## TECHNICAL NEWSLETTER

#56 - August 2021

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# OPTIMIZING YOUR PROTECTION THROUGH STRUCTURED REINSURANCE

The basic dilemma for anyone buying reinsurance is how to get the best coverage for the lowest price. While there is no magical way to achieve this, one efficient thing to do is to buy the right contract, which only provides the coverage you actually need.

In the current "hardening" market, and more generally in an environment where the need for "optimization" and "efficiency" have become the norm, insurance companies and even industrial and commercial companies are increasingly considering tailor-made insurance or reinsurance. These structured solutions protect them against a range of risks, while keeping the (re)insurance premium within their budget.

Based on actual cases of companies facing price increases – which in turn increase their retention - this technical

newsletter aims to illustrate the main points to consider when designing bespoke contracts providing the right level of risk transfer.

As well as providing optimal value for money, tailor-made reinsurance has the advantage of taking accounting issues into consideration, such as certainty on performance and impact on solvency, capital and liquidity. With regard to accounting, the recognition of reinsurance contracts in financial reporting is key. Companies see the benefit of a reinsurance contract through the loss mitigation it provides, as recognized in their income statement (P&L), an annual measure of their results. The purpose of structured reinsurance is to maximize this accounting benefit while limiting the overall cost of the (re)insurance transaction throughout the entire contractual period.

## MEASURING THE VALUE OF A REINSURANCE CONTRACT FOR AN INSURANCE COMPANY

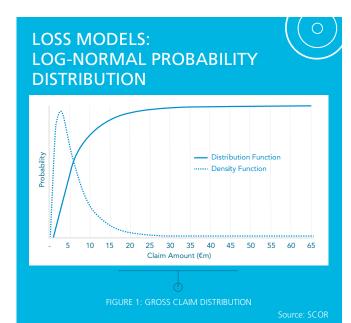
The first to thing to determine here is how to measure the efficiency of a transaction. The Net Present Value (NPV) is commonly accepted as an appropriate way to assess the cost of a reinsurance contract. In this first section, we will see how the risk-mitigation value of insurance or reinsurance can be captured by the "NPV" metric. NPV is based on a statistical model of the underlying risk - as a distribution of probable scenarios - and the risk-transfer function embedded within the structure.







#### **EXPECTED CASH-VALUE: NPV**



Because the level of future claims is uncertain, the range of outcomes is described using a statistical distribution. Original risk can easily be modelled by a log-normal function

In Figure 1 above, the average loss of €7.5 million and the volatility of outcomes around the average are reflected by a standard deviation of €7.5m. With those parameters, at a 99.9% confidence level, the cedant's gross losses will lie somewhere between €0 and €65m (start and end points of each line). In most scenarios, gross claims will be less than €20m (amount exceeded only once in 20 years). This is shown by the large area to the left of €20m under the dotted line. It is also shown by the blue line "tailing off" at around €20m. This is typical of most portfolios – small claims most of the time and very large claims some of the time.

An insurance company can assess the value of its insurance risk portfolio based on the expected value of cash-flows, as measured by the net present value (NPV) distribution metric:

NPV = premium - claims - commissions and expenses + discounting factor

In other words, NPV is the insurance company's profit adjusted for the time value of money. This can be measured gross or net of reinsurance.

From the chart of a log-normal distribution shown in Figure 1, we can translate the claim distribution into an NPV distribution by adjusting for premium income, expenses and the time value of money:

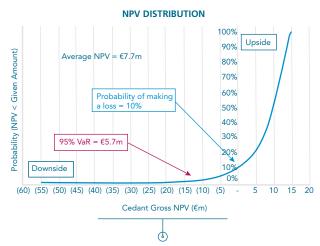


FIGURE 2: TYPICAL NPV FUNCTION FOR A LOG-NORMAL RISK ( $\in$ 7.5M,  $\in$ 7.5M ), WITH A  $\in$ 17M PREMIUM.

