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WHITE PAPER 3 OF 3

Corporate Risk Appetite and Program Structuring

AUTHORED BY:

Jason Flaxbeard
Alternative Risk Leader

Andrew Golub
Chief Innovation and Analytics Officer

Scott Hornyak
Chief Actuary

Introduction

The first paper in this series discussed the impact that loss volatility has on the risk finance decision-making process, and the second paper explored the notion of loss dependence and the influence of interdependencies between sources of corporate risk. In this third installment in our Alternative Risk series, we build on these concepts and discuss the mapping of retained volatility levels to corporate risk appetite in a multiple risk setting. This process is illustrated through the design of an optimized insurance program structure, where stochastic loss models are coupled with market intelligence to perform a risk versus reward trade-off analysis.

- White Paper 1: Beyond Expected Value – Considering Volatility
- White Paper 2: Loss Dependence – A Portfolio Level View of Retained Exposure
- White Paper 3: Corporate Risk Appetite and Program Structuring

Case Study Overview

As in the prior papers, we will focus on a simplified setting in which a fictitious organization (Company ABC) is exposed to several sources of risk. Risk X and Risk Y are each associated with high frequency and moderate severity losses, similar to those often observed in some casualty lines of business. Risk Z is subject to the low frequency and high severity types of losses typically observed in catastrophic perils. In this simple world, insurance policy structures available in the market are also limited. For Risk X and Risk Y, respectively, the policy types available are guaranteed cost and per occurrence deductible options at $1M, $2M or $3M. For Risk Z, the market is offering policies with per occurrence deductibles of $50M, $70M and $90M. Management at Company ABC is somewhat averse to fully self-insuring Risks X and Y. They will not consider fully self-insuring Risk Z due to its catastrophically driven hazard profile.

In this world, realistic stochastic models exist for each of the three sources of risk, and output from them can be tailored to describe the distribution of Company ABC's retained exposure given a selected retention level. A summary of the monoline retained loss model estimates, rounded to the nearest million, is included in the following table.

Source of Risk	Risk X			Risk Y			Risk Z		
Per Occurrence Decuctible	$1M	$2M	$3M	$1M	$2M	$3M	$50M	$70M	$90M
Expected Retained Loss	$66M	$69M	$69M	$40M	$45M	$51M	$8M	$9M	$10M
Retained Loss VaR(90)	$79M	$85M	$89M	$54M	$63M	$75M	$43M	$43M	$43M
Retained Loss VaR(95)	$84M	$92M	$96M	$59M	$71M	$86M	$50M	$70M	$91M
Retained Loss VaR(99)	$93M	$104M	$111M	$70M	$87M	$109M	$50M	$70M	$90M

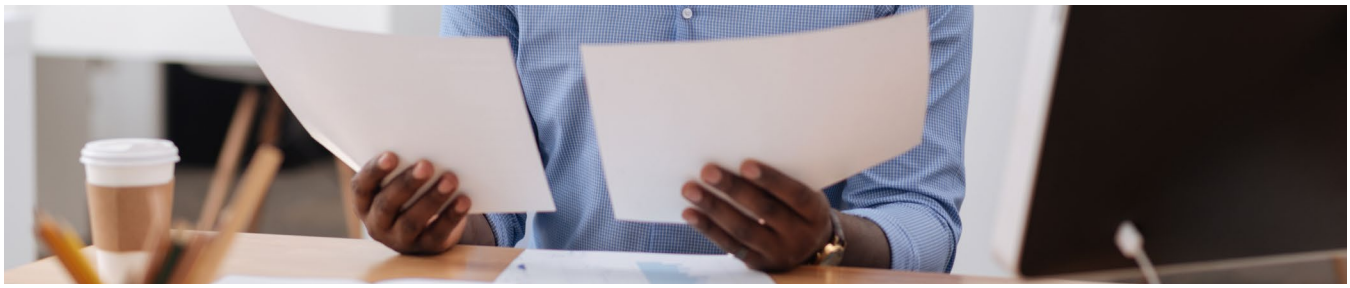
For illustrative purposes we make the simplifying assumption that the dependence structure between the three lines of business can be fully described by a correlation matrix. Please see the second white paper from this series for a more detailed note on the technical implications of that assumption.

The pairwise correlations that have been estimated for the three sources of Company ABC's risk are summarized in the following matrix. Risk X and Risk Y are determined to be moderately correlated with one another, and Risk Z is determined to be statistically independent from the other two sources of risk.

Company ABC Loss Correlation Matrix

Risk X	1	0.5	0
Risk Y	0.5	1	0
Risk Z	0	0	1

It is important to note that in specific real world settings these assumptions may be inappropriate. We recommend that careful consideration be given to dependence model selections on an individual company basis.



Risk-Reward Trade Off

From Company ABC's perspective, there are a number of comprehensive risk financing strategies that could be employed. When evaluating this set of options, there is an inherent trade-off between risk and reward that must be considered. Insurance companies pricing coverage set premiums that contemplate not only the expected losses transferred to them but also the underwriting expenses and a target level of profit adjusted for investment income anticipated on the premium float. Therefore, when Company ABC is transferring a tranche of their risk into the insurance marketplace, they will be charged a premium that exceeds the expected value of losses in that tranche.

