

Using Capital Allocation to Steer the Portfolio towards Profitability

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Abstract

A modern reinsurance company needs to manage its capital efficiently. The problem is that there are many views on capital, depending on the various positions of the stakeholders of the company involved. In this publication, we present a consistent way of defining capital and of managing it, taking into account the view of all stakeholders. We answer the question of how much capital is required by the business and introduce the notion of buffer capital. This is used to reduce the likelihood of the company having to call too often on its shareholders to refurbish its capital. We show how this concept relates to the setting of return on equity objectives for the company.

Capital allocation is the driver for measuring the economic performance of a business. The fixing of limits relating to capital consumption is linked to capital allocation because it preserves the diversification of the book. We advocate the use of the internal model to determine all of these parameters and to set the stage for good enterprise risk management within the company.

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In financial institutions, the primary focus of capital is not mainly to provide finance, but more to absorb the risks undertaken. Capital allocation is thus not ancillary to business processes; it should be at the heart of them. It is a precondition for the optimisation of shareholder value for financial institutions ranging from banks to insurance and reinsurance companies. In this document, we would like to show how a clear capital management and allocation process can help a company to steer its risk portfolio towards profitability.

1. The different views on capital

There are many stakeholders in an insurance company. The major ones are: the shareholders, the policyholders and their representatives the regulators, the rating agencies, and the management and employees. For each of them, the capital of the company plays a different role:

- From the point of view of management, capital is the means by which to generate business and profit, and it should be managed in such a way as to satisfy all other stakeholders.
- For policyholders and regulators, capital is the guarantee for liability payments that exceed expectations. It should thus be as large as possible.
- For rating agencies, capital equals the monetary value of a company. The rating agencies use this capital to assess the creditworthiness and potential risk of a company. Rating agencies conduct an assessment of “sufficient” capital levels on the basis of the balance sheet and management meetings.
- For shareholders, capital is the monetary “value” of a firm for its “owners”. It is used to generate *future profits* and should stay as small as possible (target capital). The shareholder’s concern is that the riskiness of the company’s activities is properly compensated for in the form of returns generated on his investment.

The shareholder’s perspective is arguably the most important one, as it drives the optimisation of shareholder returns, which is (or should be) the prime objective of the managers of a publicly traded company. His perspective starts with the share price, which implicitly contains the expectation of future profit. This will of course influence our definition of risk. The risk for the shareholder is that the company will not achieve its expected profit.

2. The available capital from the point of view of the shareholder

From the investor’s point of view, the available capital starts from the amount of equity reported on the balance sheet of a company¹. It can then be adjusted to obtain the economic capital:

$$\begin{aligned} & \text{Equity} + \text{Hybrid debt} - \text{Goodwill} \\ & - [\text{Net deferred tax asset} = \text{DTA} - \text{DTL}] \\ & + \text{adjustments for market consistent valuation of liabilities} \\ & + \text{adjustments for market consistent valuation of assets}^2 \end{aligned}$$

Starting from the equity reported on the balance sheet, the investor will look at how much return the company generates on it, and he will judge the profitability of his investment by comparing the profit the company declares with the capital it holds.

Bearing this in mind, let us analyze the process that management has to go through in order to define the amount of capital needed as well as the profitability targets. The aim of this paper is to answer the following questions:

- How much capital does the business require (required capital)?
- How does the profitability target in terms of ROE translate to the required profitability of the business?

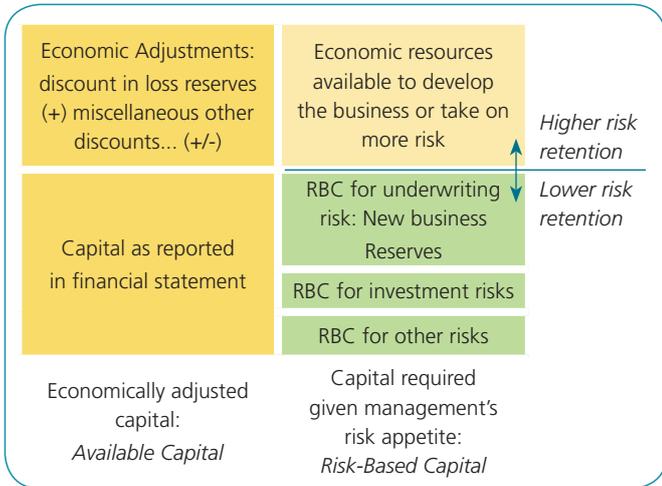
3. How much capital does the business require?

