Wednesday, 20 June, 09:15-10:30

ASTIN Paper Presentations

Session 1 – Nutcracker Ballroom 1
Moderator: Amy Bouska

A Closure-Based Regression Method
Peter Anhalt and Stephen Marsden

This paper outlines a simple regression methodology using closure ratio as the independent variable and cumulative net paid loss & ALAE (paid loss) development factor (LDF) as the dependent variable.

The method, in addition to its simplicity, has three favorable characteristics. First, retrospectively, it has proven to be very accurate when accident year exposures are fully earned. Secondly, there is a pure analysis of the relationship between claim closure level and paid LDF. The standard Berquist-Sherman type of adjusted paid loss development method (Adjusted Paid Loss Development Method) uses interpolation at many points to transform an age-based triangle into a closure-based triangle. The chain ladder method is then used to develop losses to ultimate. The Closure-Based Regression Method by contrast directly evaluates the relationship between closure ratio and paid loss development. Finally, the method has the advantage of being visually compelling. The actuary often can see a dramatically improved fit in the paid loss development factor as the independent variable is changed from age to closure level. This improvement stems from the theory that a closure-based triangle is inherently superior to an age-based triangle (unless too much error is introduced in estimating closure based data points). Age is only a weak surrogate for closure. It is fortunate that this methodology has proven to work well for Bodily Injury with very low closure ratios. Bodily Injury is the most difficult coverage to predict in personal lines auto due to its long tail. A very accurate loss development curve for Bodily Injury can be modeled beginning at only about a 35% closure ratio if all exposures for the accident year are earned.

Various extensions based on Munich Chain Ladder method
Petr Jedlicka

In this paper we present some extension and possible generalisation of Munich Chain Ladder reserving method. Discussed themes are method of estimate of regression parameters and its impact on the value of the reserves, calculation of mean square error that enables to specify a safety margin of the reserve and also multivariate generalisation of Munich Chain Ladder method that is based on recent derivation of multivariate standard chain ladder models.

Session 2 – Nutcracker Ballroom 2
Moderator: Donald Mango

Continuous Monitoring: Look before You Leap
Snorre Lindset and Svein-Arne Persson

In this paper we present a model for pricing credit risk protection for a limited liability non-life insurance company. The protection is typically provided by a guaranty fund. In the case of continuous monitoring, i.e., where the market values of the company's assets and liabilities are continuously observable, and where the market values of assets and liabilities follow continuous processes, the regulators can liquidate the insurance company at the instant the market value of its assets equals the market value of its liabilities, making the protection worthless. When jumps are included in the claims process, the protection provided by the guaranty fund has a strictly positive market value. We argue that the ability to continuously monitor the equity value of a company can be a new explanation for why jump processes may be important in the study of credit risk.

Reinsurance Market Microstructure
Donald Mango

Capital market microstructure analysis is the study of (i) price formation and discovery—how latent investor demands are translated into realized prices and volumes; (ii) market structure and design—relation between price formation and trading protocols; and (iii) information and disclosure—transparency, the ability of market participants to observe information about the trading process. By studying the market microstructure, and in particular the *order book*, where bids and offers are managed, the mechanics of price movement, liquidity, and market depth can be understood. Of particular importance, investor risk preferences and aversion, usually assumed away in efficient market theory, emerge as critical drivers of order book density and depth, and therefore liquidity and price movement.

This paper will first provide a brief overview of capital market microstructure, then explore reinsurance market microstructure. The focus will be on (i) how the fundamental auction characteristics differ from the capital markets, (ii) the reinsurance order book, and (iii) reinsurance price movement and market liquidity.

Session 3 – Nutcracker Ballroom 3
Moderator: Gary Venter

Using Multi-Dimensional Credibility to Estimate Class Frequency Vectors in Workers Compensation
Jose Couret and Gary Venter

The US workers compensation system is different from that in many countries, but it is reinsured in the world-wide market and so has international impact. From its origin it has been a laboratory for actuarial credibility techniques. In recent years deductibles have been increasing, so that fairly high excess coverage is now commonplace. This puts growing emphasis on estimation of the percentage of loss that is excess of high deductibles. A key element of the excess percentage is the frequency of loss by injury type. Fatalities and permanent disabilities cost more than other injury types, so when they have high relative frequency, more of the claims cost arises from large losses. The vector of

claim frequency by injury type can be estimated by class of business using multi-dimensional credibility techniques. Historically the fraction of costs excess of various retentions has been calculated for large groups of classes (hazard groups) and not individual classes. We show, by testing a hold-out sample, that credibility estimation by class does produce additional information in comparison to a widely-used seven-hazard-group system.

