

ABSTRACT OF THE DISCUSSION

HELD BY THE INSTITUTE OF ACTUARIES

Mr P. J. Sweeting, F.I.A. (introducing the paper): This paper has a number of purposes: to outline the main risks faced by financial institutions; to look at how each risk applies in a similar way to each type of institution; and the differences between these risks across institutions.

Credit risk is a good example. Retail banks face credit risk from their loan books; insurers face it mainly from reinsurer failure; and a pension scheme's greatest credit risk is that of sponsor failure. These aspects of credit risk are different and require different treatments. For example, modelling credit risk for a bank means finding a way of dealing with a number of small risks, whereas pension scheme sponsor risk is close to the credit analysis carried out by a rating agency for a single entity.

It is also worth noting that there are similarities between apparently very different risks, for example between credit risk and general insurance risks. Both can be regarded as depending upon the incidence and the intensity, and, although the risk factors driving these two risks are very different, this suggests that general insurance actuaries, at least, already have the skills needed to assess credit risk.

The question of how to deal with risk is covered in Section 5, on 'Measuring and Modelling Risks'. This section posed a problem, because I wanted to give enough information for the section to be useful, but not so much that the whole section was akin to a risk management textbook. I urge you to look at some of the references given in the paper.

In this section I look, not only at modelling each of the risks individually, but also at the ways in which they interact. For example, going back to banks, if a bank is modelling credit risk on its loan book, then it is also going to take into account future economic prospects, since these will affect the likelihood of default. The economy will be modelled consistently with capital markets. A downturn in the economy will increase the rate of loan defaults, but it will also coincide with a fall in interest rates which will affect bond yields, and, possibly, a fall in equity markets, so that these items should be modelled together. I also look at how best to assess the results of any modelling carried out. This is important, since many practitioners still regard risk as being equivalent to the variance of returns. There are several situations for which this is not appropriate. For example, if the risk is asymmetric, then a downside measure of risk is far more appropriate. More importantly, the variance may tell us nothing about the capacity for risk which an investor has.

Value at Risk (VaR) type measures are often more appropriate if the probability of a particular limit being breached is of importance. If what happens in the tail of that particular distribution is important, then measures such as expected shortfall are more appropriate.

I now look at some of the ways of managing these risks. There are a number of analogies illustrating the ways in which different institutions manage risk. For example, looking at the impact of changing investment strategy is an approach used by all financial institutions. The main differences between institutions arise from the regulatory environments in which they operate.

Similarly, changing the amount of capital backing an institution has been used, to varying degrees, by all financial bodies. For a bank or an insurer, this may be through the issuance of equity or debt. For a pension scheme, it may be the payment of additional contributions. The interesting differences here arise from the drivers of each business. Does the level of business written drive the amount of capital required, or does the level of capital drive the amount of business which can be written?

Investment banks generally follow the former route, adjusting the level and mix of capital as business opportunities change. However, insurance companies and retail banks face operational constraints on the level of change and business volume which can be achieved in the short term, so that they are more likely to adjust their capital on a strategic basis rather than on a tactical

basis. Pension schemes generally change the level of capital in response to the business written. In other words, they will change the level of contributions in response to accruing benefits and changes in surplus. However, changing future benefits is also an option, and it is also worth considering the prospect of risk sharing, where the level of business — in this case members' benefits — are subject to greater changes in exchange for a greater predictability around capital requirements or contributions.

A related area is that of capital market risk transfer. Banks have been active in this market for a long time, converting books of loans into securities which are then traded, extending this more recently into multi-tranche collateralised debt obligations, or CDOs. Insurance companies have been involved in this market to an extent as well, in terms of the issuance of catastrophe bonds, and life assurance companies have more recently followed suit with mortality catastrophe bonds. There is, perhaps, less scope for pension schemes to go down this route. You need to be of large enough size to come up with enough risk to sell to the market. However, credit default swaps or similar instruments can be used to mitigate sponsor credit risk. There is growing interest in the market for mortality, with survivor bonds and, more plausibly, swaps, being discussed extensively.

So, what are the main messages in this paper? First, you should consider all risks together. In many cases this is already being done. Anecdotally, I understand that banks use complex and wide-ranging models to ensure that all risks are considered simultaneously, with a consistent approach to modelling. Insurance companies do use the model office when looking at all risks together. Pension schemes, perhaps, need to ensure that their approaches are similarly holistic. Investment risk, contribution rates and sponsor credit risk should be considered together.

The second important point to recognise is that there are similarities between some of these risks, and that actuaries can use their skills in several areas, such as general insurance risk and credit risk. Pension scheme sponsor credit risk can be modelled by actuaries, and it can be done consistently with the other risks borne by pension schemes — in particular investment risk.

As a profession, our reaction to changes in financial markets should be to seize these opportunities to move into new areas, and not to retreat into our core practice areas.

Mr M. H. D. Kemp, F.I.A. (opening the discussion): My conclusion, on reading this paper, is that it is a well-written generalist paper, which covers a wide range of topics. I hope that it will generate a fruitful discussion on modelling and managing risk, or at least a way of anchoring our discussion. I describe it as a generalist paper in the 'traditional' actuarial mould. It is wide ranging; it contains much which seems to make sense — at least to actuaries; and it is relatively non-mathematical, so that it is not really for those who are out and out quants. It also does not have much focus on governance. I work for an asset management business, and, within my company, risk management is functionally split into two parts. There is a market, credit, investment risk function and there is a separate compliance, operational risk function. The former is more mathematical, and the latter is more focused on ensuring that you have the right procedures, protocols and so on. There is not much on procedures and protocols in this paper, and how you might go about mitigating operational risk, or that kind of thing. So, it is more focused on the halfway house, which probably is where many actuaries are.

I want to pose the question of whether the 'traditional' actuarial mould, the actuarial paradigms and the general actuarial flavour which permeates the paper will actually be the right way to think of modelling and managing risk going forward. It is a very good paper within that mould, but my question is whether that mould will reflect the way in which the world is going to be in the years to come.

