

## An executive's handbook for understanding and risk managing unit linked guarantees

---

### Abstract of the London discussion

[Institute and Faculty of Actuaries, 1 November 2010]

#### Contact

James Maher, F.F.A., E-mail: james.maher@ie.ey.com

This abstract relates to the following paper: Maher, J., Corrigan, J., Bentley, A. and Diffey, W. An executive's handbook for understanding and risk managing unit linked guarantees. *British Actuarial Journal*, doi: 10.1017/S1357321712000013

**The President (Mr R. S. Bowie, F.F.A.):** Welcome to Staple Inn Hall, and to this Sessional Research Event. It is a great privilege to be standing here as the first President of the Institute and Faculty.

The term "Sessional Research Meeting" may not mean much to many of you. It is part of an attempt to evolve and broaden the range of different meetings that we have here, and, in turn, broaden the range of offerings to include webinars, and so on.

Before we get onto the paper itself tonight, I want to introduce Ms Ruth Loseby, who is the Profession's research manager. Ms Loseby is going to say a word or two about what you can expect from this evolution in the form of meetings over the course of the next few months.

**Ms R. L. Loseby, F.I.A.:** Thank you for giving me a few moments to expand on what the President has just said about the new title of Sessional Research Event. This is not a very big change but, it is to be hoped, builds on the success and the tradition of the past, while also expanding and moving into the future.

The new merged body gives us more freedom on how our flagship learned society events, our sessional meetings, are run, in that it does not constrain the format of the meetings or the way in which they are published, as was the case previously.

Also, we have already been looking at, with a view to improving, the profile of the profession's journals, and a project to outsource these to an academic publisher resulted in a move to Cambridge University Press in the early summer.

These two events seemed an ideal opportunity to review how we can build on the historic reputation of sessional meetings by taking the best of what already happens, but also looking afresh at how research sometimes lends itself to different formats for presentation.

Sometimes traditional meetings like this will be the ideal forum; but, for others, an open forum style event or a seminar or a formal lecture may be more appropriate.

We also want to encourage greater participation, both in numbers and in contributions. Greater flexibility, obviously, also brings risks and a need for greater co-ordination and, as such, we have formed a subcommittee of the Member Support Executive Committee. This subcommittee has been formed to oversee the new programme and to make sure that we have a really good and consistent programme of events over the year. This includes representatives from all the practice area executive committees, the qualifications executive, the journal editors, the Scottish Board, and the relevant staff.

We obviously do not want to stop doing what we already do very well, but we want to use the new flexibility to move forward and to explore new ways of having meetings. We see the current period very much as one of transition where we will, mainly, continue with the traditional form of meetings while we seek views, from both people who come to the meetings and also people who do not traditionally come to the meetings, to see how we might improve the offering in the future.

This subcommittee, called the Programme Committee, will meet for the first time in November so we are still at the early stages. There will be an opportunity for more formal input into the project as we move forward. I and other members of staff are always very happy to receive informal input on how we can take the best of the old but also move to the new.

Hence, we have a very slight change of name. We have still got the link to the past with the word “sessional”, but we wanted to indicate that, as we move forward, the events may not always be of the traditional sessional meetings style, hence the slight change to “Sessional Research Event”.

**The President:** Thank you. I seem to have spent most of the last three working days in this building because, on Thursday and Friday, we had four new qualifier ceremonies, where we welcomed another 130 newly-qualified actuaries into the Institute and Faculty of Actuaries. They are among the happiest of events: people come with their families and with a sense of great pride and pleasure and, in many cases, relief to have made it across the finishing line to become fully qualified actuaries.

But they also come with a lack of inhibition. They come with great excitement about what their qualification can do. We were encouraging them on Thursday and Friday to make the most of that qualification, to reach out as broadly as they possibly can.

There were a number of features about the audience. Fewer than half of the 130 people from in and around central London and a number had come from abroad. Increasingly, as Ms Loseby says, sessional meetings like this are not the best way to reach those people. But, nonetheless, coming to one of these events still carries with it that great sense of tradition, that sense of the learned society. Therefore, while we want to expand our offering, we do not want to lose the special nature of times like this.

The Council of the Institute and Faculty is getting underway with a review of its strategy. Completion of the review will allow us to explain what it is we will do to provide member support, to build public confidence and to extend the reach and reputation of actuaries. We expect to have taken that forward just after Christmas and to be able to share that with you. It is already clear that, by comparison with the corresponding strategic review five years ago, Council feels much more positive about the future for the Profession. Five years ago we were still in the aftermath of Equitable Life. Today we are looking forward, and many of our members are pushing out into new areas and doing well in those new areas. Certainly those 130 new qualifiers last week are excited about the opportunity of reaching out into areas that, perhaps, we would not have thought of ten years ago.

