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# NON-TRADITIONAL SOLUTIONS

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An introduction to risk finance  
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# CONTENTS

How insurance works	03
What is risk finance	05
Probability distributions	07
Sample programme	13
Potential applications	16

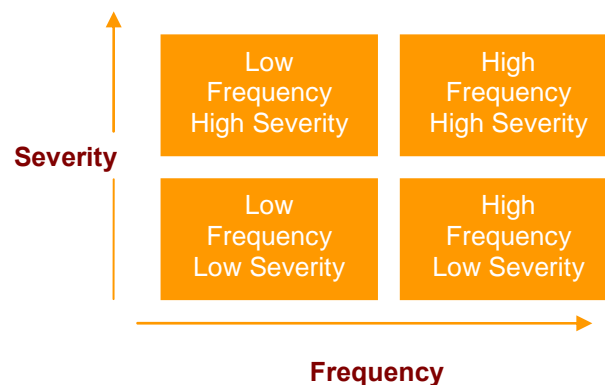
## How insurance works

Risk has two key dimensions, frequency and severity: both help determine insurability.

“Frequency” relates to how often a loss occurs, i.e. whether the risk/event is common or relatively rare.

“Severity” relates to how costly losses resulting from that risk could be; whether they could be relatively inexpensive or truly catastrophic in nature.

Figure 1



Insurance can be an appropriate method of risk transfer for low-frequency, high-severity losses (e.g., aviation loss or earthquake), as well as for high-frequency, low severity losses (e.g., shop lifting). However, insurance may not be the most appropriate method for treating all risks facing individuals and businesses. For example, insurance could be too expensive for certain risks (low-frequency, low-severity) or unavailable for other risks (such as high-frequency, high-severity, or risks whose frequency and/or severity is difficult to predict, such as terrorism).

Additionally, insurance may be unable to fully compensate for a loss (e.g., the destruction of family photos, which have great emotional value but little financial value).

In taking on the risks of society, the insurance industry relies on two fundamental tools:

- 1) Pooling
- 2) The Law of Large Numbers

An insurer can cover the risk of losses from a few policyholders by combining (pooling) the premiums from a much larger group of policyholders.

This also improves predictability, thanks to the statistical principle known as the Law of Large Numbers, which states that the accuracy of loss prediction increases with the number of policyholders in the pool.

## Organisations and risk diversification

When thinking about how the organisation might manage risk, the same principles apply as we have just described for the individuals in society who seek to transfer the risk of a fire, or flood to insurers.

There is however some difference in approach, because an organisation will have a somewhat different financial profile:

Organisations:

- are financially stronger than individuals and therefore better equipped financially to pay a premium to transfer risk.
- often have a broad range of risk classes to insure (property, casualty, workers compensation, motor etc.).
- Risks will often have a broader geographical scope – i.e. the portfolio will be spread over a wide area, not a single location or country.
- Due to their financial strength and geographical diversification, organisations are also better able to retain risk than an individual.
- A risk manager will be employed to identify risk and decide the most efficient means of managing or transferring risk for the organisation.

The above issues (and many others), lead some organisations to hold large deductibles when they do purchase insurance, and in some instances the organisation will consider retaining and managing risk by using captive insurance and other tools, which can be more efficient in certain circumstances.

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## What is risk finance?

Risk finance or structured (re)insurance is an approach which can allow an organisation or captive to efficiently combine risk transfer (insurance) and risk financing (saving) to obtain cover that may not be otherwise achievable through insurance or the capital market.

The risk finance approach often enables an organisation to combine a number of lines of business into one (re)insurance contract; this can be a benefit due to the inherent diversification provided by a 'basket' of non-correlated risk.

### Benefits

As an approach to managing risk for the organisation, it has the following advantages:

It can be a more efficient purchase, because while premium cost is similar to the traditional approach initially, the potential for profit commission upon commutation can help the organisation save money in the long term.

A risk finance approach requires the organisation to hold more risk internally and therefore focuses the minds of senior management on risk management issues. This can lead to loss cost reductions.

Pricing is usually locked in over a multi-year term; this insulates the organisation against the cyclical pricing practices of the insurance market. A good example of the boom/bust mentality of the insurance market would be the massive price rises felt across the industry after the 2005 Atlantic hurricane season. Losses from hurricanes Katrina, Rita and Wilma resulted in claims that were so high, the cost of insurance needed to rise all over the world to replenish the pool. Organisations that had adopted the risk finance approach did not find themselves paying the huge increases in premiums that others did.