The paper covers the existence of a link between risk and capital; and it covers who, typically, 'looks after' / advises different parties in different types of financial institutions. It looks at the main types of risk affecting the different institutions. It has quite a lot on how to measure, model and assess risk. It talks about the different ways of managing risk, including raising capital and changing the business mix.

Of course, it has also, being an actuarial paper, a good plug for actuaries and for the idea of a 'coherent risk management system', which means trying to identify all the different types of

risk. However, it also contains a hint that not everybody sees the world in a 'traditional' actuarial light. This is described in ¶8.1.1.

There are some good, broad descriptions of many of the main and different players which exist within the marketplace, and of the techniques which actuaries use to advise these players. It picks up on a number of themes, e.g. how important demographic risk is to defined benefit pension schemes and the impact which behavioural biases can have. It has some good sections on areas which are probably less familiar to some actuaries, like how credit rating agencies typically carry out their credit risk analysis, and some of the ways in which you can apply the same kinds of concepts outside the credit risk arena.

Is the paper correct in its conclusion that actuaries do have a role to play in a broader range of risk management activities than is currently the case? Many actuaries have those skills, and, perhaps, participants in the discussion can share some examples of how they have been involved in those areas, and how they can see risk management and risk modelling being applied.

However, there are a few simplifications en route. For example, the paper claims that the FSA has two broad reasons, or rationale, for its existence. The FSA has a couple of other aims, one of which is to encourage competitiveness in the United Kingdom. This, incidentally, suggests to me that the FSA would encourage us to look at how other people do things.

The paper talks about pricing teams within banks, and notes that, not surprisingly, they focus on pricing. However, one aspect of their role, less well covered in the paper, is that of hedging. Indeed, the idea of hedging is very important to them! If you cannot hedge something, then, maybe, that alters the price which you are prepared to put on it. In this respect, hedging and pricing are two sides of the same coin.

There is something for the mathematicians among you in terms of the paper's comments on mean-variance analysis. However, it asserts that this technique is never mathematically appropriate when the distributions are not jointly elliptical, which is not true if the utility function is quadratic. The paper also claims that market risk is 'secondary' to admissibility issues for insurance companies. Clearly, there are instances where admissibility issues are important, but, in my experience, typically, market risk is the more important, particularly if market risk is deemed to include earnings at risk.

I now focus on whether the framework within the paper is going to be one which will work well in the coming years. What do I mean by the 'traditional' actuarial approach? Actuaries come up with a range of scenarios, and they build up some kind of probability distribution describing the likelihood of future events. It is typically based on looking at what has happened in the past, and inferring from that and some common sense (otherwise known as 'actuarial judgement'), what might happen in the future. It is more mathematically focused than governance focused. Although there is a wide range of different skills which actuaries can bring to the table, most have a relatively mathematical background.

I will let you into secret. Not everyone believes that actuaries are the best thing since sliced bread, and that they know everything about risk management! Not everyone holds actuaries at quite the high level of esteem which we would like them to, or, perhaps, they ought to. You need to be aware that there are ways of approaching risk management other than the typical actuarial paradigm just described.

When I tried to figure out how to highlight this in the context of this paper, it seemed to me best to skip, mentally, all the material in the paper between its observation that there is a link between risk and capital and the view that maybe not everybody thinks that actuaries have everything right. It seems to me that this is the key. Is the way in which actuaries focus on the link between risk and capital, when following the 'traditional' actuarial paradigm, the same as how others view this link? If not, who is right?

I presented a paper to the Institute of Actuaries (Kemp, 2005), which tried to explore this topic further. In effect, I argued that, when you focus on the link between risk and capital, you are driven towards what I described as a 'market consistent' risk management approach. The underlying idea there is, instead of looking at what you believe is going to happen, you look at what the market believes (or prices) is going to happen. I have previously touched on the link between pricing and hedging. The less that a risk is hedgeable, and therefore the more difficult it

is to form a view as to what the 'market' thinks of it, maybe the less you will be interested in taking that risk on board.

There is already a substantial body of risk management which occurs, which is very focused on market consistent analyses, projections, distributions, etc. It is hinted at in ¶8.1.1, which refers to other parts of the financial services industry seeming to place more attention on 'market consistent' risk management than actuaries do.

The author has mentioned collateralised debt obligations (CDOs). What has struck me most about CDOs is that they can, in theory, have any sort of underlying risk and still convert it into a credit risk form. A CDO is a structure where you have some assets and you fund them with something else. You issue pieces of paper which have a different priority. So, the underlying CDO concept does not need to be limited to debt. Instead, it encompasses collateralised loans (CLOs), collateralised equities (CEOs) or even collateralised funds (CFOs). Indeed, with a little bit of balance sheet manipulation, you can repackage practically any type of financial institution whatsoever, and think of that as being equivalent to a suitably defined CDO structure.

As a result, when you try to gather together a coherent framework which looks at every type of financial institution, you need to take into account the way in which your framework would handle a CDO, since it is prototypical of any type of financial institution.

Therefore, one of the things on which I would have liked the paper to have put more focus is the importance of priority ranking within the capital structure. This is the underlying building block on which a CDO is based.

For example, why might I want a higher priority ranking? Clearly, because it is less risky, but what does this mean in terms of the price at which I am prepared to transact and to trade that risk? How ought this to influence my modelling and managing of risk?

REFERENCE

KEMP, M.H.D. (2005). Risk management in a fair valuation world. *British Actuarial Journal*, 11, 595-725.

Mr D. M. Pike, F.F.A.: The author stated, in ¶1.1.1, that his purpose was to assess the techniques available for financial risk management and to discuss the use of these methods.

The paper is a valuable overview of just how wide the available techniques for risk management now are. I approve of the author's approach of looking first at the users of risk information and their needs, which is exactly the approach which the Board for Actuarial Standards has just taken in a recent paper in the development of its conceptual framework.

