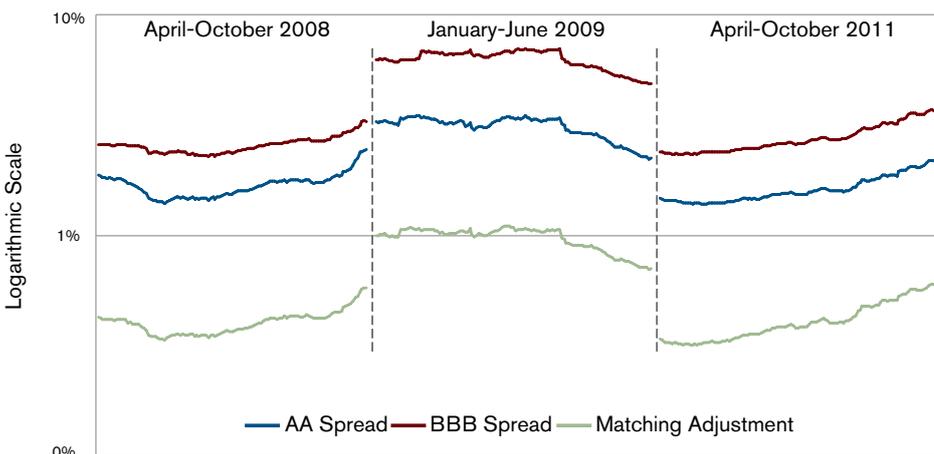me frame. Despite being comfortably capitalised for the majority of the analysis period, MLC would nevertheless have been technically insolvent, i.e., in breach of its SCR, during most of the first half of 2009.

Clearly, there is a genuine need for high-frequency solvency monitoring in such an environment, to provide both an early warning system and to test the effectiveness of management responses to solvency threats.

INVESTIGATION 2: COUNTER-CYCLICAL PREMIUM AND EVOLUTION OF THE MATCHING ADJUSTMENT

We observed a reduction in solvency of our MLC in moving from SI to SII, a major driver of which was the elimination of an allowance for illiquidity in the valuation of liabilities. The potential introduction of two measures addressing this, the matching adjustment (MA) and counter-cyclical premium (CCP), has been hotly debated over the last year and has now been tested through the LTGA.

Four different versions of the MA were tested in the LTGA in addition to the classic version. These additional versions test the impact of various restrictions and calculation

FIGURE 2: EVOLUTION OF MATCHING ADJUSTMENT AND SPREAD

approaches. In what follows, we focus on the impact of the classic MA. In this form, the MA is essentially an illiquidity premium implemented as an upward shift to risk-free interest rates applied to illiquid liabilities, such as traditional annuities in payment. It is derived as a weighted average of the spreads on eligible assets, such as bonds, and will not track any particular index. We have examined the MA over the three periods set out in Investigation 1 and from this it can be seen that, as expected, the MA follows the general shape of the progression of credit spreads in the market. The MA itself was calculated within ECSight, based on the individual fixed-income holdings of our MLC and a daily assessment of the associated illiquidity premia in excess of fundamental spreads. Adjustments were made to allow for the ineligibility of some of MLC's fixed income assets.

Given MLC's significant exposure to credit fluctuations, the results above pointed towards a material counter-cyclical effect which could help stabilise the company's excess capital.

In a similar fashion to the MA, the CCP is an adjustment to the risk-free interest rates that reflects the depressed market values of assets during periods of market stress. The LTGA tested three default levels of the CCP: 50 bps, 100 bps and 250 bps. In the next investigation, we examine the impacts that the MA and CCP have on our MLC's statutory solvency over the three stressed periods of the GFC.