By part-financing your own risk, it enables the inclusion of some classes that might otherwise be considered "un-insurable" in the traditional market.

A good example of this would be an organisation looking to buy general environmental clean up coverage for a large portfolio of brown-field sites. If the organisation does not have the wherewithal to assess each site on the schedule, it will make it hard for insurers to price the programme. The risk finance approach would enable that organisation to begin to build a fund that can respond in the event of an environmental loss, and whilst the limits may not be high, the requirements are much less onerous when you are financing your own losses.

In reinsurance, it might be possible to include a Gulf of Mexico (GOM) Nat Cat specific alongside more straight forward lines. Full coverage might not be available immediately, but the risk finance approach would enable the cedant to begin building a fund that could respond in the event of a GOM loss.

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## Analysing the portfolio

As mentioned in the introduction, insurance organisations use “pooling” and “the law of large numbers” to help them determine the correct level of premium to charge their clients.

When looking at the risk portfolio that they have assumed, insurers also try to describe the range of potential outcomes in terms of frequency and severity of loss. In simplistic terms, this is done by analysing historic claims experience, making adjustments to those figures for inflation and/or changes to the exposure base, before coming up with a figure for “trended and developed” losses for each year of analysis.

Once the analysis for each year has been performed, we can then employ stochastic modelling techniques to produce a probability distribution that describes the whole range of potential outcomes, together with their associated probability of occurrence.

## Probability distributions

A probability distribution describes the values and probabilities that a random event takes place. The values must cover all of the possible outcomes of the event, while the total probabilities must add up to exactly 1, or 100%. For example, a single coin flip can take values heads or tails with a probability of exactly 50% (0.5) for each; the sum of these two values and two probabilities make up the probability distribution of the single coin flipping event. This distribution is called a discrete distribution because there are a countable number of discrete outcomes with positive probabilities

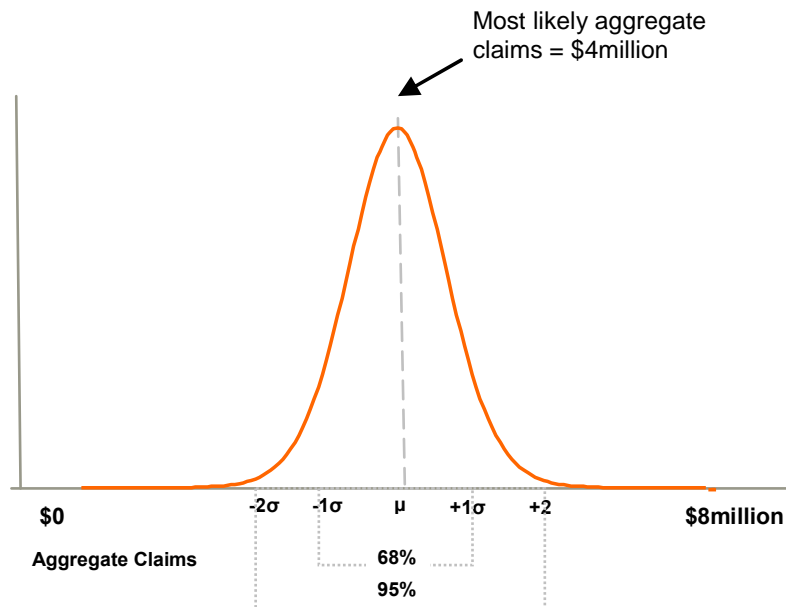
In insurance we might use a probability distribution (or cumulative density function) to describe the range of potential aggregate claims that a portfolio might sustain.

In most cases the range of potential outcomes is so vast as to be uncountable. In such instances we use a "continuous distribution". For example, a dart thrown at a dartboard has essentially zero probability of landing at a specific point, since a point is vanishingly small, but it has some probability of landing within a given area.

Figure 2 is a probability density function chart. This was produced following the analysis of one of our client's historical claims. The area under the curve represents the probability of aggregate claims being less than or equal to the value on the x-axis; the x-axis represents the range of aggregate claim values we would expect to be incurred for the portfolio being analysed.

NOTE: We are using a normal distribution for simplicity and the purpose of illustration. We accept that log normal would be more appropriate.