This leads us to the conclusion that Company ABC can minimize their Expected Total Cost of Risk by undertaking the simple strategy of retaining all of the risk to which they are exposed; however, doing so would leave them with an extraordinarily high Comprehensive Retained Loss Value-at-Risk. Conversely, Company ABC can minimize its Comprehensive Retained Loss Value-at-Risk by purchasing as much insurance as possible, which in this case would mean the lowest retentions available in the market for all lines of coverage. In doing so, however, they would end up with a very high Expected TCOR.

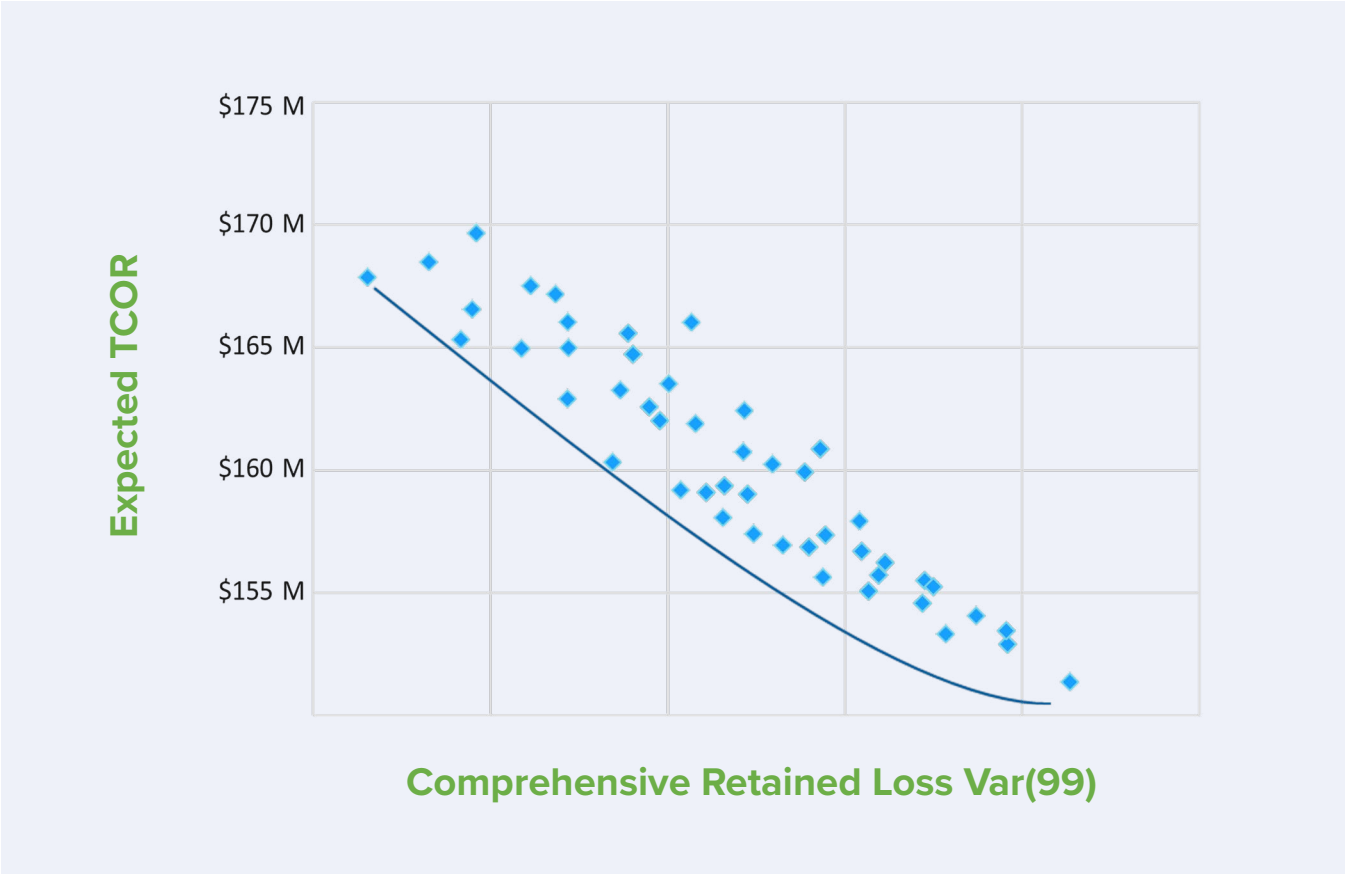
Most program structure options lie somewhere on the spectrum between these two extremes – representing the trade-offs between risk and expected reward. The following chart summarizes this trade-off for the 48 program structure options that Company ABC is presented with by the market. Each blue point corresponds with a specific combination of retentions for Risks X, Y and Z.

