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Looking at OSFI's Recent LICAT Guideline Through a Cost of Capital Lens

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Abstract: Canada's Federal Insurance Regulator (OSFI) has recently published proposals for a revised set of regulatory capital requirements for life insurers in Canada. The new model called LICAT (Life Insurance Capital Adequacy Test) is a significant departure from previous Canadian regulatory capital models and has some features in common with the Solvency II model when it comes to insurance risk.

This paper looks at some simple risk margin models that Canadian actuaries should consider if they want to engineer risk loadings that are consistent with the cost of capital principle and the new regulatory capital model. We show how the cost of capital method can be implemented by developing a set of risk loaded decrement and interest rates. This is significant because it avoids the computational cost of a brute force capital projection.

There are some conceptual flaws in the new by Canadian model (and Solvency II) that become apparent when we look at the model through the lens presented in this paper. These flaws could be material when applied the kind of lapse-supported product that is common in the Canadian retail insurance market. The flaw becomes apparent when look at the dual of the capital model. The paper concludes by suggesting some simple and practical modifications to the capital model to avoid the flaws.

Introduction

When the Solvency II capital model was introduced in 2010, European regulators defined the total balance sheet requirement (TBSR) a life insurance liability as the sum of

1. A best estimate liability
2. A risk margin
3. A capital requirement

Risk margins and capital are tied together in the Solvency II model by requiring that the risk margin be determined using the cost of capital method. The cost of capital rate used is 6.00% in that model. If best estimate assumptions come true, an insurer should see profits emerge equal to 6.00% of required capital plus interest on that capital.

In Canada, risk capital and risk margins have not been tied together in a formal way. The Canadian regulator (OSFI) specifies capital requirements and individual Appointed Actuaries choose best estimate assumptions and risk loadings consistent with guidance developed by the Canadian Institute of Actuaries (CIA). This is the Canadian GAAP model that has been in place since 1992.

One consequence of risk capital and risk margins being tied together using the cost of capital method is that, in theory, a company can be valued without doing an embedded value calculation. Actuaries have known for decades that the risk adjusted present value of distributable earnings coming from a risk enterprise is equal to the current statement surplus plus the present value of the mismatch between after-tax profits and the cost of capital. If the mismatch is zero the value of the inforce business is just the surplus on the balance sheet[1].

The Canadian accounting/capital model is in the process of changing. Canada has formally adopted IFRS as an accounting standard and OSFI has just announced a new capital model (LICAT). A new (to Canada) feature of this model the need to hold capital for potential changes to actuarial assumptions.

For vanilla life insurance policies, the new capital model requires capital to cover a 25% increase in best estimate mortality rates and, for lapse-supported products, a 30% decrease in best estimate lapse rates.

The current Canadian GAAP model calls for mortality risk loadings of the form

$$q_t \rightarrow q_t + \frac{k}{e_t}.$$

Here, e_t is the expectation of life at attained age t and k is a factor that reflects the relative risk of the business being valued. The specific choice of the factor k is governed by professional guidance from the Canadian Institute of Actuaries[2]. The high level idea is that blocks of business with well understood characteristics would have small values of k and less well understood or experimental blocks would have larger values of k.

When the professional guidance outlined above was developed in the late 1980's, it made some sense because it followed a precedent set out when the 1958 CSO mortality tables were being developed by the Society of Actuaries for US regulatory reserve purposes. At that time, actuaries needed a mortality loading process that could guarantee whole life reserves calculated using net premium methods would increase. The loading method described above meets that requirement.

In a world governed by gross premium reserve calculation methods, such as IFRS and Canadian GAAP the net premium loading constraint described no longer applies. We are free to use other risk loading methods if they make sense in the current environment.

A paper outlining how to construct risk loadings that are consistent with modern capital models such as Solvency II, LICAT and a number of internal economic capital models, was presented at the 2014 ERM Symposium in Chicago[3]. In the language used by the current LICAT guideline, it considered two very different kinds of risk

1. Catastrophe risk (called contagion risk in the 2014 paper)
2. Assumption change risk for both level and trend

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[1] See the 2011 AAA Practice Note on Embedded Value

[2] See section 2350 of the CIA's actuarial standards of practice.

[3] Manistre B.J. "Down but Not Out: A Cost of Capital Approach to Fair Value Risk Margins". Proceedings of the 2014 ERM Symposium. The paper is on the SOA website and in a monograph published by the conference organizers. There is also a link on the Actuarial Foundation's website.

The 2014 paper showed that if we want to hold capital for a short-term catastrophe of ΔQ extra deaths above our best estimate then we need to hold capital equal to $\Delta Q(F - V)$ and build in a risk loading equal to $\pi\Delta Q$ into our mortality rates i.e.

$$q_t \to q_t + \pi\Delta Q.$$

Here, π is the assumed cost of capital rate e.g. $\pi = 6.00\%$. This particular loading formula ignores any potential diversification issues. The paper calls this a static risk loading. In general, this kind of risk loading is smaller than the current $\frac{k}{e_t}$ professional guidance.