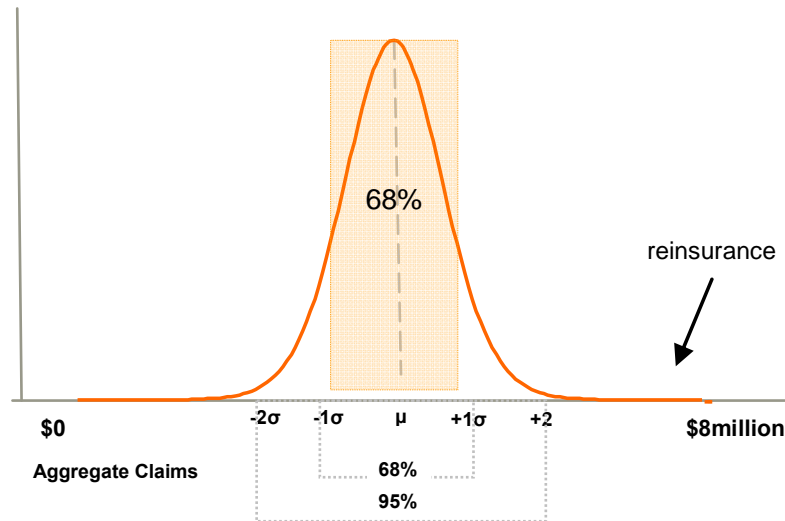
Figure 2 - Normal Distribution (for illustrative purposes)



The diagram shows that the risk ceding entity could sustain any aggregate loss between \$0 and just over \$8million in any given year. It also shows that the most likely aggregate loss will be \$4 million.

\$4 million represents the mean loss, but the chart also shows that at 1 standard deviation from the mean, losses will be between \$3m and \$5m. This is interesting because 1 standard deviation represents roughly 68% of all possible outcomes.

Figure 3 - The probability of aggregate loss between \$3m and \$5m is 68%



The chart also shows that the entity will sustain a loss of between \$2.5m and \$5.5m at 2 standard deviations; this represents 95% of all potential outcomes.

When looking for (re)insurance, it's usually the low probability high severity part of the distribution that we are looking to transfer (see the reinsurance arrow on the diagram). This is the area where losses will have the biggest impact on the balance sheet.

### Why is this relevant?

We can use these probabilities to assess whether any given aggregate protection would represent value for money.

For example, the probability that aggregate losses will exceed \$5.5m is 2.5%; calculated as, 100% of all probabilities minus 95% of situations where losses will fall between \$2.5m and \$5.5m, divided by 2 so that we take out the situations where losses are lower than \$2.5m.

So for an annual aggregate excess of loss that enables our client to recover aggregate losses in excess of \$5.5m, we can say that the pure "risk charge" should be 2.5%.

Obviously the final cost of the (re)insurance product may be higher than this. Carriers will price their capacity to reflect the need to make a profit, the other risks in their portfolio and the prevailing market conditions, however this approach provides us with a broad idea as to the ideal pricing if based solely on historic experience.

Figure 4 - Log normal distributions for a number of classes

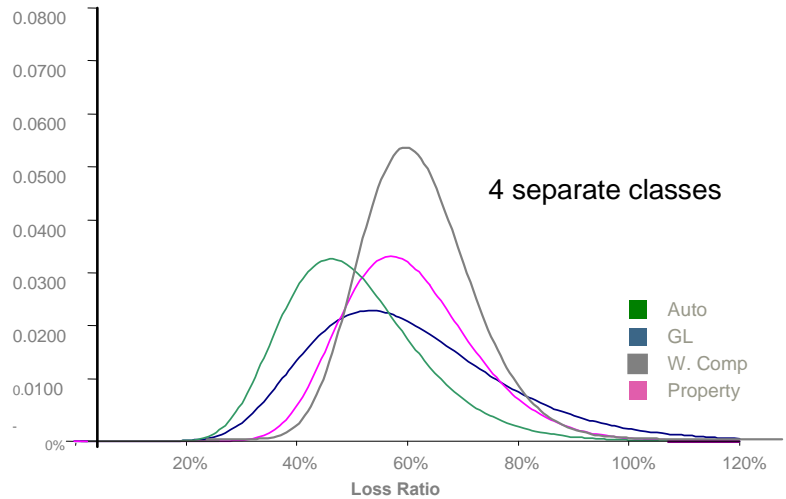


Figure 4 shows the continuous probability distributions of four classes of business. Note that each class of business has a separate and distinct distribution.

