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Getting Results – And Exploiting Them

In an essay published in Risk Transfer *magazine, Maya Belubekian of our Instrat® unit explains how a number of approaches to portfolio management for Guy Carpenter's clients represents the next level of catastrophe-model results.*

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Over time, natural-catastrophe models have developed to incorporate more scientific and engineering research and data. They have also expanded to different perils, new geographical regions and more sophisticated financial-modelling functionality.

Traditional implementation of catastrophe-model results

Catastrophe models produce estimates of loss to an insurance portfolio, including expected loss, standard deviation and an exceeding probability curve, which represents the probabilities of exceeding various levels of losses at least once a year or within the return periods of the losses. This curve is critical, as it shows projected annual losses to a portfolio with associated levels of risk. Traditionally, the results of catastrophe models are used to assess reinsurance adequacy, for example, a company's net loss in a 100-year loss or 50-year loss. Companies can use long-term average-loss estimates to test the adequacy of their primary-insurance pricing.

Insurance-portfolio behaviour and risk

As companies have become more familiar with the composition and behaviour of modelled portfolios, they have become interested in the causes of large losses and how they can improve their situation. In other words, they are looking at a portfolio from various risk perspectives and trying to reorganise exposures to create a better loss pattern without sacrificing premium.

The trend today is to adopt an underwriting strategy that results in a desirable future loss/profit behaviour based on current portfolio loss estimates rather than managing a portfolio according to traditional underwriting guidelines and finding out about prospective losses to the portfolio after it has been created. The financial industry has dealt with other such portfolio-management issues and uses commonly accepted solution theories and algorithms to address these questions.

The problem of portfolio management/optimisation in the financial world can be stated as follows: Determine the composition of a portfolio so as to satisfy a certain objective function (e.g. maximising return/minimising risk) that is subject to some constraints (e.g. a defined group of financial instruments that can be used). However, the mathematical apparatus developed for solving such problems is only directly applicable to a portfolio of financial instruments since a critical theoretical assumption of quick availability of standard instruments (bonds, stocks) in any desired quantity holds true in the financial world (high liquidity).

Unfortunately, insurance contracts are not standardised and, therefore, not readily available in a variety of sizes. This means that the insurance industry is highly illiquid. Indeed, insurance portfolios

cannot be changed dramatically in a short period because it takes time to add new policies to a portfolio and there is not necessarily an abundance of desired policies.

Unlike financial portfolios, insurance portfolios tend to change gradually over time.

A direct application of the portfolio-optimisation theory can therefore yield a very unrealistic and unachievable insurance-portfolio mix, generating dangerous loss consequences if only a piece of the optimal portfolio mix is acquired. Other complications for insurance companies include:

- Defining business goals or objectives (risk/return framework may not be clearly identified);
- Industry-specific constraints (regulatory, market-share);
- Company-specific constraints (existing agency base or lines of business).

For these reasons, an alternative methodology may be developed to give insurance companies periodic guidance with respect to the direction of their portfolio remix.

Other approaches to portfolio management
Guy Carpenter has developed a number of approaches to portfolio management for its clients. These approaches represent the next level of catastrophe-model results and are not just aimed at answering traditional questions: "What are the potential annual losses for our company?" Instead they also ask: "How can our company reorganise its portfolio to perform better at a certain risk level?"

As already mentioned, the business goals of the insurance sector are not as easily definable as those of the financial sector. These goals are only shaped after carefully studying a client's portfolio to determine existing problems and future opportunities. Once they have been defined, relevant constraints must be identified too. At this stage of the process, clients provide maximum input, especially with regard to company specifics and rules. In addition, market share and regulatory constraints are established. Objectives and constraints often vary significantly among insurers so the actual portfolio analysis is unique to individual companies.

Although there is no "one-size-fits-all" solution to portfolio management, there are some oft-used techniques in the portfolio- management process that can be applied to a large segment of client portfolios based on level of risk and current exposures. In the most common approach, clients define a particular layer of risk within which the portfolio is to be evaluated. There can be many reasons for selecting a certain risk layer. These are very client-specific and depend on the modelled peril, reinsurance in- force, risk tolerance and numerous other factors. This is called a "risk-managed layer" (e.g. between 100-year and 250-year return periods). Various performance measures, including loss ratio or coefficient of variation of the losses in the risk-managed layers, are considered in every case. Performance measures are also unique for every client since they reflect the underwriting guidelines and policies of that company.

To evaluate current portfolio performance and improvement opportunities, companies can measure the relative sensitivity of growth in certain geographic areas to the change in losses in the risk-managed layer. To do this, the portfolio exposure is sub-divided into a grid of locations and a hypothetical unit of exposure is added to every one of these locations. The updated portfolio is analysed to see which locations contribute the most (or least) to losses in the risk-managed layer.

