

Pitfalls in the New European Orthodoxy

REFERENCE 211
AUTHOR Tony Jeffery
TITLE Pitfalls in the New European Orthodoxy
TRACK Life Insurance (IAALS)

Synopsis

The Solvency 2 regime which is to be introduced across the EU from 2012 is based on the same concept that underpins the UK ICAS regime. This concept is that risks can be priced and sold at that price. By holding capital sufficient to absorb losses until a sale can take place a company fulfils its obligations to policyholders for solvency.

This has become the New European Orthodoxy (NEO) and is being applied to the calibration of the standard formula SCR (the Solvency Capital Requirement). Companies have the option of producing internal models to calculate the SCR as an alternative to the standard formula. It is clear, however, that these are based on the NEO.

This paper will explore ways in which NEO based models may not accurately reflect solvency threats to life insurance companies. In particular the threats from

- a) The short term nature of financial markets being different from the medium (modelled) term
- b) The long term nature of demographic variables being different from the medium (modelled) term
- c) Inherent bias towards stability under NEO
- d) Convergence of models causing systemic risk.

This paper will be building on my paper “Life Office Valuation Evolution & the Actuary” presented this October to the Society of Actuaries in Ireland.

<https://secure.actuaries.ie/web/events/2009/10/life-assurance-valuation-principles-now-and-tomorrow>

Please note that the paper represents my own views and are not necessarily the views of my employer.

1. The New European Orthodoxy (“NEO”)
 - 1.1 The EU is in the process of developing adopting and implementing a radically new approach to regulating Insurance Company Solvency called Solvency 2.
 - 1.2 Solvency 2 is intended to have universal application across the EU. It will apply to life insurance companies, accident, health, property and all forms of non-life companies and to all reinsurance companies.
 - 1.3 It is a “maximum harmonisation” directive which means that the same rules (no more and no less) apply to all insurance companies in every EU member state. This is a contrast to the current environment where there is a list of rules that must be applied but member states are free to apply additional rules (no less but more are permitted).
 - 1.4 Solvency 2 includes many requirements for Governance and Control of insurance companies but the part of most mathematical interest to actuaries is the approach to Solvency Capital. This is based on a philosophical argument which is as follows:-
 - a) Companies should hold assets to cover technical reserves
 - b) In addition to that they should hold the market value of any options or guarantees given by the company
 - c) In addition to that it should hold solvency capital equal to or greater than the amount that the technical reserves would move by at the 99.5% VAR outcome over one year. This may be calculated by reference to standard measures or by use of an “internal model”
 - d) Therefore unless the outcomes are more severe than 1 in 200 the insurance company should have at the end of the year sufficient assets to be able to pass the risks onto a willing buyer.
 - 1.5 This is a powerful generalised approach with the virtue of separating out the best estimate technical reserves from solvency capital and also gives a criterion for assessing how much solvency capital is needed. Although many aspects of the Solvency 2 regime are being fiercely debated, this approach has attained general acceptance across the EU. Therefore I have christened it the New European Orthodoxy or “NEO”.
 - 1.6 However, like all generalisations it should be approached with caution. For example, there are very few insurance risks in which a market sufficient for pricing the cost of holding risks exists and so the NEO substitute is based on the cost of holding capital, which may not be sufficient. Moreover, the experience of late 2008 is that when troubles come they do “*come not single spies but in battalions*”(1) and therefore if a company needs to close out its liabilities it may not be able to do so. There are other issues, but it would not be right to point out deficiencies in NEO without looking to its advantages. In any case the debate in the EU is over, NEO is the basis.
 - 1.7 However Solvency 2 does require a back up mechanism. Insurance companies are required to carry out an “Own Risk Solvency Assessment” (ORSA) and Regulators are required to carry out a Solvency Review Process. This has acquired the name “Pillar 5” (it is the sum of Pillars 2 and 3). It is in this back up process that one can try to ensure that companies do not fall into the pitfalls that may exist in blind adherence to NEO.
 - 1.8 This paper presents some areas for examination in that process. The aim being to frame some questions to be addressed as part of the Pillar 5 process.