Understanding Split Credibility
Ira Robbin

Under an experience-rating plan with a primary-excess split, losses are divided into per occurrence primary and excess components. Then an estimate of total loss is obtained by adding together credibility-weighted estimates of these components. But why should this splitting procedure lead to a better estimate? As proved in this paper, the general answer is that a split will improve on a no-split plan only if it produces a proportionately different allocation of process and parameter risk between the components. When that happens, credibility rises on the component that gets the relatively greater portion of parameter risk and falls on the other one. Unfortunately, a primary-excess split does not always lead to such a differential allocation. This is demonstrated in the paper using a Count-Severity model of loss based on conditionally Poisson claim counts, conditionally exponential severities, and Gamma priors. In some cases the split yields no improvement at all and in others it produces a primary-layer credibility that is smaller than the excess-layer credibility. Such an inversion of primary and excess credibilities can never happen under the Workers Compensation split rating plan that has been successfully used in the United States. The paper explains why these contrary results might occur by analyzing parameter variance relations between small and large claims that follow from the Count-Severity model. The disquieting conclusion is that split credibility will struggle to be effective if losses are modeled with a single claim count distribution and a single claim severity distribution that is subject to scale parameter uncertainty. The paper ends with brief discussion of areas for future research.

CAS Spring Meeting Sessions

Assessment of Target Capital for General Insurance Firms – Fantasia Ballrooms C/D
The paper is by Andrew Hitchcox, Ian Hinder, Allan Kaufman, Trevor Maynard, Andrew Smith and Martin White, and was presented to the Institute of Actuaries in November. It discusses how to put financial economics views of risk and actuarial modeling of insurance into a common practical framework. It describes the different approaches to setting the target capital for a general insurance firm, and how to reconcile them. It describes the approaches to modeling the cost of capital, and the available stock market data to support them. Finally, it describes how the financial economics concept of 'frictional costs' can be applied in a practical way to set target underwriting margins.

The paper will be of interest to all general insurance actuaries involved in the use of capital modelling for steering the firm's overall financial targets. It will also be of interest to actuaries outside the general insurance field for demonstrating the connections between actuarial and financial economic approaches to risk.

Panelists:
Allan M. Kaufman, Actuary and Consultant, AMK Consulting
Ian Hinder, Manager, KPMG

The Goal of ERM is to "Create Value"–But to Whom? – Fantasia Ballrooms A/B
This session will discuss the mechanics of the potential value creation for a P&C insurer and its potential benefits with respect to the company, stakeholders, the market place, and regulators. In particular, the discussion is intended to reflect the value creation of ERM with respect to:

- Value to the Foreign parent
- Value to the Insurance Group
- Agency Ratings
- Wall Street
- Regulatory Review
- Value to a Small Company

Moderator: Alfred O. Weller, Weller Associates
Panelists: Wayne H. Fisher, Consultant, Zurich Insurance Group and David N. Ingram, Consulting Actuary, Standard & Poor's

Use of Predictive Modeling in Claims Management – Fantasia Ballroom H
This session will cover the various applications of predictive modeling to the claims function. Emphasis will be placed on the personal automobile and workers' compensation lines. Some applications to be presented include estimating claim settlement values, estimating the impact of law changes on claim values, identifying potential fraudulent claims, and managing the claims process.

Moderator: James Paugh, Deloitte Consulting LLP
Panelists: Roosevelt C. Mosley, Principal & Consulting Actuary, Pinnacle Actuarial Resources, Inc. and Robert J. Zwerling, CEO, ISIS Solutions, Inc.

Variance Paper Presentation – Fantasia Ballrooms E/F
"Loss Reserve Estimates: A Statistical Approach for Determining 'Reasonableness'"
Mark Shapland
While accounting principles and actuarial standards of practice are all well designed, they provide only broad guidance to the actuary on what is "reasonable." This broad guidance is based on the principle that "reasonable" assumptions and methods lead to "reasonable" estimates. Unfortunately, this broad guidance can leave the low end of a range of "reasonable" reserves open to an interpretation that could lead to unintended consequences in practice. This paper reviews some current actuarial practices and examines how they relate to the question of what is "reasonable" from a statistical perspective. Moreover, it reviews and further develops some statistical concepts and principles that actuaries can add to their repertoire when developing ranges and distributions of liability estimates and then evaluating the "reasonableness" of management's best estimate within those ranges and distributions.

Writing Technical Papers That People Will Read – Part I – Olympus A/B
Learn to produce papers that are readable, effective, and suitable for the new journal, Variance. The first half of this experiential workshop focuses on developing good writing skills.

Facilitator:
Henriette Anne Klauser, Ph.D., professional speaker and author of Writing on Both Sides of the Brain; Put Your Heart on Paper; and Write It Down, Make It Happen.

Wednesday, 20 June, 11:00-12:15

ASTIN Paper Presentations

Session 1 – Nutcracker Ballroom 1
Moderator: Gary Venter

Refining Reserve Runoff Ranges
Gary G. Venter

Actuaries who use the well-known reserve variance formulas of Mack and Murphy find that these tend to give quite high variances and, when distributional assumptions are made, reserve ranges. This paper looks at ways to increase the accuracy of reserve estimates and reduce their variances and ranges through three basic methods: finding better fitting models; avoiding using too many parameters; using exposure information. After reviewing some reserve modeling background, a series of examples illustrates the use of the three methods. This provides a way to build better models, but a comprehensive approach to finding the best model is not attempted.