Note: downside = 1-in-1000 scenario Source: SCOR

In Figure 2, we use some important metrics. The average, or expected, NPV is €7.7m. This is the profit the company expects to make in the long run. The maximum upside is €15m (far right) and, while unlikely, the downside could exceed a €55m loss (far left). The probability of making a loss is shown where the blue line crosses the vertical axis, which is around 10%. The final metric we use is the Valueat-Risk (VaR).

The VaR tells us how much the company could lose at a given level of confidence, or quantile. For example, we can say that we are 95% confident the loss will not exceed €5.7m. In other words, the chances of the loss being more than €5.7m are roughly 5%, or one in twenty. This is shown in where the blue line is at 5% on the vertical axis.

#### IMPACT OF REINSURANCE ON THE NPV

Let's now introduce a reinsurance contract into the equation, which the company buys to mitigate its exposure to the risk at hand. The contract will have an annual aggregate deductible of €10m, an annual aggregate limit of €10m and a reinsurance premium of €3.5m (illustrative amount).



We expect the average NPV and upside to decrease because the cedant is paying some of the profit to the reinsurer. In return, we expect the probability of loss, and the VaR at high quantiles, to decrease.

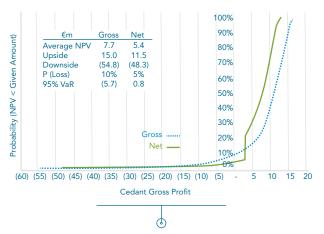


FIGURE 3: TYPICAL NPV GROSS AND NET OF XL REINSURANCE
Source: SCOR

As shown in Figure 3, the net NPV curve is narrower and more condensed than the gross curve. There is less upside but also significantly less downside. In exchange for a reinsurance premium, the cedant has significantly reduced the likelihood and magnitude of losses. From this, we can see that cedants will try to strike the right balance between shifting the curve as far to the right as possible (more profit), while limiting how far the curve can extend to the left (more loss).

#### OTHER PERFORMANCE INDICATORS

The NPV is obviously the main metric for "risk" measures. From the NPV, we can derive the capital requirement (which is usually a Value at Risk (VaR) or Tail Value at Risk (TVaR) under most risk-based capital models. From the NPV we can also measure the efficiency of a risk transfer, e.g., via the Expected Reinsurance Deficit (ERD) or the 10-10 tests.

The value of a reinsurance contract can also be considered from other important perspectives, such as its impact on the loss ratio or combined ratio (which are not reflected in the NPV), on the liquidity position, or on the predictability of future results.

## CASE STUDY: MULTI-YEAR AGGREGATE EXCESS OF LOSS

Now that we have a basis on which to measure the value of a reinsurance contract, we can illustrate how the main features of structured reinsurance help to achieve optimal reinsurance.

One of the features we should mention here is the excess of loss contract with an aggregate deductible and limit, as found in traditional markets, but expanded to cover multiple years. The benefits of this multi-year feature are:

- Diversification across years resulting in lower volatility and hence lower reinsurance premium
- Greater certainty over future reinsurance costs
- Closer alignment with long term risk appetite

Let's return briefly to the example illustrated in Figure 3 and assume that it describes losses within a given layer. The reinsurance contract used in the example was a €10m Annual Aggregate Limit (AAL) in excess of a €10m Annual Aggregate Deductible (AAD) over one year. In other words, the coverage under this contract would be exhausted if

claims were greater than €20m. Under the assumptions of Figure 3, the actual chance of annual claims exceeding €20m is around one in twenty or 5%.

Now let's extend this example so that the reinsured purchases the same contract for three (individual) years in a row. We know that the probability of exhausting cover in a single year is 5%. Assuming the three consecutive years are independent of one another, the chances of exhausting cover in each of the three years is  $5\%^3 = 0.0125\%$ , which is equivalent to a circa 1-in-8,000 chance.

So, while the purchase makes sense on a one-year basis, too much capacity might be purchased in the long term if the company has appetite for more risk. This can be managed by a multi-year version of this contract.



The total losses across the three years are combined into one contract, which has a Term Aggreagate Limit (TAL) rather than annual ones. This is illustrated in Figure 4.