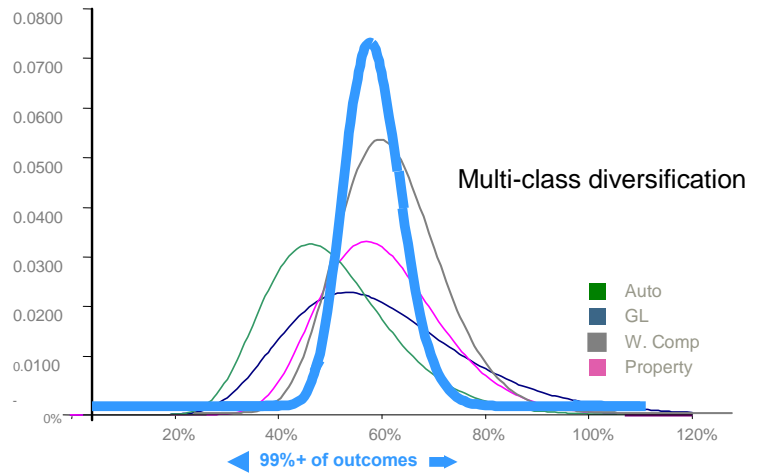
The potential for loss in any given year can fall at any point in each class's probability distribution; however the most commonly occurring result for each class corresponds to the highest point on each curve.

The potential for variance from the mean (standard deviation) is also different for each class of business. Some classes will have a larger standard deviation than others. When underwriters price each class of business, they will be looking at the expected loss (mean), and the standard deviation. The greater the potential for variance from the mean, the higher the price they are likely to charge you.

Our aim therefore is to find a structure that increases the probability of the mean result occurring, and narrows the standard deviation.

The thick blue line in figure 5 shows the probability distribution of all four classes of business combined.

Figure 5 - Cross class diversification benefits



Note that the probability of achieving the mean result has increased. We have also managed to reduce the standard deviation, meaning that the probability of losses being close to the mean has also increased. All in all, the expected losses have become more predictable.

Both of these improvements have been achieved because we combined the classes of business into a single “basket” product.

Each individual class has the same probability of loss as before. However, these classes of business are not 100% correlated with each other and as such there will be some occasions where a poor result in one class will be offset by good results in others.

It is important to point out here that looking at risk in this way does not eliminate the probability of a severe adverse loss scenario, but it does reduce the probability of occurrence.

### Multi-year benefits

It is also worth pointing out that the diversification principle applied to aggregating different classes of business into one "basket" contract can also be applied to stretching the purchase across a number of years.

Figure 6 - Model output, expected aggregate losses at selected probabilities

A Percentile	B 12-month expected loss	C 36-month expected loss	D 3 x 12 month loss	E Time diversification credit (D minus C)
99.6th	43,956,300	88,932,236	131,868,899	42,936,663
99.5th	42,482,459	87,665,450	127,447,378	39,781,928
99th	38,740,278	81,719,073	116,220,835	34,501,762
50th	15,361,661	46,167,699	46,084,984	-82,715

The table above was generated from one of our stochastic models. It compares expected aggregate losses on a portfolio at various points along the probability distribution.

Column B is the 12-month expected loss, Column C is the 36-month expected loss. You can see that at the mean, the 36-month expected loss is roughly 3 x the 12-month loss (column D). This shows little benefit from purchasing a three year contract. However, at the 99th percentile, you can see that column C is only just over 2x the 12-month expected loss. This suggests that the ceding company needs less overall limit to achieve protection to the 1-in-100 level if they purchase over three years.

Column E shows the diversification credit the cedant can achieve at each selected level of probability.

Looking at risk on a multi-year basis makes it more predictable and therefore easier to manage than when considering it on a single-year basis. This should result in lower capacity requirements and efficiency savings.

## Summary

Insurance underwriters use the potential volatility associated with a single class of risk, placed on a single year basis as part of their pricing mechanism. The higher the standard deviation in your portfolio of risk, the higher the premium you will be charged.