“Sufficient” capital is the monetary value a company needs to have according to the risk assessment of that company by a stakeholder or stakeholder’s agent (rating agencies, regulators, investors, management). How much is the investor willing to lose? How well is a policyholder protected? This is basically the Risk-Based Capital (RBC) plus some “buffer capital” on top of it. All of these quantities are computed at the given time horizon, t_1 , generally one year. In Figure 1, we illustrate the distinction between the available capital and the risk-based capital.

¹ Clearly this is neither the sole source of information nor the sole view of capital for the investors. They can also use the share price to compute the market capitalization, which includes the expectation of future cash flows for future business.

² This includes negative discounting effects on assets like reinsurance assets.

Figure 1
The two dimensions of capital of an insurance company:
available versus required capital



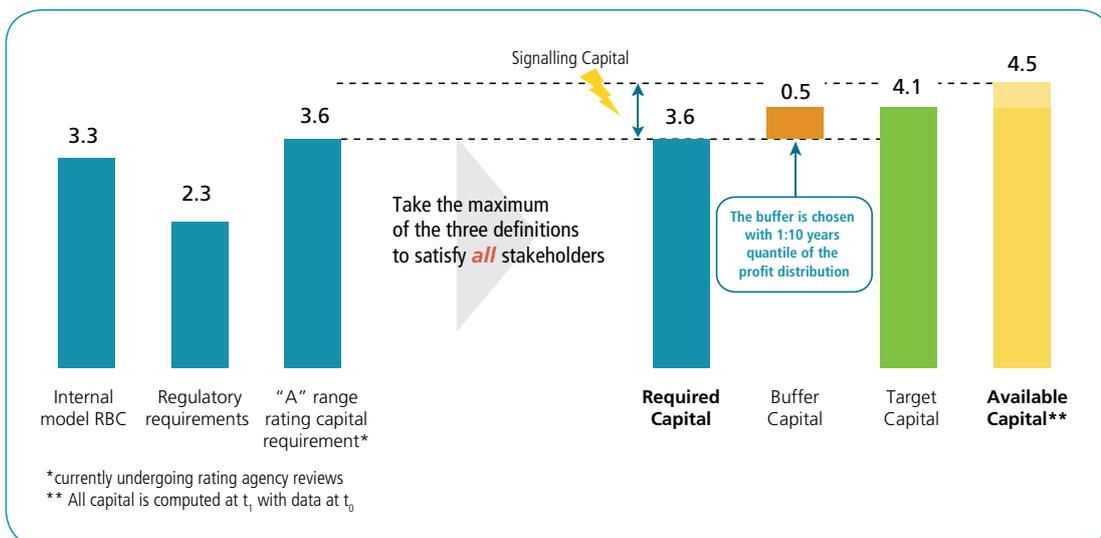
Although this definition seems simple, we should remember that various stakeholders have different views on the RBC depending on their risk tolerance as well as on their depth of knowledge about the risks and their inter-dependencies within a company.