The working principle of the structure is to retain one "bad" year over the term of the contract and reinsure a hypothetical second "bad" year over the period, being reasonably certain that there won't be three bad years in a row. This illustrates the benefits of diversification: adverse experience in one year is offset by better experience in another.

Let's first consider a multi-year contract based on a €10m xs €10m annual limit and various amounts for the three-year Term Aggregate Limit.

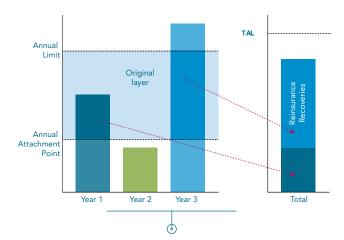


FIGURE 4: MULTI YEAR AGGREGATE

Source: SCOR

Amounts in €m	Year 1 10 XS 10	Year 2 10 XS 10	Year 3 10 XS 10	Total over 3 years	AXL option 1 (10 X 10, TAL = 30)	AXL option 2 (10 X 10, TAL = 25)	AXL option 3 (10 X 10, TAL = 20)	AXL option 4 (10 X 10, TAL = 15)
Aggregate retention	10	10	10	-	-	-	-	
Aggregate limit	10	10	10	30	30	25	20	15
Probability of exhaustion (years)	1/20	1/20	1/20	-	0	1 / 1,300	1 / 325	1 / 35
Expected loss	1.2	1.2	1.2	3.5	3.5	3.5	3.5	3.4
Standard deviation of Loss	2.8	2.8	2.8	-	4.8	4.8	4.7	4.5
(Indicative) premium	3.5	3.5	3.5	10.5	10.5	10.0	9.5	9.0

FIGURE 5: ANALYSIS OF A MULTIYEAR SOLUTION

Source: SCOR

The table in Figure 5 above illustrates the benefit of combining three years into the same contract on the volatility (Standard deviation of loss relative to the mean). It also shows that reducing the TAL from €30m to €20m still provides sufficient cover for a 325-year return period event.

The reduced volatility and limit explain why the reinsurer can commit to protection over a longer term at a reduced price.

Let's now introduce a "structured" retention which will allow the cedant to retain one "bad" year under this contract.

Take AXL option 3 and assume a €5m annual premium (or €15m over the three years). We can virtually split this €15m premium into €5m of "ultimate margin" and €10m of "funding".

The "funding" is used first to pay for any losses that arise. Any remaining "funds" will be returned as a profit commission at the end of the three-year term. In other words, if there are no losses a profit commission of €10m will be paid. The "ultimate margin" is kept by the reinsurer and can be interpreted as the cost of risk transfer net of profit commission. This is illustrated in Figure 6 below.



CASE 1: MAJOR LOSS

All amounts in €m		Year 1	Year 2	Year 3	End	Total
Gross loss		-20	-20	-5		-45
Ceded loss 10 XS 10		10	10	0		20
	RI premium	-5	-5	-5		-15
Structured	Profit com.				0	0
	RI result	+5	+5	-5	0	+5
Traditional	RI premium	-4	-4	-4		-12
	RI result	+6	+6	-4		+8

#### CASE 2: LOW LOSS

All amounts in €m		Year 1	Year 2	Year 3	End	Total
Gross loss		-5	-5	-5		-15
Ceded loss 10 XS 10		0	0	0		0
Structured	RI premium	-5	-5	-5	10	-15 10
	RI result	-5	-5	-5	10	-5
Traditional	RI premium	-4 -4	-4	-4 -4		-12 -12
	Ri result	-4	-4	-4		-12

FIGURE 6: EFFICIENCY OF TRADITIONAL VS. STRUCTURED COVER

Source: SCOR

You could say that the funding premium remaining constitutes a self-financed buffer - for the company to retain the first loss, manage cost and liquidity over time, and provide a material reduction in premium. The contract provides risk transfer for the second loss, which no longer fits within the company's risk tolerance.

Figure 7 below shows the NPV of both the multi-year and the annual strategies over three years alongside a gross strategy (without reinsurance), on both a regular and a log scale. The latter is useful for seeing the "tail" of the distribution, but note that the vertical axis is not linear.

