Life Office Valuation Evolution and the Actuary

 Part A
There are principles that underlie valuation, they are

> Basic principle
> Timing Principle
> Prudence principle
> Public Perception Principle
> Publicity Principle
> Stability principle

Valuation methodologies are actually approaches based on concepts which can differ

Solvency 2 is one such methodology

There are lots of others

Solvency 1 is supplemented by a basket of such methodologies applied piecemeal

Part B
Solvency 2 - Pillar 1 fails the Publicity principle as the 1 in 200 is not communicable

But the situation is worse than that because
- Financial structures are inherently unstable
- Institutions act in ways to make them homogenous which is good for them but bad for everybody else

Part C
Therefore Pillars 2 and 3 are necessary if we are to prevent another collapse like last year's' this time of the insurance industry

Therefore we need to keep our tool belt from Solvency 1 and use it in the ORSA.

And we need to not focus exclusively on Pillar 1 but build up supporting techniques, just as we have for Solvency 1.

Track 1 Introduction

The aim of this paper is to emphasise the importance of the Pillars 2 and 3 of the Solvency 2 process. When I first envisaged this paper, it was before the crash of 2008 but the warning signs were well visible. A crash was to be expected but the severity has surprised us all. The Pillar 1 approach to Solvency where we try to invent a formula that will apply in all circumstances, is doomed to failure which is why we have Pillars 2 and 3.

In recent days those working on CEIOPS have begun to establish what the calibrations should be and the weak tests of QIS 4 are being strengthened. This will reduce the dangers of the Pillar 1 but will not be enough by itself.

Ultimately it is how we use Pillars 2 and 3 that will determine the success of Solvency 2.

I must stress that the views expressed in this paper are my own and not those of my current employer or indeed any previous employer. I would like to thank all colleagues who have helped develop these ideas in countless discussions over many years. Particular thanks to Andrew Mawdsley and Sean Casey whose ideas I have stolen, Yvonne Lynch and Patrick Brady for help with the presentation and Bill Hannan for help on the paper.

Part A: A Review of the Principles of Life Office Valuation.

Track 2 These Principles we hold to be self evident

The title to this part is a steal from the 1952 Paper by Frank Redington (1) which was for many years the touchstone of Life Valuation. However the foundation of Solvency 1 was actually set down in a 1966 paper by Skerman (2) in which he laid down the following principles (as he called them).

*1. That the liabilities should be valued by a net-premium method or on
some other basis producing stronger reserves
2. That an appropriate zillmerized reserve would be acceptable in order to allow for
initial expenses.
3. Adequate margins over the current rate of expenses should be kept in
the valuation of the liabilities in order to provide for future renewal expenses.
4. That appropriate recognised tables of mortality should be employed.
5. That the valuation of the liabilities should be at rates of interest lower than implicit
in the valuation of the assets, with due regard to the incidence of taxation.*

Reading these it is hard to see how they fully proscribe solvency. Only one mention is made of assets and no consideration of credit risk, market risk or operational risk.

In fact Skerman is not setting principles, he is describing a method.

If we go to Annex 4 of the 1994 Regulations, we find a similar story for non-linked business. There is no need to set down the rules here; we are all familiar with them. Again they prescribe a method.

Curiously there is little on unit-linked in the Regulations. Practice has grown up of a Unit Reserve plus a Cash Reserve. There are other methods possible but as software has been developed to do Cash Reserves very easily, this method has predominated.

But are there deeper principles, ones that might be used to assess these methodologies? I believe that there are, and in this section I'd like to set down my selection.

Principle 1 The Basic Principle: Reserves exist to ensure that offices can pay the liabilities as and when they fall due.

This seems at first sight to be self-explanatory but consider a company transacting the same portfolio of business every year but growing each year. It could be writing unprofitable business yet be paying its current year outgo out of current year income, all the while accumulating greater capital losses. In short a Ponzi scheme. This is clearly not on so we need some matching of the assets in hand with the liabilities accrued.