When I reached the end of the paper, the conclusion seemed rather sweeping. It said that many actuaries already have the skills and knowledge necessary for a broader range of risk management activities. However, the preceding paragraphs appear to lead readers to the conclusion that, for instance, pensions actuaries have much to learn from banks on credit risk, and so on, before they can model and manage the risks of pension schemes. It might be fairer to say that actuaries already have the skills to acquire the knowledge and techniques in the future.

I was interested in the use of the Basel/FSA categorisation. The author started to use it in Sections 4 and 5, but seemed to find it difficult to carry it through to the risks of insurance and pensions. It is useful to have a categorisation scheme when you are identifying risks, and the FSA scheme is as good as any for that. Once the risks have been identified, is it worth pursuing this particular categorisation scheme when approaching the modelling and the management of the risks?

On a technical point, ¶6.2.14 states that the VaR and the expected shortfall are special cases of spectral risk measures. I have not read the Acerbi (2002) paper, but my understanding, based on Dowd & Blake's (2006) paper, is that, because the VaR lacks the property of monotonicity, (that is that the total portfolio should be less than or equal to the sum of the sub-portfolio VaRs), then the VaR cannot be a spectral risk measure, whether or not it is weighted by a risk aversion function. I would be interested if the author can explain that.

Mr T. J. Birse, F.I.A.: I support the author's conclusion that actuaries have the skills to work in this area, and therefore I take issue with the previous speaker. We are currently looking at how we can build more about risk management into the syllabus. When we look at the substantive subject, which is CA1, we find that several of the techniques of risk management are there already, albeit in slightly different words and order than one might use if we were driving that subject through a risk management approach. There is not much new material which actuaries need to learn, however, we might have to re-order our thoughts slightly.

Like some of the speakers, I am very keen on the absence of equations. One issue which was touched on in the paper, but has not yet been covered in the discussion, is operational risk. The banks go into quite a lot of detail about the other risks with lots of models, and then add a percentage on the top for operational risk. In the work which the FSA has been pushing insurance companies to do for their ICAs, we have done much more operational risk analysis, but it is still very much the actuarial judgement or the applied commonsense which comes in there. If you are going to apply extensive commonsense on top of the calculations, what real benefit do you get from doing a huge amount of work on detailed numbers lower down?

My final point is a cautionary warning to actuaries of my vintage. In the work which I have seen covered on this topic, actuaries know that they are supposed to start with best estimates and then apply risk margins and risk analysis techniques, but their best estimates are: "This is a best estimate, which is on the prudent side, because we have always been prudent." We need to be aware of that. If we are talking about a best estimate, we have to be open, and to say that the risk of deviation in either direction is 50% one way or the other, and not: "This is our best estimate, but we really assume that it will go wrong in only one direction."

The President (Mr N. J. Dumbreck, F.I.A.): Just to add a couple of comments to what Mr Birse said about the education developments. Certainly the Education and CPD Board is looking at revamping the syllabus for the Core Applications Concepts subject, to include more specific risk management material, or at least to present it in a clearer format. The U.K. Profession is also participating in an evaluation of a possible global actuarial risk management qualification, which is being studied in conjunction with a number of other actuarial bodies from around the world, though mainly, at the moment, the English speaking world.

The aim is to produce a global qualification, which can be achieved by sitting a sub-set of the Institute and Faculty examinations, concentrating on risk management topics. It is only at the evaluation stage, but I hope that there will be more news on its progress before the end of 2007.

There are also plans to introduce a specialist risk management option at the specialist-applications and specialist-technical levels. So, there is quite a lot of focus on improving actuarial skills in the risk management area. As that proceeds, it will be important to have input from people like the opener, so that we do not look at it from just a traditional actuarial perspective, and that we recognise what is going on in the outside world.

Dr G. D. Kaye, F.I.A.: I am the project leader of an enterprise risk management working party of the Society of Actuaries. Our aim is to create a beginner's guide to ERM, based on a list of frequently asked questions, and to publish the project's results on a website.

To help us succeed, I would welcome your 'frequently asked' questions, but with a supplied answer as well. We have set up a dedicated e-mail address: erm@gaaps.com. Once we receive an FAQ, we will track any changes which we make to it, seek the opinion of other specialists, and then return it to the person who originally submitted it, before going online. Obviously, once it is on the website and open to proper scrutiny and peer review, we will be happy to field other comments.

Mr P. Grey (a visitor; Head of Operational Risk, Cooperative Financial Services): I am not an actuary, but I work in operational risk. I am the bridge between the actuaries and business, to some degree.

One of the challenges about enterprise risk management is how we look at all the different risk categories, when you have risks, which are displaced from one category to another. For

example, how often does an operational risk cause a credit risk event, or how often does a default result in loss because the legal documentation is not robust enough? Similarly, how often do we outsource transfer risk, in terms of process or systems, to a specialist? Very often that can result in increased credit risk in the event that the supplier defaults or goes bust, and we lose the services.

That is where, if we can integrate the measurement of those types of risk across risk categories, we will add value. At the end of the day, the business wants to understand what risks it is taking, regardless of what risk categories they are in.

In terms of capital as a driver for operational risk management, if we focus on putting operational risk figures in, a few percent here or there, then why bother with all of the work? The real benefit, from the business point of view, is understanding what risks it has, day-to-day, and how big or small those risks are and how probable or not they are to occur. This reflects the different nature of operational risks — there are two dimensions:

- the total impact of a risk occurring with a ½% probability may be quite large and on the tail; and
- from the business point of view, it is really the probability of the risk occurring with a much smaller impact, which people tend to manage day-to-day in terms of profit and loss. This is going to drive the predictive and the detective controls, but not necessarily the mitigative controls, because that is when the event occurs. So, even though the tail events may still be very high, what it is trying to do is to reduce the probability of the event.

So, the most important issue is: “Does the business know what risks it takes?” The capital numbers are a secondary benefit.