INVESTIGATION 3: HOW MUCH DIFFERENCE WILL THE MATCHING ADJUSTMENT AND COUNTER-CYCLICAL PREMIUM REALLY MAKE TO THE LEVEL AND DYNAMICS OF OUR SOLVENCY POSITION, AND ARE THEY WORTH IT?
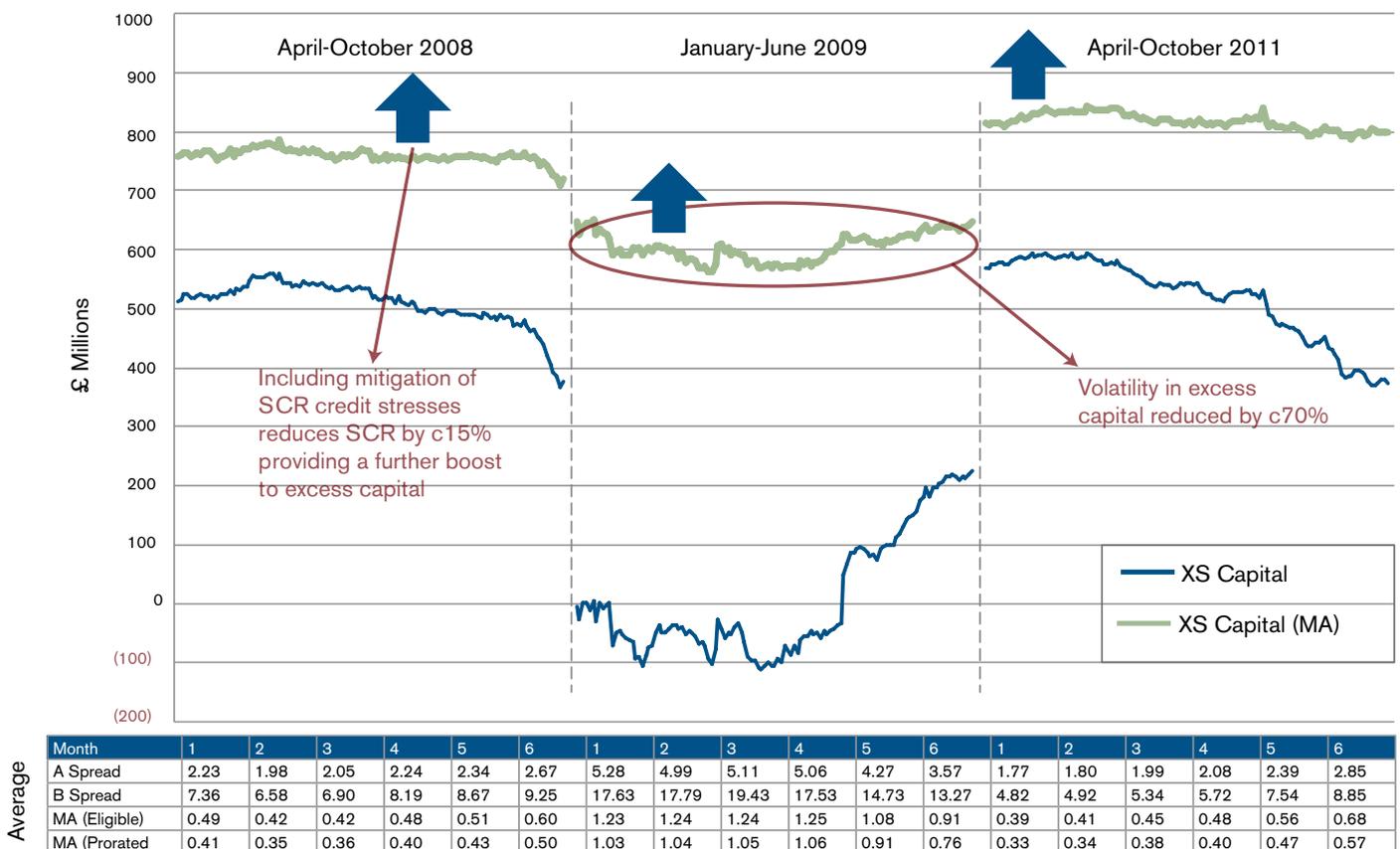
The MA had a strong positive impact on our MLC's capital resources as at 30

December 2011, offset to an extent by very small increases in the SCR, as presented in Figure 3.

In particular, the MA is seen to have a very significant positive effect on MLC's solvency position and during 2009 would have enabled the company to avoid breaching its SCR. The impact of expanding the MA to offset credit stresses under the SCR is being tested in the LTGA and our modelling has indicated this would reduce the SCR by approximately 15%.

Through its dynamic derivation, as a weighted average of spreads on MLC's eligible bonds, the MA is also seen to be effective at mitigating credit-spread-related balance sheet volatility—reducing the range of variation in the surplus capital during the first half of 2009 by around 70%. Despite being a stated aim of the MA, we and several insurers we have spoken to are unaware of this statistic having been previously measured using a full-scale economic capital model.

