Calculating Market Value Margin (MVM) using the Cost of Capital method with ultimate risk horizon based on an ICRFS-Plus™ composite model and forecast scenario

Introduction

From a composite model for multiple LOBs all necessary details can be deduced, - mean loss, risk capital for a particular quantile (based on VaR/T-VaR), and MVM using the Cost of Capital method.

In the context of this memo, the following definitions hold,

BEL – best estimate liability, deduced from the mean loss as a present value of mean loss,

RC – risk capital to cover non-hedgeable (that is, insurance) risk; defined from VaR or T-VaR for a particular quantile (e.g. 99.5%) of the predictive aggregate loss distribution; defined for each future calendar period until run-off,

MVM – present value cost of holding risk capital; defined for each future calendar period until run-off,

Total MVM - the sum of MVM for all run-off periods,

Insurance liabilities fair value - the sum of BEL and total MVM. This quantity is also referred as technical provision.

For the purpose of Insurance Liabilities fair value calculation we assume,

- Insurer does not borrow the capital, it raises it instead. That is, RC is raised.
- In one case out of 200 (99.5%) insurer is ruined.
- The liabilities fair value is relevant to the evaluation date. This quantity is assumed to be funded from premiums; the total MVM is estimated at inception (evaluation date).

RC and the associated MVM can be computed for one **year risk horizon** and **ultimate risk horizon**. The Solvency II regime favours the former.

In order to compute MVM using the Cost of Capital approach and RC for both one year risk horizon and ultimate risk horizon for the aggregate of all long tail LOBs and each LOB the following critical information is required:

- Probability distributions of paid losses (liability stream) by calendar year (k=1,..,n) and their correlations, for each LOB and the aggregate of all LOBs.
- Probability distributions of total reserves for each LOB and the aggregate of all LOBs.
- Probability distributions of the aggregate paid losses from calendar year k to calendar year n for each LOB and the aggregate of all LOBs. This is required for each k raging from 1 to n, where complete run-off is achieved at the ultimate calendar year n.

The above mentioned distributions facilitate, amongst other calculations, the **VaR(k)** for the paid losses (total loss) in calendar year k, and **VaR*(k)** for the aggregate paid losses from calendar year k to n for each LOB and the aggregate of all LOBs.

This document is relevant to the ultimate risk horizon. Please refer to http://www.insureware.com/Library/SolvencyII/solvencyii_oneyear.php for one year horizon Solvency II metrics calculator.

Ultimate risk horizon

With the ultimate risk horizon, capital is raised at inception (valuation date) and is gradually released on a yearly basis.

The amount of the risk capital raised at inception is VaR*(1) = VaR(aggregate). The amount of risk capital that needs to be retained at the beginning of year k (for the remaining run off) is VaR*(k). Assuming the spread above the risk free rate is s, and the risk free rate is d, the MVM for year k is given by

MVM(k) = VaR*(k) * s / (1+d)^k

Total MVM = Sum(k)[MVM(k)], k ranging from 1 to n.

Note that RC* = VaR*(1) = VaR(aggregate reserves) and VaR*(n) = VaR(n).

In the ultimate risk horizon context, the total risk capital raised from the capital providers is RC* = VaR(aggregate). At the beginning of the year k (k > 1), equivalently, at the end of year (k-1), the amount of the capital the insurer retains is VaR*(k) for the remaining run-off period. Depending on

the losses in calendar years 1 to (k-1) and the relative values of $VaR^*(1)$, $VaR^*(k-1)$ and $VaR^*(k)$, the amount of capital released to the capital providers can be determined. For example, if the total paid losses in the first calendar year is equal to the mean, then the capital released equal $VaR^*(1) – VaR^*(2)$.

Note that the interest rate spread above the risk free rate for the one year risk horizon and for ultimate risk horizon are not necessary the same, and the RC^* is raised from the capital providers, whereas the MVM is funded by the policyholders.

Indeed, comparing to the one year risk horizon, the ultimate risk horizon requires much more risk capital at inception and every year, except the last year than the one year risk horizon. Hence, the spread above the risk free rate should be higher for the one year risk horizon.

The spread above the risk free rate used by the Cost of Capital method should not be confused with the expected excess return over the risk free return the capital providers receives. The expected return on the risk capital must be adjusted by the expected consumption of the risk capital.

Ultimate risk horizon metrics module

ICRFS-Plus™ estimates risk metrics for both one year and ultimate risk horizons, based on the identified composite model for multiple LOBs with the associated forecast scenarios.

Ultimate risk horizon metrics module performs the following operations:

- runs the identified composite model with the associated forecasting scenario that predicts lognormal distributions for each cell and their correlations for each LOB;
- uses the PALD module to simulate from the predicted lognormals to obtain samples of the aggregates by calendar year for each LOB and the aggregate of all LOBs;
- computes $VaR^*(k)$ for each calendar year $k = 1$ to n, for the aggregate of all LOBs;
- based on the $VaR^*(k)$, risk free rate and interest rate spread, MVM(k) are computed.

Calculating MVMs using the Cost of Capital method is a trivial task provided risk capital allocation by calendar year is available from the predictive distributions for each calendar year (and their correlations). It is possible to customise the approach presented (e.g. integrate Insurer' margin; implement tax adjustments; use Percentiles method instead of Cost of Capital method to calculate

MVM etc.), but it is hard to develop a meaningful solution without predictive loss distributions that are produced by ICRFS-Plus™ composite model for multiple LOBs.

References:

Ernst & Young's report "Market Value Margins for Insurance Liabilities in Financial Reporting and Solvency Applications" , 2007. The Ernst & Young's report describes the Cost of Capital method and contains some valuable examples, - Appendix D, Tables 30 and 32, and Appendix E referring to ICRFS-Plus™.