OSFI's current LICAT requirement for catastrophe risk is $\Delta Q = 1/1{,}000$ for Canadian business and $\Delta Q = 1.5/1{,}000$ for US and European business.

The 2014 paper also showed that if we want to build in risk margins for assumption changes we need a new mathematical tool the author calls a dynamic risk margin.

If $\mu_0(s)$ is our best estimate force of decrement and we want to hold capital to cover a potential shock to a new level $\mu_0(s) + \Delta\mu(s)$ then we need to use a risk loaded decrement assumption of the form

$$\mu(t + s) = \mu_0(t + s) + \beta(s)\Delta\mu(t + s).$$

The quantity $\beta(s)$ is zero on the valuation date, i.e. $\beta(0) = 0$, and then grows over time at a rate determined by the cost of capital rate π, the size and sign of the decrement shock $\Delta\mu$ and a third quantity α. The parameter α governs how big subsequent assumption shocks might be if we actually found ourselves in a world where the best estimate had changed from $\mu_0(s)$ to $\mu_0(s) + \Delta\mu(s)$. For example, in the shocked world we may want to hold capital for an assumption change to

The 2014 paper showed how to calculate $\beta(s)$ for the Solvency II model along with some other approaches. One of the issues identified there is that, in the Solvency II model, β might grow without bound if we are dealing with lapse-supported products where $\Delta\mu < 0$. Unfortunately, the same is true of the LICAT model.

Put differently, the LICAT model is so conservative that an insurer might have to use negative lapse rates in order to build in enough risk margin to pay for the cost of holding LICAT required capital. The author believes this situation is unreasonable.

Margin Analysis of the Current LICAT model

We start with a simplified model of the current LICAT model for assumption change risk. We assume a single decrement rate $\mu_0(s)$ and a shocked rate $\mu_1(s) = \mu_0(s) + \Delta\mu(s)$.

The LICAT guideline instructs the insurer to compute capital as the difference between two values V_1, V_0 each calculated using their respective decrement assumptions and a regulator specified interest assumption $\rho(s)$[4]. Under reasonable assumptions the two values V_1, V_0 evolve in time according to a system of equations like

[4] It is the author's understanding that the reason for fixing an interest assumption in the capital calculation is to make the resulting capital more stable as interest rates fluctuate. This is understandable but has some negative unintended consequences detailed later.

$$\frac{dV_0}{ds} = (\rho + \mu_o)V_0 - (\mu_o F + e - g),$$

$$\frac{dV_1}{ds} = (\rho + \mu_1)V_1 - (\mu_1 F + e - g).$$

Here e, g represent unit expense and gross premium functions respectively.

Now assume the insurer wants to calculate a reserve $V(s)$ based on a valuation interest assumption $r(s)$, best estimate decrement $\mu_o(s)$ and the same premium and expense assumptions. The corresponding evolution equation for $V(s)$ is

$$\frac{dV}{ds} = (r + \mu_o)V - (\mu_o F + e - g) - \pi[V_1 - V_0].$$

The idea is to treat the cost of capital $\pi[V_1 - V_0]$ as an additional expense.

In order to analyze this system of differential equations we introduce dual variables p, p_0, p_1 and consider $W(s) = p(s)V(s) + p_0(s)V_0(s) + p_1(s)V_1(s)$

Then

$$\frac{dW}{ds} = \frac{dp}{ds}V + p\frac{dV}{ds} + \frac{dp_0}{ds}V_0 + p_o\frac{dV_0}{ds} + \frac{dp_1}{ds}V_1 + p_1\frac{dV_1}{ds},$$

use the expressions for above for $\frac{dV}{ds}, \frac{dV_0}{ds}, \frac{dV_1}{ds}$ so this becomes

$$\frac{dW}{ds} = \frac{dp}{ds}V + p[(r + \mu_o)V - (\mu_o F + e - g) - \pi[V_1 - V_0]] + \frac{dp_0}{ds}V_0 \\ + p_o[(\rho + \mu_o)V_0 - (\mu_o F + e - g)] + \frac{dp_1}{ds}V_1 + p_1[(\rho + \mu_1)V_1 - (\mu_1 F + e - g)].$$

Rearrange to collect like terms in the primal variables V, V_1, V_0.

$$\frac{dW}{ds} = V\left[\frac{dp}{ds} + p(r + \mu_o)\right] - p[\mu_o F + e - g] + V_0[\frac{dp_0}{ds} + p_o(\rho + \mu_o) + \pi p] - p_o(\mu_o F + e - g) \\ + V_1[\frac{dp_1}{ds} + p_1(\rho + \mu_1) - \pi p] - p_1(\mu_1 F + e - g).$$