Mr A. J. Toole: Two areas from our discussion stand out for me, and can be addressed simultaneously: firstly, many risk practitioners have a more market-consistent, perhaps even a ‘gut feeling’, approach to risk management than the traditional, mathematical actuarial methods; and secondly, not everybody loves and respects actuaries quite as much as we do!

So, perhaps the Actuarial Profession does need to take a more governance-based viewpoint to risk assessment. It is also possible that, in order to improve the perception of us as a profession, we need to be more proactive in marketing ourselves.

These two suggestions are not hugely controversial, and they complement each other. Would others not be more receptive to actuarial input in the risk arena (and to actuaries working in other fields too) if we move, however slightly, towards a more governance-orientated basis when looking at risk?

Mr D. B. Duval, F.I.A.: I would have liked more on stakeholders. The Figure 1 diagram is fascinating. I do not agree with how the author has allocated everybody in each of the individual cases. However, I recommend the intellectual exercise in any situation where you are advising: work out who all the stakeholders are; in which box you would put them; and why.

Because much actuarial work has been in areas where rights and obligations have been unclear, the basic message from actuaries 40 years ago was: “Actuaries do the right thing. My successor will do the right thing in 40 years’ time — whatever that might be.” That may have worked well then. More recently, it certainly has not. Consider the way in which orphan surplus has developed, or the way in which the benefits in pensions have moved from being objectives to guarantees. If you look at Figure 1, some of the stakeholders have moved boxes during the time of their relationship with an institution, without being asked, and normally without even being told.

At one time, with-profits policyholders fell into the ‘provider of equity’ box. More recently, they have probably been treated far more as customers; and, if you are a customer in an institution which is not trying to sell new business you may be badly treated because there is no incentive for the institution to treat you any better.

There has also been a lack of clarity about who bears operational risk. The biggest operational risk cost which we have seen was pensions mis-selling. Which stakeholders were hit

by that in each company? It certainly was not in accordance with any previous plans or agreement.

There are two key issues. One, which the opener brought out, is what is the priority of claims? This is quite important. The second is where does the power lie?

Life companies and defined benefit pension funds are pretty similar institutions in many respects. However, there is one massive difference; who appoints the people who run them and what their objectives are. In a life company it is clear; the shareholders appoint the directors who run the company. In a pension fund the appointment of trustees is a more complex and arcane process. Therefore, the behaviour of the two institutions at the governance level is entirely different. It is not just what people's legal duties are, it is who appoints the people making the decisions.

The previous speaker and the opener asked whether actuarial risk models are consistent with pure market driven models. This is particularly interesting with risks which float in and out of being in the market. Reinsurance risk is placed in listed markets, for example through catastrophe bonds, but this is a tiny proportion of the amount of catastrophe risk actually placed. Really, catastrophe bonds only come up in a big way when the reinsurance market has run out of capital. Most of the time, nearly all catastrophe risk goes through the reinsurance market which behaves differently, and prices risk differently, from listed markets.

We may be seeing something similar with mortality. Currently, almost all mortality transfers are priced on actuarial models — theoretical models, of one form or another. We might be seeing a market model develop, and the market does not have to be logical, indeed there is no reason why it should be. It has to be arbitrage free, but it does not have to be logical beyond that.

Mortality is an interesting example in other respects. The paper recommends 'holistic risk measurement'. This is vital for institutions as a whole, but if you are trying to do pricing, holistic risk becomes much less important. Just as for pricing, mortality is probably best just looked at as a single issue, in depth.

Can actuaries do this? We can, but not if we are frightened of equations. The one skill which actuaries have to offer in this area is mathematical proficiency. This paper does not need equations, because it has references to all the relevant mathematical papers, but if practising actuaries are not comfortable with equations, there is no point in using them for risk management.

The President (Mr N. J. Dumbreck, F.I.A.): One of the comments which the author made in his introduction was that sponsor credit risk for pension funds can be measured by actuaries. As I understand it, the Pensions Board took a contrary view on that subject, and concluded that sponsor credit risk was really not an area where the profession had a great deal of knowledge, and that we should really leave it to the experts, the rating agencies, accounting firms and others, to do that sort of work. Is this an area about which the author or anyone else would like to comment?

Mr Sweeting: My view is diametrically opposed to the Pension Board's view. If you have a very large complex institution and you want to measure credit risk accurately for the purposes of a bondholder, the bondholder is going to be relying on the credit rating to see how likely he is to get his money back at the end. Then a credit rating agency can add a great deal to the discussion, with the covenants on the debt, the various priorities, the different forms of debt, looking at how likely it believes that a firm would want to default, looking at its motivations and so on.

If you are looking at a smaller firm, the chances are that the rating agency is not going to be able to do that for a reasonable fee. You are going to be able to come up with about as good an answer by doing something quantitatively, by looking at things like financial accounting ratios. Importantly, whatever the credit rating agency does, the chances of it taking into account the asset allocation of the pension scheme or even the interest rates and the liabilities is pretty much nil. That is a really important point when you are looking at the credit-worthiness of the sponsoring employer. If you have a sponsor whose credit-worthiness is very closely tied to the equity market, this has to be taken into account when looking at the size of the sponsor covenant

— how much you would like that sponsor to put in and at what point. Anybody not taking that into account is likely to underestimate seriously the amount of risk being taken. If you look at the pension schemes in the U.K., there are few of them where the sponsor is large enough for it to be worthwhile and cost-effective to get a credit rating agency to look at the strength of the business model and that particular firm's expected profitability over the next few years. In many cases the money could be better spent by putting it straight into the pension scheme.

Mr Kemp: My view is that in any such area you would be wise to take into account your own business risk. Maybe the Pensions Board is reminding actuaries that claiming competence in areas where you think you might have competence, but in fact you do not, is itself risky for the wider Actuarial Profession.