Tonight's paper reaches out into new areas because it is a paper written, in part, for the many non-actuaries, such as non-executive directors, with whom we need to work together in a team. This paper draws on a huge amount of top quality actuarial and mathematical work but is accessible to an external audience.

I am delighted, therefore, that we have with us tonight three of the authors: James Maher, a Fellow of the Society of Actuaries in Ireland (where he sits on Council) and a Fellow of the UK Actuarial Profession with over 20 years' experience, predominantly in the realm of reinsurance and capital management. Over the last three years James has focused heavily on the risk management and mitigation of variable annuity guarantees. He has been an active leader of research and communication of these products, both through his work at Ernst & Young, more recently, and as a member of the Variable Annuity Member interest Group, which has been one of the member interest groups that has really worked up a head of steam. Next to him is Mr William Diffey. William is also involved in enterprise risk management in the form of Solvency II internal modelling. He is at Genworth doing both UK and US financial reporting, having previously been at Tillinghast. He is also a Member of the Society of Actuaries in Ireland. The third member of the authors' group who is with us tonight is Mr Anthony Bentley. He is the Group Risk Actuary for HSBC Insurance, where he has worked for the last three years, and Anthony is responsible for evolving and implementing a risk strategy at the global level.

**Mr J. A. Maher, F.F.A. (introducing the paper):** Josh Corrigan, another of the authors, is currently working with Milliman in Sydney and, unfortunately, could not make it back here tonight.

I suppose everybody thinks we are going to talk today about variable annuities. We tried to hide it by calling it 'unit linked guarantees', but I do not think we fooled anybody. But that is only half right. We are actually going to talk more broadly than unit linked or variable annuity guarantees: we are going to talk about universal risk management of market risk within the insurance product spectrum.

So our subject today is risk management of investment guarantees, and we have taken an enterprise, or an economic, risk management perspective. The aim was to produce a paper that will be somewhat timeless. In particular, we are going through a huge amount of regulatory change at the moment and if we were to ground our analysis in Solvency II, whether third or fourth generation, it would become redundant in very short order. Hence, we have taken a broader enterprise, or economic, perspective.

It is now 2010. Three years ago we had the "Next Big Thing" conference where everybody talked about variable annuities as being a next big thing. We have had a very interesting three years. Through that period, although we might not have written much business, we have written an awful lot of papers on the topic. Part of the motivation for this paper was to consolidate those various papers – papers on products, papers on strategy, papers on hedging and capital. If you look at the bibliography of the paper this evening you will see that most of the bibliography is quite home-grown. It is not relying too heavily on external academic research but it is consolidating a lot of work done within the Profession and, in particular, within the Variable Annuity Member Interest Group.

The target audience, as we say, is the "C Suite" as well as the non-executive directors. If you have a senior title – Chief Executive, Chief Risk Officer, Chief Financial Officer – this paper is for you. It does not pretend to be a simple paper, because the subject matter is complex. What we have tried

to do is to bring it to a level that should be accessible with a little bit of diligence. So, we are targeting the executive level, recognising the fact that we are covering the breadth of the subject of unit linked guarantees from strategy right through to hedging through to operational and infrastructure considerations. There is, within that, a very broad topic.

This work extends the work done up to 2007. So, we are taking the paper from Colin Ledlie and Dermot Corrie, which was a very important paper, and also the work of Tamsin Abbey and Catherine Henshall, and extending that work.

The approach in the paper is descriptive and linguistic without too many formulae. We have also made an accessible bibliography. CEIOPS will be delighted with the approach we have taken. We have this macro document and on each subtopic there is going to be a paper behind it and you can drop down to the lower level of documentation which will probably contain formulae. So, we have a neat tiered approach to documentation.

The paper was born within the Variable Annuity Member Interest Group. I chaired that group, and I have to say we had a sterling year last year: there was a lot to talk about and we presented at many of the conferences last year. We have not been as good so far this year, but it is to be hoped that this paper will make some amends. Anthony, Josh and I represent the enterprise risk management stream within the Variable Annuity Member Interest Group.

We have attempted 'a balanced perspective' with the mix of authors. We wanted to make sure that the paper was not hijacked by one particular perspective, by, say, the consultant or investment banker with something to sell. I would represent the static risk transfer reinsurance investment bank type solution in terms of my working day. Mr Corrigan represents a dynamic hedging perspective, and we also have representatives from financial reporting and risk management.