Generalized Linear Models beyond the Exponential Family with Loss Reserve Applications
Gary G. Venter

The formulation of generalized linear models in *Loss Models* is a bit more general than is often seen, in that the residuals are not restricted to following a member of the exponential family. Some of the distributions this allows have potentially useful applications. The cost is that there is no longer a single form for the likelihood function, so each has to be fit directly. Here the use of loss distributions (frequency, severity and aggregate) in generalized linear models is addressed, along with a few other possibilities.

Session 2 – Nutcracker Ballroom 2
Moderator: Harry Panjer

Optimal reinsurance for variance related premium calculation principles
Manuel Guerra and Maria de Lourdes Centeno

In this paper we compare stop loss reinsurance with the optimal form of reinsurance from the ceding company point of view, when the cedent seeks to maximize the adjustment coefficient of the retained risk and the reinsurance loading is an increasing function of the variance.

We arrive to the conclusion that the optimal arrangement can provide a significant improvement in the adjustment coefficient when compared to the best stop loss treaty.

Enhancing insurer value through reinsurance, dividends and capital optimization:
an expected utility approach
Yuriy Krvavych

The paper investigates the existence of risk management incentives in insurance in the presence of insolvency cost using an expected utility approach. The insurer's objective is to maximize

shareholder value under a solvency constraint imposed by a regulatory authority. In this paper we show that the maximization of shareholder value under solvency restrictions is approximately equivalent to the maximization of shareholder value using utility approach with a special isoelastic utility function. Using this isoelastic utility function we maximize the expected present value of utility of future dividends by three uncontrolled variables: dividend rate, leverage ratio and retention level of quota share proportional reinsurance, for the surplus which follows a geometric Brownian motion.

Session 3 – Nutcracker Ballroom 3
Moderator: Donald Mango

An Introduction to Insurer Strategic Risk
Donald Mango

This paper considers the definition of strategic risk, reviews strategic risk management research to date, provides examples of strategic risks for an insurer, and explains how effective strategic risk management begins with scenario planning (with examples). The paper also addresses advanced scenario planning and enterprise risk modeling.

An Introduction to Insurer Operational Risk
Donald Mango and Gary Venter

This paper considers the definition of operational risk and reviews operational risk for insurers by exploring the causes of impairments or insolvencies in the U.S. insurance industry. Rather than list all possible operational risks insurers face, the paper demonstrates the relevance of some of the critical risks in a setting that is familiar: cycle management. The paper also explores operational risk from an agency theory perspective.

Many operational risks are common to all businesses, but identifying them as risk sources and managing their impacts can avoid unexpected problems and lead to profit opportunities. The paper covers some general operational risks and explores the elements of good operational risk management used in banks and manufacturers. The paper concludes with a discussion of operational risk modeling.

CAS Spring Meeting Sessions

2006 ARIA Prize Paper: "Estimating the Cost of Equity Capital for Property-Liability Insurers" – Fantasia Ballroom H
This article presents new evidence on the cost of equity capital by line of insurance for the property-liability insurance industry. To do so we obtain firm beta estimates and then use the full-information industry beta (FIB) methodology to decompose the cost of capital by line. We obtain full-information beta estimates using the standard one-factor capital asset pricing model and extend the FIB methodology to incorporate the Fama-French three-factor cost of capital model. The analysis suggests the cost of capital for insurers using the Fama-French model is significantly higher than the estimates based upon the CAPM. In addition, we find evidence of significant differences in the cost of equity capital across lines.

Authors: J. David Cummins, Executive Director, SS Huebner Foundation, Wharton School, University of Pennsylvania and Richard D. Phillips, Professor of Risk Management and Insurance, Georgia State University

Data Quality and the Impact on Cat Modeling Results – Fantasia Ballrooms E/F
The importance of accurate exposure data in ensuring the accuracy of CAT model output is now recognized by most insurers. While many companies have begun to improve the accuracy of replacement cost estimates, coding of risks and geocoding of addresses, there are still other critical data elements that can have a significant impact on model results.

In this panel discussion, catastrophe modelers will address the most important data quality factors for their catastrophe models and highlight how various levels of data quality can affect the results for the same portfolio.

Moderator: Benoit Carrier, Actuarial Director, Zurich North America
Panelists: David Lalonde, Senior Vice President, AIR Worldwide Corporation and Hesaam Aslani, Senior Catastrophe Risk Modeler, Risk Management Solutions, Inc.

ERM Case Studies – Fantasia Ballrooms A/B
This session will discuss actual case studies of an ERM program and its resultant strategies based upon implementing such a program. The perspectives of both a P&C Insurance company and a non-insurance company will be included in the discussion.

Moderator/Panelist: Steven J. Johnston, Consultant, Oliver Wyman
Panelists: TBD

The State of the Property/Casualty Insurance Market in China – Fantasia Ballrooms C/D
The rapid development of the China economy, the opening of the insurance market to private companies, and rapid growth (and enormous future potential) of premium volume has energized a significant wave of interest from foreign and domestic investors wanting to participate in the insurance business in China. This panel will provide an overview of the current property/casualty insurance market in China, and will share information and insights regarding the new compulsory auto liability law, the regulatory environment and the role of actuaries in the regulatory regime, solvency considerations, and various opportunities and challenges in the marketplace.