To compute its RBC, an insurance company needs to define a risk measure and a risk tolerance level. We propose using the expected shortfall of the firm's economic capital at the 99% level³. This measure is also used in the Swiss Solvency Test and has the major advantage of being mathematically coherent. This property crucially permits an additive⁴ allocation of the capital to individual risks. As a general rule, the company will estimate its RBC from its internal model (a precise definition of RBC is given in the Appendix). The internal model represents the highest level of knowledge concerning the risks involved in the portfolio. However, in order to accommodate the various stakeholders, the required capital for running the business needs to amount to the maximum of the RBC from the internal model, the rating agency's model (at the required rating level, for instance A+ for S&P), and the solvency capital. Moreover, the management of the company will want to add some buffer capital to this required capital to protect itself from having to go to the market to raise capital too often, and to account for model uncertainty. In Figure 2, we illustrate how we define the various capitals (which are precisely defined in the glossary).

³ In monetary amounts, this generally corresponds quite closely to the capital resulting from a Value-at-Risk at a 99.6% level.

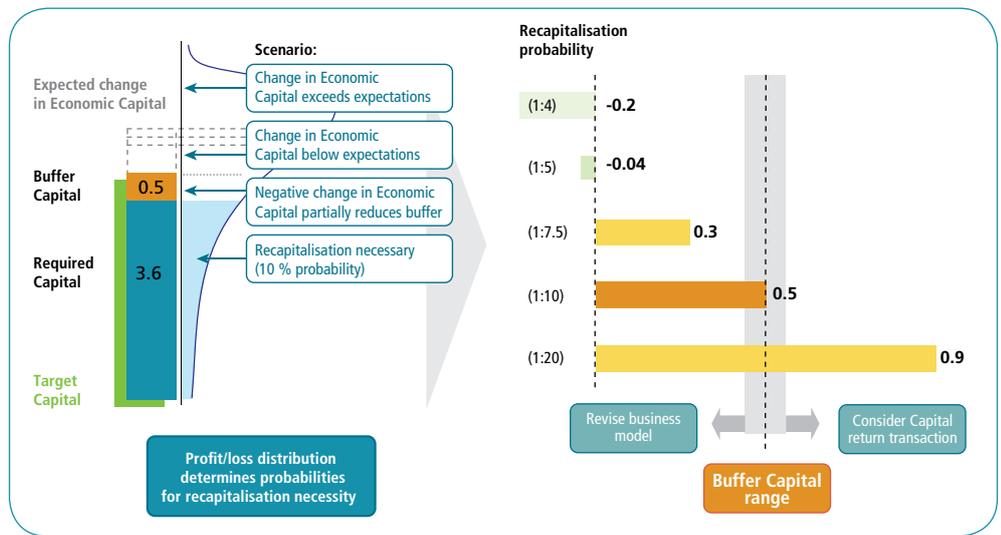
⁴ The sum of all allocated capital is equal to the RBC for the entire portfolio.

Figure 2
The internal capital requirement satisfies all stakeholders
Internal RBC, Required Capital, Buffer and Target Capital
In € billions, based on figures for 2008



A convenient way to determine this buffer capital is to calculate it using the internal model. From the internal model we also deduce the probability distribution of shareholder equity after one year. To determine the buffer capital, we add the quantile of the distribution, which has a 10% probability of being exhausted, to the required capital. In simple terms this means that management does not want to go back to the capital market to ask for a capital increase after big losses more than once every 10 years.

Figure 3
SCOR actively manages its capital to optimise return
 Buffer Capital limits probability of a capital increase - In € billions