*Mr Maher then presented a brief overview of the earlier sections of the paper with the aid of slides.*

**Mr W. T. Diffey, F.I.A. (also introducing the paper):** There is a lot of material in the paper on group structural considerations, reinsurance, and so forth. As the President noted in his opening remarks, work started on this paper in early 2008, brought together under the auspices of the Enterprise Risk Management Practice Group. But that was before the roof fell in on the world economy. At that stage companies were looking at market entry strategies, seeking to leverage experience from the US and Ireland.

The Variable Annuity (VA) and unit linked guarantees market faced significant headwinds in 2009, notably with the departure of The Hartford from writing new VA unit-linked guarantee business in the UK during that year.

The credit crunch itself led to quite a bit of scepticism about these products, and the ability of insurance companies to risk manage complex guarantees.

My own involvement in the paper has been that of an "interested" lay person, coming at the work from an insurance company perspective, but also from the perspective of a former career as a consultant. My main interest has been that of strategic considerations companies should consider when entering a new market but also the risk and capital management challenges they would face seeking to manage unit linked guarantees.

I think this is a very practical paper. It asks the questions:

- (i) How do I go about writing VA unit linked guarantees in a market which is very worried about VA and unit linked guarantees?
- (ii) What is the customer value proposition? It seems to hinge on using flexibility to meet customer needs.
- (iii) Are companies and customers able to articulate these needs; and how should companies go about pricing such products?
- (iv) What should their market entry strategy be? Or, what do companies wish to sell in a manner which is consistent with their existing risk and capital strategy?
- (v) (v)Are VA unit linked guarantees consistent with a history and risk strategy of a company already seeking to enter the market? Is such a move consistent with a company's DNA, so to speak?
- (vi) Do companies have the right governance culture and structures in place to allow them to balance risk and reward? Or, are they driven mainly by a desire to maximise volumes and market share and combat competition?

I think our paper is helpful as a guide book in this new and unfamiliar market.

The early sections – sections two and three – discuss the strategic aims that companies may have, such as the ones I have just noted. Section three draws a distinction between the first order market risks which are generally accepted as easy to hedge, such as delta risk, and harder to hedge, second order market risk such as vega risk.

In fact, any hedging strategy may end up reallocating risk between risk buckets, for example, substituting liquidity risk, counterparty risk, and basis risk for direct market risk. The focus of any forecast or any risk-based earnings analysis needs to be on the P&L based on residual risks after hedging and allow for the true hedging costs including the rollover of transaction costs.

The middle sections, sections 4 and 5, focus on managing a dynamic hedging strategy. It could be argued that, during the credit crunch, derivative markets remained more liquid than the corresponding physical asset markets.

It is worth noting that although delta hedges remained fairly effective during the credit crunch, over a month the average difference in the indices has been identified as about 10% of the average index movement. So, even if the benchmark and option index are aligned, basis risk will still exist for active equity mandates because the portfolio performance will not track the index.

So topics covered in these sections include instantaneous hedging, the need for dynamic hedging and implications for market consistency.

Section 5 asked the question whether a bank or insurer is best placed to hedge these risks given the hedging costs and the need to manage residual risks.

Section 6 covers risk management issues, alternative static solutions.

The final sections cover strategic considerations, such as group structures, regulatory and economic capital considerations and strategic management considerations.



**Figure 1.** Seven Key Principles knit together with Clarity of Purpose

I would now just like to make a few comments about Solvency II. The paper was written long before the publication of QIS 5 so it does not bring into account the issue of mark to model valuation under QIS 5, the VA riders, with separate reference rates and volatility parameters. I think it is totally unclear whether QIS 5 is market consistent or not in respect of variable annuities. In my mind it brings to light the old problem of the UK realistic balance sheet regime whereby long-term guarantees could not be effectively valued with reference to implied volatilities obtained from short-term equity options.

Also QIS 5 appears to correct a currency bias towards euro denominated jurisdictions by penalising companies for holding surpluses in non-functional currencies or non-euro currencies for the currency risk component of the SCR.

I agree that VA writers are apparently being forced down the internal model route, under Solvency II, because the standard formula does not allow for dynamic hedging strategies.

I think Solvency II also pushes companies towards a single jurisdiction with a branch structure under a group under freedom of services. And therefore understanding the regulator and tax characteristics of the product in each jurisdiction becomes important. Having appropriate governance procedures and controls in place for monitoring business is a key factor. I think the VA market is a genuine example of a cross-border reinsurance market.

*Mr Diffey then proceeded to summarise the later sections of the paper. He concluded with Figure 1, which identifies seven key principles and has at the centre the need for clarity of purpose in entering this market.*

Clarity of vision and purpose is important to understand what we expect from unit linked guarantees. We need to design the product with risk mitigation in mind, notwithstanding the GMxB

will be designed to serve a specific purpose. It needs to be designed with risk management in mind and to understand the true cost of the guarantee.