Moderator: Robert F. Conger, Principal and Consultant, Towers Perrin
Panelists:
Zhigang Xie, Professor, Shanghai University of Finance and Economics
Peng Ding, Deputy Director, China Insurance Regulatory Commission
Qian Tao, Renmin University, Beijing
Ray Yao, Renmin University, Beijing

Writing Technical Papers That People Will Read – Part II – Olympus A/B
Learn to produce papers that are readable, effective, and suitable for the new journal, Variance. The second half of this experiential workshop focuses on editing.

Facilitator:
Henriette Anne Klauser, Ph.D., professional speaker and author of Writing on Both Sides of the Brain; Put Your Heart on Paper; and Write It Down, Make It Happen.

Wednesday, 20 June, 13:30-14:45

Session 1 – Grand Republic Ballroom C (2nd Level)
Moderator: Jean Lemaire

Risk Perceptions and Rationality in Measures of Risk (Risk Measures)
Morteza Aalabaf-Sabaghi

Individuals may have biased perceptions of health and safety risks. We conjecture perceptions of mortality risk from various risk measures using parametric and non-parametric methods. We investigate how risk perceptions are measured and what rational explanations can be found for these measures.

Technical reserves and solvency capital of insurance company: how to use the Value-at-Risk?
Pierre-E. Thérond and Frédéric Planchet

The advent of the future European prudential framework (Solvency II) and, to a lesser extent, of the phase II of the IFRS dedicated to the insurance contracts, will systematize the use of the Value-at-Risk (VaR) risk measure in insurance. Especially used for financial purposes, the measure of an insurance risk by a VaR technique requires a specific adaptation. Schematically we may distinguish two different contexts, which impose distinct approaches:
- the measurement of the risk related to the sinistrality by the use of a VaR in the heart of the probability distribution: the technical provision will have to be enough to pay the claims with a 75% probability;
- the measurement of risk related to the ruin of the company by the mean of a very high order VaR: the solvency capital must to be calibrated to control the ruin if the insurer with a probability higher than 99.5%.

In the first situation, the two standard approaches (historical VaR or modeling the sinistrality) can be based on a statistical material of relative but sufficient size to estimate a VaR in the heart of the probability distribution. In the second case, we are confronted to the absence of observations. Also we have to model the basic variables which influence the solvency of the company in order to be able to simulate the ruin of the company and finally to estimate the high order VaR. This last stage will require the use of Extreme Value Theory.

In this paper, we present the contexts of VaR computation in insurance, the related probabilistic results and the limits of these kinds of criterion for insurance purposes.

Session 2 – Fantasia Ballrooms K/L
Moderator: Charles Levi

Modeling and Management of Nonlinear Dependencies – Copulas in Dynamic Financial Analysis
Martin Eling and Denis Toplek

The aim of this paper is to study the influence of nonlinear dependencies on a non-life insurer's risk and return profile. To achieve this, we integrate several copula models in a dynamic financial analysis (DFA) framework and conduct numerical tests within a simulation study. We also test

several management strategies in response to adverse outcomes generated by nonlinear dependencies. We find that nonlinear dependencies have a crucial influence on the insurer's risk profile that can hardly be affected by the analyzed management strategies. Depending on the copula concept employed, we find large differences in risk assessment for the ruin probability and for the expected policyholder deficit. This has important implications for regulators and rating agencies that use these risk measures as a foundation for capital standards and ratings.

On the Subadditivity of Tail-Value at Risk: An Investigation with Copulas
S. Desmedt and J.F. Walhin

In this paper, we compare the point of view of the regulator and the investors about the required solvency level of an insurance company. We assume that the required solvency level is determined using the Tail-Value at Risk and analyze the diversification benefit, both on the required capital and on the residual risk, when merging risks. To describe the dependence structure, we use a range of various copulas. This allows to judge whether or not the Tail-Value at Risk is too subadditive under a wide range of conditions. Furthermore, we discuss the effect of different copulas on the diversification possibilities.

Session 3 – Fantasia Ballrooms M/N
Moderator: Roger Hayne

Thinking Outside the Triangle
Glenn Meyers

Overfitting is the result of having a model that is too complex for the amount of data that is available. This is typically the case for a loss reserve model which has a large number of parameters on a smallish triangle of data. This paper uses simulation methods to diagnose overfitting in estimating the predictive distribution of loss reserves by the method of maximum likelihood. This paper then shows how to use a Bayesian fitting methodology to overcome overfitting using prior information that is "outside the triangle."