Choose the dynamics of the dual variables to make the square brackets above vanish i.e.

$$\frac{dp}{ds} = -p(r + \mu_o)$$

$$\frac{dp_0}{ds} = -p_o(\rho + \mu_o) - \pi p$$

$$\frac{dp_1}{ds} = -p_1(\rho + \mu_1) + \pi p$$

We now note that if the initial conditions for the dual system are $p(t) = 1,\ p_0(t) = 0,\ p_1(t) = 0$ then $W(t) = V(t)$ and, if the ODEs above hold,

$$\frac{dW}{ds} = -\{p[\mu_o F + e - g] + p_o(\mu_o F + e - g) + p_1(\mu_1 F + e - g)\}.$$

One approach to using the machinery developed above is to solve the system of ODEs for $p(s)$, $p_0(s)$, $p_1(s)$ and then use them to compute $W(t) = V(t)$ by using

$$W(T) - W(t) = -\int_t^T \{p(\mu_o F + e - g) + p_o(\mu_o F + e - g) + p_1(\mu_1 F + e - g)\} ds$$

When the contract matures at time T all three values $V(T), V_0(T), V_1(T)$ must be the same so

$$W(T) = V(T)[p(T) + p_o(T) + p_1(T)].$$

This allows us to write an expression for the risk-loaded value $V(t)$ as

$$V(t) = V(T)[p(T) + p_o(T) + p_1(T)] + \int_t^T \{(p + p_o)(\mu_o F + e - g) + p_1(\mu_1 F + e - g)\} ds.$$

The expression above is technically correct, and can be useful for actual calculation, but it sheds little light on what is really going on. A change of variables adds a significant amount of transparency.

Let

$p_T(s) = p(s) + p_o(s) + p_1(s), \quad \rightarrow \; p_T(t) = 1,$

$\beta = \dfrac{p_1(s)}{p_T(s)}, \qquad \rightarrow \beta(t) = 0,$

$\gamma = \dfrac{p_0(s) + p_1(s)}{p_T(s)}, \qquad \rightarrow \gamma(t) = 0,$

$\Delta\mu = \mu_1 - \mu_0.$

A new expression for the risk-loaded value is then

$$V(t) = V(T) p_T(T) + \int_t^T p_T(s)[(\mu_o + \beta\Delta\mu)F + e - g] ds.$$

At this point, it looks like $p_T(s)$ is a risk loaded discount factor and $\mu_o + \beta\Delta\mu$ is a risk loaded decrement rate. That this interpretation is reasonable can be checked by calculating the time derivative of $p_T(s)$.

The result is

$$\frac{dp_T(s)}{ds} = -p_T(s)[(r + \gamma(\rho - r)) + (\mu_o + \beta\Delta\mu)].$$

In what follows, we will refer to the quantities β, γ as *margin variables*. The equation above shows that if we know the margin variables we can compute the discount factor as

$$p_T(s) = \exp\left[-\int_t^s [(r + \gamma(\rho - r)) + (\mu_o + \beta\Delta\mu)] du\right].$$

This confirms the interpretation of $\mu_o + \beta\Delta\mu$ as a loaded decrement rate, and shows that we also need to use a risk adjusted interest assumption given by $r + \gamma(\rho - r)$.

We now examine the behavior of the margin variables to see if the model emerging above is reasonable. We do this by calculating their time derivatives. The results are

$$\frac{d\gamma}{ds} = (1-\gamma)[\gamma(r-\rho) - \beta\Delta\mu], \qquad \gamma(t) = 0,$$

$$\frac{d\beta}{ds} = \beta(\beta-1)\Delta\mu + (1-\gamma)[\pi + \beta(r-\rho)], \ \ \beta(t) = 0.$$

Given the key input parameters π, $\Delta\mu, (r-\rho)$, this is a system of differential equations for the margin variable pair (β, γ). In general, there is no closed form solution for this system but there are some tools that can help us understand how this system behaves in both the short and longer term.

In the short term, the non-linear system above can be approximated by a linear system obtained by ignoring all the quadratic terms. This is reasonable because we always start the system at $(0{,}0)$. The linear approximation is

$$\frac{d\gamma}{ds} \approx \gamma(r-\rho) - \beta\Delta\mu,$$

$$\frac{d\beta}{ds} \approx \pi - \pi\gamma - \beta\Delta\mu + \beta(r-\rho).$$

The first order behavior of the system is then $\beta(s) \approx \pi(s-t)$, $\gamma(s) \approx 0$.

We consider two realistic cases.

