



AMERICAN ACADEMY *of* ACTUARIES

July 21, 2011

Mr. Alan Seeley, Chair
Solvency Modernization Initiative Risk-Based Capital Subgroup
Capital Adequacy (E) Task Force
National Association of Insurance Commissioners
2301 McGee Street
Suite 800
Kansas City, MO 64108

Dear Alan:

This letter provides an update on the work by the Property/Casualty (P/C) Risk-Based Capital Committee of the American Academy of Actuaries¹ on a project requested by the National Association of Insurance Commissioners (NAIC) to evaluate and suggest improvements to the methodology used by the NAIC, to reflect the effect of interdependency among risks in the P/C Risk-Based Capital (RBC) formula.

The P/C RBC Committee of the Academy has been working to address the following request by your subgroup that we provide:

Recommendations for improving the correlation/covariance methodologies used in RBC, including the merits of replacing current formulas with correlation matrices ...

Progress to Date and Plan of Action

We have thus far examined the theoretical underpinnings of the NAIC methodology currently in place with the P/C formula for taking into account risk interdependency, and we have surveyed alternative approaches. The question of how interdependency among risk factors should be properly reflected in establishing capital requirements for insurance companies and banking institutions has been the subject of extended active research and debate.

To be able to provide the NAIC with analysis and recommendations based on sound research, we have requested the assistance of the Casualty Actuarial Society (CAS). The CAS has substantial research resources that are invaluable in a project of this scope and complexity. In response to our request of them, at the end of last year, the CAS formed a

¹ The American Academy of Actuaries is a 17,000-member professional association whose mission is to serve the public and the U.S. actuarial profession. The Academy assists public policymakers on all levels by providing leadership, objective expertise, and actuarial advice on risk and financial security issues. The Academy also sets qualification, practice, and professionalism standards for actuaries in the United States.

working party that is assisting our Committee with the research aspects of this project.² That working party has made significant progress in its research for this project.

While research projects often do not run according to planned schedules, we hope to be able to make a general recommendation on the choice of an overall approach or approaches near the end of this year, based on our analysis of the CAS research as it becomes available.

Once a general approach or approaches have been chosen, we would like to share and discuss our findings with the NAIC. Our subsequent plans, to be finalized based on our dialogue with the NAIC, would include working with the CAS to evaluate the accuracy of, and challenges posed by, implementing these approaches, to be followed by the development of more detailed recommendations.

Importance of Appropriately Accounting for Risk Interdependency

We recognize that the way risk diversification is accounted for may have a significant effect on RBC. In determining minimum capital levels for solvency regulation, appropriate consideration of risk interdependency can be as important as appropriate quantification of individual risks.

The Current Methodology and Our Objectives in Identifying Potential Improvements

We view the structure of the current NAIC RBC formula as one based on the general assumption that some risks facing an insurance company are fully correlated, while others are completely independent.³ This approach can be seen as utilization of the more general linear correlation approach, with correlation coefficients equal to 0 or 1. This results in the so-called square root rule,⁴ under which the total P/C RBC is calculated as

$R_0 + \sqrt{R_1^2 + R_2^2 + R_3^2 + R_4^2 + R_5^2}$, where R_0 through R_5 represent capital charges for the six primary risk categories.⁵

Depending on the probability distribution of the individual risk elements, the accuracy of the dependency structure chosen, and the choice of risk measure, the square root rule can understate or overstate capital requirements. However, no approach will be perfect, and we must seek a method or methods that most effectively and appropriately balance considerations of theoretical correctness against the accuracy and cost of their application in practice.

² The P/C Risk-Based Capital Committee of the Academy has also asked the CAS to assist with the research aspects of other projects related to solvency requirements and RBC.

³ The theoretical considerations underlying the formula include a number of additional elements, but the overall structure is largely based on the assumption of either perfect or zero correlation among risk elements.