A Simple Multi-State Reserving Model
James Orr

This paper presents a simplified claims number model, with a Poisson arrival process for losses occurring during each Accident Year and Exponential waiting times in two intermediate states, being State 0 for Incurred But Not Reported (IBNR) and State 1 for Reported But Not Settled (RBNS) claims; paid losses are absorbed into State 2. Aggregate claim number development data is simulated using this model and standard reserving methods are applied, using the 'reserving' package in R to derive estimates of the ultimate claim numbers. The model itself is then fitted to the simulated data, using least squares and Bayesian approaches. Finally, extensions of the model to fit different real world circumstance are presented. Simulation from the simplified claims number model is shown to generate plausible data, to which existing reserving techniques may be applied. The model is also shown to be readily extendable to encompass a number of different circumstances that arise in practice, including inception (i.e. year of account) based accounting, catastrophes and the "negative" development of incurred claims. Whilst not proven in a real world context, this model shows potential as an alternative basis for the study and estimation of insurance claims development. Its strengths include the incorporation of both paid and outstanding claims data within the estimation process and its ready expression in a Bayesian framework.

Wednesday, 20 June, 15:15-16:30

Session 1 – Grand Republic Ballroom C (2nd Level)
Moderator: Roger Hayne

A Gamma IBNR Claims Reserving Model with Dependent Development Periods
Werner Hürlimann

Two distribution dependent IBNR claims reserving models with gamma distributed paid claims are considered. The first model assumes independent development periods and allocates the coefficient of variation of the total ultimate claims of a line of business with multiple underwriting periods to the coefficient of variation of the total ultimate claims of a single underwriting period inverse proportionally to the squared-root premium volumes. The second model extension is based on a simple Fréchet like multivariate distribution, which models the whole range of dependence between independence and comonotone dependence. The chosen model uses only one additional dependence parameter, which is chosen such that it yields the most conservative model for IBNR claims reserving with respect to the concordance order for the bivariate margins of this model. The use of the introduced models is compared with the results obtained through application of a recent optimal credible loss ratio IBNR reserving method.

Predictive Distributions for Reserves which Separate True IBNR and IBNER Claims
Huijuan Liu and Richard Verrall

This paper considers the model suggested by Schnieper (1991), which separates the true IBNR claims from the IBNER. Stochastic models are defined, using both recursive and non-recursive procedures, within the framework of the models described in England and Verrall (2002). Expressions for the prediction errors of the reserves are derived analytically. A bootstrapping procedure is also described which allows the prediction errors to be estimated straightforwardly. The full predictive distribution of reserves is estimated using the bootstrapping method.

Some extensions to the original Schnieper model are also discussed, together with other possible applications of this type of model.

Session 2 – Fantasia Ballrooms K/L
Moderator: Nino Savelli

Cape Cod Credibility (CCC)
Jack Barnett

In many instances when using the BF method, we do not have an external source for the expected loss costs. In this situation, we will frequently use a weighted average of ultimate loss costs of the preceding accident periods. The Cape Cod method suggests using weights proportional to exposure and inversely proportional to development. Unfortunately, this approach fails to recognize variability in both the historical loss estimates and loss development factors. This paper attempts to recognize this variability, via credibility formula, and apply the results as alternative weights to the traditional Cape Cod method.

Credibility for the Chain Ladder Reserving Method
Alois Gisler and Mario V. Wüthrich

We consider the chain ladder reserving method in a Bayesian set up, which allows for combining individual claims development data with portfolio information as for instance development patterns from industry-wide data. We derive the Bayes estimators and the credibility estimators within this Bayesian framework. We show that the credibility estimators are exact Bayesian in the case of the exponential family with its natural conjugate priors. Finally, we make the link to classical chain ladder and show that by using a non-informative prior we arrive at the classical chain ladder forecasts. However, the estimates for the mean square error of prediction differ from the ones found in the literature. Hence the paper also throws a new light upon the estimator of the mean square error of prediction of the classical chain ladder forecasts and suggests a new estimator.

Session 3 – Fantasia Ballrooms M/N
Moderator: Andrew Cairns

A Multiline Risk Factor Model
Spencer M. Gluck

For a risk model to provide a realistic picture of the risks of an insurance or reinsurance enterprise, it is essential that the model capture systemic risks and parameter risks that are often neglected, including market risks (e.g. pricing and underwriting), parameter risks related to embedded projections (e.g. trend and development), and risks related to processes in the external environment (e.g. inflation and economic performance). These risks are typically non-diversifying and create interdependencies (correlations) among different lines of business and between current underwriting and risk accumulated from prior underwriting (reserves). This paper presents a modeling structure that provides for the reflection of various types of risks in a form structurally related to the operation of such risks. The structure is first presented for a single accident year and then extended to reflect the accumulation of risk over time. The various risk factors provide a basis for understanding the source of correlations and a mechanism for reflecting them. The resulting model can provide a basis for Enterprise Risk Management, capital allocation and risk-adjusted performance measures, and for evaluating the impact and effectiveness of reinsurance.