Principle 2 The Timing Principle: The reserves set up must be sufficient to pay for the liabilities (both actual and contingent and also both monetary and service liabilities) already incurred.

On top of this we note that being insurance liabilities there is a distribution of values for both the assets and the liabilities. It is generally accepted that there should be a high probability that the reserves should be sufficient.

Principle 3 The Prudence Principle: The chance that Reserves are adequate must be suitably high.

Just how high is debateable. Actuaries are comfortable with the idea that distributions may stretch out to infinity and that there is therefore no way that one can ensure 0% chance of insolvency. Whether the public are happy with that idea is another matter altogether. I believe that there are occasions when the public will accept insolvency though in general they will not. This is given by the next principle.

Principle 4 The Public Perception Principle: Risks should be assessed on the basis of how the Public would perceive them, in retrospect, should the office fail.

If a company fails there are two possible outcomes. The Public may be baying for blood or it may accept that the company's failure was due to circumstances beyond that which might be reasonably expected. We are not expected to reserve for a second Black Death or an asteroid strike on Dublin.

Principle 5 The Publicity Principle: If an approach cannot withstand exposure to the public view, then it is not valid. Note that the public view is somewhat inclined to be jaundiced and cynical.

Principle 6 The Stability Principle: If a method leads to the financial system being unstable or pro-cyclical then it is dangerous.

The concept that profit should be recognised over the lifetime of the policy or in proportion to the risk undertaken while having some attraction in terms of measuring profitability is not relevant to valuation. Therefore I do not hold this to be a principle.

Some of these principles will be used later in the paper to critique some problems with Solvency 2. But first let's look at some more methodologies.

Track 3 Some Methodologies.

The classical methodology of actuarial science is the net premium valuation. This rather arcane technique restricted the future premium valued to that which would provide the guaranteed policy benefits. It has some nice mathematical properties if one has to do valuations without computers. It is also a useful way of releasing the profit part of the with profit business provided one is not investing heavily in equities. Use of book values for asset values and interest rates provides (an illusion of) stability. Prudence comes from using lower interest rates that are earned and from the gap between Office Premium and Net Premium (not from margins in mortality rates as the shape of the mortality table determines prudence not the level).

However, today the classical Net premium Method is rather outmoded and not used.

Turning now to the Solvency 2 model, it is based on economic concepts. One starts with the economic best estimate of liabilities. To this one adds the cost of getting somebody else to take the risks that one is incurring. So you have how much you would in theory need to get this business off your books and onto somebody else's.

Then one mentally projects forward one year and says well how bad could all my risk factors get in that year. You have to allow for this at the Var level of 99.5%.So in theory if that 1 in 200 set of events did happen you would burn up your risk money but still have the price of unloading the business in your pocket.

That's the theory and we are moving all Europe onto it. I will come back to this.

Meanwhile, it is instructive to examine Solvency 1 in more detail.

The basis of Solvency 1 is reducing the future flow of liabilities to a single figure. The flow of future premiums is likewise reduced to a single figure which is knocked off the value of liabilities and then compared against the market value of assets held. The Net premium valuation element is actually not in the Directive but was prescribed in UK and Ireland. Nowadays (apart from residual use on declining CWP books for a few companies) the use of Net Premium is arguably not in accordance with generally accepted actuarial methods. Prudence is satisfied by taking conservative assumptions in the basis. Interest rates are calculated from the assets held, with a cautious sort of RFR on new money.

One might characterise this as a valuation balance sheet method. It satisfies one of the old actuarial principles which was that provided you value assets and liabilities on the same basis, it doesn't really matter what economic basis you use. It is most definitely based on the assets that one holds at the time. The use of such a concept could lead to

over-investment in equities. It is also based on the concept of closure to new business at the valuation date no matter how unlikely that assumption is in practice. This satisfies the Timing principle.