FIGURE 3: EFFECT OF MATCHING ADJUSTMENT ON DAILY HISTORICAL EXCESS CAPITAL POSITION

Month	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
A Spread	2.23	1.98	2.05	2.24	2.34	2.67	5.28	4.99	5.11	5.06	4.27	3.57	1.77	1.80	1.99	2.08	2.39	2.85
B Spread	7.36	6.58	6.90	8.19	8.67	9.25	17.63	17.79	19.43	17.53	14.73	13.27	4.82	4.92	5.34	5.72	7.54	8.85
MA (Eligible)	0.49	0.42	0.42	0.48	0.51	0.60	1.23	1.24	1.24	1.25	1.08	0.91	0.39	0.41	0.45	0.48	0.56	0.68
MA (Prorated	0.41	0.35	0.36	0.40	0.43	0.50	1.03	1.04	1.05	1.06	0.91	0.76	0.33	0.34	0.38	0.40	0.47	0.57

In Figure 4, we show the significant impact the CCP can have on Own Funds, offset by stresses of the CCP in the SCR. On the left, we show the impact of different levels of CCP (all at 08/05/2008), with the impact of 100 bps CCP at different dates on the right (end June 2008 and end December 2009 and 2011, respectively).

The CCP can have a significant impact on an insurer's capital position, adding materially to Own Funds. However, allowing for the CCP to be stressed in the SCR offsets the benefits by approximately 50%.

Moreover, the CCP becomes an increasingly dominant element of the SCR, and exhibits decreasing marginal residual benefit. Second-order impacts on other risk factors depend on the risk exposure of the insurer; for MLC we saw a negative net impact in this regard.

CONCLUSION

Combining advancements in modelling techniques and computing technology has made it possible to address a range of business-focused questions in ways which would previously have been infeasible.

The ability to undertake a full economic balance sheet calculation for several hundred consecutive business days has provided us with a new tool to generate insights into the behaviour and dynamics of a typical business.
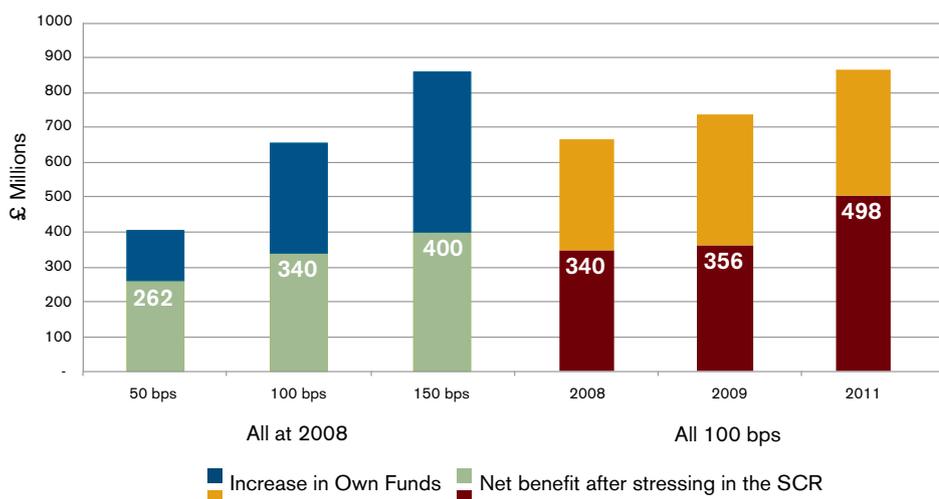
We have developed an ability to evaluate the volatility of excess Own Funds and the impact of regulatory change on risk profile and financial stability. We have also been able to 'road-test' potential management actions and asset liability management (ALM) strategies, and monitor the impact of actions post-implementation to support ongoing decision making.

Our investigations have shown that balance sheet volatility, even over a short period of time, can be considerable. The matching adjustment appears to achieve the goal of reducing credit-spread-driven volatility of the regulatory solvency position. The matching adjustment led to approximately a 70% reduction in volatility of the excess capital position over some periods.

The CCP presents some further challenges. The final form of the CCP in the implementation of SII may be more dynamic and based on spread movements of a representative portfolio of assets. However, if implemented as a static, temporary adjustment, the lack of dynamism would limit its effectiveness at reducing solvency position volatility. Moreover, the level of solvency is improved but the overall increase in Own Funds, as seen above, can be eroded by typically around 50% through direct and indirect increases in the SCR.

If you have any questions about the LTGA, matching adjustment, counter cyclical premium or other aspects of Solvency II, please contact Russell Ward at russell.ward@milliman.com, Matthew Cocke at matthew.cocke@milliman.com, Russell Osman at russell.osman@milliman.com, William Coatesworth at william.coatesworth@milliman.com or your usual Milliman consultant.