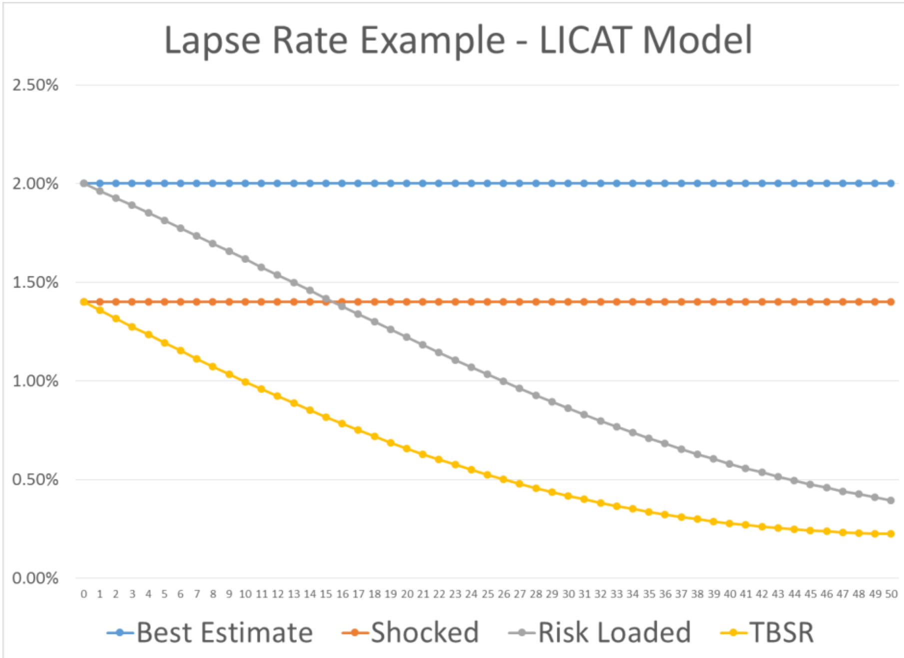
1. If $\Delta\mu$ is small and positive e.g. $\Delta\mu \approx 1/1{,}000$, as it would be for many life insurance applications, then cost of capital rate driven growth of β will be attenuated or accelerated by the $(\rho - r)$ term. Over the short to intermediate term, the γ function will remain small but may become negative over longer time scales.

2. If μ is a lapse decrement and we are dealing with a lapse-supported product, the shock $\Delta\mu$ will be negative and could easily be 100 times larger than a mortality shock. For example, if our best estimate lapse rate is $\mu_0 = .02$ then the current (May 2016) LICAT draft says $\Delta\mu = -.30\mu_0$.

   In this situation, both β, γ have the potential to grow over time and this situation is exacerbated if $r > \rho$ as the following numerical examples suggest.

The first numerical example considers a lapse supported situation with a best estimate lapse rate of $w_0 = 2.00\%$ and a shocked lapse assumption consistent with the current LICAT model of $w_1 = 1.40\%$. The assumed interest rates are $r = 4.00\%$ and $\rho = 3.00\%$ and the cost of capital rate is $\pi = 6.00\%$.

The chart below shows what can happen over a 50 year time horizon.

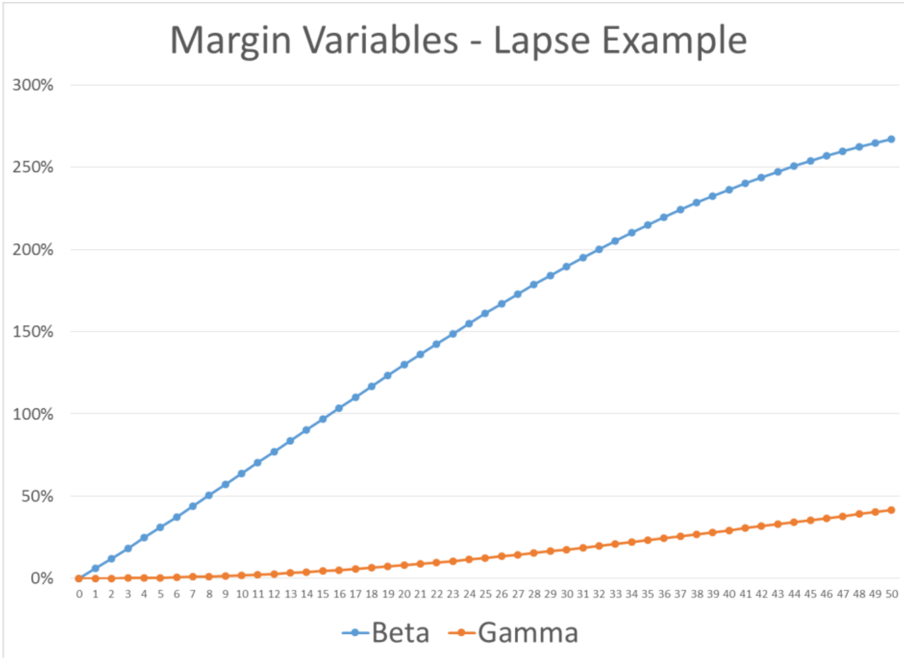


This particular chart shows the input lapse assumptions together with the risk-loaded lapse assumption needed to pay for the cost of capital. The ultimate risk loaded lapse rate is just below 0.50%.