2 Equity markets

- 2.1 The behaviour of equity markets has been extensively modelled and debated. One could hold a whole Congress on this subject alone and neither exhaust the subject nor reach final conclusions. However it is possible to come up with some statements that might be largely accepted.
- 2.2 Firstly is that equities returns are **not** distributed log normally. Despite that it is normal practice to use Black-Scholes as a transformation between option prices and *market implied* volatility. This is sensible if all one is doing is transforming from one measure of a market to another. However even at this limited use one ends up with a volatility “smile”. One might regard this as a euphemism for the formula failing to fit the observed curve.
- 2.3 However one frequently meets log normal in insurance stochastic models. Does this matter? It may not, after all if the market implied volatility is obtained by applying a log normal model to observed data, then reversing the process should lead to a reasonable answer. I would, however, suggest that this is only valid if the insurance option is similar to the market option.
- 2.4 The second aspect that I think universal agreement can be reached on is that time scales do matter. Market behaviour on the large scale may appear to be a continuous line but at the smallest scales it will appear as a series of jumps.
- 2.5 A simple experiment to demonstrate this is to look at the ISEQ (Irish Stock market index). The ratio of the variance of the monthly returns divided by the variance of the daily returns is about two thirds of what one would expect if the monthly was a simple sum of the independent daily returns.
- 2.6 In an article (2) Dr J. Doynne Farmer reviews various models of stock market behaviour and draws attention to how short term behaviour is different from long term e.g. *“the fact that the distribution’s shape changes with τ makes it clear that the random process underlying prices must have nontrivial temporal structure”*.
- 2.7 This issue starts to matter a great deal when one moves from evaluating options and guarantees that are approached passively to those that are supposedly mitigated by dynamic trading strategies. Even the assumption that a trade can be made at a future date at all, never mind at a particular price may be faulty. A classic example of this is the 1980’s technique known as portfolio insurance. The theory ran that one could ask a broker to buy a stock coupled with a instruction to sell if it fell below a certain percentage of purchase price. In the event a concentration of similar approaches led the market to fall in a discontinuous manner on Black Monday in October 1987.
- 2.8 Insurance products that rely on such approaches include CPPI and Variable Annuities. At the Society of Actuaries meeting to discuss Variable Annuities James Hillman recounted the story of a VA company that had a well established dynamic hedging program. During the 2008 crisis it found that the delay of a few hours from market movements to analysis to planned trades to actual trades meant that its purchased hedges actually had negative effectiveness in the chaotic market.

THE PITFALL

Risks from the potentially highly erratic behaviour of financial markets over very short time scales may be obscured by more orderly behaviour in the model assumed for longer time scales.

AVOIDANCE

It is unlikely to be practical to combine long term and short time scales into the same model. I suggest using scenario testing over a selected scenario to establish extent of vulnerability.

3 Demographics

- 3.1 The change in longevity over the last few decades has been truly remarkable. There has been much debate as to whether this change has been due to medical factors (e.g. statins, bypass operations), behavioural (e.g. reduction in smoking) or socio-economic (wealth and longevity seem to be correlated). What is clear is that it was unexpected. For a period actuaries were playing catch-up with successive increasing estimates of future improvements proving inadequate.
- 3.2 I would like to suggest three thought experiments of models that might actually apply to demographic behaviour. Each of these suggest that just as for financial markets long term behaviour may be different from short term. However in this case the long term is potentially more dangerous to insurance companies.
- 3.3 My first (“transmission”) model is that there is an “ideal” state of mortality in which the full impact of all medical, social, economic and lifestyle changes is instantly reflected. The ideal state then transfers to the real world over a very long period. An example of this might be smoking behaviour. It was known that smoking was harmful in the 1950’s but we are still seeing beneficial impacts from reductions in smoking.
- 3.4 Such a model would imply that there would be very strong correlations of improvements or disimprovements from period to period.
- 3.5 My second (“accumulation”) model is that in advances in longevity occasional steps forward may not have an large impact but if several small changes occur together they may have a combined effect greater than the sum of the changes taken alone. The classic example of this is the treatment for AIDS where it is the combination of partially successful drugs that have had a major impact. Likewise for circulatory diseases.
- 3.6 Such a model would suggest that a typical pattern of improvements would be moderate most of the time punctuated by periods of very rapid improvement.
- 3.7 My final (“show me the money”) model suggests that there is at any time an optimum age and or gender for the medical industry to focus it interest on. This may or may not succeed in generating mortality reducing innovations (hopefully profitable ones). If one succeeds then this will create more opportunities at a later age for the same cohort where there might not have been (because there are now more people alive at that age). This may partially account for some cohort effects. The cohort will be exposed to conditions which might not have been financially significant in the past and hence there are greater chances of new developments.
- 3.8 These models are plausible but hypothetical. I believe that they are as least as plausible as a model that supposes some form of Gaussian behaviour after all *“there’s definitely, definitely, definitely no logic to human behaviour”* (3)

THE PITFALL

Demographic changes are poorly understood, a Gaussian model may be far too stable.

AVOIDANCE

Take statistical models of demography as being part guesswork. Do not over-expose. Scenario test and build in safety valves.