For example, there is clearly a link between what actuaries do and what credit rating agencies do, but none of them are necessarily going to get it right all the time. Recently, one of the major credit rating agencies has created an issue with an idea which it developed in the context of implied sovereign guarantees. They changed the ratings which they assigned to a number of banks to take into account the perceived likelihood that the sovereign state would support the relevant bank if it got into trouble. This led to huge changes in the ratings of a relatively small number of banks. The rating agency was quite open in explaining its logic, but, subsequently, market participants appear to have said publicly: "This does not make a lot of sense", and the rating agency in question has apparently largely reversed its previous rating changes (despite having previously argued that it was right to make the earlier changes). As a result, it may lose face.

It seems to me that credit rating agencies have the luxury that such events are unlikely to affect their business, long term. The entities in question are unlikely to go bust while the rating agency sorts things out in the meantime. However, it does appear that this is a lesson in the risks of potentially getting it wrong, even if you craft seemingly well-reasoned arguments in favour of your stance. What if there was a liability claim on the back of such advice? Typically, actuaries do not have the luxury of the kinds of balance sheets which I cover, and those which some of these other players may have.

So, I suspect that the Pensions Board was making the point that, while actuaries might be able to contribute to this debate, they need to think carefully about their own business risk when so doing.

Mr N. R. Bankhead, F.I.A.: One issue which comes out, and, probably, it is relevant to pensions, is the comment in ¶2.1.7, which states that the interests of debt holders are protected by the Financial Reporting Council, which is my employer. It is an interesting assertion. When you read the work done by the various boards, you find that the Accounting Standards Board starts by looking at the various people who use accounts, and recognises the existence of a number of stakeholders, but concludes that it will prepare accounts from the position of the equity shareholder. That is how accounts are prepared, and that is what is audited.

That, in itself, drives at some of the problems which then go into the question of looking at sponsor covenant. In fact, a pension scheme is broadly in the position of a debt holder, yet accounts are prepared on a going concern principle.

One of the big questions is then: "How do you convert the financial information which you have, which is a going concern, and try to look at potential recovery if that is not the case?" That requires you to do a great deal of work, which is not directly statistical. It requires you to know a lot about finance.

When I did some work in recovery, I found that you needed to know how businesses are likely to be sold or to be disposed of when in that position. There were often two approaches, one of which tended to be referred to as a pre-pack sale, where the insolvency practitioners managed to sell the business as a going concern, which would give you a higher value, and you get a lower value if you are reduced to selling the assets.

It is quite difficult for a pensions actuary to say: "I have that familiarity, so, for a going

concern balance sheet, this is how it will convert and this is the dividend distribution which will then come through to the pension scheme.”

However, it does lead to the question of information, the point which I was going to make, which, perhaps, ties in with what Mr Kemp said. The question is really the conundrum posed by this concept of the perfect market. What exactly is it? Is it the all-knowing market? Is it the perfectly processing market? If it is all knowing, why does it need any information for the term and the price? Does it not just determine price? Is that its role? Is it something which needs to be given perfect information to operate properly, so that it can determine price if it is given information along the way?

That leads to the question which comes up in accounts: “How is the market distorted according to where the information is given and how it is given?” It is well known that some information on the face of the accounts is likely to lead to a different answer when you convert it through to price, than if you bury it in the notes. A perfect market should not do that. However, if you follow it through and you take it to the area of risk, you then have to ask the question: “What is the market, and what does it need?” If it is pricing risk, does it need the answer if it is the determinant of price itself, or is it that it needs information? What it needs to determine price is some sort of reliable information, like accounts, which it can process when it is setting price. Then, what is that information?

That might answer the question which I think Mr Kemp referred to when he said that the market view of price is very relevant. However, is it actually relevant to the information which is given? That is the point which I wanted to raise.

Mr Kemp: Clearly, some markets are more liquid than others, and deeper than others. What I find interesting is the degree to which people take into account that depth outside the actuarial profession. So, referring to my earlier comments, the assumption that you know everything is a potentially risky assumption. The less easy it is to find out things in the market about a certain type of risk, the more people shy away from that risk in terms of trading it. Perhaps you can argue that actuaries have been bequeathed the task of handling risks which are not very well catered for by any other profession!

I do not want to knock the importance of our profession in terms of helping society and helping manage these less liquid types of risks. However, I think that it behoves actuaries to bear in mind that the risks which you cannot trade in the market are, by definition, less ‘hedgeable’ than the ones which you can. That, in itself, creates a risk, which, perhaps, we, as a profession, have not focused on as much as we might have done.

Mr M. R. Kipling, F.I.A.: My comments mainly relate to Section 4.

The author refers to anchoring as being the practice of basing a belief about the future rather too much on the continuity of the past. There are many examples of this which we can list easily. The overreaction to AIDS in the U.K. actuarial community is a good example of an opposite practice; namely, being a little bit too ready to believe in a new theoretical model.

In ¶4.6.3 the role of an employed insurance company actuary with regard to regulatory reporting was cited as an example of agency risk. However, such reporting, for U.K. life insurers, is now subject to audit, and is, in any case, the ultimate responsibility of the board. When taken with what I hope we can still class as actuarial professionalism, I am not at all convinced that this is a particularly good example.

In ¶4.4.5 I should like to take issue with the assertion that the main credit risk for insurers is inevitably reinsurer failure. Failure or failures following the occurrence of catastrophic or pandemic events may indeed be a serious risk. However, exposures in respect of financial reinsurances can often be collateralised. For some life insurers, at least, the credit risk from their corporate bond portfolios can exceed that from their reinsurance significantly.

In ¶4.4.6, while the financial strength of annuity buyout firms is indeed an important consideration for pension schemes considering buying out their liabilities, the Scheme Actuary assessing this option also has to bear in mind the cover provided by the Financial Services Compensation Scheme.

In ¶5.1.10 the author refers, quite rightly, to the possibility that the association between different types of risk is greater in circumstances of extreme stress than in normal times. However, one needs to question carefully whether this really justifies the description 'as it often is'. I recently had cause to look at the five years of the largest percentage falls in the U.K. equity markets since the start of the 20th century, and I found that they did not coincide with the five years of the largest percentage falls in long-term interest rates. Moreover, in only 31 out of 105 years did the two even move in the same direction.