We should not lose sight of the secondary risks. Secondary risks in VA are only secondary due to the complexity and not the scale of the risks.

We need to appreciate the full cost of the replication. We need to ensure security of supply. Once we have committed to and undergone the cost of committing to our provider, GMxB, which is enormous cost, the question of capacity and the maintenance of that capacity must be addressed.

We need to accept that it is a risk business not a spread business. So, no matter how good the modelling or the hedging, there is no way to mitigate all the risks.

The final point we have got in our seven points is 'big is beautiful'. There are clear advantages of scale through expense management or the development of expertise.

**Mr O. J. Lockwood, F.I.A.:** I congratulate the authors for their paper, drawing out the key lessons for management on a subject which has the potential to be highly technical.

I believe variable annuities have the potential to be an attractive product class for a range of customers because of the combination they offer of investment flexibility, guarantees, and transparency of the charging structure. However, we must recognise that there are customer segments for which the complexity of these products makes them inappropriate. We must also recognise that not all the providers entering this market will be successful.

It is natural that an insurance company embarking on the launch of a variable annuity product will seek extensive advice as to the risk management processes it should establish. This advice is likely to place particular emphasis on the fact that the second-order interactions between risks can often be significant for this product class.

However, the main concern I have regarding these products relates to the extent to which the risk management processes will be kept in place if the business changes strategy and variable annuities are no longer seen as a core part of the business. Suddenly one then has a legacy block of business where it is necessary for actuaries to provide a clear justification of the continued need for the risk management processes to a management who might otherwise make the assumption that any second-order risks are invariably small.

I do not believe the importance of second-order risks for variable annuity portfolios can be fully demonstrated purely by means of instantaneous stresses. Any business is exposed to the risk that two of the risk factors it faces simultaneously exhibit sudden jumps. Even if the business is hedged against each risk separately, unless it holds a specific hedge against the risk of such a simultaneous jump, the jump in the first risk will alter the exposure to the second risk and there will not be time to rebalance the hedge of the second risk appropriately.

It is true that the possibility of such jumps needs to be considered as part of risk management. However, it could be argued that a more typical scenario would be for the two risk factors to move together in an adverse way over a timescale shorter than the effective rebalancing frequency of a simple hedging strategy but longer than the effective rebalancing frequency of a more complex strategy.

These are the types of scenarios that need to be considered to determine the value added by the more sophisticated strategy.

This suggests that to demonstrate the need for a relatively sophisticated hedging strategy, one needs to analyse the outcomes of different strategies over a finite period, such as a year, under a number of simulated scenarios. However, if the simulations are used only to derive an overall distribution of profits or losses, then the full benefit will not have been gained from the exercise. What I believe is needed to gain the full benefit from the exercise is a breakdown of which risks, including second-order risks, the profits or losses come from, which, when considered in conjunction with a risk appetite, will give an indication of which risks are and are not being adequately managed. Such a breakdown is not trivial to produce, as it is necessary first to formulate a precise definition of what the first-order risks are and then to make a complete classification of the ways in which second-order risks can arise.

The second-order risks will consist of more than simply non-linearities in exposure to the identified first-order risks and interactions between those risks. For example, a level movement in interest rates, calculated as a weighted average of the movements at individual terms and assumed to occur uniformly over the year, might be defined as a first-order risk. It would then be necessary to capture second-order risks in that interest rate movements at individual terms have altered the exposure to other risks, even if the impact of interest rate changes has been calculated correctly to the first order.

It would also be necessary to capture second order risks due to uneven changes in interest rates over the year. It is clear from this that there are considerable computational challenges to producing such a breakdown, but I feel actuaries will need to rise to these challenges to provide a clear demonstration of all the risks in variable annuity business and hence the need to manage them. If companies implement such a process at an early stage then there will be an effective means of communicating the risks in place, before the business strategy changes and it may no longer be possible to justify investing resources in better managing the risks in this business.

**The President:** In your introduction, you talked about how three years ago this was expected to be one of the emerging products. Yet it remains relatively rare. One of Mr Lockwood's points is that you have to be prepared to enter the market for the long-term because there is a real risk if you start it, and then do not follow through, you have this ticking parcel in the corner with nobody paying any attention to it. How many insurance companies are actually writing this business consistently at the moment?

**Mr Maher:** I suppose the question is best answered by considering how many companies are writing it and where they are located.

From a European perspective, there are still only a handful of companies. I think what we witness, which could have been anticipated, is that there is a significant polarisation as, in this business, "big is beautiful". One cannot dabble in variable annuities. It requires strategic commitment to build scale and roll it out. So, if you look at the providers in Europe, it is Axa and Met Life and some others.