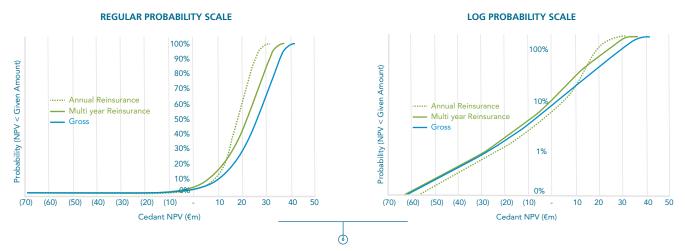


FIGURE 7: NPV FOR THE REINSURED OF EACH STRATEGY OVER THREE YEARS ALONGSIDE THE STRATEGY WITHOUT REINSURANCE

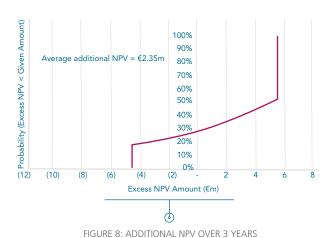
Source: SCOR

By reducing the economic cost, the multi-year strategy brings additional value (the curve has shifted towards the right-hand side) to the reinsured in most adverse scenarios (e.g. peak in frequency of events), where the risk transfer is still there. It reduces the value in less adverse scenarios, where the reinsured wants – and can afford – to retain the risk. Figure 8 below highlights the additional NPV over three years derived from the multi-year strategy over the single-year strategy.

Most of the time, no losses will be ceded under either strategy, so the company will simply save the difference in reinsurance premium.

This is illustrated by the vertical line at €5.5 million on the right. In some scenarios, the claims in a single year will be so high that they exhaust the aggregate limit in that year, whereas claims in other years will be small. This is where the company will benefit from the higher overall term limit and make additional recoveries (right of chart).





Source: SCOR

The downside will occur when losses in an individual year result in recoveries but are too small to result in a recovery across three years.

The vertical line on the left of the chart at (€4.5m) occurs when ceded losses across the three years reach €10m. This is equal to the funding premium and usually occurs when one year exhausts its annual limit, but the other

years don't attach. In this scenario, a single-year structure would recover €10m minus the €10.5m (€3.5m x 3) total premium, leaving net payments of €0.5m to the reinsurer. Under the structured deal, the cedant would pay €15m to the reinsurer and recover €10m, leaving net payments of €5m. The difference between the two is €4.5m. Approximately 70% of the time, the multi-year strategy performs better. Overall, it results in an average saving of €2.35m, or circa 22% of premium spend.

Another reason for the popularity of this kind of structure is premium stability. By using a structured program that covers multiple years in one contract, cedants can "lock-in" coverage for an extended period at a predictable premium. This protects cedants against significant future rate increases if markets harden further.

To summarize, multi-year contracts combine lower premiums, higher certainty over future premiums, and sufficient downside protection. These contracts can be further extended to include multiple layers and / or multiple lines of business. This means further diversification benefits and more efficient purchasing where retentions can be combined across different sections of a cedant's portfolio.

### MOST COMMON ADDITIONAL FEATURES

To satisfy the specific risk appetites of reinsureds, as well as any key objectives or constraints (accounting, need for P&L certainty, tax frictions, liquidity, flexibility over the long term, capital, and so on) while remaining acceptable to the reinsurance market, these contracts can combine further features, whose parameters can also be optimized.

#### **Cancel and Rewrite**

Multi-year contracts can include an early cancellation option (also called a "cancel and rewrite" contract), which works in the following way:

- the reinsured pays a low first-year premium, like an "option cost";
- at the end of the first year, if the reinsured has not suffered a loss, it can choose to cancel the contract at no further cost;
- however, if reinsured notifies the reinsurer of losses in the first year, then the contract continues for the whole period, at pre-agreed conditions.