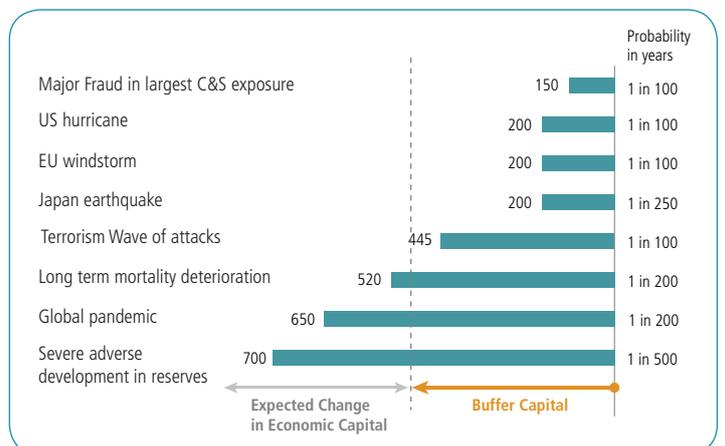
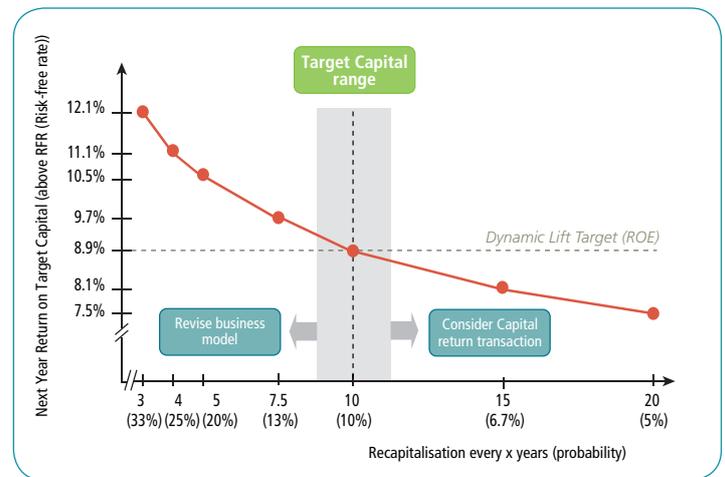


This threshold depends, of course, on the company's risk appetite and its access to financial markets, as well as on the market expectations regarding company profitability. If management fixes the target ROE, this will automatically set limits on the size of the buffer. An acceptable range should be between 5 and 15 years. Given the company risk/return profile, the 10% value corresponds more or less to the target ROE of 900bps above the risk-free rate proposed by management. In other words, proposing a target ROE is directly linked to the quantile of the buffer. The size of the buffer capital is derived by a risk-return trade-off. The lower the recapitalization probability, the more buffer capital is required. The higher the target capital (the sum of the required capital and the buffer capital), the smaller the ROE is for a given profit. Such a trade-off can be found on the risk-return curve produced by the model once the target ROE has been determined, as shown in Figure 4. In the Appendix, we show how the size of the buffer and the target ROE are functionally related.

An alternative way to check the reasonableness of the buffer is to compare its amount to the results of the evaluation of extreme scenarios and see if the buffer covers a good portion of them, as illustrated in Figure 5, where we show typical results for SCOR's book of business.

Figure 5
The Buffer Capital absorbs the single worst case scenarios
 Buffer capital checked against single worst-case scenarios (examples) – In € millions, net of retro

Figure 4
 The Buffer Capital policy is consistent with the return target
 Risk/Return trade-off for different recapitalisation probabilities



4. Capital allocation and performance

Once we have agreed on how to calculate the target capital and have derived it, there are two questions left: What will we do with possible excess capital, and how will we allocate the target capital? The answer to the first question is obvious: Excess capital should either be used to increase business profitably, or returned to the investors if this is not possible. Often a combination of both is optimal. The rest of this section deals with the second question: How should we allocate the target capital? Concepts of capital are crucial within a company when it comes to distributing the capacity profitably between the various different lines of business and the investment side. Optimal “capital allocation” to a line of business or a treaty is related to the risk contribution of the line of business or the treaty to the overall risk (e.g. expected short-fall) of the economic capital. The allocated capital must be profitable, i.e. must generate sufficient profit on average to meet the profit expectations communicated by management. In other words, capital becomes the “currency” for doing business and for measuring its profitability. In order to achieve this, systems for measuring the capital at risk should be in place. Moreover, the individual players must reach a consensus on how to calculate the capital at risk, and on how to allocate it. Once such a system is in place, a business with less risk but the same premium will require less capital and thus look more profitable. Conversely, a business that adds exposure to an already very exposed book will be penalized by more capital requirements and thus appear less profitable. This way, the portfolio is steered towards more diversification and greater profitability. This is

illustrated in Figure 6 by calculating the price of a set of CAT-layers with similar risk exposure whose price changes when valued against the portfolio. We develop this further in the next section.