Using Interpretive Structural Modeling to Identify and Quantify Interactive Risks
Rick Gorvett and Ningwei Liu

The typical insurance firm is subject to a wide variety of risks. Understanding and quantifying the interrelationships between individual risk elements is a significantly important but complex challenge. If we view all the risks in a firm as an integrated system, we can apply a computer-assisted learning process called Interpretive Structural Modeling (ISM) to construct a structural graph and illustrate those risk interrelationships. In this paper, we use ISM concepts and techniques to better understand an insurance company's overall risk profile. Delphi techniques can be used to "parameterize" this process according to group consensus regarding risk elements and interrelationships. An Analytical Hierarchy Process (AHP) can then be used to quantify relationships and weigh the significance of different risks. Such a modeling approach can be of great value to a firm's enterprise risk management (ERM) process.

Session 1 – Fantasia Ballrooms C/D
Moderator: Robert Conger

The Last Thing a Fish Notices is the Water in which it Swims
Competitive Market Analysis: An Example for Motor Insurance
Alessandro Santoni, Eduard Folch, and Bob Sanche

This paper describes a statistical model used to assess an insurance company's competitive position and how to use the result of the model to improve an insurer's pricing strategy. We call these techniques/methodologies: Competitive Market Analysis (CMA), which we define as an analytic process through which premiums charged in the market for a very large number of risks are used as an input to a model that can answer the following questions:
- How can the market's competitive intensity be summarized in one straightforward measure?
- Which are the market segments with the highest/lowest competitive intensity and what is my positioning for customers falling into these segments?
- What is my average overall premium compared to my competitors?
- In which segments am I particularly expensive or inexpensive?
- Who is competing against me in these expensive, or inexpensive, segments?

Finally, these results are combined with other analytics to optimize an insurer's pricing strategy. We also provide a brief overview of two other critical components of the rating processes: costing and analysis of elasticity; however, our main focus is on CMA.

Analysis of Chinese Motor Insurance
Comparative Study of Third Party Liability Insurance Systems
Ray Yao and Qian Tao

This paper provides an introduction to Chinese third party motor liability insurance. The paper appraises the rating criteria and rating factors applied by various insurers to calculate third party motor insurance tariffs, including bonus malus systems. The study also compares the Chinese compulsory auto liability market, and the economic environment in which it operates, with those in U.S. and Japan, where the regulatory supervision on the insurance industry appears to be stricter.

Session 2 – Fantasia Ballrooms E/F
Moderator: Amy Bouska

Optimal strategies for ruin probabilities and expected gains
Cary Chi-Liang Tsai and Gary Parker

This paper studies ruin probabilities based on the classical discrete time surplus process. The individual claim size random variables come from one of nine combinations of tail types (heavy, neutral and light) and frequency/severity (low/high, mid/mid and high/low) distributions. We consider strategies to reduce the ruin probabilities and enhance the expected profits or gains. First we analyze a pricing method where the renewal premiums are based on Buhlmann's credibility theory. Then we add two policy provisions, a deductible and a policy limit. We also propose two criteria, an index and a value at risk measure, which can be used to select optimal strategies.

Operational Risk and Insurance: A Ruin-probabilistic Reserving Approach
Vladimir K. Kaishev, Dimitrina S. Dimitrova, and Zvetan G. Ignatov

A new methodology for financial and insurance operational risk capital estimation is proposed. It is based on using the finite time probability of (non)ruin as an operational risk measure, under a general ruin probability model, according to which operational losses may have any joint (dependent) discrete or continuous distribution, and the function, describing the accumulation of risk capital may be any nondecreasing, positive real function $h(t)$. The probability of nonruin is explicitly expressed using closed form expressions, derived by Ignatov and Kaishev (2000, 2004) and Ignatov Kaishev and Krachunov (2001) and by setting it to a high enough preassigned value, say 0.99, it is possible to obtain not just a value for the capital charge but a (dynamic) risk capital accumulation strategy $h(t)$.

In view of its generality, the proposed methodology is capable of accommodating any (heavy tailed) distributions, such as the Generalized Pareto Distribution, the Lognormal distribution the g-and-h distribution and the GB2 distribution. Applying our methodology on numerical examples, we demonstrate that dependence in the loss severities may have a dramatic effect on the estimated risk capital. In addition we also show that one and the same high enough survival probability may be achieved by different risk capital accumulation strategies one of which may possibly be preferable to accumulating capital just linearly, as has been assumed by Embrechts et al. (2004). The proposed methodology takes into account also the effect of insurance on operational losses, in which case it is proposed to take the probability of joint survival of the financial institution and the insurance provider as a joint operational risk measure. The risk capital allocation strategy is then obtained in such a way that the probability of joint survival is equal to a preassigned high enough value, say 99.9%.