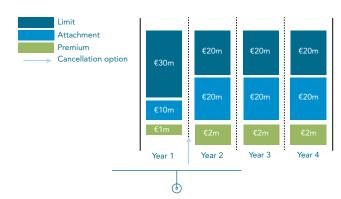


FIGURE 9: MULTIYEAR AGGREGATE XS WITH "CANCEL AND REWRITE" OPTION ILLUSTRATIVE NUMBERS, ILLUSTRATIVE CONDITIONS

Source: SCOR

On some markets, there may also be the option to rewrite a new, similar contract for the next year, after the early cancellation.



If the company never incurs a loss, it will not use any reinsurance capacity and will not pay the full price for that capacity. If losses occur, the premium increases are known in advance and are spread over multiple years.

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#### **Additional premium**

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The Additional Premium (AP) is a loss-dependent premium that can be structured within a reinsurance contract. The reinstatement premium is the most common type of additional premium on traditional per risk or per event treaties, but more parameters may be introduced.

The payment of an additional premium is triggered by the aggregate ceded losses. The additional premium can be then calculated as a percentage of the ceded losses, either taken in excess of a threshold or taken from ground up, capped to a maximum AP amount.

This feature gives the reinsured the benefit of a lower base premium - hence a lower total premium if the loss activity remains low – and can make the deal more appealing to the reinsurer by excluding some layers from the risk transfer.

- A €50m XS €100m traditional cover for a reinsurance premium of €20m;
- (Left chart) A €50m XS €100m cover with a 100% additional premium calculated in excess of ceded losses when those equal 20 (equal to ground-up losses at €120m), with a cap at €15m AP. The base reinsurance premium for this cover is €10m;
- (Right chart) A €50m XS €100m cover with a 100% additional premium calculated on the losses ceded to the reinsured layer when those ceded losses have reached €20m, with a cap at €15m AP. The calculation of the additional premium from ground up will lead to an AP jumping in directly at €15m when original losses reach €120m. Let's assume that the base reinsurance premium is also €10m for this cover.

With the AP, the reinsurance coverage protects scenarios above €110m (the result with reinsurance is larger than the result without reinsurance). Without the AP, losses have to reach €120m before the reinsurance coverage becomes valuable for the cedant.

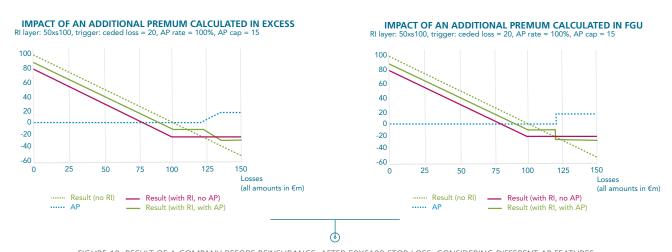


FIGURE 10: RESULT OF A COMPANY BEFORE REINSURANCE, AFTER 50XS100 STOP-LOSS, CONSIDERING DIFFERENT AP FEATURES

Source: SCOR

The graphs below in Figure 10 show how the reinsured's technical result varies according to losses and reinsurance structure.

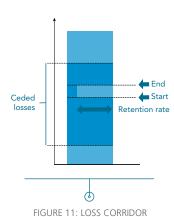
Figures are based on an original premium of €100m (for illustration). Three reinsurance structures are considered:

The AP feature allows the cedant to retain some risk in a selected range of losses (above the AP trigger, between €120m and €135m). This leads the reinsurer to offer a lower base premium foregoing a bit of coverage in the largest loss scenarios compared to a cover without additional premium.



#### **Loss corridor**

A loss corridor is a feature by which a proportion of a given range of ceded losses is retained by the cedant. It accounts for the same loss-optimization of the treaty as an additional premium calculated in excess of a threshold.



Source: SCOR

Source: SCOR

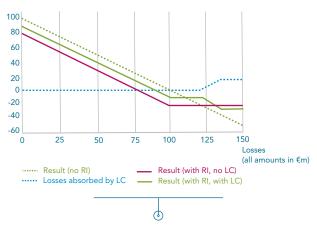


FIGURE 12: IMPACT OF A LOSS CORRIDOR considering the same 50 XS 100 stop-loss as before, a 100% loss corridor starting when the ceded losses equal 20 and ending when they reach 35 has the same impact as an in excess additional premium

Since they both result in the same risk transfer, the choice between additional premium and loss corridor features can be driven by other considerations. For instance, they often follow different accounting rules and generate different reporting indicators.

