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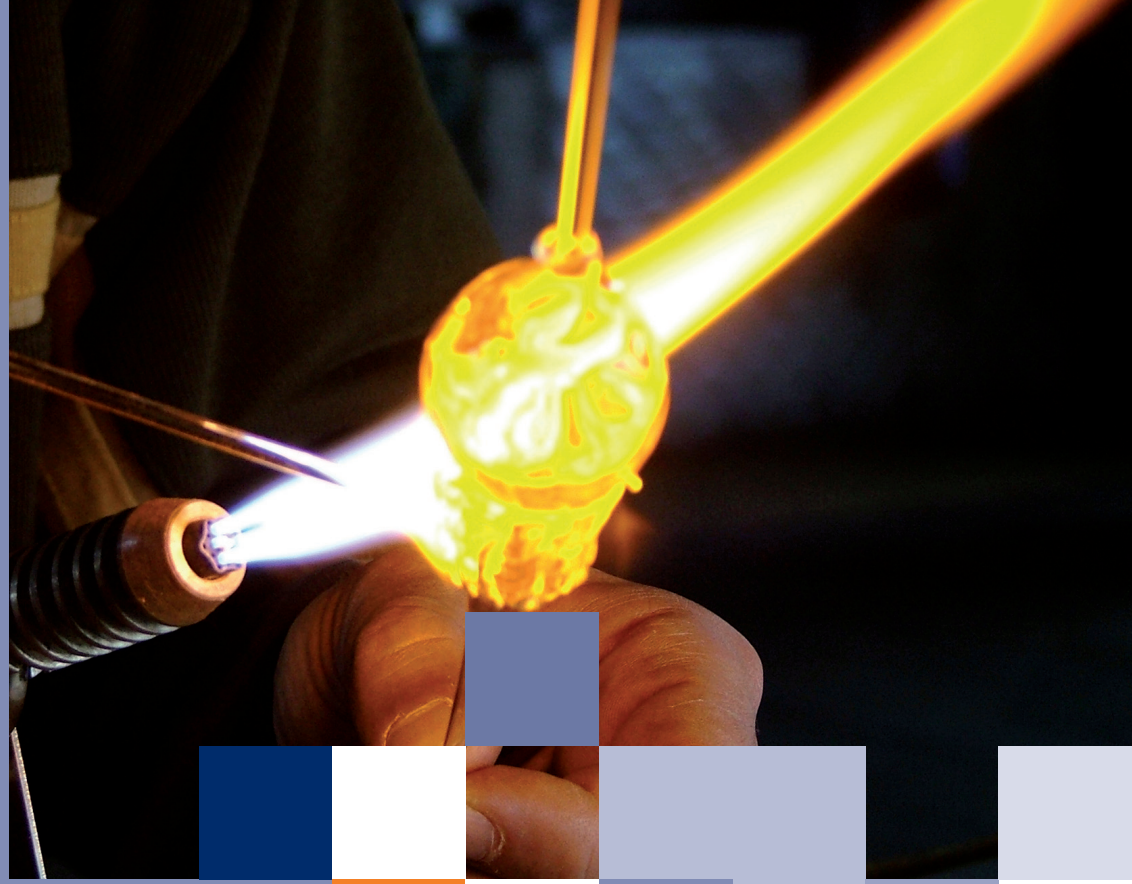

**Insurance Risk** Management:

# Risk Based Capital

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# **Risk Based** Capital

Risk Management Solutions for Insurers

Risk based capital (RBC) or economic capital (ECAP) is a crucial concept in new regulatory frameworks that enforce a stricter oversight on the financial markets. Prime examples are the Financial Assessment Framework (FTK) in the Netherlands, Twin Peaks and Individual Capital Assessment (ICA) in the United Kingdom and the Swiss Solvency Test (SST), as well as more international-oriented directives such as Solvency II. A central question asked by all these frameworks is the following: how much capital is needed today in order to survive future unexpected losses with a high degree of confidence? RBC or ECAP results also form an important component in assessing the risk-adjusted return on capital (RAROC) at the balance sheet, portfolio or product level.

### The standard solvency testing approach

For solvency testing purposes the assets and liabilities are typically valued on an economic basis (i.e., market value including all options embedded in the liabilities). Risks are also divided into different kinds of risk on the one hand (such as market risk, credit risk, insurance risk and operational risk) and product groups on the other hand.

In the new regulatory frameworks, the standard capital requirement for insurers is typically based on a 99.5% confidence level for a period of one year. This means that after one year the market value of the assets should exceed the market value of the liabilities with a probability of 99.5%. This confidence level is then translated into appropriate (deterministic) shocks for the different risk factors, for example a downward shock of 40% for stocks or 25% for currencies. The impact of each shock on the (market value) surplus is then evaluated which yields a capital charge for each risk factor.