When it comes to measuring profitability of business and to defining targets, the entire target capital should be taken into account. The ROE target announced by the management can only be achieved if we allocate the entire target capital (including the buffer) to the risks and require that every risk produces on average the allocated target ROE. For practical purposes, we define two different profitability thresholds: the hurdle and the target. The hurdle is defined as the return required for covering all costs including cost of capital as derived from market expectations (CAPM). It must in principle be reached by every policy; otherwise we are not able to cover all our costs. Any policy written below hurdle should be either avoided or considered as an investment for future earnings. The target will be set in order to, on average over the cycle, meet the company’s target: 900bp above the risk-free rate. In certain circumstances, for instance during hard markets in P&C, the target could be set higher so as not to “leave money on the table”. In others, it could be set lower in order to keep market shares. For Life, since there is no real market cycle and contracts have a long-term effect, the target rate is not likely to vary from one year to the next. In any case, the choice of target should be a conscious management decision.

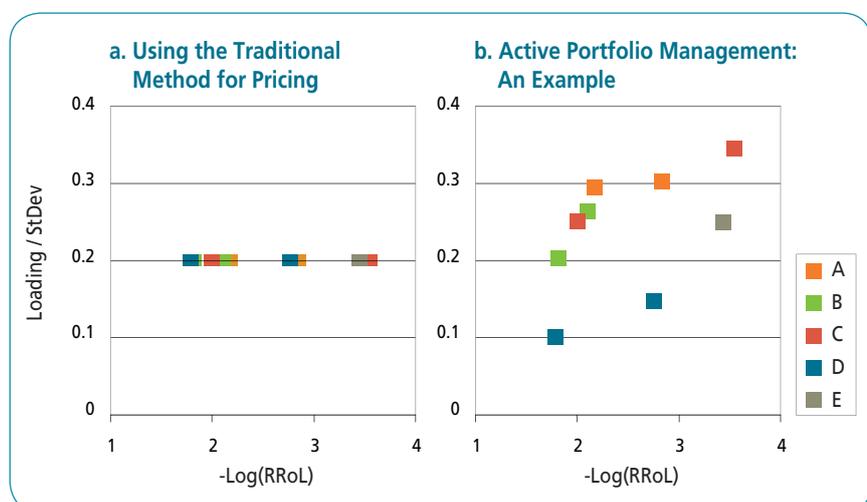
Figure 6
Risk Loading for Various CAT Programs

a. Using the standard deviation loading makes all these programs lie on a straight line since they present very similar risk characteristics.

Risk Rate on Line:

$$RRoL = \frac{\text{Expected Loss}}{\text{Granted Limit}}$$

b. Diversification or risk accumulation are favoured respectively penalized in the price. As a result, the pricing mechanism implicitly optimizes the portfolio.



5. Portfolio Management and Capital Limits

Why go through all this trouble in order to allocate capital to the various units of a firm? Simply because it is the best way to steer the portfolio towards higher profitability. If management is able to allocate an amount of the company's equity to a business unit, it can also measure the performance of this unit, and then reduce or increase the exposure according to the potential results of that particular line of business, leading to portfolio optimization. Moreover, explicitly assigning capital to a business unit and relating the amount to the risk assumed by that unit facilitates the development of a risk management culture within the company. The simple fact that a monetary amount is assigned facilitates discussion among the various stakeholders as to the underlying assumptions that led to this amount in the first place. Moreover, a very efficient way to insure the risk-reward strategy of the company is to set limits on the capital consumed by the various business units. This is particularly true in the case of the asset management of a reinsurance company. Asset management is not a core reinsurance business and very often it is not even really clear how it should be managed. On the one hand, assets should be invested so as to produce high investment yields. On the other hand, the company should not

take too much risk on the financial markets, in order to keep enough capacity for its core business. This is why we suggest limiting the amount of risk-based capital consumable by the asset managers to no more than 25% of the total allocated capital in the ALM model. One can also add a limit to the rating agency capital that the company is willing to use for this activity. This limit does not need to be the same as for the internal model since the risk model of rating agencies for assets differs substantially from our own models. A reasonable limit here would be 15% for S&P capital (subject to revision with new models).