To satisfy the Prudence Principle the Life Directives imposed a requirement that margins for prudence be added on every single assumption. This has been criticised (inter alia by me (3)) as not focusing enough on the risks actually incurred. So in some cases (in fact in Ireland most cases) it ended up being over prudent, but in some instances the prudence for a single big risk factor might be understated.

This defines the base product of Solvency 1 but is far from the whole story.

Unit linked business doesn't fit into this scene at all. On classic unit linked with no guarantees the reserves are taken as the sum of unit reserves and cash reserves (Sterling reserves if you live in Albion). The cash reserves are calculated by lifetime projection on a realistic basis (i.e. allowing for equity risk premiums). Lifetime is a totally different methodology than the valuation balance sheet method. One is tempted to wonder whether the lifetime method would have been used for non-linked liabilities had PC's been widely available when the rules were drafted. In fact some companies use lifetime projections for term insurance.

Then to ensure protection for the company against our marketing colleagues selling too much at unprofitable rates and making the company insolvent, we have to confirm that new business is being written at rates that if not profitable will not use up capital. This needs to look at profit tests of new business expected. Another method.

Then to protect against mismatching we are asked to carry out resilience tests. This is a stress test. Another method.

Then should we have investment guarantees, we are required (normally) to look at them stochastically. This would be stochastic life time projections.

And once every three years we need to do a series of projections for the FCR. These need to allow for new business for the whole period of projection, which is a fixed period not the lifetime of business in force. The projections are done on a variety of scenarios to illustrate sensitivity to various factors and conditions.

So one can see that we are using the following features in a number of different methodologies
>
> Valuation balance sheet numbers
> Deterministic Projections
> Stochastic Projections
> Closed to new business assumprion
> Open to one years' new business
> Open to several years' new business
> Stress tests
> Scenario tests

The most significant point about all this is that these have all been evolved over time to supplement the basic solvency 1 approach. We are about to take on a new method, raw and partially untested. Should we throw out all the other tools?

Part B: Welcome to the Black Parade.

Track 4 An EMO View of Finance

To the discerning music fan the choice of the acronym MCR for the Minimum Capital Requirement is somewhat Gothic as MCR really stands for "My Chemical Romance", the leading EMO band. Their third album is entitled "The Black Parade" which has always struck me as a good metaphor for the never ending and every more frequent series of financial crashes, collapses, bubbles and busts that our financial markets have become. So I have stolen the title track's title for this part. I think it's more fun than Black Swans anyway.

In this part I am going to discuss some reasons for these phenomena. I do not have a long list of these crashes from Tulipomania and the South Sea Bubble onwards. You can get these from Wikipedia (try "List of Stock Market Crashes").

Then I am going to have a go at Solvency 2 Pillar 1.

Track 5 This really is Rocket Science.

There are a number of explanations and theories why markets are unstable. I think that one can get an insight from some simple control theory applied to the theory of steering a guided missile.

One might imagine a missile that has been launched towards a distant target. After a time interval it will have strayed from the direct line between launcher and target. This will be picked up by the radar tracking and the missile steering applied to move it back to the line. The natural, intuitively obvious, way to do this would be to make the corrective action directly proportional to the distance from the desired line. This would lead to a differential equation something like

$$\frac{d^2 x}{dt^2} = -\omega^2 x$$

However this is the condition for simple harmonic motion and were one to program this into the missile it would weave back and forward across the target flight line and only hit the target by pure chance. The general solution being

