

XXII ASTIN COLLOQUIUM
MONTREUX, SWITZERLAND, 9th to 13th SEPTEMBER 1990

The Swiss organisers of the 22nd ASTIN Colloquium, mindful of the need to bring theory and practice closer together, arranged for the meetings to be held in the Casino in Montreux. Judging by the number of actuaries who at the end of the Colloquium departed for Geneva in second-class carriages, there is scope for further progress to be made.

With such an attractive setting as Montreux it was scarcely surprising that the attendance reached a new record level, with 256 actuaries from 23 countries and all five continents represented. The traditional ASTIN conviviality was well under way by the end of the reception with which we were welcomed on the Sunday evening, and anyone who did not make new friends during the days that followed can scarcely have been trying.

The business meetings began, naturally enough, with the opening ceremony, the highlight of which was an invited lecture by Peter Gmeiner, the First Secretary of the Swiss Insurance Association, on "The future European insurance market and the Swiss insurance industry". Part way through the Colloquium there was a second invited lecture by James W. MacGinnitie on "Actuarial ethics and integrity". In view of the wide general interest of these lectures, which were not available in printed form, summaries of the lectures are appended to these notes.

Topic 1: Models of Finance

Uncertainties abound in the world of investment, and most actuaries need to be concerned with financial risk whatever their field of work. Not surprising indeed, that ASTIN now has a sister group, AFIR, formed to consider financial risk. There is clearly an overlap between the two groups, as regards areas of interest. It was remarked by Philippe Maeder who, with Jean-Pierre Melchner, had prepared the summary of the papers under Topic 1, that there was scope for co-ordination between the two groups regarding topics for papers.

The four papers presented on Topic 1 confirmed the scope for applying models of finance to diverse areas of actuarial work. Philippe ARTZNER and Freddy DELBAEN consider credit insurance, and discuss the optimal time at which a borrower with default risk should prepay a risky fixed rate loan. Werner HURLIMANN considers the concept of a premium to cover the investment risk in life insurance. David SANDERS discusses a possible use for option pricing in the premium rating of stop loss and excess of loss reinsurance. Patrick BROCKETT and Yehuda KAHANE consider how a rational investor may choose between two investment opportunities.

Topic 2: Experience rating

Twelve papers were presented on this topic, including one paper transferred from Topic 3, and Alois Gisler presented a summary of them which he and René Schnieper had prepared.

The first group of papers is related to the determination of the pure risk premium and to the assessment of claims reserves. Alois GISLER and Peter REINHARD suggest that the problem of outliers in rating is best dealt with by a combination of credibility and robust statistics. GABRY et al. are also faced with outliers in a large volume of Dutch industrial fire insurance data which they are using to derive a set of risk premium rates. They use a pragmatic approach, applying a combination of top-slicing and credibility techniques. Erhard KREMER shows how to determine the necessary coefficients to make practical use of the exponential smoothing credibility estimator which he puts forward as an alternative to the credibility estimator with geometric weights. Ragnar NORBERG considers linear predictors and credibility estimators based on a continuous time model rather than a finite set of observations.

The final paper in the first group, by Thomas MACK, is alone in being unconnected with credibility theory. MACK reveals that the estimation of IBNR claims reserves is a special case of the analysis of cross classified data. He shows that, for example, the method of marginal totals for cross classified data leads to the chain ladder method for assessing reserves. The author advocates the use of an alternative model for the total claim amount, for both rating and reserving, based on the Gamma distribution.

The second group of papers relates to bonus-malus systems. Jean-Luc BESSON and Christian PARTRAT advocate the use of the Poisson-Gamma model for claim frequencies in motor insurance. They use a goodness-of-fit test to illustrate the superiority of this model, although Chresten Dengsoe suggested in the discussion that the test statistics put undue emphasis on the small number of policies with four or five claims. Hans GERBER explains the recent change in the bonus-malus system used in Switzerland. The new system imposes an increased penalty following a claim and is thereby an improved discriminator between low and high risks. Tormod Sande pointed out in the discussion that, even under the new system, high risk policies continue to pay on average substantially less than their share of premiums in the long term. This feature is common to all bonus-malus systems.

The third group of papers is devoted to the pricing of non-proportional reinsurance covers. Gunnar BENKTANDER advocates the use of a simple model to determine the extent to which the reinsurance risk premium for excess of loss cover in fire insurance is affected by varying the retention.