FIGURE 4: EFFECT OF CCP ON EXCESS CAPITAL POSITION

REGULATORY UPDATES:
MANDATORY CENTRAL CLEARING CLOSER TO BECOMING A REALITY

In this issue, we provide a brief update on the progress that has been made in the implementation of the European Market Infrastructure Regulation (EMIR), as well as changes in expected timescales for the remaining steps, since our last edition of *Issues in Brief*. In our last article, we discussed in detail some of the potential implications from central clearing obligations.[1] This time around, we take a quick look across the Atlantic at the equivalent US central clearing regulations, governed by the Dodd-Frank Wall Street Reform (Dodd-Frank), which has already started to go live. In particular, given the territorial reach of Dodd-Frank, this will be important for any institution that transacts with a US-incorporated counterparty, as the regulation is likely to be applicable in such transactions.

The EU Commission adopted the Regulatory Technical Standards (RTS)[2] on 19 December 2012. It was subsequently passed through the EU parliament and Council on 19 February 2013, and came into force on 15 March 2013.[3]

EMIR IS THE MAIN REGULATORY VEHICLE THROUGH WHICH THE EU IS DELIVERING ON G20 COMMITMENTS MADE IN SEPTEMBER 2009, TO ACHIEVE MANDATORY CLEARING AND REPORTING OF OTC DERIVATIVES. THESE MEASURES AIM TO REDUCE RISK AND INCREASE TRANSPARENCY IN THE DERIVATIVES MARKETS, TO ADDRESS SOME OF THE KEY CONCERNS RAISED DURING THE GLOBAL FINANCIAL CRISIS.

As a result, the earliest indicative reporting requirement for interest rate and credit derivatives will start on 23 September 2013 if a trade repository has been registered by 25 June 2013. For the other assets this is expected to start on 1 January 2014.

The framework and the infrastructure for the clearing obligations in Europe are starting to take shape, although progress has been slower than anticipated. The CCPs have begun to apply for authorisations from 15 March 2013 through to 15 September 2013. They are expected to obtain authorisations by the end of Q1 2014. From mid-October 2013, the European Securities and Markets Authority (ESMA) will be expected to start publishing drafts on the applicable products under the clearing obligation and the associated timeframes. Interest rate swaps, used in the hedging and duration matching strategies by many insurers to manage interest rate risk, are set to be amongst the first asset classes to be subject to the central clearing obligations. With the latest RTS now ratified, it is expected that clearing obligations for interest rate swaps will go live in Q2 of 2014.[4]

KEY ELEMENTS OF RTS INCLUDE:

- Clearing of derivatives: Provisions relating to clearing obligation procedures, the requirement of non-financial counterparties (NFC), and risk mitigation techniques for non-central-cleared derivatives

- Central counterparties (CCPs): Requirements for CCPs, including provisions relating to the capital, retained earnings and reserves, and format of records to be maintained

- Trade repositories (TRs): Provisions relating to the minimum detail of trade data to be reported, the format and the frequency of reporting, and the data that is to be published and how this is treated

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1   Dissanayake, N. & Varnell, E. EMIR is fast approaching: What does this mean for long-term financial guarantees? Issues in Brief, Milliman, Winter 2012.
    Accessed 11 June 2013 at http://uk.milliman.com/perspective/life-insurance-newsletter/pdfs/issues-in-brief_winter-2012.pdf.

2   European Securities and Markets Authority. Final Report: Draft technical standard sunder the Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC
    Derivatives, CCPs and Trade Repositories. Accessed 11 June 2013 at http://www.esma.europa.eu/system/files/2012-600_0.pdf.

3   European Securities and Markets Authority. European Market Infrastructure Regulation (EMIR). Accessed 11 June 2013 at http://www.esma.europa.eu/page/European-Market-Infrastructure-Regulation-EMIR.

4   LCH.Clearnet. Regulatory Reform Timeline, SwapClear. Accessed 11 June 2013 at http://www.swapclear.com/images/reg-timeline-15_tcm14-62950.pdf.

In the US, the implementation of Dodd-Frank is around a year ahead of EMIR, with deadlines for clearing obligations either passed or on the near horizon. There is a lot of commonality between the two regulations. However, there are also differences that will need to be observed by multinationals participating in transactions that are covered by different rules, and also implications from the lag in timing between implementation of the two sets of regulation. We summarise these in the table below.