$$x(t) = A\sin(\omega t + b)$$

The idea of value investing is to invest more in assets that are undervalued. So if financial markets do react in proportion to value propositions then the expectation would be that they would move sinusoidally.
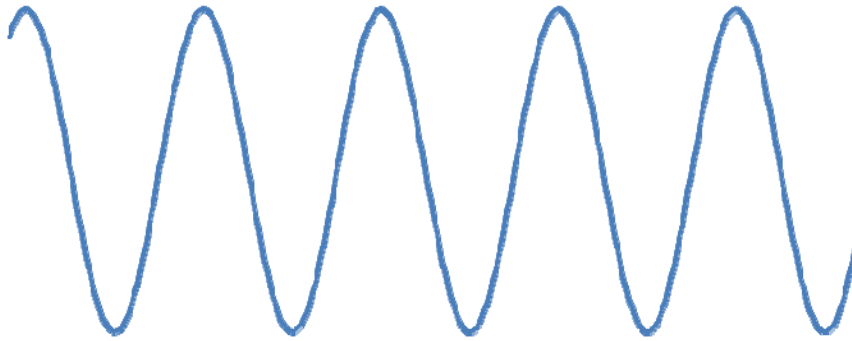
However if we add the first derivative into the physical world then we get air resistance or friction and a more complicated general solution.

$$x(t) = A\sin(\omega t + b)\exp(-t/T)$$

Which gives an oscillation that dampens over time.
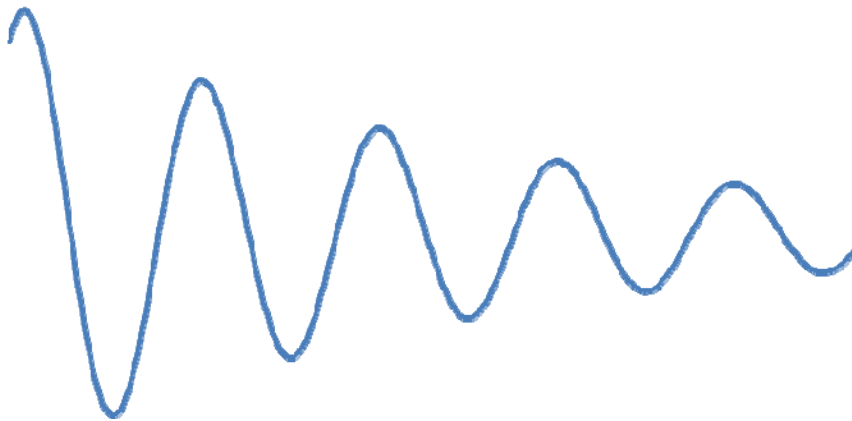
However, in the financial world how do systems respond to the first derivative? Is it not the case that when markets rise they tend to rise more and when they fall they fall more according to whether the predominant emotion is greed or fear. Therefore it is apparent that the decay constant in the second part of the general solution is negative and the oscillation instead of being damped actually lurches from side to side in greater arcs of movement.
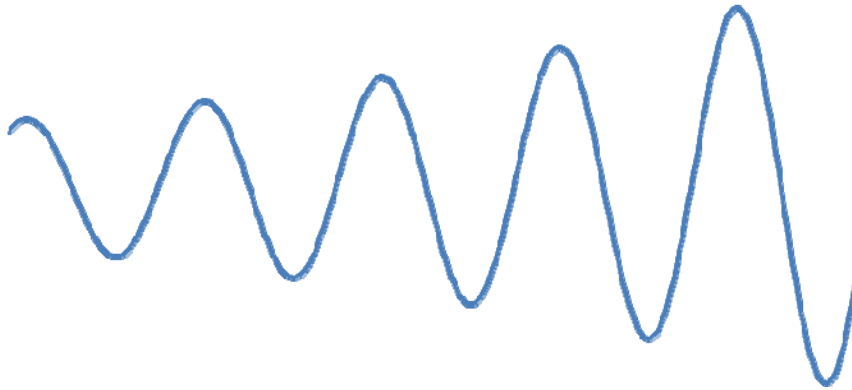
Of course this is arguing from analogy not rigorous analysis but perhaps you might want to consider this picture of the performance of the ISEQ since 1983. It bears an astonishing resemblance to the negative damping oscillation.