There are clearly immense practical difficulties in rating stop loss reinsurance cover. There is always the potential for over-generous claim settlement by the cedant at the expense of the reinsurer, especially if liability claims are covered. Reinsurers need all the help they can get if they are to make this form of cover available at affordable rates. In this regard, the two papers on stop loss cover are to be welcomed. Jozef TEUGELS and Bjorn SUNDT describe a scheme of

stop loss rating for motor fleets which takes account of the claims experience of the individual fleet. Lionel MOREAU also considers the rating of stop loss cover for motor fleets. He uses data from a large company over a five year period and, despite some shortcomings of the data, obtains a set of numerical results.

Reinstatement premiums are a common feature of non-proportional reinsurance cover, but there is little in the actuarial literature on the mathematical treatment of such premiums. Bjorn SUNDT discusses the pure premium and the loading needed for excess of loss cover with reinstatements. Reinstatement premium is a form of claims-dependent premium, and Stefan BERNEGGER considers the variance loading for excess of loss cover taking into account the influence of claims-dependent premiums. Since this paper addresses very much the same problems as that by SUNDT, it was presented under Topic 2 even though it was originally allocated to Topic 3.

Topic 3: Numerical methods

Fifteen papers were presented on this topic and Erwin Straub presented a summary of them which he and André Dubey had prepared.

The first group of papers considers ruin probability and applications. Marc-Henri AMSLER uses the probability of ruin, the severity of ruin and the time of ruin in assessing the riskiness of an insurance portfolio. Examples are given relating to life assurance, and the results show the influence of different reinsurance programmes on the financial stability of the portfolio. François DUFRESNE, Hans GERBER and Elias SHIU show how classical risk theory, and in particular ruin theory, can be adapted when the gamma model is used to represent the aggregate claims process. Lourdes CENTENO provides an algorithm to calculate an optimum excess of loss retention, given certain assumptions regarding the calculation of the reinsurance premium. David DICKSON and Howard WATERS give an algorithm for approximating the finite time non-ruin probabilities for the classical risk model. The authors show that the algorithm can also be used to calculate infinite time non-ruin probabilities, and they address certain problems of numerical instability. Hans SCHMITTER derives an explicit expression for the ultimate ruin probability when the claim amount distribution is discrete with a finite number of steps.

The second group of papers considers the aggregate claims distribution. Marc GOOVAERTS and Robert KAAS give a recursive algorithm, using Panjer's formula, to compute the distribution function of a compound sum of claim numbers, when the number of summands follows a generalised Poisson distribution. Werner HURLIMANN proposes an approximation of the aggregate claims distribution by approximating the claim size distribution using the algebraic moment method. Thomas MULLER treats compound Poisson processes, their Panjer recursion and the effect of merging two or more portfolios. Some properties of compound Poisson processes are shown to be basic properties of the exponential power series. Bob ALTING VON GEUSAU proposes

a method to test the possibility of a trend over time in given data. In the Poisson case the distribution function of the proposed statistic can be calculated by means of the shovelboard approach, i.e. by making use of the fact that Poisson distributed variables, given their sum, are multinomially distributed. To aid our understanding, the author's presentation at the meeting included the display of a picture of a shovelboard, which is the basis of a well-known family pastime in the Netherlands. Erhard KREMER uses Fourier analysis to deal with the computation of the distribution function of total claims amounts where the ordered claims have been multiplied by given coefficients.

The third group of papers relates to claims reserves. Teivo PENTIKAINEN and Jukka RANTALA analyse the three basic types of inaccuracies inherent in the estimation of claims reserves; model errors, parameter errors and stochastic errors. The authors simulate a claims process and analyse various estimation methods with regard to their sensitivity in respect of the three basic types of errors. Erwin KUMMERLI applies two formulae proposed by De Vylder and Kahane to run-off triangles for each of several classes of non-life business in a medium-sized company, and comments on the results. Hans EKHULT presents a program to calculate claims reserves in disability insurance as expected present values of future annuity payments.

The two remaining papers could not be allocated to any of the above three groups. Bruno KOLLER discusses spreadsheet programming languages and then shows how to use a spreadsheet to carry out Bayesian graduation, using an example from health insurance. Erhard KREMER applies the Cauchy-Schwarz inequality and derives an upper bound for the variance of the claims amount covered by stop-loss reinsurance.