The same dual machinery was used to compute a lapse assumption consistent with holding assets equal to the Total Balance Sheet Requirement (TBSR)[5]. A regulator who is asking for protection down to the 1.40% lapse level is actually getting a much stronger balance sheet than he realizes. The ultimate lapse rate in both the risk loaded and TBSR scenarios is less than 0.50%.

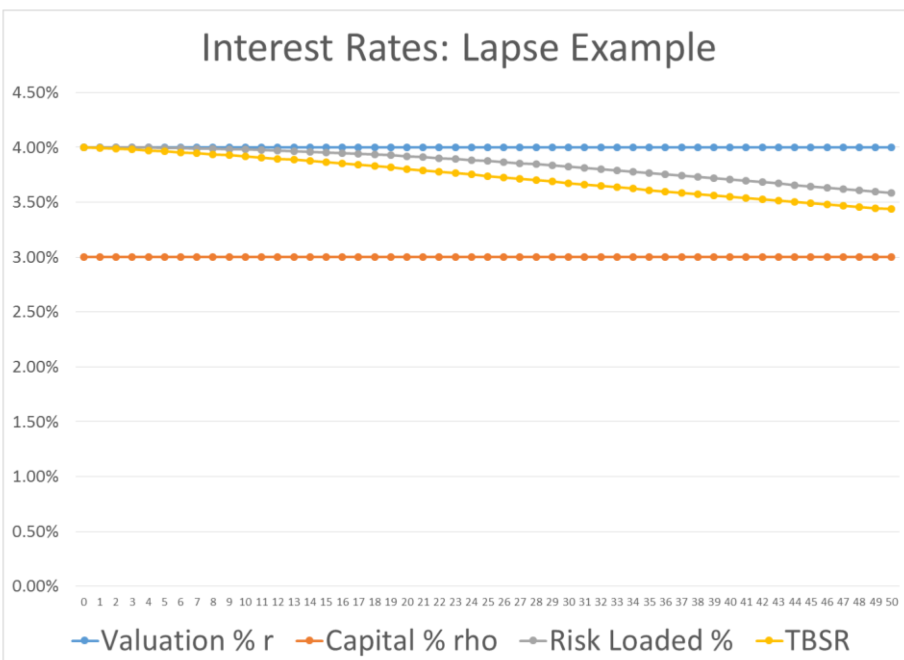
The next chart shows the margin variables β, γ for the same example.

[5] This is done by solving the system of differential equations for p, p_0, p_1 with initial conditions $p(t) = 1,\ p_0(t) = -1,\ p_1(t) = 1$.



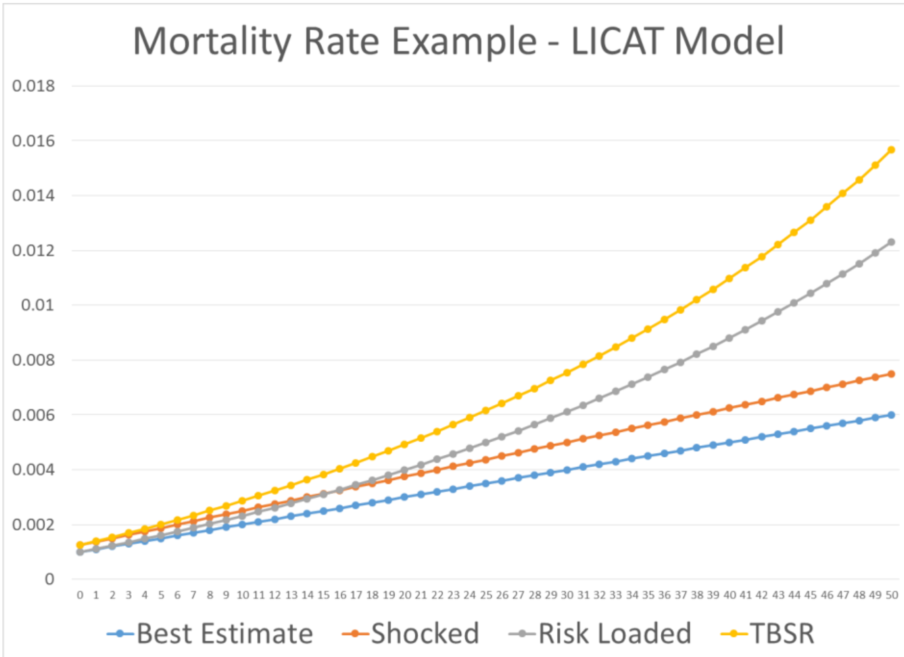
We see the margin variable β has grown to over 250% by the end of the projection. This is the consistent with the first chart.