Terminology

We define the company's **Expected TCOR** (Expected Total Cost of Risk) to be the expected retained losses plus the insurance premium and frictional costs (premium taxes, collateral costs, etc.), summed across the three sources of risk to which the company is exposed. As Expected TCOR increases, Company ABC's budgeted risk management expense increases.

We define **Company ABC's Comprehensive Retained Loss Value-at-Risk** (evaluated at a given confidence level) as the Value-at-Risk of uninsured losses that they will be responsible for across Risk X, Risk Y and Risk Z. From the second paper in this series, we know that the estimated Comprehensive Retained Loss Value-at-Risk will typically not be equal to the sum of the monoline Value-at-Risk estimates for these three exposures. An increase in the Comprehensive Retained Loss Value-at-Risk corresponds with an increase in the amount of loss volatility being held by Company ABC. Please see the first paper in this series for additional background on the implications of retained loss volatility in a corporate finance setting.

Combined Lines Program Structure Comparison



We can see from the chart that the blue points do not fall on a straight line and that there appears to be some vertical variation in the data for any specific point on the horizontal axis. This natural variation is driven by a wide variety of factors including differing perceptions of risk among carriers quoting coverage, insurer operational constraints and alternative underwriting strategies. The lower boundary of this observed pattern of potential program structure options is referred to as Company ABC's efficient frontier.

From the perspective of Company ABC, the choice of where the risk transfer program falls on the horizontal axis of this chart is driven by internal risk appetite. A more risk averse company will want to position themselves farther to the left of the diagram, all else being equal. In providing this plot, we are assuming that Company ABC has selected Value-at-Risk at the 99% confidence level as its risk measure of choice in making financial decisions. For a given level of retained risk (i.e., point on the horizontal axis) being targeted by Company ABC, they will want to select the associated program structure option that results in the lowest Expected TCOR. In other words, they will want the risk program they end up binding in the marketplace to fall on their efficient frontier. Ensuring that this takes place and that Company ABC does not end up engaging in an inefficient transaction is an important source of value that can be added by a broker partner.

After convening a group of key managerial stakeholders, Company ABC decides that its risk appetite for the Comprehensive Retained Loss Value-at-Risk is between $215M and $225M. This decision is informed by their corporate balance sheet size and liquidity, non-hazard risk sources of volatility to which the organization is exposed and perceptions of the company's investor base with respect to EPS shocks from non-recurring events.

After limiting the purview of their focus through the application of this risk appetite filter, Company ABC is left with the following set of potential program structures.

Risk X Retention	Risk Y Retention	Risk Z Retention	Expected TCOR	Comprehensive Retained Loss VaR(99)
$1M	$2M	$90M	$162M	$218M
$1M	$3M	$70M	$159M	$219M
$1M	Fully Self-Insured	$50M	$157M	$225M
$2M	$1M	$90M	$164M	$215M
$2M	$2M	$90M	$161M	$223M
$2M	$3M	$50M	$159M	$216M
$2M	$3M	$70M	$159M	$224M
$3M	$1M	$90M	$166M	$218M
$3M	$3M	$50M	$158M	$221M
Fully Self-Insured	$1M	$90M	$162M	$224M
Fully Self-Insured	$2M	$70M	$159M	$221M

In reviewing this information, along with the previously shown graph, the company determines that several available risk financing strategies fall close to the efficient frontier and also allow them to satisfy their targeted risk appetite level. Upon considering the pros and cons of the different options, Company ABC decides to select the highlighted structure from the table above.

From the vantage point of the ABC management team, this decision is based on several factors. The selected structure falls on the efficient frontier, and so it minimizes their Expected TCOR for the accepted level of risk. It also involves an amount of retained risk toward the midpoint of Company ABC's targeted range and does not require the company to leave any sources of risk fully uninsured. Compiled together, these considerations lead the committee members to feel comfortable that they have arrived at a holistic risk financing strategy for the prospective year, which is optimized to both their internal preferences and to current insurance marketplace conditions.

Conclusion

In this series of white papers, the Brown & Brown Alternative Risk team has provided a framework for companies to review their risk appetite on a multi-line basis rather than a traditional monoline basis. This approach isn't for everyone; however, we believe that leveraging the analytics behind the efficient frontier is something that allows a company's treasury function to map retained exposure to risk appetite. Insurance is, at the end of the day, a promise to offer capital following a loss. These white papers have been focused on maximizing entity value through the efficient use of internal and external capital.

About the Authors

Jason Flaxbeard, *Alternative Risk Leader*

Jason Flaxbeard is Brown & Brown's Alternative Risk Leader responsible for managing alternative risk operations within the United States, Bermuda and the Cayman Islands.

Andrew Golub, *Chief Innovation and Analytics Officer*

Andrew Golub serves as the Chief Innovation and Analytics Officer for Brown & Brown. He is a Fellow of the Society of Actuaries and a Chartered Enterprise Risk Analyst.

Scott Hornyak, *Chief Actuary*

Scott Hornyak is Brown & Brown's Chief Actuary. He is responsible for directing actuarial consulting services and is a Fellow of the Casualty Actuarial Society (FCAS) and a member of the American Academy of Actuaries (MAAA).

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