Finally, in ¶4.2, the demographic risk of sickness, including critical illness and permanent disability, should not be overlooked. Indeed, permanent health business can act as an additional natural hedge besides annuities to pandemic risk in a life insurer's portfolio, both due to the death of claimants and to the release of reserves on death, especially for guaranteed premium business.

Mrs K. A. Morgan, F.I.A.: I work for a general insurance company, where I am an actuary, which is part of a group with a life insurance company and a bank. Over the past year I have spent some time getting familiar with the Basel II regulation. It strikes me that there are many similarities between general insurance actuarial work and, as the author mentioned, credit risk assessment, particularly in pricing. Consider, for example, a retail book of personal loans, looking at some of the rating factors which could be used, and the probability of default which is akin to a frequency of loss, and a loss given default, which is akin to the severity of a particular claim.

General insurance actuaries could be helpful to banks, in terms of looking at the exposure to bad debt, using some of the techniques which we use in assessing our exposure to floods, storms and so on, and also in setting reserves to bad debts based on past claims experience, past default experience, and linking that to the economy. There is definitely something to learn there.

Becoming more familiar with Basel II has been helpful in the work which I have done on Solvency II. This paper is very useful for Solvency II, because there is a great deal of thinking going on about how the new solvency regime will work across Europe. It is going to be very principles based; which is new to at least 26 of the E.U. member states. There is going to be a great deal of thinking needed around the internal models which will be used for assessing capital in life and general insurers in Europe, particularly as the FSA has started explaining to the U.K. industry that one of the main differences between Solvency II and ICAS is that it is models which will need to be approved rather than the capital figures. It is warning that most of the ICA models in the U.K., as they stand at the moment, will not be usable under Solvency II. This is obviously causing some panic. It is probably quite right that we should be reading this paper and thinking about how we can use this thinking, learning from one industry to another in terms of making our insurance models usable for Solvency II. The models have to be approved, as is the case under Basel II, so it is worth looking at what the banks are doing.

There are also going to be links with IFRS with the new accounting standards coming in. That is going to provide a link between Solvency II accounting and published information. So, there are many changes coming.

One of the things that Solvency II has not tackled very well, in my opinion, is the governance around risk management. The author mentioned enterprise risk management in the paper. It is really important to have a good risk management system, in order to do that and to bring all our risks together across the whole enterprise. One of the key things which we need is to have people who understand and believe in risk management, and also the appropriate culture. If there is a blame culture, then we are not going to get information about losses and near-misses, because nobody is going to admit to them. It is key that we do not have just systems for assessing capital, systems for assessing risk, but that each company which wants to introduce an ERM system introduces a no-blame culture or, my personal preference, that people are blamed when they start hiding things, and you sack them then, but not when they actually make a mistake.

Dr T. S. Bunch, F.I.A.: This paper is a good all round summary, but there are many embryonic

techniques out there, all with potential problems. So, I conclude that, in many cases, we would end up falling back on judgement.

One of the two areas of difficulty which I noted is the question of what is a best estimate. That has been referred to already. It is stated, in ¶5.1.5, about best estimates, that it would be helpful to define what we mean by a best estimate.

Another area of difficulty is the distributions which should be used for each risk type. There is a temptation to use normal distributions in the absence of anything else, but we all know that that can be quite dangerous, because the tails are not necessarily representative of extreme risk.

There is the question of how to allow for correlations between the different risks and distributions. The use of correlation matrices is quite common, but usually the parameters are chosen fairly subjectively. There is the difficulty of the modelling of operational risk. A great deal more work needs to be done on this to bring us up to speed.

Another point touched on in the paper is how to link risk and reward. There is some discussion in Section 6.4, of efficient frontiers, but they are highly dependent on the inputs, as was stated in the paper. They tend to force heavy weightings in the favoured asset types, that is to say the asset types which have the most favourable input parameters, unless artificial limits are imposed. As soon as you reach that stage, you fall back once again on judgement and subjectivity.

The opener drew attention to the fact that, where possible, we should use market price for risk, when hedgeable. We would probably all endorse that, but not all risks are hedgeable. For a non-hedgeable risk, we need to be able to work out how much capital we should be holding against the risk, and then to estimate what we expect the return on that capital to be. That is an important element of business planning.

For all of these things we need a real-world model, which then brings us back to the questions which I have just raised about what distributions to use, and so on.

Mr Sweeting: In terms of which statistical distribution to choose, it depends on how important that part of the modelling is. If it is absolutely core to the job which you are doing, it is over a very short period of time and you are having to assess your risk as accurately as possible, then you want to know exactly what the shape of the distribution is, which probably will not be normal. You want to know exactly what the shape of the tail of the distribution is and the dependency function between various other distributions, which, probably, will not be correlated, because you will have different dependencies in the tail and in the middle. That, to a large extent, is what many banks do when they are trying to model their risk on a daily basis, looking at Value at Risk on a daily basis.

If you are looking over a ten-year time horizon, trying to find the same sort of information is probably not going to be as feasible, particularly if you also have many 'unhedgeable' risks. If your asset-distribution risk is not necessarily going to be an overwhelming risk which dominates everything else, then you might be able to use less exact models, such as the normal distribution, as part of your modelling. There is merit for not being too exact in many forms of asset modelling. If you are, say, doing some asset/liability modelling for pension fund clients, and you explain in great depth in a 100 page document exactly how you have parameterised your asset model, they are going to think that the result is cast iron and rock solid, and often it is not. It is often as well not to over-parameterise or to over-complicate things, to make it clear that this is going to give, say, pension scheme trustees an indication of the level of risk which they are taking, but it is not seeking to be definitive.

In many cases, the numbers going into a model do not give an appreciably more accurate result using a more complicated approach than they do from using a higher level approach. That is important.