Finally, we finish this example with a chart showing what the risk loaded interest rate scenario looks like.

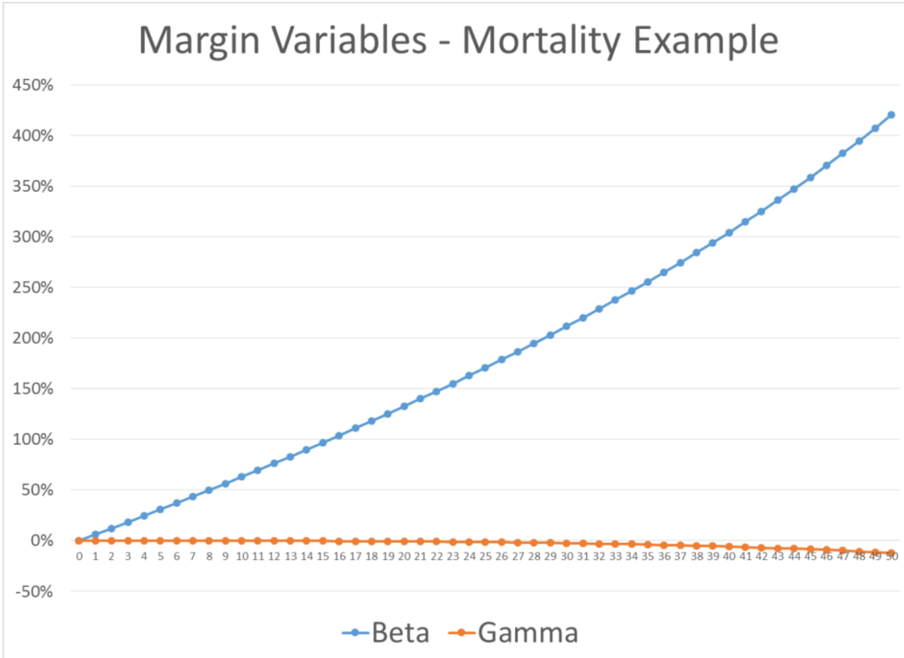


Since the margin variable γ is positive, this shows the effective valuation interest rate grading from $r = 4.00\%$ to the capital rate of $\rho = 3.00\%$.

The next example shows what happens when we use a small positive decrement shock as would be expected in a mortality risk model. This particular example uses a best estimate mortality rate that starts out at 1/1,000 and grades up linearly by 1/10,000 each year. The decrement shock is +25%.

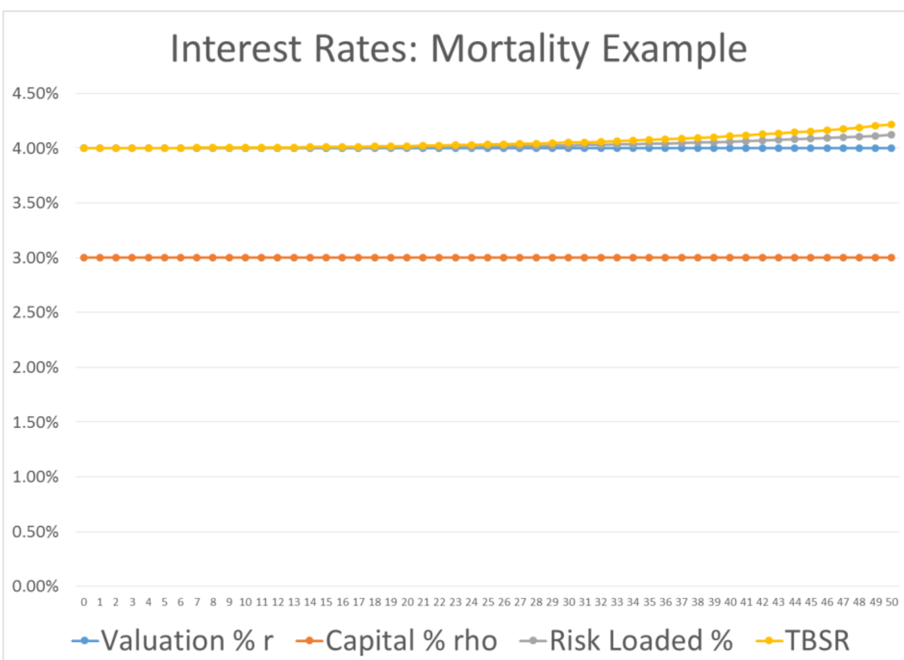


By the end of the 50 year projection the best estimate mortality rate has grown to 6/1,000 while the risk loaded mortality rate is more than double that value. The TBSR value is almost 16/1,000.