An example is given below. In this test, six types of risks are distinguished (labeled from S1 through S6).

| | | |
|---|---|---|
| **S1** | Interest Rate Risk | (maturity-dependent) shift in interest rate and inflation plus a 25% shift up and down in the implied volatility for (embedded) interest rate options |
| **S2** | Equity Risk | 40% shift down in the value of equities plus a 25% shift up and down in the implied volatility of stock options |
| **S3** | Currency | 25% shift down in foreign currencies |
| **S4** | Commodity Risk | 40% shift down in commodity prices |
| **S5** | Credit Risk | 60% increase in credit spreads |
| **S6** | Insurance Risk | a% / √n depending on type of insurance |

Types of risks in the standard solvency test. This is an example for the solvency test of the Financial Assessment Framework (FTK) in the Netherlands.

The capital charges for the individual risk factors are then combined using appropriate assumptions with respect to their mutual correlations. For the situation at hand, the required capital under FTK becomes:

$$\sqrt{S_1^2+S_2^2+2\cdot 0.80\cdot S_1\cdot S_2+S_3^2+S_4^2+S_5^2+S_6^2}$$

Note that this formula assumes a 0.80 correlation between interest rate and equity risk and 0 correlations between all other types of risk.

### The internal model approach

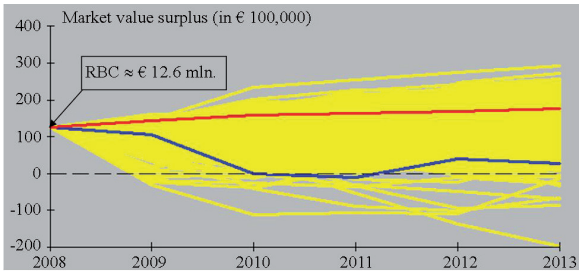
RBC or ECAP calculations are not necessarily carried out using pre-described, deterministic stress scenarios. Under the new regulations, like Solvency II, insurers also have the possibility to use an internal model to determine their capital requirements. These internal (ALM) models typically evaluate the evolution of the insurer's balance sheet for a variety of stochastic economic scenarios. For solvency testing purposes, the risk tolerance is often set equal to the 99.5% threshold for a period of one year, in line with the standard test. Using a stochastic economic scenario set, it then becomes possible to determine how much capital is (just) sufficient to satisfy this confidence level.

For internal risk management purposes, insurers sometimes also relate their risk tolerance to a minimum acceptable rating. Using default probabilities for a reasonable peer group (i.e., the financial sector) an "acceptable" probability of experiencing a negative surplus (or a surplus below a minimum value) over a certain period of time can then be determined. Several choices are thus possible with respect to the horizon, the threshold probability and the minimum acceptable level of the surplus.

## Example

As an example of the internal model approach, we now show how the RBC of an insured pension contract can be determined. In The Netherlands, such an insured pension plan typically has a contract period of 5 to 10 years. During this period, both the assets and the liabilities of the pension plan are on the balance sheet of the insurer as a separated account. At the end of the contract period, the client (i.e. the provider of the pension plan) often has the right (not the obligation) to leave all liabilities with the insurer even if the assets are insufficient to cover the liabilities. This right constitutes an embedded option. It would be rational to exercise this option if the market value of the liabilities is larger than the market value of the assets when the contract expires.

Because the option value has a direct impact on the surplus of the insurance company (it is a liability of the insurance company) there should be sufficient capital to avoid the occurrence of a negative surplus for the insurer over a certain period (with a certain probability). In the example given in the next figure, the horizon is equal to 5 years. This insurer demands that a negative surplus may only occur with a probability of 0.5% for one or more years. This risk criterion is just satisfied in the figure below.




Example of an RBC calculation for an insured pension contract given a 5 year time horizon. This figure shows the effect of 5,000 different economic scenarios on the market value of the surplus. Each yellow line represents a single scenario and the red line represents the average value of these 5,000 scenarios. The blue line displays a specific scenario which violates the risk criterion (the surplus becomes negative in 2011). In total, for 25 out of 5,000 scenarios a negative surplus occurs. This means that the risk-based capital for this contract is equal to the surplus at the end of 2008 (approximately € 12.6 mln., as indicated).

## Diversification

It is very useful to determine the RBC for all insurance products with the same stochastic scenario set. By comparing the RBC for the entire portfolio with the sum of RBCs for the individual contracts, the effect of diversification can then be determined. For the example at hand, the positive effect of diversification is more than 20% when we consider all insured pension contracts. Diversification effects are in general not equal to zero because the scenarios that constitute the risk need not be the same for all contracts. There can, of course, also be a substantial amount of diversification when an insurer operates in multiple countries or when a wide variety of insurance contracts is sold.

The above case study is carried out with Ortec Finance's Asset Liability Management (ALM) model for insurers. This model is an excellent tool for all kinds of RBC or ECAP calculations because all required components (like economic scenarios and the market consistent valuation of assets and liabilities) are standard features.