If you are using Markowitz's efficient frontier, then you are at great risk of having a portfolio change every time you change an expected return by a tenth of a per cent. There are a number of ways around this. One is to see what happens if you do change some of your results by a tenth of a per cent and then try to target the portfolios, which always stay fairly close to the efficient frontier rather than the ones which move from being right on the edge to being absolutely hopeless.

There are other ways in which you can look at efficient frontiers by doing some form of resampling, which I describe briefly in the paper. Effectively, what you are doing is allowing for some variability in the assumptions by looking at many fairly small samples. An alternative approach is that, rather than saying what assumptions we think are appropriate, we assume that the market knows what the right assumptions are, hence we take the market asset allocation as being efficient and then find the assumptions which will get that result.

Both those approaches generally come up with more sensible asset allocations than the ones which always suggest that you have 50% in hedge funds and 50% in commodities, which tends to happen if you use unconstrained Markowitz optimisation.

Mr Grey: Just building on the point raised by Mrs Morgan about Solvency II being principle-based regulation, one of the key challenges in developing models and making decisions is going to be around building corporate memory. So, that is how we interpret regulation, how we devise the model, what the model was intended to be and why, and having that documented, audited and stored somewhere. Over time, with the benefit of hindsight (if and when things do go wrong), that is when we are going to be challenged around why we did what we did at the time.

With organisational change and with limited resources, there needs to be a corporate memory to say: "We did this because. ..." As we improve and change models or rationales, we can then justify what we have changed and why. That is a wider point around matters of regulatory compliance, and why we need to do what we do. There needs to be some way of storing that information centrally.

The President (Mr N. J. Dumbreck, F.I.A.): I now respond to an earlier comment, when it was suggested that we ought to be doing more to advertise the profession's capabilities in this area. The point that, perhaps, we should be doing more to market the profession was a good one, but there is something of the chicken and egg about this. We cannot really market ourselves as experts in an area until we have acquired the necessary expertise.

The Actuarial Profession has come a long way in improving its understanding of risk over the past five years, partly thanks to the FSA and to the introduction of the ICAS regime, but I think that we have to admit that we do not know all the answers at this stage — 99½% VaR over a one-year time horizon probably is not the last word in sophistication. As the author mentioned in the paper, it does not necessarily capture the interactions between risks very well nor does it deal with non-linearity.

So, there is much more work which the Profession could do to improve its understanding of risk management. In some areas of risk much has been done already. Longevity is a good example, where there have been some very good papers, there has been some very good research done, but there is much which we do not understand, and there is more still to do.

It is interesting that a great deal of money is now coming into the bulk buy-out market, or has come into the bulk buy-out market, from investors wanting to take on longevity risk, and it is essentially actuaries who are being relied upon to make the assessments of these risks.

In other areas of risk management, I am sure that more needs to be done to improve our understanding. Certainly there is a lot of scope for further research projects.

With regards to advertising the profession, it is interesting to look at what the U.S. profession is doing in terms of branding. The Society of Actuaries has embarked on a branding campaign. Its slogan is 'Risk Is Opportunity'. Whether you like that or not, they have certainly put a lot of effort into positioning the actuarial profession as the profession that understands risk.

One of the things which they are doing is to champion some of whom they call 'the pioneers within the profession', those people who have moved from traditional actuarial areas into new types of work. These include putting profiles on the website, and so on. There is probably more which we could do in the U.K. to champion some of our more successful members, both in new areas and in business generally.

Mr P. K. Mayes, F.I.A.: I would like to add a cautionary note, which is that risk management

is not a perfect science. No matter which models one uses, it will always require some judgement in terms of the inputs which go into these models.

The benefit which we can add, as actuaries, is to communicate clearly to the users of the information that this is not a perfect science, other techniques need to be used along with quantification models. For example, using point of failure stress testing, developing a range of scenarios based on past events, and asking boards and risk management committees to think about future events, and illustrating these results alongside those of any model.

Mr Kipling (closing the discussion): I echo the many speakers who have thanked the author for producing such a comprehensive and accessible paper on the modelling and management of risk associated with financial institutions, especially, but not exclusively, insurance companies and pension funds.

Since the advent of the FSA Individual Capital Assessment regime, there can be few actuarial advisers to U.K. insurers who have not been intimately involved in modelling the risks outlined in this paper. However, even for them this paper serves as a useful checklist, to ensure that no material risks have been overlooked or have been inappropriately measured.

For those advising defined benefit pension schemes, and their sponsoring employers, perhaps there are more fundamental messages to assimilate. Whilst it is not necessary for either the fund or the employer to hold risk capital, it is surely useful for both trustees and employer to be aware of the level of capital which would provide the virtual certainty of benefit delivery, even if this knowledge is expressed rather in terms of an extreme maximum deficit to be funded.

As in any paper which covers such a wide range of substance and applicability, readers will inevitably find areas which the author could have covered in greater depth. For example, the opener would have liked to have seen more demonstration of the profession's prowess in mathematics; also more focus on the governance of risk. In particular, however, he wanted to challenge the apparent acceptance of the traditional actuarial approach, espousing, instead, the market consistent route. I agree. There are many among us who now regret the unhedgeable risks taken on by our actuarial predecessors. Let us hope that some lessons have been learnt.

According to Mr Pike, though, had the author extended his paper to cover every aspect of risk, it would have amounted to some 800 pages — rather beyond the upper limit in the Institute's guidance for authors.

Mr Birse then warned us of the spurious accuracy which may arise from adding broad measures, derived using applied commonsense to detailed technical results, from the more statistically tractable risks, and of the need to be careful not to add explicit prudence accidentally on top of implicit prudence.

Mr Grey reminded us of the educative value of analysing a business's risks, so that those in a position to be able to prevent them are aware of the risk exposures over which they have control. He later reminded us of the need to establish a corporate memory.

Mr Kemp and Mr Bankhead both addressed actuaries' abilities to assess the credit risk of individual firms and warned those attempting to do this to check their PI cover very carefully.