⁴ Risk diversification can also be taken into account in other ways, for example, using the loss concentration factor and the premium concentration factor to adjust components of the charges in the current NAIC P/C RBC formula to reflect diversification by line of business. While this letter focuses on the square root rule, in our overall analysis of dependency among risks for the purpose of establishing regulatory capital requirements, we also expect to consider these other ways of reflecting risk diversification.

⁵ The focus here is on the general principles relevant to the treatment of risk dependency in NAIC P/C RBC rather than on the actual calculations. Detailed directions for the calculation of RBC are contained in the most recent NAIC *Property and Casualty Risk-Based Capital Report Including Overview and Instructions for Companies*.

Challenge of Appropriately Accounting for Risk Interdependency in RBC

RBC requirements are intended to a significant degree to address the risk of insolvencies under unusual, extreme circumstances. These are events at the tail of the probability distribution of possible outcomes.

As the recent financial crisis demonstrated, interdependencies under crisis conditions can change relative to those reflected in historical data. Probability distributions of individual risks and the degree to which those risks are interdependent could be affected when a segment of the industry, the industry as a whole, or the entire economy is in a state of crisis.

Similarly, an individual company experiencing financial difficulties can also experience significant changes in the interdependencies among the risks to which it is exposed, regardless of the state of the industry or the economy.

In determining RBC requirements for solvency regulation, rare events—those at the tails of the probability distributions—provide the most relevant information on risk interdependencies. However, because historical information on interdependencies among risks is dominated by data collected under “normal” conditions, such information may have limited applicability to risk interdependencies in the tails of the probability distributions.

Approaches to Measuring Risk Interdependency

A number of approaches have been proposed for measuring risk interdependency in the context of solvency regulation. Some examples of potential approaches for solvency regulation include the following:

- Linear correlation that uses a variance-covariance matrix based primarily on historical data with possible additional adjustments
- Linear tail correlation, with a correlation matrix based to a significant degree on expert judgment, and designed specifically to capture risk interdependency in extreme circumstances
- Copula formulation that expresses a risk dependency structure not limited to the assumption of linear correlation, and potentially allowing the use of the whole dataset, including both “normal” conditions and expert judgment regarding extremes
- Scenario testing based on a comprehensive scenario generator that includes numerous combinations of risk factors, typically under stress conditions, and usually with a probability assigned to each scenario

The list above is not all-inclusive, and other approaches have also been proposed. The approaches on the list also include significant overlap. Many of the approaches are general and not limited to insurance. Similar issues are faced by individual companies in their enterprise risk management (ERM), but the focus in ERM is different, and the solutions chosen might not always be appropriate for purposes of solvency regulation.

No approach is perfect, and each has its advantages and disadvantages. A methodology that might appear to be preferable from a theoretical point of view is not always preferable from a practical viewpoint. For example, an approach that seems superior from a theoretical perspective may require significant assumptions and judgment in calibration and general

implementation, potentially negating any theoretical advantages and introducing significant uncertainty.

The considerations mentioned above highlight both the importance and complexity of appropriately handling risk interdependency in RBC. Our goal is to provide the NAIC with assessments and recommendations that are both practical and based on sound, current research.

We will keep you informed of the status of this project as it progresses, and would be happy to discuss with your group any questions that you might have. We hope that our work will assist the NAIC's efforts to further improve the U.S. insurance solvency framework, of which the RBC system is a critical element. If you have any questions about this report or generally about our work, please feel free to contact Lauren Pachman, the Academy's casualty policy analyst, at pachman@actuary.org.

Sincerely,



Alex Krutov
Chairperson, P/C Risk-Based Capital Committee
American Academy of Actuaries

cc: Anne Kelly, Chair, P/C RBC Working Group of the Capital Adequacy (E) Task Force, NAIC
Lou Felice, Chair, Capital Adequacy (E) Task Force, NAIC
Christina Urias, Chair, Solvency Modernization Initiative (EX) Task Force, NAIC
Kris DeFrain, Director, Actuarial and Statistical, NAIC