Thursday, 21 June, 10:30-11:45

Session 1 – Fantasia Ballrooms C/D
Moderator: Gary Venter

The Quantitative Modeling of Operational Risk: Between g-and-h and EVT
Matthias Degen, Paul Embrechts, and Dominik D. Lambrigger

Operational risk has become an important risk component in the banking and insurance world. The availability of (few) reasonable data sets has given some authors the opportunity to analyze operational risk data and to propose different models for quantification. As proposed in Dutta and Perry [10], the parametric g-and-h distribution has recently emerged as an interesting candidate. In our paper, we discuss some fundamental properties of the g-and-h distribution and their link to extreme value theory (EVT). We show that for the g-and-h distribution, convergence of the excess distribution to the generalized Pareto distribution (GPD) is extremely slow and therefore quantile estimation using EVT may lead to inaccurate results if data are well modeled by a g-and-h distribution. We further discuss the subadditivity property of Value-at-Risk (VaR) for g-and-h random variables and show that for reasonable g and h parameter values, superadditivity may appear when estimating high quantiles. Finally, we look at the g-and-h distribution in the one-claim-causes-ruin paradigm.

Catastrophe Equity Put in Markov Jump Diffusion Model
Shih-Kuei Lin and Chia-Chien Chang

Most prior studies (c.f. Louberge, Kellezi, and Gilli (1999), Lee and Yu (2002), Vaugirard (2003), Cox et al. (2004) and Jaimungal and Wang (2006)) assume that the loss claim arrival process follows Poisson process when pricing the catastrophe insurance products. However, for catastrophic events, the assumption that resulting claims occur in terms of the Poisson process is inadequate as it has constant intensity. To overcome this shortcoming, this paper proposes Markov Modulated Poisson process (MMPP) where the underlying state is governed by a homogenous Markov chain to model the arrival process for catastrophic events. Next, we propose a generalization of Radon-Nikodym processes that a changing measure corresponds to a change of drift for the underlying Brownian motion and a change of the stochastic intensity for the Markov jump diffusion model. We derive pricing formulae and dynamic hedging for Catastrophe equity put options and our pricing formulae could be the generalization of Cox, Fairchild, and Pedersen (2004) and Jaimungal and Wang (2006).

Session 2 – Fantasia Ballrooms E/F
Moderator: Roger Hayne

A general framework for forecasting numbers of claims
Thomas Wright

In applications of the collective risk model, significantly more attention is often given to modeling severity than modeling frequency. Sometimes, frequency modeling is neglected to the extent of using a Poisson distribution for the number of claims. The Poisson distribution has variance equal to mean, and there are multiple reasons why this is almost never appropriate when forecasting numbers of non-life insurance claims.

The inappropriateness of the Poisson distribution for forecasting has long been recognised by many, and collective risk algorithms (Panjer (1980), Heckman & Meyers (1983)) have been developed that work just as well with other frequency distributions, in particular the Negative Binomial. However, to calibrate a Negative Binomial model requires two parameters, equivalent to specifying both mean and variance. The author believes that one reason for the prevalence of Poisson models is lack of knowledge about how to objectively quantify the variance as well as the mean. This paper aims to contribute in this area.

The main reasons why the variance should exceed the expected number of claims are identified as parameter estimation error, heterogeneity, contagion, and future exposure uncertainty. While all these factors have long been recognised by some practitioners, this paper provides a framework for their systematic analysis and quantification. A mathematical model is developed in which these concepts are precisely defined, and statistical methods are developed for the quantification of these factors from claim frequency data. The model also shows how these factors interact to produce the overall variance for forecasts.

It is not claimed that the particular form of model presented will be appropriate in all circumstances, but where necessary, modifications will often be possible within the general framework presented here.

An Extension Model of Financially-balanced Bonus-Malus System
Yugu Xiao, Shengwang Meng, and Robert Conger

Due to lack of information disclosure among insurers, a policyholder who pays high premium in one insurance company can transfer his policy to another company without necessarily carrying the malus points associated with past claims. When the leaving rate of a policyholder is related to the bonus-malus scales, i.e., high malus policyholders are more likely to leave because of high premiums, it is impossible for a bonus-malus system (BMS) with a finite number of classes, which is used to approximate the optimal BMS that has an infinite number of classes, to be financially-balanced. We propose a BMS that is intended to reduce the approximation error when it is used to approximate an optimal BMS and also to reduce the financial imbalance. Our result resembles the BMS scales used in practice, i.e., the bonus-malus scales are mild: bonuses are not high and maluses are also low, so the financial imbalance is not too severe.

Friday, 22 June, 10:30-12:00

Session 1 – Fantasia Ballrooms K/L
Moderator: Glenn Meyers

Enterprise Risk Management in Insurance Groups: Measuring Risk Concentration and Default Risk
Nadine Gatzert, Hato Schmeiser, and Stefan Schuckmann

In financial conglomerates and insurance groups, enterprise risk management is becoming increasingly important in controlling and managing the different independent legal entities in the group. The aim of this paper is to assess and relate risk concentration and joint default probabilities of the group's legal entities in order to achieve a more comprehensive picture of an insurance group's risk situation. We further examine the impact of the type of dependence structure on results by comparing linear and nonlinear dependencies using different copula concepts under certain distributional assumptions. Our results show that even if financial groups with different dependence structures do have the same risk concentration factor, joint default probabilities of different sets of subsidiaries can vary tremendously.

actuar: an R package for Actuarial Science
Vincent Goulet

The actuar project is a package of Actuarial Science functions for the R statistical system. The project was launched in 2005 and the package is available on CRAN (Comprehensive R Archive Network) since February 2006. The current version of the package contains functions for use in the fields of risk theory, loss distributions and credibility theory. This talk will present the most recent developments and demonstrate how the package can be useful in teaching, research and practice.