I think there is a challenge with, say, a single country focus in terms of building scale and capability. So, while the numbers are still in the handful area, we are definitely seeing others coming out of the shadows.



Back in 2007 we had more people talking about doing it but without a complete understanding of what was involved. Now there is a much more considered approach to entering this space and develop solutions sustainable for both the policyholders and the shareholders.

An analogy with dotcoms is, I think, apposite. I remember in the dotcom era everybody talked about the peak of euphoria, the trough of despair and then the plateau of reality. Variable annuity business has just gone through that: we had euphoria in 2007, followed by three years of despair and now we are approaching the plateau of reality.

Mr Lockwood's comments brought to my mind an intellectual development of actuaries from the insurance perspective of pricing market risk to understanding market risk manufacture – a change in perspective that can apply itself throughout a whole range of endeavours for actuaries, not least in how we interact with investment banks. Our shareholders might not be in good shape but we have never been in better shape intellectually than we are now.

**Mr P. A. C. Seymour, F.I.A.:** As you probably noticed, my hand was only half up to speak, because I am not particularly competent in this highly technical area. However, I did get involved in the '1970s in writing papers about unit linked guarantees. So I was pleased to see the title of the paper used that unit linked term, if only for nostalgic reasons.

On a minor point, but I would be interested in the answer, you have GMxB as guaranteed maximum benefit in keywords inside the front cover of the paper, which I think is a misprint when you look at paragraph 1.2.5. But I just did wonder what this x was.

My more material point is that when we were discussing the viability of accumulation unit linked guarantees on savings products, which of course is not what you are talking about here, we had quite a big debate. In the end, the estimated cost became so prohibitive that people decided that customers would not pay. That is your 10% or 20%, or whatever, you have in the paper. But, after that, we had a bit of a discussion about whether guarantees could be offered on managed funds, where the office had the right to change the investment approach as the guarantee got nearer, and so on. To my mind, that concept was a sort of version of what you are now calling dynamic hedging, although obviously much, much simpler, and without the sophisticated instruments available today.

So my second fundamental point is this. Since your dynamic hedging actually operates, as you have said in the presentation and in the paper, on a sort of instantaneous view of what you need to be matched, and then something really big might happen next week, does that instantaneous view actually get you through the big happening next week? That is to say, does dynamic hedging actually work?

**Mr Maher:** Some of this knits together with Mr Lockwood's comments. Mr Lockwood talked about the risk of being overly confident in how we model risk and the need to identify vulnerability when things happening together. As we now know, correlation tends to go to 1 (or 100%) in a crisis. If you think it through in terms of dynamic hedging, even under the Black-Scholes model, the stresses in terms of (i) the cost of borrowing stock is going to go up in a crisis, (ii) the bid/offer spreads are going to go up in a crisis, (iii) the spread between three month LIBOR and overnight LIBOR is going to open up in a crisis, (iv) the level of interest rates is going to drop and, (v) the level of statistical volatility is going to go up. So all this stuff goes wrong at the same time.

The question Mr Seymour asks is does dynamic hedging work? The short answer is that it works for one party. Take as an example variable annuity guarantees with their key selling point of CPPI protection. What the provider offers is a guarantee, but it does not re-weight the policyholder out of risky assets. The provider who sold the guarantee has to handle that through a short hedging position. The point is if it all goes to hell in a hand basket, somebody is going to suffer a loss because, whilst you might say, "I have bought an option to cover off that gap risk", somebody has sold you that option. So it is a game of 'pass the parcel'.

This is my law of conservation of risk. Risk just gets passed around. It eventually lands on someone's desk. That is why you cannot separate credit risk from event risk. All you can do is make best endeavours. I do not know whether it is out of hubris or ignorance, but when, for example, we identify a risk model to quantify the capital associated with a risk, we then invariably apply a too high a degree of confidence to risk mitigation. So, say I have £100 million of capital available to me with which I could write £1 billion of variable annuity guarantees. But if I could compress my capital needs through hedging to 10%, I could now write £10 billion of guarantees on the basis of my £100 million of capital. But this is all predicated not just on my capital but also on fate of risk mitigation against my gross capital. So I am leveraged to the market and to my recoveries, a compound exposure which cannot be evaluated with just a simple stress test. That is a much more brittle form of capital, and that is why things tend to go bad in a crisis.

If you take a look at the direction of regulation under Solvency II, Basel II, and everything else, it is very much putting in frictional costs for exchanges between parties. So there is much more frictional capital that is going to force people to de-leverage business, and that is going to cause a lower overall risk appetite and maybe much more transparency on risk mitigation.