Again, we see far more conservatism than may have been intended by the Canadian regulator. Since γ is small the large growth in β is driven mostly by the cost of capital and the interest rate difference $r - \rho = 1.00\%$.

There is one piece of good news for this example captured in the interest rate chart below.



The key take away from both examples is that the current LICAT model is very conservative when looked at through the cost of capital lens. The main issue is that the LICAT model (and Solvency II) fail to take into account the change in risk margins that should occur when an assumption is changed.

A second issue is the use of an interest rate ρ different from the valuation rate r. This may be well intentioned but, in the end, the cure is worse than the disease the methodology is trying to deal with, especially when applied to Canadian products like Term to 100.

Comparison with Solvency II

We now briefly indicate how the current Solvency II methodology would handle the same simple example we introduced above. In this methodology there are three primal variables V_1, V_0, M which evolve according to the system of equations

$$\frac{dV_0}{ds} = (r + \theta + \mu_o)V_0 - (\mu_o F + e - g),$$

$$\frac{dV_1}{ds} = (r + \theta + \mu_1)V_1 - (\mu_1 F + e - g),$$

$$\frac{dM}{ds} = (r + \mu_o)M - \pi[V_1 - V_0 - (1 - \alpha)M].$$

The interest assumption for V_1, V_0 is $r + \theta$. This is intended to be the risk free rate plus a liquidity spread θ specified by the regulator.

The risk margin M is then calculated assuming the required economic capital is $(V_1 + \alpha M) - (V_0 + M)$ and discounting using only the risk free rate r. No liquidity premium is used here because European regulators think the risk margin cash flows are not as well defined as the basic benefit cash flows used to compute V_1, V_0 . As we will soon see dual analysis shows this is not really the case.

The parameter α is used to capture the idea that the risk margin in a shocked environment could be different from the base case. Solvency II specifies $\alpha = 1$ but that may not be appropriate when valuing a lapse supported product where $\mu_1 < \mu_0$. For lapse supported products it is usually appropriate to choose $0 < \alpha < 1$ for reasons that will be explained shortly.

The differential equation for the risk margin can be solved by projecting the two base reserves $V_1(s), V_0(s)$ and then computing the risk margin as the present value of the cost of capital

$$M(t) = \int_t^\infty e^{-\int_t^s (r+\mu_o+\pi(1-\alpha))dv]} \pi[V_1(s) - V_0(s)]ds.$$

Again, dual analysis can be used to get more actuarial insight into the computational process outlined above. Introduce dual variables p_0, p_1, m and consider the linear combination $W = p_0 V_0 + p_1 V_1 + mM$. The dual equations are

$$\dot{p_0} + p_0\left(r + \theta + \mu_o\right) + \pi m = 0, \quad p_0(t) = 1,$$
$$\dot{p_1} + p_1\left(r + \theta + \mu_1\right) - \pi m = 0, \quad p_1(t) = 0,$$

$\dot{m} + m(r + \mu_o) + \pi(1 - \alpha)m = 0, \quad m(t) = 1.$

The initial conditions have been chosen to bring out the risk-loaded value $V(t) = V_0(t) + M(t)$ on the valuation date.

Again we introduce margin variables $p^T = p_0 + p_1, \beta = p_1/p^T,\ \omega = m/p^T$ and $\Delta\mu = \mu_1 - \mu_0$. It can now be shown (Manistre[2014]) that the risk loaded value $V(t)$ can now be calculated as a standard actuarial present value using a risk loaded decrement rate $\mu_o + \beta\Delta\mu$ and the liquidity adjusted interest rate $r + \theta$.

$$V(t) = e^{-\int_t^T (r+\theta+\mu_o+\beta\Delta\mu)dv}\, V(T)$$
$$+\int_t^T e^{-\int_t^s (r+\theta+\mu_o+\beta\Delta\mu)dv}\left[(\mu_o + \beta\Delta\mu)F + e - g\right].$$

The evolution equations for the margin variables β, ω can be derived from the dual equations and are

$$\frac{d\beta}{ds} = \beta(\beta - 1)\Delta\mu + \pi\omega, \qquad \beta(t) = 0,$$
$$\frac{d\omega}{ds} = \omega\big(\theta + \beta\Delta\mu - \pi(1 - \alpha)\big), \quad \omega(t) = 1.$$

These equations have the unfortunate property that if $\Delta\mu < 0$ and $\alpha = 1$ then inappropriate behaviour of the margin variable β is possible. The resulting risk loaded decrement $\mu_o + \beta\Delta\mu$ rate can become negative. In the author's opinion this is a serious conceptual flaw if lapse supported products are a material issue.

