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Advanced Reinsurance Modelling for Captives

Caleb Hancock, Director, Client Services – Actuarial at GPW and Associates, discusses how predictive analytics and artificial intelligence are reshaping reinsurance modelling for captives.

For captive actuaries accustomed to traditional methods, what are the most compelling advantages of incorporating predictive analytics and artificial intelligence into their reinsurance modelling processes?

Predictive analytics and AI build on top of traditional actuarial techniques by providing benefits in efficiency and deeper analysis. Implementing Artificial Intelligence (AI) and predictive analytics allows actuaries to focus on judgement and technical expertise rather than data processing. The internal efficiencies gained can reduce turnaround time for actuarial analysis and ultimately reduce costs for captive owners. Using AI will, specifically, gain efficiency regarding data processing of client-provided data, such as financial information and commercial loss runs.

In addition, AI and predictive analytics provide the ability for the actuary to enhance scenario modelling and stress testing. Tools incorporating AI can optimise an insured's retentions, limits, and capital considerations. AI can assist the actuary in assessing multiple scenarios. Actuaries can

incorporate risk segmentation driven by predictive models to identify diversifiable, lower-severity risk layers and cede the higher-limit, lower margin layers to the commercial market.

Could you outline specific examples of how predictive analytics can enhance the accuracy and sophistication of reinsurance loss projections for captive insurers, particularly in areas such as frequency and severity modelling?

Traditional actuarial methods assume claim frequency and severity are independent when developing loss distributions. Actuarial research has found some instances where there is correlation between claim frequency and severity. Using predictive analytics, an actuary can quantify the correlation between claim frequency and severity.

This is especially useful for accurately modelling the extremes of the loss distributions. With more accurate and realistic aggregate loss distributions, captive actuaries can better model retentions, limits, and solvency considerations over multiple policy years.

How can AI algorithms be effectively utilised to identify emerging risk patterns or correlations within a captive's historical data that might be overlooked by conventional actuarial techniques when structuring reinsurance programmes?

AI and predictive analytics can be used to augment and enhance, rather than replace, traditional actuarial techniques.

Actuaries iteratively build models, applying actuarial judgement at every step. AI and predictive analytics excel at uncovering emerging trends and notifying an actuary to assess the trend.

Without AI or predictive analytics, these trends may be overlooked within a conventional actuarial technique. Using AI and predictive analytics allows captives to fine-tune programme structures sooner, protecting the captive's surplus and responding to pricing needs faster and more effectively.

What are some practical considerations and potential challenges that captive actuaries should be aware of when implementing AI and predictive analytics tools for reinsurance modelling, such as data quality, model interpretability, and regulatory compliance?

Data quality is the primary concern of all captive modelling. Captive portfolios generally have limited historical loss experience compared to commercial insurance carriers. This presents the challenge of misinterpreting data noise as signal. Actuaries should always utilise multiple methodologies and assess the drivers of differences in the results.

Actuaries should be up to date on available industry guidance and best practices regarding predictive analytics. The Actuarial Standards of Practice require actuaries to consider the appropriateness and limitations of their models and projections.

As this process is complicated, it is important to maintain extensive documentation of the model along with key assumptions.

Additionally, the National Association of Insurance Commissioners (NAIC) issued guidance on AI in their 2023 bulletin 'Use of Artificial Intelligence Systems by Insurers' which emphasises "the importance of the fairness and ethical use of AI; accountability; compliance with state laws and regulations; transparency; and a safe, secure, fair, and robust system".

As these models continue to gain prevalence, actuaries must maintain flexibility to adapt to a changing regulatory and professional standards environment. In addition, actuaries should strive to maintain explainability and transparency in the modelling process.

> **Turning the captive model from a once-a-year snapshot to a continuously updating, recalibrated model can provide the benefit of dynamic and scalable optimisations.**

In what ways can advanced reinsurance modelling, leveraging AI and predictive analytics, empower captive owners and risk managers to make more informed decisions regarding their reinsurance purchasing strategies and risk retention levels?

Predictive analytics and AI provide the advantages of better loss insight, capital allocation, and stronger negotiating power.

This translates into better decision making about how much risk to retain in the captive and how much to purchase in the commercial markets. Predictive analytics and AI can be used to create optimisation frameworks that model thousands of simulated treaty and retention combinations against solvency constraints and capital allocation considerations.

Scenario-driven multi-year stress tests powered by predictive analytics and AI can help captive owners and risk managers better understand whether their captive can meet their long-term goals of utility and expected surplus. Additionally, a captive owner and risk manager may be able to leverage their models to create a clear story about their claims. This will help fronting carriers and reinsurers see the risk retained in the captive is well understood and managed, yielding more competitive pricing or terms in the reinsurance market.

How might the integration of real-time data feeds and external datasets, facilitated by AI, improve the dynamic responsiveness of reinsurance models to evolving risk landscapes for captives?

With an integration of real-time data feeds, captive programmes can become significantly more responsive to the risk profile of the portfolio. Captive owners may be able to recognise significant risks earlier, potentially purchasing additional insurance cover or adjusting retentions mid-year rather than waiting for renewal. Turning the captive model from a once-a-year snapshot to a continuously updating, recalibrated model can provide the benefit of dynamic

and scalable optimisations of reinsurance strategies for captive managers and owners. Additionally, real-time external data feeds may increase the captive programme's resilience to emerging perils, identifying new correlations before they are present in traditional actuarial methods.

What are the key skill sets and professional development areas that actuaries working with captives will need to cultivate in order to effectively utilise and oversee advanced reinsurance modelling techniques involving predictive analytics and AI?

The core skills that actuaries looking to utilise advanced reinsurance modelling will need are data programming and data engineering. Models built by actuaries typically require clean data, which is often the most difficult component of the modelling process. Developing the skill set to effectively and efficiently aggregate, reconcile, and cleanse data from multiple sources is paramount to an effective modelling process.

Actuaries must develop a deep knowledge of the tools available to develop these models. Learning machine learning programming languages like Python will be incredibly beneficial. Additionally, as documentation is paramount to a transparent and effective model-building process, actuaries should establish version controlling using available solutions like Git.

Looking ahead, what are some of the most promising future applications of AI and predictive analytics in the realm of reinsurance modelling for captives, and how might these advancements reshape the industry?

AI and predictive analytics are an exciting development in the world of insurance. The industry may see lower costs and faster underwriting cycles. As previously mentioned, the constant recalibration that AI and predictive analytics can bring to reinsurance modelling for captives will allow captive managers and owners to adjust their programmes quickly and effectively. ■