The Report of the Research Working Party on Correlations and Dependencies Among All Risk Sources

Introduction

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Enterprise risk management requires the quantification of the total risk of an enterprise. As we undertake this task of quantification we first attempt to quantify the risk of individual parts of the enterprise. Examples of "individual parts" of an insurance enterprise could include the losses arising from its new business, its loss reserves or its asset portfolio. To properly combine these risks one needs to consider the "correlation" between the risks. We put the term "correlation" in quotes to draw attention to the fact that we are not restricting ourselves to the linear correlation that we all study in introductory statistics. This report considers a variety of ways for different risks to "move together."

There are three aspects of this problem that deserve some discussion.

Formulating models of correlated risks. An example of this includes inflation affecting the losses of different lines of insurance causing them to be correlated. A second example is where a correlation between inflation and interest rates that drives the correlation between the losses and assets of an insurance company.

Combining the models of correlated risks. This aspect refers to the mathematical techniques that are needed to combine to obtain the combined distribution of all the individual parts.

Parameterizing the models of correlated risks. If correlation matters, we should be able to find data somewhere that reflects this correlation and use it to parameterize a model that describes this data.

As the working party began its discussions, we quickly found out that these aspects of the correlation problem could not be treated in isolation. In the end, individual authors took the lead and produced four separate papers (or "chapters") that make up this report. Here is a summary of each paper.

1. "Correlation and Aggregate Loss Distributions with an Emphasis on the Iman-Conover Method" by Stephen J. Mildenhall. This paper gives a grand tour of a variety of multivariate models exhibiting correlation that should be of interest to the casualty actuary. The focus of the paper is the Iman-Conover method which can take arbitrary marginal (or individual risk) distributions and derive a multivariate distribution that has an arbitrary rank correlation matrix.

2. "Aggregating Bivariate Claim Severities with Numerical Fourier Inversion" by David L. Homer. This paper uses the very powerful technique of Fourier transforms to calculate the aggregate loss distributions with correlated claim severity distributions. Once we have settled on a standard set of models to describe the stochastic nature of the insurance business, the techniques described in this paper can significantly reduce the time needed to compute the distribution of an insurer's total losses.

3. "The Common Shock Model for Correlated Insurance Losses" by Glenn G. Meyers. This paper addresses the problem of estimating the correlations between lines of insurance. It takes the data from several insurers and produces stable estimates of parameters underlying the collective risk model for correlated insurance losses. And along the way it provides on how the parameters of the collective risk model change as the size of the risk changes.

4. "Serial Correlation of Interest and Inflation Rates" by Hans E. Waszink. This paper discusses an approach to modeling the present value of reserves under the impact of uncertain interest and inflation rates. The dependence between interest rates and inflation rates is modeled using copulas. The paper also shows how to test the goodness of fit of data to members of the class of Archimedean copulas.

In addition to the chapter authors listed above, there were several others who contributed to the work of the Correlation Working Party by either presenting ideas or by reviewing papers. These individuals are listed below.

Shawna Ackerman
Kevin Dickson
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Leigh Halliwell
Roger Hayne
Philip Heckman
Daniel Heyer
Youngju Lee
Christopher Monsour
James Rech
Kevin Shang
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