During one of the working sessions on Topic 3 there was an impromptu debate on whether models or, alternatively, the observed data would normally provide the better indicator of future experience. Conflicting—and entertaining—views were expressed. The issue was finally clarified by Hans Bühlmann's comments that neither models nor data of the past will normally be in accord with the future experience, but that a model is constructed to try to reflect one's perception of what the future will hold.

Speakers' Corner

Speakers' Corner is a well-established feature of ASTIN Colloquia, and provides an opportunity for members to make a contribution on the topic of their choice without the constraint of submitting a paper several months before the time of the colloquium.

Three of the papers in Speakers' Corner considered the probability of ruin and made the assumption of an underlying compound Poisson process. Richard VERRALL derives a sample re-use estimate of the probability of ruin, making use of the full bootstrap distribution and a saddlepoint approximation. Angela van HEERWAARDEN and Robert KAAS consider the concept of stop-loss order and develop a proof from which can be shown that the risk with higher

stop-loss premiums generates a higher ruin probability. Anna STEENACKERS and Marc GOOVAERTS obtain upper and lower bounds for stop-loss premiums and for ruin probabilities where certain features of the claim severity function are known.

Menachem BERG develops procedures for detecting possible trends in time non-homogeneous claim occurrence processes. Use is made of Bayesian revision procedures, and results for claim occurrence and claim size processes are combined to predict the total claim process. Udi MAKOV presents a sampling-resampling technique to assess the posterior distribution of a Bayesian credibility model for arbitrary likelihood function and prior distribution. It is explained that thereby the computational difficulties of evaluating integrals are overcome. Benedetto CONTI and Felix LAUHLI consider two classes of distribution functions which are regarded as important in non-proportional reinsurance work. Properties of these classes are set out and results are given following an analysis of the maximum likelihood estimator.

Bill JEWELL presents the third act of what has been described as a three-act play. The author advocates the formulation of the IBNR problem in continuous time and using a Bayesian approach. The paper points to the possibility of the working actuary of the future being able to predict *distributions* of numbers and amounts of IBNR claims.

Arthur RENSHAW shows how the existing range of actuarial graduation techniques can be considerably extended using generalised linear models. There is detailed discussion of how such models can be used to graduate the probabilities of death and the force of mortality.

Georg HARBITZ summarises the discussions which have taken place recently in Norway leading to the making of government regulations requiring appointed actuaries in general insurance companies as well as in life insurance companies. The detailed regulations are given by way of Appendix. These developments in Norway will be of interest in other countries where some statutory role for non-life actuaries is being considered.

Other Colloquium Events

The ASTIN General Assembly took place after the coffee break on Wednesday morning. Alf Guldberg, President of the Swedish Actuarial Society, announced that the next Colloquium will be held in Stockholm in the summer of 1991, and welcomed members to complete a provisional registration form.

For the last few years there has been debate, sometimes heated, at ASTIN business meetings on the topic of the composition and system of election of the Committee. The Committee put forward some proposals at Montreux for changing the ASTIN rules and some alternative proposals were put forward by an ASTIN member. An interesting debate took place in which several members took part. Although contrary views were expressed, the discussion took place in a friendly atmosphere, as we would expect within a group such as ASTIN. The Committee's proposed changes to the rules were accepted by a majority

decision and will be implemented. It is pleasing to note that the matter has finally been resolved.

Following the rule changes, the Committee will remain responsible for making nominations for Committee membership, and also it will still be possible for members to make further nominations at a General Assembly. However, the Committee, in making their nominations, are now charged with the responsibility of seeking a good balance of Committee membership as regards geographical spread, type of employment and research versus applied orientation. The Committee will give particular consideration to proposals through national actuarial organisations, but will reserve the right to make other nominations.

On Tuesday afternoon we boarded coaches for an enjoyable excursion into the Swiss countryside and mountains, including a visit to Gruyères.

We were privileged to meet on Wednesday evening for aperitifs inside the Château de Chillon, not normally available for private functions. This lakeside castle dates back to the 13th century, and narratives by well-known writers have contributed to its fame. Byron wrote "The Prisoner of Chillon", but we were not persuaded by the assertion of one eminent actuary that Byron had himself been imprisoned in the castle!

On this occasion the after-dinner speeches were delivered before the dinner began. Heralded by a fanfare of trumpets, the speakers included the retiring Chairman, Jean Lemaire, and his successor, Bjorn Ajne, who elegantly, entertainingly and appropriately referred to Jean's ability to make elegant, entertaining and appropriate speeches.