4 Inherent Bias towards Stability.

- 4.1 Solvency 2 is not intended to be pejorative. The NEO concept is used to allow companies to take any risks that they wish provided that they have sufficient capital to fit the NEO requirement which is intended to be a fair and objective assessment. Solvency 1 by contrast contained areas where companies were actively dissuaded from taking risks.
- 4.2 “Sufficient capital” is defined as the sum of the cost of 99.5% one year VAR and the market cost of closing out exposure.
- 4.3 As has been mentioned, if the cost of the options and guarantees cannot be measured by reference to an appropriate market then a cost of capital approach is used. In practice there are few occasions when there is a deep and liquid market capable of being so used and this is reflected in the Solvency 2 rules. This means referring to the Solvency capital measure. So “sufficient capital” is completely dependent on the VAR measure and this is in the process of being determined by “calibration” which means looking at history.
- 4.4 This examination of history has two inherent biases causing NEO to underestimate “sufficient capital” for risks which do not have a very long history of being part of the insurance market.
- 4.5 The first is survivor bias. This is well known from the world of exotic investment funds. The only funds that survive are the successful ones. So the historic performance figures looking back will be biased to show an out-performance compared to what one would get looking forward. This effect will be stronger the greater the volatility of the return from the investment type.
- 4.6 Risks show the same behaviour. If we imagine an insurance company deciding to launch a radically new product would it look at a risk that recently performed badly or erratically? Or would it look for some area where recent history was stable and potentially exploitable?
- 4.7 So in entering a new risk area, an analyst performs a two stage process. The first is an unconscious filtering of areas to those with a beneficial recent history. The second is an apparently objective assessment of the same history but this is unlikely to remove the *seller selection bias*. Thus the assessment is unconsciously biased to give a more benign position than is the case.
- 4.8 The second feature is more dangerous and volatile. Once a price for risk is assessed it will be used to set the market (though obviously with margins for expenses and profit). A buyer of this product will have their own assessment of the risk it is buying protection for. That assessment will be subjective but it may be based on more specific data than the analyst has. Therefore if a buyer of protection is of the belief that his true cost is lower than the market price then if there is a choice for the buyer not to purchase at that price he will not. Conversely if he believes he is getting a good deal he will buy with alacrity.
- 4.9 This is scarcely an original observation as life insurance has been indulging in underwriting to remove buyer selection bias for centuries. But as life actuaries are aware this is not just an individual level effect. It affects the whole experience. In mortality one gets interesting selection effects. Annuity experience is lighter than assured life experience. Assured life experience is lighter in the first few years. So it is not hard to imagine that (for example) if one makes it easier to get credit by providing sub prime loans then the default experience will change.

THE PITFALL

Assessments of risk made on data available may be too optimistic because of seller or buyer selection risk.

AVOIDANCE

Make an explicit allowance for seller selection. Underwrite out buyer selection if you can. If you cannot, stay out of this business unless you can find somebody else to take it on. Allow for the possibility in your capital.

5 Convergence and Systemic Risk.

- 5.1 The most important lesson from the financial crisis of 2008 is that financial markets are now closely connected across the world. So when one market is in difficulty, they all may be. It has however impacted on different countries in different ways because the banking industries are different. Now NEO will encourage convergence across the entire EU.
- 5.2 More than this, Solvency 2 encourages other countries to sign up for NEO as “equivalence” will only grant reinsurance credit for business placed with reinsurers in the EU or countries with “equivalent” solvency regimes.
- 5.3 Internal models will in theory be produced separately by each insurance group and therefore there might be expected to differ to an extent but this will be limited by a number of factors.
- 5.4 Firstly the standard calibrations will place a bound on assumptions. It is unlikely that a model designer will place a more conservative assumption than the automatically acceptable assumption available from the SCR.
- 5.5 Secondly large groups are very much the leaders in internal modelling as they have the resources to carry out ground-breaking work. Such groups are multinational and so assumptions and methods will be spread across many companies.
- 5.6 Where companies have different approaches then consultancies are likely to draw attention to areas where there are differences particularly to companies who may be able to save capital in areas where they have been more conservative than the norm. On the other side of the range of assumptions, regulators will look to those areas where a company may stand out as being less prudent than the rest and push it towards the central point.
- 5.7 In short we may expect much less variation between models, methods and assumptions than has been the case in the insurance industry in the past.
- 5.8 But worse than this we may expect that if somebody can game the system, they will. If companies all have the same trigger point (there or thereabouts) then it is surely very likely that if there is money to be made from pushing the industry to the trigger then somebody will make that money.

THE PITFALL

Convergence between models can engender systemic risk

AVOIDANCE

Find out what other people have in their models, have something different but lie and tell them that you are the same as them. Make sure that if the market is gamed you will be the last to go, not the first.

References

- (1) From “Hamlet”; William. Shakespeare
- (2) From “Physicists Attempt to Scale the Ivory Towers of Finance”; J Doyne Farmer Working paper 99-10-073 Santa Fe Institute
- (3) From “Human Behaviour”; Bjork Gudmundsdottir