A simple way to correct the issue identified above is to use an α parameter less than one. A practitioner's rule of thumb is to choose α so that the inequality $\mu_o + \frac{\Delta\mu}{1-\alpha} \geq 0$ is satisfied. The actuarial intuition behind this inequality is this is that, if $\alpha < 1$, then $\frac{1}{1-\alpha}$ is an approximate upper bound for the margin variable β in both the Solvency II and LICAT models. Note that if $\Delta\mu$ is expressed as a fraction $\varphi\mu_o$ then the inequality above becomes $\alpha \leq 1 + \varphi$. The general rule is therefore to choose $\alpha \leq \min(1,1 + \varphi)$.

A Suggested Alternative for LICAT

OSFI's LICAT model only specifies the capital calculation. It is silent on the issue of risk margins since that is the domain of the Canadian Institute of Actuaries. However, we have shown that if an actuary tried to compute risk margins using the cost of capital method then he will run into issues with lapse supported products. In the author's opinion, the Canadian regulator could address these issues by

1. Modifying the capital calculate to take into account the change in risk margins that can be appropriate when a best estimate assumption is changed. See below for details.

2. Negotiating with the Canadian Institute of Actuaries to modify the existing risk loading guidance in the standards of practice to be more consistent with the cost of capital concept as outlined here.

Suppose we have a best estimate decrement rate $q_{[x]+t}$ using standard select and ultimate notation. Assume also that we want to hold capital for a shock $q_{[x]+t} \to (1+\varphi)q_{[x]+t}$ then the process we recommend is as follows:

1. If $\varphi < 0$

   Compute a fair value V (best estimate plus risk margin) using the decrement assumption

$$q_{\{[x]+t\}+s} = (1+\pi)^{\varphi s} q_{[x]+t+s}.$$

   Compute a shocked fair value $\hat{V}$ (shocked best estimate plus shocked risk margin) using the decrement assumption

$$\begin{aligned}\hat{q}_{\{[x]+t\}+s} &= (1+\varphi) q_{\{[x]+t\}+s}, \\ &= (1+\varphi)(1+\pi)^{\varphi s} q_{[x]+t+s}.\end{aligned}$$

   Report capital as the difference $\hat{V} - V$.

2. If $\varphi \geq 0$ choose a second parameter $0 < \alpha \leq 1$

   Compute a fair value V using the decrement assumption

$$q_{\{[x]+t\}+s} = q_{[x]+t+s} \begin{Bmatrix} 1 + \dfrac{\varphi}{1-\alpha}\left(1-(1+\pi)^{-s(1-\alpha)}\right) & \alpha < 1 \\ (1+\varphi\pi s) & \alpha = 1 \end{Bmatrix}.$$

   Compute a shocked value $\hat{V}$ using the decrement assumption

$$\hat{q}_{\{[x]+t\}+s} = (1+\varphi) q_{[x]+t+s} \begin{Bmatrix} 1 + \dfrac{\alpha\varphi}{1-\alpha}\left(1-(1+\pi)^{-s(1-\alpha)}\right) & \alpha < 1 \\ (1+\alpha\varphi\pi s) & \alpha = 1 \end{Bmatrix}.$$

   Report capital as the difference $\hat{V} - V$.

The model in method (2) above coincides with method (1) if $\alpha = 1 + \theta$. The parameter α has been introduced in method (2) to control the otherwise explosive growth that could occur in the risk loaded decrement value.

Both models have the desirable property that, as time unfolds, the risk margin released into income as the risk loading process evolves is close to the amount needed to provide an investor an incremental return π on the required capital $\hat{V} - V$.

The high-level rationale behind method (1) above is that if we found ourselves in a world where the assumption had changed to $(1+\varphi)q_{[x]+t}$ then, in that world, we would need to hold capital for a change to $(1+\varphi)^2 q_{[x]+t}$ etc. Method (2) assumes that if we were in the shocked world we would need to hold capital for a move to $(1+\varphi+\alpha\varphi)q_{[x]+t}$. For more details on theory behind this proposal see the 2014 ERM paper by Manistre.

Conclusion

This paper has shown that it is possible and practical to build risk loadings into decrement assumptions that are consistent with the cost of capital approach to risk margins. The technicalities are not onerous. The methods proposed here overcome a number of conceptual flaws in both the Solvency II approach and the current LICAT guideline.

To be sure, this paper does not cover all of the issues that would need to be considered if one wanted to fix the current LICAT model and, at the same time, modify the CIA's current approach to risk loadings so that is consistent with an appropriate capital model. Nevertheless, the author hopes the current work is a step in that direction.