ISEQ 1983 - 2009
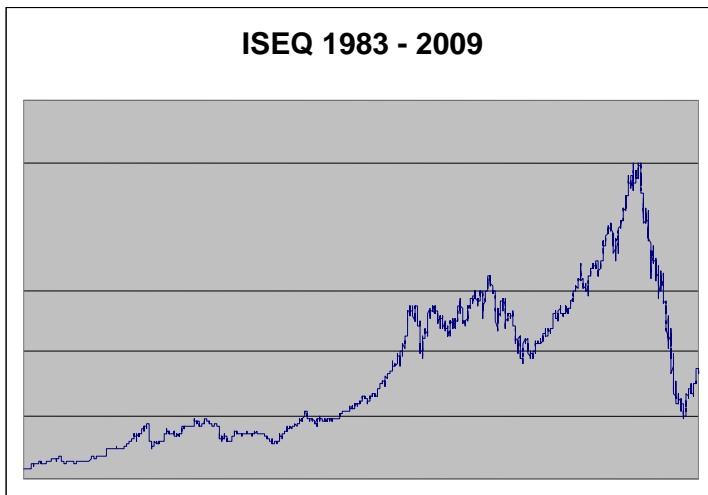
Track 6 More Doom and Gloom about financial markets

There are plenty of reasons to suspect that markets are unstable, unpredictable and far from rational or efficient. There has been a great deal of literature on this, much of it before the markets came apart last year.

Nassim Nicholas Taleb in the Black Swan (4) and Fooled by Randomness (5) has argued that we are inclined to under estimate randomness and the appearance of anomalies.

Mandelbrot in the Misbehaviour of Markets (6) has argued that the behaviour is actually fractal.

This might be summed as "events, dear boy, events" (7)

Then there is a whole field of investigation called behavioural finance which looks at the irrationality of the markets caused by the fact they are run by people.

Then there is the effect of feedback loops in which movements can feed on themselves. One example of this is the effect of defined benefit pension schemes being invested in equities. If markets go up the schemes show surplus. So pension contributions can come down. So profits go up. So the equity prices go up.

Of course the above also holds if we change up and down around.

Another applied to the Irish property market. We were building more houses. So we needed more people to build them. So we got them (from Poland and other Eastern European countries). These builders needed places to live. So we needed more house. So we built them.

Again the cycle is reversible.

All this is bad enough but it has all been around for a while. We are now aware of another effect which we might call the Turner effect. Financial Services has been a growing sector for many years. There are many financial products that did not exist a few years ago. But at the end of the day, are these services adding to consumer wealth or are they destroying it? In particular as the power of the financial services sector grows is it making the financial world more or less stable?

Lastly I would wish to challenge the influence that financial modelling has had. By concentrating on such factors as interest rates, equity prices and volatility, are we undermining the importance of underlying reality? Would we not be better off by considering that actually economies exist in a number of possible states (e.g. stable growth, bubble growth, freefall, low inflation, deflation, hyperinflation etc). We could consider these as Markov states with finite transition probabilities. This would give better awareness that some variables can go through periods exhibiting certain behaviours and yet in another period be quite different.

The Graph below, taken from IMF data, shows non-performing loan provisions over the last few years. It shows that the provisions do vary dramatically over time but that the cycle is scarcely predictable. Most importantly it shows that analysis over any short period is likely to be highly misleading.
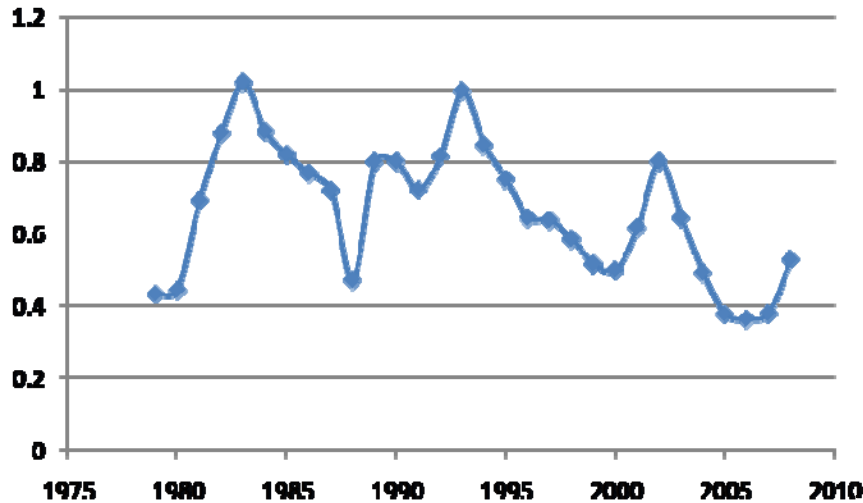
Track 7 Do you really mean it or Insolvency Too.