There is a subtle difference between the limits that we propose to set and our risk appetite. The limits are related to the company's risk tolerance and should not be exceeded under any circumstances. Coming back to the 25% limit for asset management, the risk appetite would usually be much lower than this, around 15%. If we are already above the 15% mark, let us say at 20%, we should, in normal circumstances, already be taking measures to reduce our risk level so that we do not exceed the 25% limit. We should also act in a similar way with other insurance risk limits.

6. Appendix: Mathematical definition of risk-based capital and solvency requirements

The definition of risk-based capital is often left vague in the publications where it is discussed. We would like here to give precise mathematical definitions in order to avoid any confusion and because our way of calculating this quantity differs slightly from the pure solvency definition. First, let us start with some notations:

$EV(X)$	means economic value of the variable X
A_i	are the assets at time t_i
L_i	are the liabilities at time t_i
C_i	is the available capital at time t_i discounted at t_0 where $C_i = EV(A_i) - EV(L_i)$
P_i	is the profit made at time t_i discounted at t_0 where $P_i = C_i - C_0$
$E[X]$	is the expectation of the stochastic variable X
$VaR_\alpha(X)$	is the value-at-risk of the stochastic variable X at the α probability
$ES_\alpha[X]$	is the expected shortfall of the variable X at the α probability

For ease of notation, we have not added here the Net Present Value (NPV), which usually expresses discounting. From the point of view of the shareholder the risk is that he will not, at the end of the year, be able to reach the profit he expects. We thus define the **RBC** as:

$$RBC = E[P_1] - ES_\alpha[P_1],$$

where the 1 is for t_1 the end of the year. Since the expectation of C_0 is C_0 , the above expression can be simplified in terms of available capital at t_1 as follows:

$$RBC = E[C_1] - ES_\alpha[C_1].$$

If we now turn to the regulatory solvency **RBC** and the regulator solvency requirement, we can write the solvency RBC_s as:

$$RBC_s = ES_\alpha[C_1] \geq 0$$

This is the Swiss Solvency Test requirement. Solvency II will require the Value-at-Risk at 99.5% to follow the above condition, but in terms of monetary amounts they are equivalent. Coming back to our definition, our own solvency requirement is that:

$$RBC = E[C_T] - ES_{\alpha}[C_T] \leq E[C_T],$$

which is equivalent to

$$RBC \leq E[P_T] + C_0,$$

and satisfies also the regulator's requirements. We also note that:

$$RBC_s = RBC - E[P_T].$$

The two definitions differ by the expected economic profit for the year. This quantity constitutes the departure point for shareholder risk.

The buffer B is then defined as the 90% quantile of the profit distribution: $VaR_{0.9}(P_T)$.

7. Appendix: Required Capital and Risk-return profile, limit for buffer capital

As we have seen above, the choice of probability for the capital buffer is not arbitrary; in this Appendix, we formalize this idea and deduce the theoretical boundaries to these choices.

If we define, λ , to be the market risk premium for a total loss at the 99% expected shortfall, and z is the risk-free rate, the market will thus expect that we reward our required capital R at a level of: $z + \lambda$.

If $B = B(N)$ is the buffer representing the quantile of the (capital) distribution which has a 1 in N probability of exhaustion, then, by default, the market will allow us to earn

$$R \cdot (z + \lambda) + B \cdot z$$

as B must be invested risk-free.