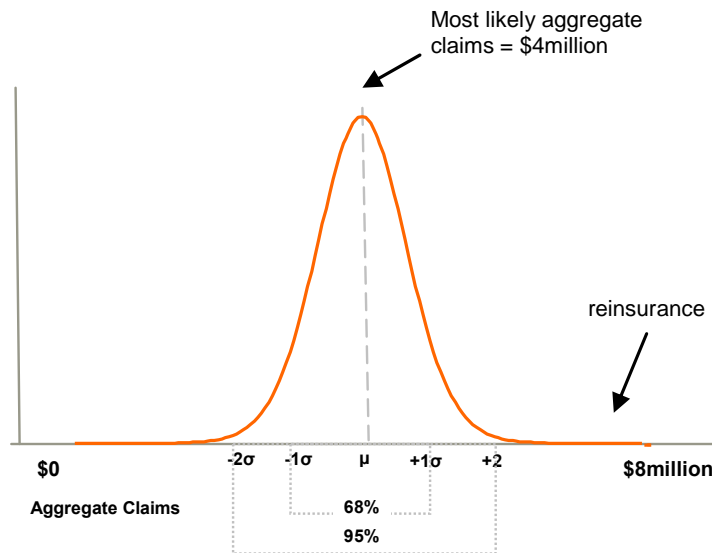
We can create diversification in your portfolio by packaging the risk on both a multi-year and multi-line basis.

By structuring your (re)insurance purchases in this way, it should be possible to achieve savings over the long term.

### Risk finance revisited

We mentioned earlier in this paper that structured (re)insurance involves a blending of traditional insurance and saving. The intention therefore is for the (re)insured to use the concept of aggregating risk across multiple years and classes to make the expected results more predictable. Having done this, the (re)insured then seeks to pass the less predictable “tail” of the probability distribution to the insurance market.

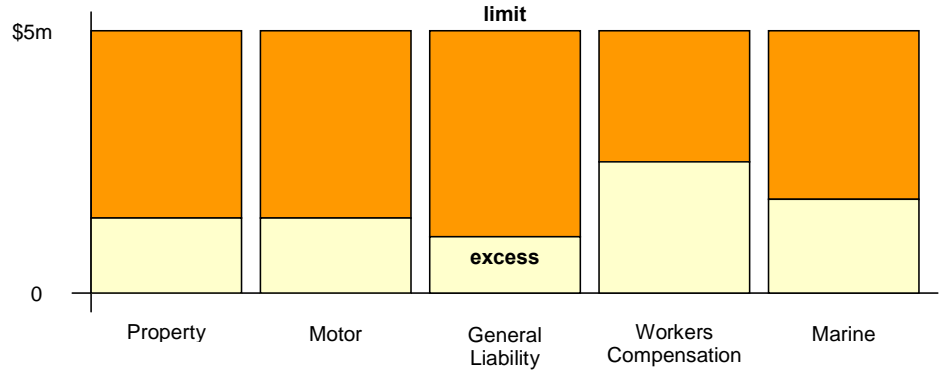
Figure 7



Over the next few pages we will outline an example programme together with an overview of typical features

## Traditional approach to (re)insurance purchasing

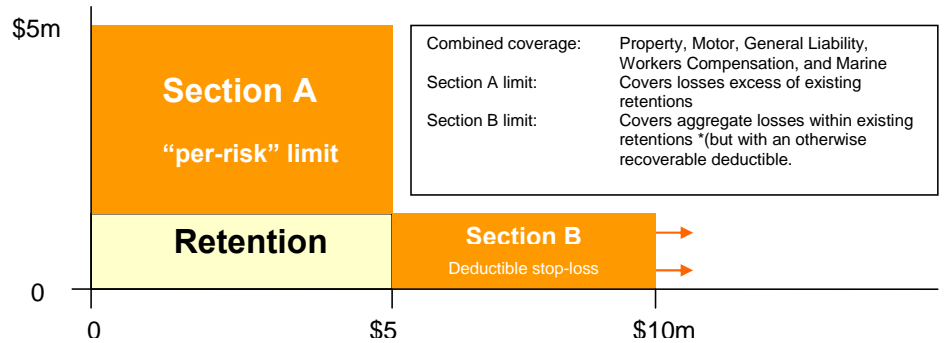
Figure 8



In figure 8 the buyer purchases a specific excess contract for each class of business. Each “pillar” is bought on an annual basis, it will have separately priced premium, varying limit / excess points and different underwriters.

## Alternative approach:

Figure 9



In the alternative structure the buyer, having analysed their portfolio, purchases one product that covers all classes under one policy. Less overall limit is bought, but it is stretched across all classes and 36-months to improve efficiency. There is also a stop-loss section that protects against unexpected accumulation of losses within the retention.