#### **ACCOUNTS - INCURRED LOSS RATIO = 125%**

125% loss ratio	50xs100	With AP	With LC
Premium	100	100	100
RI premium	-20	-10	-10
Subject loss	-125	-125	-125
Ceded loss	25	25	25
Additional premium	0	-5	0
Loss corridor	0	0	-5
Net premium	80	85	90
Net loss	-100	-100	-105
Net result	-20	-15	-15
Net loss ratio	125%	118%	117%

#### **ACCOUNTS - INCURRED LOSS RATIO = 140%**

140% loss ratio	50xs100	With AP	With LC
Premium	100	100	100
RI premium	-20	-10	-10
Subject loss	-140	-140	-140
Ceded loss	40	40	40
Additional premium	0	-15	0
Loss corridor	0	0	-15
Net premium	80	75	90
Net loss	-100	-100	-115
Net result	-20	-25	-25
Net loss ratio	125%	133%	128%

#### ACCOUNTS - INCURRED LOSS RATIO = 100%

100% loss ratio	50xs100	With AP	With LC
Premium	100	100	100
RI premium	-20	-10	-10
Subject loss	-100	-100	-100
Ceded loss	0	0	0
Additional premium	0	0	0
Loss corridor	0	0	0
Net premium	80	90	90
Net loss	-100	-100	-100
Net result	-20	-10	-10
Net loss ratio	125%	111%	111%

FIGURE 13: IFRS 4 ACCOUNTS FOR THE DIFFERENT REINSURANCE STRUCTURES, AMOUNTS IN  $\in$ M Source: SCOR

(1)

When the loss ratio exceeds the trigger, an additional premium increases the ceded premium amount whereas the loss corridor decreases the ceded loss. The net result is identical, yet KPIs such as the loss ratio will be affected by this phenomenon.



#### Sliding scale commission

A parallel can also be made between the additional premium/ loss corridor (usually used to structure an aggregate excess of loss) and the sliding scale commission (usually used to structure a quota share treaty). A sliding scale commission is a loss-dependent commission. The larger the loss ratio of the treaty, the lower the commission.

The graph below displays the way a Sliding Scale Commision (SSC) works, highlighting its impact on the net result of the cedant as part of a 50% quota share.

In this example, the rule defining the SSC (blue dotted line) is as follows: the SSC is set at 50% for a loss ratio below 45% and at 10% for losses above 85%. The commission rate is linearly interpolated for loss ratios between 45% and 85%, decreasing by one point when the loss ratio increases by one point.

The SSC provides a better alignment of interests between the cedant and the reinsurer within the loss ratio range (between 45% and 85%). The net result of the cedant (green solid line) is parallel to the gross result in this range. The SSC imposes more risk retention on the cedant in the most adverse loss scenarios (the net result with a flat commission is larger than with an SSC when the loss ratio exceeds 65%). As the reinsurer is less at risk with a SSC, it will give some reward to the cedant if fewer losses occur.

#### **Profit commission**

Additional premium, loss corridor and sliding scale commissions are different ways to allow the cedant to retain some of the losses in a pre-agreed framework where it

SSC: 50% if LR  $\leq$  45%, 10% if LR  $\geq$  85% linear interpolation in-between

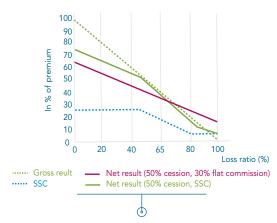


FIGURE 14: IMPACT OF A SSC ON THE RESULT

Source: SCOR

has risk-appetite. Conversely, the cedant can also share the profit on the contract through a Profit Commission (PC) or a no-claims bonus.

The PC is a feature allowing the reinsurer to pay back a certain amount to the reinsured when the losses ceded on a reinsurance contract remain below a given amount. Its main purpose is to limit the cost of reinsurance in the risk area where the reinsured wants to retain the risk, while benefiting from the financial function provided by the treaty.