So risk is just passed around and distributed. A lot of confidence in the previous cycle was created from banking diversifying its normally concentrated risk through securitisation. But, it seems, that then we went and reaggregated it all again. So you need to have your eyes open when you develop a new-fangled product, to make sure it has a purpose and to make sure that when you rely on a model for your risk mitigation you understand its limitations and do not over-leverage your company from your confidence in your model.

That is why I talked about asset management in VA. You can hedge, for example, by using total return swaps with an asset manager. Looking into the future, well-placed companies would have a long-term agreement with an asset manager to guarantee total return swap capacity with fixed bid/ask spreads, etc, and with a secured supply so that dynamic hedging can happen. I think the fundamental change is that once we understand what is driving our costs and we understand what is causing our risk mitigations to break down, we can start to design products that are more robust – at least more robust than our current approach of relying on post-hoc risk management.

I will digress briefly. In actuarial work we have actuarial-speak. We speak of real-world valuations and we speak about fat-tailed distributions and equity risk premiums and liquidity premiums. They do not talk about that in the banking world. There they talk about replication costs and risk neutral frameworks. What can happen, of course, is that we can develop a patois where we talk a little bit of actuarial and a little bit of risk neutral and a little bit of real-world, and it can all get a bit garbled.

What we need to do, as a profession, is to become thoroughly bilingual. We understand the language of banking and we understand the banking of real-world, and we know how to bring them together, but not have some hybrid patois that serves no purpose.

So part of the purpose of this paper is to help those actuaries get a little bit more up to speed on the banking side, know what we do not know; and have a bit of humility about what we do not know, so that we are better placed to make more informed decisions going forward.

**Mr Seymour:** Just on my minor point which you did not answer, what is the  $x$  in GMxB?

**Mr Maher:**  $X$  is a variable in a variable annuity contract. It is a bad actuarial joke on humanity. The GMxB is such that  $x$  is a variable that can be whatever guarantee you want. So it can be a guaranteed minimum DB (death benefit), IB (income benefit), WB (withdrawal benefit) or AB (accumulation benefit).

**Mr Seymour:** Perhaps that is why there was the inadvertent slip in describing GMxB as a “Max” guarantee in the keywords!

**Mr Maher:** *Mea culpa*. I take responsibility for that.

**Mr M. H. D. Kemp, F.I.A.:** I would like to thank you for this paper, and particularly for trying to expand out the actuarial skill-set in the risk management area, and in market risk management in particular.

The question I have is this. When I look at how bankers actually price hard to hedge instruments, they quite often focus on who they can offload that risk onto, i.e. who might provide the other side of the hedge. They often endeavour to be intermediaries rather than wholesalers.

You said that we needed to think more like banks. Are there any people out there, beyond the financial services sector, who you feel might be the other side of some of the harder to hedge risks that you have described earlier? For example, can we create products that have approximately the opposite delta exposures to the types of VAs that we have been concentrating on earlier in this meeting?

**Mr Maher:** This is a key point. We are talking about the inventory. Have I got offsetting trades in my portfolio or distribution capacity? Can I sell this to somebody?

An example of this is that all those lovely structured products we get from banks may actually be the banks selling their correlation exposure to the retail policyholder. So there is a question. We do have a portfolio of policyholders, so maybe we need to look at how we structure our own internal products to re-sell back, recycle products within our own portfolio.

But a much simpler way of looking at it, drifting into put/call parity, is that the difference between a structured product and a variable annuity is as follows. In a structured product I go out there and I get cash, invest in the zero coupon bond, buy a call option, and long futures, or whatever, to get my market exposure. With a variable annuity, because we like the idea of being fully invested, we take a 100% position in equities, and then buy a put on which I need a short delta position. So, if I am selling structured products and variable annuities, I have a net delta position to potentially offset within my own portfolio.

In a similar vein, an insurance company with an asset manager can make a little bit of money on the side by stock lending. I get fees for my stock lending, but I have the guy from the hedging side of my balance sheet having to pay somebody for stock lending to get a short position.

It is like an offset account. We charge policyholders for delivering performance by charging 100% on their fund, and then we charge them for taking away delta of it. What it has created is one minus delta upfront.

There is a lot of scope within an insurance company to reduce those exposures so I can get much more integrated hedging between my asset management and my guarantee. That is purely on the hedging side. I can also do macro hedging, offering a combination of structured products and equity indexed annuities.

This brings me to another point. Did you ever wonder why investment banks like selling calls but not puts? It is basically exposure to the negative gamma: the gap risk. It is generally seen as preferable to be buying stock in a rising market than shorting it in a falling market.

I think we may see ourselves moving a little bit away from an infatuation with the long equity and the put option towards something a little bit more sustainable. I think we are going to have to see a much closer integration between asset management, performance delivery and the guarantee. We are going to see that macro hedging has an offsetting part in the portfolio and we can start looking at our inventories and designing our products with regard to the marginal capital impact of the product.