## Sample Term Sheet

Period:	36 Months with effect from 30 <sup>th</sup> June 2009
Type:	Multi-class / multi-year (re)insurance
Interest / classes covered:	Property Motor General Liability, Workers Compensation Marine
Per loss limits:	
Section A:	Up to \$4.5million each and every loss in excess of \$500,000 deductible each and every loss.
Section B:	Up to \$5million recoverable in the annual aggregate, for losses within the insured's deductible in excess of \$5million otherwise recoverable in the annual aggregate.
Annual aggregate limit:	\$10million maximum recoverable each policy year
3-Year term limit:	\$15million maximum recoverable across ALL policy years
Contract profit commission:	100% of any positive experience account balance upon commutation.
Experience account clause:	At the commencement of the contract, an Experience Account will be established in order to track movement of monies.  The Experience Account balance will be recalculated quarterly as follows: Balance as previously calculated, PLUS Annual premium paid, MINUS Annual margin, MINUS Claims paid, PLUS Investment credit on positive balances.
Annual premium:	\$3.5 million each policy year
Annual margin:	\$750,000 each policy year (as part of Annual Premium as defined above)

## Key features

### Structured premium

Part of the premium paid is used as a self-financing element of the contract. This amount is placed into an experience account and will be used to pay for some of the losses under the contract. At the end of the term, any funds left in the experience account will be returned to the (re)insured as a profit commission. The (re)insurer makes a charge separate from the self-financed premium called the "margin"; this is required to cover the risk provided under the transaction over and above the part of the limit that the buyer has financed.

### Experience account

This concept is central to many structured (re)insurance arrangements, particularly those that operate over a number of years. The experience account is a simple way of keeping track of how much has been paid in premium and how much has been received in claims payments over the term of the contract. Any positive balance in the experience account will receive an interest credit during the contract period. This can be quite beneficial in high interest rate environments. The real advantage of the experience account comes at commutation, because it is at this point that you can potentially realize a high profit commission (the profit commission is often 100% of the experience account balance).

**Other features:**

- **Multi-Year:** By stretching the limits across a three-year period, we can make the coverage work harder for you. This is particularly true if you have historically low loss experience.
- **Annual Aggregate Limit:** Reducing the amount of limit you buy on an annual basis can make your purchase more efficient. The contract will be structured to ensure that you should have enough limit, but the annual aggregate recoverable will be less than that provided by the traditional “pillared” approach.
- **Contract limit:** When considering limit requirements over a multi-year period, stochastic modelling often proves that you don’t need 3 x your previous annual limit. With two annual limits stretched of three-years, you can achieve the desired level of coverage in a more efficient manner, this should result in improved price efficiency.
- **Additional Premiums:** The example terms do not include additional premiums or even reinstatements for reasons of simplicity. However, these features can easily be incorporated in order to achieve your risk management objectives.
- **Profit Commission:** Depending on experience you could receive a substantial profit commission

## Potential applications

The most common use of risk finance is to manage retained risk as described in the example, there are however other reasons to consider such structures:

### Managing the jump to a higher retention

As companies evolve, their capital base will become stronger and they will consider running a higher retention to maximise shareholder value.

Sometimes a company's management may view the move to a higher a retention as a risky proposition. For those that wish to consider a conservative approach, a multi-year / multi-line aggregate contract can cap the worst case scenarios. Risk finance uses the experience account structure so large profit commissions are available if losses are low. This can make it a very cost effective way of making the jump.

### Moving premium offshore via a captive

Some companies will use a captive to take a share of their insurance program. Usually such contracts are written on an annual basis.

There is potential to use multi-year / multi-line whole account reinsurance to protect the captive in a more efficient manner. Not only will this provide greater confidence in achieving expected results, it should also reduce capital requirements for the captive.

Since premium can be deducted from bottom line as an expense, increasing the use of a captive for this purpose reduces net income for tax purposes. Any profit commission payable to the captive would be subject to taxation in the captive jurisdiction.

## Information required

If you are interested in looking further at these concepts we can help guide you through the process.

The data underwriters need in order to indicate terms will vary, but in most instances they will look for the sort of information you would provide as part of your annual renewal pack:

- Overview of the subject business (classes, occurrence / claims made etc)
  - Claims triangulations by class
  - Individual claims experience (by class / geographical area) if available
  - Historical exposure information (payroll, property scheule etc..)
  - Financial statements of captive and parent
  - Limits and attachment point profiles
  - Detail of any inuring reinsurances
  - Detail of any anticipated exposure changes over the next few years.
-

## Other Products

- Multi-line captive reinsurance
- Aggregate excess of loss
- Spread loss
- Loss portfolio transfers / captive buy-outs
- Adverse development covers

**For more information, please contact**

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