High-loss values in the layer indicate that the corresponding locations already have significant exposure and that certain measures (e.g. ceasing to write new policies, shedding some existing policies, changing policy terms or purchasing facultative reinsurance) need to be applied to alleviate the risk in those locations. Low-loss values in the risk-managed layer may signify a potential opportunity for growth given that all constraints have been satisfied, in particular, market-share and agency-base constraints.

The analysis described above illustrates a commonly accepted direction of portfolio growth, attrition or both. However, it does not provide the exact size of the change (the number of written or withdrawn policies) because the actual exposure (TIV, structural type and occupancy) is not known in advance. Hence, after recommended changes to the portfolio are made, the new portfolio has to be re-evaluated and the portfolio-management analysis has to be repeated. This is a dynamic multi-step process that can help to ensure a client's portfolio is moving in the direction of the goals specified. At every step of the process, clients can be provided with a growth/attrition directional map, as well as other maps -- for example, availability of exposures in the market place, premium rates -- that need to be used in conjunction to arrive at a final portfolio-management strategy.

Another useful technique is to study closely all policies in the portfolio in relation to their contribution to losses in the risk-managed layer. The policies can then be ranked according to associated losses, enabling exposures covered by the "worst" policies to be eliminated hypothetically from the portfolio. A comparison of losses to the risk-managed layer in the proposed and existing portfolios could then be made to assess the impact of eliminated exposures on the entire portfolio. Exposures could be removed from the portfolio based on other considerations too (region, premium) and the effect of this removal on the risk-managed layer then evaluated. This technique may reveal potentially dangerous concentrations of exposure and could provide a way of stabilising losses in the risk-managed layer.

A useful exercise involves simulating a large number of potential portfolios following the guidelines of growth/attrition identified by previously described client portfolio-management techniques. This may result in a range of exceeding probability loss curves. The proximity of these curves to each defines the stability of forecasted losses, especially those associated with high-return period (tail) events. If the simulated curves were to diverge significantly around the risk-managed layer, the growth/attrition guidelines would have to be re-evaluated, which might mean re-establishing business goals, re-examining risk levels of interest or introducing additional constraints.

Portfolio management in the multi-model environment

Portfolio-management techniques developed by Guy Carpenter represent simple yet powerful tools to study portfolio behaviour closely. These techniques are not limited to the solution of portfolio-management problems but can be expanded to answer a range of "what-if" scenarios that, ultimately, could be formulated in the defined portfolio-management framework. This is a general framework in the sense that it does not depend on a modelling platform and so can be applied to any catastrophe-model results.

The elegance of the described approach is that it provides relative rather than absolute results. It illustrates how contributions to losses of the risk-management layer are distributed geographically and which areas contribute more in relation to others rather than the absolute values of these contributions. For this reason, portfolio-management analysis performed on different modelling platforms result in similar maps of growth/attrition despite the possibility of large absolute differences in model results. This occurs because although modellers may differ considerably in their estimation of absolute hazard levels or vulnerability in various areas, they generally concur when it comes to relative loss estimates. For example, hurricane losses in coastal areas are higher than in inland areas in all catastrophe models. So the results of portfolio-management analysis, unlike regular catastrophe-loss analysis, are not very sensitive to the selection of a particular model.

Conclusion

The insurance industry has much experience of catastrophe models. Companies are familiar with the results of these models and use them actively to re-evaluate their portfolios. Within such an environment, it becomes important to boost utilisation of catastrophe-modelling results to the next level and to try and explain portfolio dynamics rather than simply forecast losses.

The portfolio-management framework developed by Guy Carpenter helps to formulate and solve problems associated with improving an exposure mix, while taking into account the unique risk tolerances and requirements of every company. It is a convenient tool that can be used to study the

details of individual portfolio behaviour and identify potential problems, such as concentrations of exposure with respect to a certain risk level that might otherwise remain hidden.

The multi-model platform, which is being adopted by more and more insurance and reinsurance companies, presents its challenges when dealing with differences in model results. Portfolio-management analysis is less model-sensitive than traditional loss analysis and, therefore, can be more successfully applied in a multi-model environment. In my opinion, Guy Carpenter's approach leads to realistic portfolio-management strategies because it takes into account the illiquid nature of the insurance industry as a whole, as well as the unique goals and constraints of a particular client's portfolio. The implicit assumption in this approach is that the recommended changes are not dramatic (e.g. less than 10% of original portfolio exposure) requiring this effective portfolio management to be resource intensive. In many cases, the portfolio-management exercise must be performed more frequently than once a year to ensure changes in the real portfolio are made in the right direction and to adjust this direction as needed.

Every time a model is rerun, data must be prepared and results reviewed closely. Both of these activities require the attention of experienced analysts and management-precious commodities in most organisations. Advanced risk-management techniques, such as portfolio management, are becoming increasingly important, and Guy Carpenter is working to help clients understand and use these tools to their best advantage.

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