The methodology for Solvency 2, as described above, includes the concept that we have capital up to a 1 in 200 year event or VAR at 99.5%. At first sight this sounds very conservative but is it really and does it meet the principles listed in Part A?

In the UK there has not been a significant failure of a life company since the 1970's. However we have had the Equitable spot of bother. That was not even an insolvency but was deemed so critical that the whole Appointed Actuary system was ripped up and dumped. We know that we do not live in a no fail world but when we get a failure it is not acceptable. Recent events have probably made the public less tolerant of failures.

Actuaries and statisticians are inured to distributions stretching out to plus and minus infinity. The majority of the public are not. So I ask again are the public ready for this?

Let us make the assumption that the chance of failure (0.5% p.a.) is independent for each company in Ireland. Of course it s not but I will come to that later.

Then the number of companies failing each year will be given by the binomial distribution. We had 192 direct companies authorised according to the Insurance Statistical review for 2008. If we extend the category to include reinsurers we go up to about 350 companies.

This means that the binomial probabilities are as follows

No of Insolvencies	Chance for Direct Only	Chance for Direct and RE
0	38%	17%
1	37%	30%
2	18%	27%

3	6%	16%
4	1%	7%
5	-	2%

So this method means we are going to have failures 5 years out of 6.

So do we think this would fly? Or does it fail the publicity principle?

Of course companies' chances of failure are not independent, so let's look at that.

Track 8 The Fish and the Shoal.

It is a natural tendency in many animals to flock together. You can see this is many fish, many birds and in antelopes and other grazing animals. Clearly, it must bestow some evolutionary advantage. This may be that groups can look out for predators better. Or defend against them when they attack.

I believe that financial services companies tend to exhibit the same behaviour. They group in the products they sell, the way they price them, the way they assess the risks and the way they model them and reserve for them.

There are a number of reasons why this might be so.

- o Distribution outlets look for companies to ape their competitors
- o Marketeers likewise but more so ("me too, me too")
- o Shareholders demand that if another company is making money in one area that their company does likewise
- o When companies set parameters in reserving the regulators tabulate the markets assumptions and drive the less conservative towards the pack
- o Meanwhile the participants look at the same tabulations and move themselves towards the middle if they have been more conservative than the pack
- o Often the numbers of people who actually work in a particular zone of expertise are low and they are mobile
- o Or one particular consultant may be over dominant in a field
- o In a market the service may be price sensitive, driving to a common approach in many aspects to justify the market price.

I doubt if this list is exhaustive.

Now, for the market participants this flocking together does bring some safety. We can see at the moment that the bank bail outs are being forced on the national governments. In less extreme circumstances, it is a much more comfortable position for individual with their bosses if they are not taking extreme positions.

But what of the larger society? Does the swarming process convey an evolutionary advantage?

Right now it hardly seems so. It would seem that rather than having the shoal more observant of incoming problems, they were less observant being bolstered by not being out on a limb.

In addition, the size of the problems from all banks being in the same boat exacerbated the situation.

Furthermore, the size of the problem has come close to exceeding the resources of the state to deal with the problem.

But there is a worse problem. In some cases the accumulation of a shoal with common positions can lead to an opportunity for a market player. It is widely believed that in 2003 there was manipulation of the market by hedge funds to force life insurance companies to sell equities at too low values. Whether this is true or not it points to a danger.