It is a huge area of opportunity. Insurers seem to think that they know better, but banks have been doing it for years, have access to larger inventories, and they charge more than insurers.

It is a huge opportunity but we need to understand it. There are some 'legals' to be worked out. The policyholder needs to have a structured note and equities in their fund because a structured note is the opposite side of the total returns swap on the hedge, but there are solutions.

**Mr J. P. Ryan, F.I.A.:** You made it very clear that the economies of scale are enormous on this. But from your last answer it seems that is almost impossible to do anything other than create a gigantic well diversified portfolio. But, unless I have missed something, would you even contemplate doing that? Indeed, life assurance companies will end up, if they get this right, with an enormous competitive advantage with some of the investment banks. But they will be able to offset a lot of these risks with some investment banks.

**Mr Maher:** First of all, there is a scale advantage. I think there is a hurdle level of size that you need to get to and then there is probably a decreasing utility. But size is not just to do with costs, it is also to do with the talent you acquire.

Remember, when variable annuity guarantees are written, a whole range of different risk classes are acquired, such as interest rates, equity, and credit. So either you find a superhuman trader who can trade all of these things or you need a few different traders. If you have a few different traders, you need to have enough business to keep them sufficiently busy to attract them. So there is a benefit scale in terms of talent and being able to attract and to retain it. So there is a minimum size.

Look at Axa Global Distributors. BNP, who could have manufactured it themselves, have now decided to hook up with Axa Global Distributors for its bancassurance platform. Each company must decide what is its core business.

The reality is that there is a space for CPPI products and structured products. The ideology, and the benefit of this thinking, allows you to better understand why you are going to get into it or not get into it. The reality is that there is a scale advantage but you will probably get much more disaggregated company structures, much more co-operation between investment banks and asset managers and asset managers and insurance companies. There are complex structures that can help but there definitely is a scale advantage.

**Mr Seymour:** Sorry to come back, but I found something that I meant to mention in my previous comment about whether dynamic hedging works or not. In section 8.4.3 there is a discussion about future offsets, and finally it states that the North American approach applies significant hurdles and limitations to the attainment of significant offsets for such future trading offsets to capital. I think that is saying that the American regulators rather share my scepticism on dynamic hedging.

**Mr Maher:** It is not just the North American regulator.

**Mr Diffey:** I think that scepticism is shared by regulators around the world, which we tried to cover, albeit briefly, in the sections on US economic capital and US GAAP.

**Mr Maher:** The conversation in the risk control world, and this pulls in some of Mr Lockwood's points, is about the instantaneously risk neutral. My movements on my hedge portfolio ensure that I am okay today – I can get through today to return tomorrow.

It is a difficult view for the actuary to take, to say 'and the future will look after itself'. It is predicated on an exit strategy: if I hedge my value I should have enough cash tomorrow so that I can go and hand the whole lot over to somebody else. But the reality is that there is no open market to transfer this to somebody else. The exit value is consistent with accounting standards, but in reality it is unlikely to be fulfilled. That does not mean it is not unreasonable to make sure you have enough money on the balance sheet so that you can keep trading through and have enough money at a later stage to transfer when it settles down. That is the reality for a lot of companies.

That statement in section 8.4.3 on future offsets is more about the philosophical view of the North American regulator, which I view from a capital perspective as the cost to fulfilment.

The issue can be viewed in the following way. I have hedges today and they offset my instantaneous stress test today, so I can collapse my risk mitigation and my capital strain today. If I have to project into the future the future state of the world, I am into future management actions. What will I do in the future if this scenario occurs, and what benefit will I get from my hedging programme in the future? That is really complex to model and, I have to admit, this is why I almost jumped to the opposite view.

There is a decreasing utility in getting more and more complex models as to what you will do in the future. However, you will be driven towards that to gain better and better capital treatment. So it is a technical solution to a technical question. But it is not useful.

It starts with 'the approach you take is a function of what the regulator wants'. This perspective is definitely something that we are going to get in future here in Europe. We can talk about it a little bit, but the CEIOPS VA task force is likely to follow its thinking and the thoughts of the Irish regulator, as outlined in CP 42. We are going to have a best of/worst of type scenario. For Pillar I capital requirements, we are likely to continue to be required to do some form of stress test or short term VaR test. The regulator will most likely require us to articulate our long-term exposure in his Pillar II type disclosure.

We are going to have to continue to project forward into the future and those projections into the future are fraught with model error and parameter error. We might be a bit sceptical about the day-to-day re-evaluation but there are enough checks and balances that if you manage the day-to-day and keep going day-to-day you are not necessarily in a bad position. While you have to keep an eye on the future; you cannot run your business based on that long-term perspective: you do have to hedge it today.