Session 2 – Fantasia Ballrooms M/N
Moderator: Gary Venter

Credibility, Hypothesis Testing and Regression Software
Greg Taylor

It has been known since Zehnwirth (1977) that a scalar credibility coefficient is closely related to the F-statistic of an analysis of variance between and within risk clauses. The F-statistic may also be viewed as testing a certain regression structure, associated with credibility framework, against the null hypothesis of a simpler structure.

This viewpoint is extended to multi-dimensional credibility frameworks in which the credibility coefficient is a matrix (Sections 3 and 4), and to hierarchical regression credibility frameworks (Section 6). In each case the credibility coefficient is expressed in terms of the F-statistic that tests the significance of a defined regression structure against a simpler one.

Section 5 prints out how the computation may be implemented by means of regression software.

Credibility for additive and multiplicative models
Alois Gisler and Petra Müller

Additive and multiplicative models are common in modeling multivariate tariffs. Mostly classical multivariate statistical techniques and in particular generalized linear models are used to determine the premiums of such tariffs. However, often the number of risks in the different rating cells are rather small. In these cases a credibility approach would be more appropriate. In this paper we consider beside the classical additive and multiplicative model a Bayesian additive and multiplicative model and derive the corresponding credibility estimators. Moreover, estimators of the structural parameters are given and the methodology is applied to real data from the insurance practice.

Friday, 22 June, 13:15-14:45

Session 1 – Fantasia Ballrooms K/L
Moderator: Robert Conger

Dynamic Financial Analysis as the untrodden path for company risk measurement under Solvency-II
Chitro Majumdar

Dynamic Financial Analysis (DFA) is the most advance modeling process in today's property and casualty industry-allowing us to develop financial forecasts that integrate the variability and interrelationships of critical factors affecting our results. Through the modeling of DFA, we see the company's relevant random variables is based on the categorization of risks which is generated solvency testing where the financial position of the company is evaluated from the perspective of the customers. The central idea is to quantify in probabilistic terms whether the company will be able to meet its commitments in the future.

DFA is the capital budgeting decision process of a company launching a new invention and predicting the impact of the strategic decision on the balance sheet in a horizon of few years.

To recognize the few factors that will affect the asset liability cash flow are demand uncertainty, sales volatility, credit risk, volatility in the price of raw materials cost of capital to name a few. Each of these random variables can be stochastically simulated either based on the distribution of retrospective data or under strategic assumptions. When simulated in a combined way the future cash flows can be predicted which in return would dictate the capital requirements in the future. Depending on the capital structure of the company and simulated interest rate in the capital market the final earnings volatility of the company can be predicted to identify the return and associated risks. But still we're not convinced that DFA will be the paradigm to do Solvency 2, and risk-based insurance pricing, for insurance companies.

The Study of Chinese P&C Insurance Risk for the Purpose of Solvency Capital Requirement
Zhigang Xie, Shangwen Wang, and Jinhan Zhou

The purpose of this study is to analyze the regulatory solvency capital requirement related to the insurance risk of P&C insurers in China Market. The core issue is to decide reserving and

underwriting risk factors, based on the specific market structure, available data records and a series of assumptions for the P&C insurers. The results of calculation are implemented to several sample P&C companies and compared to the current standards of calculating solvency margin. Finally the study provides recommendations for establishing a risk-oriented approach of solvency supervision and capital requirement model for P&C in China market.

Session 2 – Fantasia Ballrooms M/N
Moderator: Mette Havning

Ruin Theory with K Lines of Business
Stéphane Loisel

This paper deals with the evolution of the reserves of an insurance company with $K \geq 1$ lines of business facing dependent risks. We consider risk measures based on the behavior of the multivariate risk process from an academic point of view. To deal with multivariate risk processes, we propose a multi-risks model. We then explain how to determine the optimal reserve allocation of the global reserve to the lines of business in order to minimize those risk measures. The impact of dependence on the risk perception and on the optimal allocation is studied and used to test the consistency of the risk measures. This paper is mainly based on the two following papers Loisel (2004 2005b).

A model for numerical evaluation of continuous time ruin probabilities with a variable premium rate
Lourdes B. Afonso, Alfredo D. Egídio dos Reis, and Howard R. Waters

In this paper we present a method for the numerical evaluation of the ruin probability in continuous, finite or infinite time for a classical risk process where the premium can change from year to year. Our method is based on the simulation of the annual aggregate claims and then on the calculation of the ruin probability for a given surplus at the start and at the end of each year. We calculate the within-year ruin probability assuming first a Brownian motion approximation and, secondly, a translated gamma distribution approximation for the aggregate claim amount.

Session 3 – Fantasia Ballrooms P/Q
Speaker's Corner