If T is the shareholders' premium above the risk-free rate charged on the aggregate of the required capital R and the buffer B , then the shareholder will wish to see a result of

$$(R + B) \cdot (z + T)$$

Note that $\lambda + z$ (and hence λ) can be derived by relating the amount of reasonably expected economic return (i.e. the return on the economic balance sheet) less the cost of the buffer to the required capital. T must be derived by relating a translation to economic return of the target GAAP return (IFRS return) to the economic capital. So to make ends meet we must require that

$$R \cdot (z + \lambda) + B \cdot z \geq (R + B) \cdot (z + T),$$

which is equivalent to

$$B(N) / R \leq (I - T) / T$$

Note that this clearly only works if T does not exceed λ . If T equals I then the shareholder should at any time be prepared to recapitalize. If the shareholder wants the company to keep a buffer he must accept an economic return on economic capital below the market risk premium. The question is why would he do so? The answer is twofold: firstly, the cost of recapitalization is far from negligible, with at least 5% of the total amount required by investment banks as fees. Secondly, the determination of risk capital is not a pure science and is subject to a significant level of model risk. Shareholders need to allow for this uncertainty, which is where the buffer comes in.

Effectively this means that given λ , T and N we must manage the capital and the portfolio (and the resulting distribution of capital) in such a way that

1. $R \cdot \lambda / T = R + B$ equals our available economic capital and

2. $B / R = (\lambda - T) / T$, i.e.

the ratio of the quantile of the (capital) distribution, which has a 1 in N probability of exhaustion over the required capital, is equal to the ratio of the excess of market risk premium over shareholder risk premium.

This is a test we can perform on our portfolio on the basis of our internal model and/or extreme scenarios. Using the numbers we chose before 900 bps for T ⁵, and a risk-free rate of around 3.5%, we see in Figure 1 (assuming that this curve represents the risk/return profile of the entire company), that a buffer chosen at 1/10 probability is consistent. Knowing both the buffer and T , we can compute λ as we did for the renewal, and we arrive at a value of around 1050 bps.

Note that we use an inverse calculation here. Normally, we should start from the market expectation and deduce the buffer and the target return. In reality, we see that there is a certain consensus among shareholders to ask reinsurers to produce 900 bps above the risk-free rate over the cycle and this corresponds, in our case, to a discount of about 150 bps on market expectations given the cost of raising capital and the uncertainty relating to the RBC computation.

8. Glossary

Economic Capital: The difference between the marked-to-market-value of the assets and the market consistent value of the liabilities.

Available Capital: The economic capital deduced from the balance sheet at t_1 calculated at t_0 . When done properly, this is the economic capital at time t_1 .

Risk-Based-Capital (RBC): the quantity computed by the various models (internal, rating agency, solvency) for t_1 ⁶. For the internal model, we suggest using the difference between the expected value and the 99% expected shortfall of the economic capital at t_1 .

Required Capital: The maximum of the internal model RBC, the capital requirements of the rating agencies model and the solvency model, computed for t_1 , at t_0 ⁷.

Buffer Capital: The monetary amount above the required capital which has an X% probability (we choose 10%) of being exhausted, as calculated from the internal model computed for t_1 , at t_0 .

Target Capital: The monetary amount of capital the company needs to have at t_0 in order to be able to meet its obligations at t_1 . In our definition, this is the required plus the buffer capital.

Signalling Capital: The difference between the required capital and the available capital. It can be different from the buffer capital if the company wants to expand the business in a multi-step period.

Target Rate: The rate of return the company should produce on its target capital. We have communicated 900 bps above the risk-free rate over the cycle. The rate can be changed from one year to the next in order to achieve the target rate over the respective cycle.

Hurdle Rate: The rate of return the company needs to achieve in order to cover all its costs, including the costs of capital computed from a CAPM approach.

⁵ We should note here that using 900 bps for T is an approximation because T refers to the return on the target capital (required capital plus buffer) while the 900 bps were assigned to the return on equity deduced from the balance sheet (ignoring the leveraging of the capital by debts).

⁶ The RBC at t_1 for the internal model and the SST models allows for planned new business, expected claims, lapses (life) and non-renewed business between t_0 and t_1 .

⁷ Because it is needed at t_0 !