A reinsurance cover is the result of a negotiation between the cedant and the reinsurer to make the terms of the contract acceptable to both parties. In a hardening market the cedant might agree to retain some proportion of its losses to find coverage at a reasonable premium. Structuring features as described above help to create a customized deal that both parties agree on.

To illustrate the compromise reflected by a structured cover, let's look at the graphs in Figure 15 below representing the cedant's NPV gross and net of reinsurance cover (left chart) and the cedant's result, considering only the cash flows of the reinsurance contract (right chart plotting the distribution of the ceded loss minus the reinsurance premium). The parameters are mostly illustrative, to clearly show the benefit of structured reinsurance on the graphs.

A multi-year reinsurance contract with annual layering and a term aggregate limit provides a fair amount of protection, by reducing the probability of loss quite significantly (compare the orange and yellow curves on the left chart). However, these terms will not be acceptable to the reinsurer, which will require some risk retention from the cedant by introducing a term aggregate limit (green curve), and

maybe a loss corridor or an additional premium (blue curve). This shifts the NPV curve of the cedant upwards (blue curve) meaning a larger probability of loss for the cedant due to a larger risk retention, but in an area where the reinsured's P&L and capital are still safe, and with the benefit of a lower cost.

If the reinsured requests a "cancel and rewrite" option, the NPV (red curve) appears to deteriorate. This is misleading at first sight due to the fact that the contract boundary is reduced by early cancellation, and the displayed value no longer considers claims over the second and third years of the cover. In other words, if we modelled the renewal of the policy over the same time period, we would see more clearly that the "cancel and rewrite" option does not reduce the value of the contract for the reinsured.

This analysis of the cedant's NPV curve gives some insight into the considerations that matter when structuring a transaction. The aim of structuring is to reconcile the specific interests of the cedant and the reinsurer, in order to reach a deal that both deem optimal in terms of cost, loss probability and risk reward.

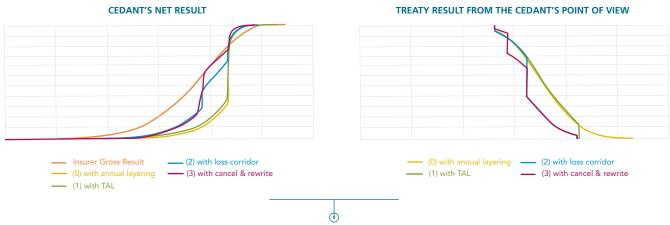


FIGURE 15: ILLUSTRATIVE CASE STUDY: OPTIMAL REINSURANCE AND NPV Source: SCOR

## CONCLUSION

This paper illustrates how a structured multi-year aggregate reinsurance contract can help an insurance company to manage the volatility of its net losses, while providing the protection it needs at a competitive cost.

It also illustrates the importance of dialogue between the insurance company and the reinsurer, so that the reinsurer fully understands all the insurance company's needs – with regard to risk tolerance of course, but also accounting, solvency and any other constraints – and can design the most appropriate solution accordingly.

Structured reinsurance has a very broad scope and can be highly sophisticated. It is by no means limited to the examples used in this Technical Newsletter. But in all its forms, it clearly demonstrates that efficient solutions can be designed by focusing on the reinsured's main objectives and the reinsurer's key constraints. Of course, this also means that structural reinsurance is inherently complex.

Interestingly, the latest risk-based capital measures (i.e., Solvency II, which has established a strong supervision framework) and the latest accounting standards (IFRS 17) are sophisticated enough to handle the complexity of structured reinsurance. They provide a sound backdrop for the development and virtual assessment of any protection,

as long as the company involved properly understands and manages that protection within its established risk appetite, tolerance and limits.

Having said that, the latest IFRS 17 financial reporting standard poses new challenges in terms of recognizing the benefits of structured reinsurance. It will require state-of-the-art structuring capabilities to ensure that these solutions are relevant.

SCOR P&C, with its highly experienced Alternative Solutions team - composed of specialists leveraging the group's worldwide presence and its strong local risk expertise - is at the forefront of structured insurance, and as such is extremely well placed to manage these challenges.







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