I would focus my attention on the instantaneous stress test but I would have to put that in a context of the long-term view.

**Mr P. W. Wright, F.I.A.:** In Mr Seymour's first contribution, he pointed out that when the costs of guarantees under unit linked contracts were identified correctly in the 1970s, nobody was willing actually to pay them.

The problem seems to me that the same applies with variable annuities in the UK at the moment. The average punter undervalues the guarantees given. Of course, with the retail distribution review, we are not going to have the option of bribing IFAs to stimulate a market by offering high commission rates. Against that, though, clearly sales of this product in the United States and in Japan are very significant.

My question really is this: do you think that they are being correctly priced in those markets where they are successful, e.g. United States and Japan? Is there a way round the under-valuation of the guarantee in the UK?

**Mr Maher:** First, this comes down to a policyholder and a sales perspective, not really a company perspective. And this comes down to how it is sold and why it is bought.

If the sale of the variable annuity is based on the value of the assets then all attention is on growth and outperformance. It is not about insurance and protection.

If you take a look at the current total costs that may come into a variable annuity contract, you might be charged 1% for asset management, 1%–1½% or so for the guarantee and 1% to get back commissions. The contract cannot afford all of that – you are taking 3% or so out of the product. Now if you drill down to the added value from the policyholder's perspective, do they value the go-go outperformance more than the security? A policyholder who is rational and risk-averse is going to look at the guarantee as more valuable than paying 1% plus for the asset management. So what we have is a disequilibrium in the pricing: there is too much value being given to the asset management side and not enough to the risk side. But it is the asset management that sells the product!

In Germany and Japan, where they are primarily protection markets and they have two other things going on. First, these are really sticky products, with lapses of the order of 2%–4%. In Japan, you

can be exposed to four asset categories: domestic bonds, domestic equities, global equities and global government bonds. That is it. Competition and product differentiation is based on the guarantee and benefit features. It is driven by bancassurance and it is not about asset management. In Germany, they are more than happy to sell you euro stocks and index returns but, again, it is about the guarantee.

But if you go to North America and you come to the UK, it is an asset conversation. And this impacts pricing. If you go to North America, the pricing is very heavily dependent on a lapse assumption and behaviour assumption and if your 10%-11% expected lapses are wrong, then you are in a world of pain.

So, country by country, you get a different perspective, and, I would say, for variable annuity guarantees to make sense, they have to be sold as a protection mindset, because what you are selling is protection.

You have the CPPI, which is a cheap way of protection because I am going to self-insure lock out, but if I want to guarantee my asset allocation, and guarantee I do not have to increase my price in the future, I am going to buy a variable annuity guarantee.

In some ways it does not make sense to be extremely risk seeking and really risk averse at the same time. There is a conversation to be had as to whether these structures are protection contracts or asset contracts or investment contracts. If they are investment contracts, then I would suggest rowing back on the guarantee cost and pumping up the asset management fee. But if you have a protection mindset in a protection market and the policyholder wants protection, then to sell it you have to cheapen your asset management costs and get the guarantee up-front.

The variable annuity guarantee is a “belts and braces” guarantee. Arguably, you can be over-insuring people with it, so it is not the right guarantee for everybody. CPPI might be more than an enough protection for some people.

**The President:** We have still not done Mr Lockwood’s contribution justice. If you would just deal with that and then we will bring things to a close.

**Mr Maher:** I agree with Mr Lockwood that simplistic stress tests are insufficient. Our modelling has to be complex, as it must allow for combined and correlated events.

This could be looked at from another point of view. There is information to be had from, say, the option cost on a basket option rather than the individual components. There are also other simplistic ways of getting a feel for the cost of protecting the risk. It is the cost of transferring it that is key.

Instead of getting really complex in modelling, one could simply estimate how much it would cost to transfer, and that at least would provide you with a benchmark cost. The part of the exercise that I see as most valuable is, after companies spend a few dollars doing the analysis, they will come out the other side much richer in their understanding of market risk management, and that knowledge can be deployed. So, a with-profits company might go in to the exercise thinking that they will end up with some sort of unitised with-profits guarantee but eventually decide to start hedging the GAO exposure and reducing the equity backing ratio’.

The acquisition of knowledge by going through the process can only serve to better enable the companies to manage their risk. The unit linked guarantee is a great place to start because they pull in every single risk under the sun, so if you understand how to manage unit linked guarantees you will be in good shape for managing the rest of your portfolio.

**The President:** You also made the point that, as well as just thinking about the risk of things going wrong, you need to understand the risks because that is also where your profits might come from.

Thank you gentlemen, it has been an excellent discussion.