If you have any questions or require any further information, please contact Neil Dissanayake at neil.dissanayake@milliman.com, Peter Lin at peter.lin@milliman.com or your usual Milliman consultant.

FIGURE 1: COMPARISON AND IMPLICATIONS OF THE DODD-FRANK AND EMIR REGULATIONS

	EU:EMIR	US: Dodd-Frank	*Implications*
Clearing Obligations			
Instrument Scope	The regulation aims to include all 'qualifying' OTC derivatives. The first qualifying derivatives include only interest rate swaps and index CDS. Spot FX and some physically settled commodity swaps are excluded.	The regulation applies to 'swaps' and 'security-based swaps,' which include options and contingent swaps. The first qualifying derivatives include only interest rate swaps and index CDS. Spot FX and some physically settled FX swaps or forwards or commodity forwards are excluded.	*The scope of each regulation is similar, with both having interest rate swaps and index CDS in the first wave. In the case of EMIR, the treatment of FX forwards is still under consideration and so we cannot conclude whether overall scope will be exactly the same between the two.*
Who does clearing apply to?	• Q2 2014: Financial Counterparties (FC) • Non-Financial Counterparties that exceed certain thresholds (NFC+).	11 March 2013: Swap Dealers (SDs), Major Swap Participants (MSPs) 10 June 2013: Financial Entities 9 September 2013: 'All other entities'	*We note that given the territorial reach of Dodd-Frank, even for EU established firms, Dodd-Frank rules may apply if they enter into transactions with a US counterparty. Various registration requirements are required to qualify for any such transactions.*
Exemptions	• Non-Financial Counterparties that do not exceed certain thresholds • Intra-group transactions • Pension scheme arrangements until 15 August 2015	• End users can apply for hedging exemptions • Central Banks	*On the other hand, the delay in timing of EMIR gives some short-term competitive incentive for EU established companies to trade with EU swap dealers rather than the US counterparties, to be able to delay central clearing obligations for another year at least.*
Geography	• Transactions between 2 EU established entities; • Transactions between a non-EU and an EU established entity, if the non-EU entity would be subject to clearing if it were established in EU; • Transactions between two non-EU established entities, if they "have a direct, substantial and foreseeable effect within the EU".	• Transactions between 2 US incorporated or US persons; • Transactions between a non-US person and a US person;	*Given the territorial reach of both, trades with counterparties established in both the EU and US will be subject to both regimes, until measures for recognition of comparable regulatory regimes are finalised.*
Reporting Obligations			
Instrument Scope	• All OTC and listed traded derivatives (cleared or not) • Historical outstanding positions on and after August 16, 2012 [5]	• OTC derivatives (cleared or not), but not listed derivatives • No need to 'backload' historic positions	*Whilst the data that needs to be reported is similar between the two regulations, there are some key differences on how this is reported.*
Who does it apply to?	• All CCPs and counterparties must report. They can delegate to an independent third party, but remain responsible for ensuring that contracts are reported without duplication. • CCPs to report exchange traded and cleared contracts.	• Only one counterparty has to report. • The obligation generally falls to the CCP, the SD or the MSP to report, if they are a counterparty of the trade.	*In particular, the real-time reporting under Dodd-Frank is more onerous. However, this falls on a narrower set of counterparties that are likely to need to report. Dodd-Frank also excludes listed derivatives.*
Timing	• End-of-day reporting only • To be reported on next business day	• OTC swaps subject to mandatory clearing within 30 minutes (first year of rule) and 15 minutes (subsequent years) • OTC swaps not subject to mandatory clearing within 1 hour/4 hours (first year) and 30 minutes/2 hours (subsequent years)	

[5] European Securities and Markets Authority. Questions and Answers: Implementation of the Regulation (EU) No 648/2012 on OTC derivatives, central counterparties and trade repositories (EMIR). Accessed 11 June 2013 at http://www.esma.europa.eu/system/files/2013-324.pdf.

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DATE	ORGANISER	EVENT
11 September	Milliman	Milliman Forum / Milliman Technical Forum
25-26 September	Infoline	Stress Testing and Operational Risk for Insurers
8-11 October	Actuarial Profession	GIRO (General Insurance Convention)
15-18 October	EACC	East Asia Actuarial Conference
10-12 November	Actuarial Profession	Life Convention
4-6 December	Actuarial Profession	Momentum

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