The existence of the swarming effect could expose life offices to the possibility of being subject to manipulated. Solvency 2 is being driven as a maximum harmonisation initiative of the EU. This means that if the chance of manipulation exists it may well be exploited with very adverse consequences.

Even it this does not happen, swarming will be pro-cyclical.

Track 9 More Doom and Gloom about Insolvency Too

Solvency 2 is open to a number of other criticisms. Some of these were made by Nick Dumbreck in a presentation to the Society (8).

In QIS 4 the calibrations were clearly set too lightly. That is now being rectified, though some are arguing that the process has gone too far the other way.

Next the calibrations are done on an individual 99.5% VAR for each factor. Then a correlation matrix is applied. This causes three problems. Firstly the correlations are based on very sketchy data. Secondly it is the nature of crisis to produce extreme behaviour. The well known adage "in crisis, correlations go to one" (9) refers to the collapse of Long Term Capital Management but is valid for any crisis. Finally the way that risk factors interact may not be additive. The effective of a lower interest rate and lower mortality on an annuity may be worse than the sum of the two effects taken separately.

The 1 year horizon approach may conceal issues related to more long term effects. Trends in mortality for example may have more powerful impacts that short term variations.

The largest criticism that can be levied, however, is that the concept that providing a cost of risk margin means that the life office would actually be able to offload its liabilities. To start with, secondary markets in insurance business are patchy at the best of time. After a 1 in 200 event it is hardly likely that the price will still be same as it was before. There may be no market at all and given the natural swarming referred to above there may be lots of companies in the same position all looking for a buyer. That would put the cost of exit up, and there might even be no exit.

There is one particular problem that exists by virtue of not having a deposit floor in Solvency 2. This means that some policies will be assets (either actual assets or the cash reserves will be assets while the unit reserves are positive). This means that in extremis such a company could go insolvent simply by the wrong customers walking out the door. Is this in accordance with the Public Perception principle? How is the run on the bank scenario to be avoided? Could a company say our solvency (i.e. our having enough money to pay you your money if you want to exit) depends on the rest of our policyholders not wanting to go at the same time? Does it pass the Publicity principle?

Track 10 Summary of Financial Angst

If Solvency 2 just did what it said on the tin (i.e. 0.005 p.a. chance of insolvency) it would not be acceptable but matters are much worse than that.

- Markets are highly unstable and possibly becoming more so, so the 0.005 may be an underestimate
- Companies are highly correlated so the incidence of failure events will be less but will be multiple when they happen
- Solvency 2 is flawed anyway so that may put up the 0.005 some more

I told you this was an EMO section didn't I? Hold on it does get better.

Part C: ORSA's for Courses

Track 11 Cheer Up EMO Kid! (10)

So far I have been using the term Solvency 2 rather glibly but actually only talking about the Pillar 1 part of Solvency 2.

There are two more pillars in Solvency 2. Under Pillar 2 is the governance that life offices are supposed to be applying to themselves. Pillar 3 is the same but applied to the office by the regulator. They are trying to the same thing but from different points of view. I will not distinguish between 2 and 3 in this paper. The term Pillar 5 is being used for this situation

There is much greater scope for individual assessment and variation in the Pillar 5 than in the Pillar 1. In this section I give some suggestions of what should be considered. It is only a few suggestions hopefully others will put forward other ideas.

Track 12 The non-use Test.

If one wants to use an internal model instead of the SCR, one is obliged to pass the use test, which is a demonstration that the model is being used throughout the office and not just by the actuarial wizards.

This is fine but there is an opposite approach. When one has a model or method that is heavily used in a company, it can lead to unquestioning acceptance by virtue of familiarity.

It therefore makes sense to on occasion throw a few tests at the company's situation which are not used in the normal run of events. These should be stress or scenario tests, ideally of a straightforward nature.

Some suggestions
- o If we made mortality different for large polices only
- o Could we withstand 1919 Flu
- o How about an old fashioned resilience test
- o Can I stand a 3% increase in inflation, allowing for management actions
- o What happens on each portfolio of reinsurance should the reinsurer fail?