Information was a common theme in the discussion, especially information conveyed by the market price mechanism. The depth of the market is important, and Mr Kemp speculated that the actuarial profession's fate was to operate at the shallow end.

Mrs Morgan agreed with the author on the ability of GI actuaries to extend themselves to assisting banks in assessing credit risk, particularly where the credit risk arises from insurable (but not necessarily insured) events in the first place.

After a brief foray into the need for more education of actuaries on ERM and into the need to publicise what some of us can already do, Mr Mayes reminded us of the need for scenario analyses, informed by the whole management team.

One area where there could have been more depth is what, in the insurance company ICA context, has become known as 'non-linearity', as the President has mentioned. Paragraph 5.1.10 refers indirectly to it in the context of market risk, where the inadequacies of the use of correlation alone are rightly highlighted, especially, as Dr Bunch told us, if the correlation matrices contain a fair degree of subjective choice.

The use of copulas or other mathematical techniques is recommended in the paper. Whilst such techniques may work for specific combinations of mathematically tractable risk distributions, when it comes to the combined effect of economic, demographic and operational risks, a more practical alternative is currently needed. Practitioners are developing tools which seek to identify ‘least solvent likely events’ by iterative means. Essentially, these are multi-risk events, with the desired probability — for example, 0.5% — at which the combined loss is greatest.

For some risk combinations, the additional risk capital requirement compared to a simple correlation approach can be substantial. For example, if liabilities are closely matched against interest rate movements based on a particular set of demographic assumptions, the joint impact of an adverse change in demographic assumptions coincident with an adverse change in interest rates can be much more severe than the result of a simple combination of individual stresses using a correlation matrix.

Another area is risk appetite. Most financial institutions will have expressed risk appetites subjectively, sometimes expressed as the blindingly obvious, for example, zero appetite for fraud — although it should be noted that, in practice, its achievement could never be proven. An obvious objective measure is where the available capital of the bank, insurer or sponsoring employer is not exhausted, with a very high and enumerated probability. Less obvious, perhaps, are measures relating to maximum acceptable shocks to reported profits in any year or to a quoted firm’s share price (or to embedded value, which is similar). There may be different levels of appetite to different risks, depending on the exposure of the relevant peer group to the same risks. For example, some firms may consider that, to suffer reduced profits or reduced value from market shocks no more than proportionately to competitors, is less damaging than to suffer damage from a unique risk exposure.

Finally, the paper was focused very much on what, in Basel II, or in Solvency II, terms, we might term Pillar II, the firm’s own assessment of its risk exposures. However, there is, of course, a third pillar: disclosure. How does one ensure that the stakeholders described in Section 2 are sufficiently aware of the risk exposures of the organisation to enable them to make informed decisions on whether to maintain or to break (where they can) their financial relationships with the organisation.

Whilst one might hope that corporate investors are adequately catered for via the accounts and rating agency reports, and U.K. bank customers and insurance policyholders by the knowledge that their firms are required to meet the tough ICA regime (an assumption not always true, although failure for insurers may be observable only in retrospect, via disclosure in the FSA returns), pension scheme members are less well catered for.

It ought not to be beyond the wit of the Actuarial Profession to devise some simple measures which might enable scheme members to assess the likelihood that their schemes will be able to deliver their commitments (and how dependent they are on any discretionary decisions on support from the sponsors or on the limits to the stressed financial capacity of those sponsors).

Mr Sweeting (replying): There are three areas upon which I shall concentrate. The first concerns equations. There was one key reason for not including equations in the paper, that this paper was a brief overview of risk measures which already ran to 42 pages. What I also wanted to get across was a broad overview of all the areas which people are exploring, are using, and should be using across a wide range of different types of risk. If you look at the reference section of the paper, there is some really good material there, particularly the books. For instance, de Servigny & Renault (2004) on credit risk shows just how far the assessment of credit risk has come since the Altman score.

Another area which generated discussion was the skills which actuaries have. I am not suggesting that all actuaries can be fully fledged credit raters. I recognise the fact that there are already some actuaries who are fully fledged credit raters, who are working in credit rating agencies. However, much of the mathematics involved in looking at some of these other risks which actuaries do not already cover is not that difficult. There are many similarities between the risks which we are considering and the risks which we should be considering.

Going back to the corporate sponsor credit risk example, it is worth noting that, if we accept that if actuaries measure this risk consistently with the pension scheme asset risk, there are risks which those actuaries will be missing. Rating agencies are measuring sponsor credit risk at the moment, and there is one big thing which they are already missing, which is the risk within the pension scheme. I am not saying that actuaries can do it perfectly, but it is certainly an area where we ought to be getting involved.

The final area which I want to consider is the area of market consistency. It is absolutely desirable, when valuing assets and liabilities, to do so in a market consistent way. I like the idea of being able to package and to securitise as many risks as possible. In particular, I like the idea of trying to tranche risks out as well, so that you do not take just a single risk and start to market it as is, but you give people the choice of having a greater or a lesser degree of security within that particular risk.

It is worth recognising that it is not always possible to find a market-consistent price for risks. We have to fall back on less perfect, more judgemental, approaches. When you are talking about trying to value a risk, market consistency is important; however, if you are trying to price something and to decide whether to go into the market or not, or trying to decide how much to charge, then the price implied by the market is not necessarily the right price.

In the discussion, several comments were made about areas where I could have expanded the paper, and areas where I could have gone into greater detail, which is why it is particularly handy that this paper is available online in a Wiki format, which means that people can go online, edit the paper themselves and add their own comments to it. Everyone is invited to make any alterations or augmentations to the paper, preferably saying who you are, so that we can see who has added the helpful comments.

The President (Mr N. J. Dumbreck, F.I.A.): We have had a very readable paper and an excellent discussion. It remains for me to express my thanks and the thanks all of us to the author, to the opener, to the closer and to all those who participated in this discussion.