I would suggest talking to non-professionals for some ideas on these scenarios.

Track 13 The Abuse Test

For companies that rely on dynamic actions in any way, it is well to reflect on the issues I raised in the Fish and Shoal. Would your company be able to sell or buy certain assets in certain circumstances? Are other companies in the same position? In which case is it possible that you might be gamed/manipulated by speculators/hedge funds.

In short are you potentially a victim of abuse?

If you are, it would make sense to think of ways to avoid this. One possibility is to ensure that the other members of the shoal fall victim before you do. Hold a little more capital than they do and you might be able to avoid the forced trade when they cannot.

Of course it would be immoral to mislead your competitors about your trading position in order to line them up to be the first to go!

Track 14 The use it or lose test

If you are dependent upon management actions then it is essential that the actions are not going to be bogged down in inaction. One should look askance at promises of the order of "well if equities really do fall X% then we would sell them".

Such concepts need to be backed up with procedures that can be acted on without seeking extensive authorisation. In the depths of a fall some people will think that the market is absurdly undervalued and it is crazy selling out now. They are usually right, but that is no consolation if you are actually insolvent.

There should be active monitoring and defined trigger points and clarity over the call, especially about who makes the call when the person who makes the call is not there.

Track 15 The Losing Policyholder Test

In Track 9 above I noted that capital provided by future earnings of policies that can be lapsed (i.e. the policy reserve is less than the deposit floor).

It would make sense that a quasi liquidity test be performed to ensure that the office can indeed pay the policyholders their money.

In this context it should be noted that CP 46 proposes that capital created from holding less than the surrender value in this way should be classified as Tier 3, which would make it not available to meet the MCR.

Track 16 Summary.

I am very conscious that I have not proposed many tests. In Part A I demonstrated that what we call Solvency 1 is actually an accumulation of many tests and methods built up over a period. This is what will need to happen under Pillar 2 of Solvency 2.

The maximum harmonisation approach may cause amendments to Pillar 1 to be quite difficult and probably slow. The Groupe Consutatif's proposals for professional guidance may help. But I suspect that more judgement is going to be required from heads of actuarial functions. This will be particularly important for offices using internal models.

The aim of reserving and capital assessment is not to minimise required capital. Having high capital requirements is not a punishment for insurance companies for having Solvency 2 coming after Basle 2. Increasing required capital may decrease the value of the limited liability put option, but that is a form of theft from policyholders. More significantly Porter (11) would argue that the higher the barriers to entry, the higher the return earned in an industry.

Our task as actuaries is not to just press the buttons of the new Pillar 1 Solvency 2 methodology, but to use all the tools that we have learned over many years to continue to manage risks and solvency.

Appendix References

(1) FM Redington; "A Review of the Principles of Life Office Valuations": JIA 78 1952

(2) RS Skerman; "A Solvency Standard for Life Assurance Business"; JIA 92 1966.

(3) A. Jeffery; "Generalised Solvency principles"; SoAI 15.05.2001

(4) Nassim Nicholas Taleb; "The Black Swan"; Penguin 2007

(5) Nassim Nicholas Taleb; "Fooled by Randomness"; Random House 2004

(6) B.B. Mandelbrot & R. L. Hudson; "The (Mis)behaviour of markets, A Fractal View of Risk Ruin and reward"; Basic Books 2004

(7) Quote from Harold Macmillan when asked what the greatest challenge was for politicians.

(8) N Dumbreck; "Recent Risk management failures in the Financial Sector"; SoAI Presentation; 15.4.2008

(9) R Lowenstein "When Genius failed, the Rise and fall of Long Term Capital management"; Random House 2000

(10) A sticker on the back of a road sign by the Bridge of Orchy, spotted by the author in the middle of the West Highland Way (it's a bit remote round there).

(11) M.E.Porter "Competitive Strategy" Free Press New York 1980