After the speeches we boarded the boat "La Suisse" for a cruise on Lake Geneva, with banquet and dancing. Needless to remark, the whole evening was superbly organised by our Swiss hosts and thoroughly enjoyed by the participants and accompanying persons.

After the final working session on Thursday morning, the brief closing ceremony took place. Bjorn Ajne announced the topics for papers for the 1991 Colloquium in Stockholm. The emphasis seemed to be very much on meeting modern challenges, the topics being The Use of Financial Theory in Insurance, High Tech Reinsurance and Modern Statistical Techniques.

It was no surprise that the Swiss organising committee, under the chairmanship of Robert Baumann and with Hans Gerber as head of the Scientific Committee, had done a most efficient job in organising all the aspects of the Colloquium. Our lack of surprise in no way diminished our gratitude to them. After making our farewells and leaving the Casino there was a final opportunity to take photographs of the flower-decked pathway by the lakeside, which had provided such pleasant morning and evening strolls in the sunshine each day. We look forward to meeting again in Sweden.

MARTYN BENNETT

APPENDIX: INVITED LECTURES**Lecture: “The future European insurance market and the Swiss insurance industry” by Peter Gmeiner**

The speaker began by drawing attention to the insurance-mindedness of the Swiss, whose insurance premiums (life and non-life combined) in 1988 amounted to US\$ 2,324 per head of the population; about 60 per cent of this was life. In addition to the group life assurance provided by many employers for their staff, life assurance is widely used by individuals as a means of saving.

The Swiss approach to cartels is to allow them in principle but to seek to outlaw abuse; a fire insurance cartel had recently been prohibited. Agreements between insurers were seen as a means of avoiding the risk of insolvency. The market is closely regulated and insurance tariffs are in principle subject to approval. There are very few brokers operating in Switzerland, almost all the business being obtained through tied agents of the companies. Such brokers as there are have been active for only a few years, and in the major centres of population — mostly for industrial risks.

A feature of the Swiss insurance companies is their high capitalisation. The increase in the level of the stock market has enabled insurance companies to expand their capital in favourable conditions. Swiss companies transact a large amount of business outside their country; some Swiss companies started transacting foreign business when they were formed in the 19th century, and out of the total premium income of SF 70bn of the Swiss companies in 1988, SF 46bn related to foreign business.

The speaker then turned to the developments currently taking place in the EC and the influence they were likely to have on the conduct of insurance in Switzerland. He referred in particular to the intention within the EC to drop the examination and approval of insurance tariffs, perhaps with an exception with regard to compulsory insurance, and to the ending of insurance monopolies where they still exist — for example in some German states.

Mr. Gmeiner then summarised the Swiss political aims and the options open to them. They would like to see European unity, of a kind which operated on the so-called principle of subsidiarity, with decision-making from bottom to top. They want to see a democratic Europe, with decisions taking account of local traditions. Switzerland would like to develop its policy of neutrality, in conjunction with the other neutral states: Austria, Sweden and Finland. Switzerland had already concluded a bilateral agreement with the EC on non-life insurance.

He ended by reviewing the reasons why, in his opinion, the Swiss insurers could face the future with confidence: they had a traditionally heavy commitment to foreign business and hence a long experience in handling it; the Swiss insurance companies are willing and able to adapt to new circumstances; they have great financial strength; and they are firmly rooted in the economically sound Swiss structure.

Lecture: “Actuarial ethics and integrity” by James W. MacGinnitie

The speaker began by referring to recent and current developments in North America, where the Society of Actuaries has introduced an admission course for new fellows, mainly on ethics, the Casualty Actuarial Society is developing a professionalism course for new associates and the Canadian Institute of Actuaries is also running courses on similar topics. He mentioned also the current discussions in Europe regarding the acceptability of actuarial reports and opinions across borders within the EC.

He next went on to summarise the features commonly associated with membership of a learned profession:

1. The members possessed expert knowledge not easily obtainable by the rest of the community or by clients.
2. The members owned a technical language not easily understood by others.
3. It was difficult for outsiders to evaluate the quality of the advice they received, this being a matter essentially to be controlled by the profession.
4. The member was in a position to be independent in a way that the client generally was not.
5. The members belonged to an *élite* group, had been subjected to a rigorous programme of study and were rewarded by such features as prestige, financial gain and camaraderie.

This all tended to lead to an unequal relationship between the professional and his or her client. It was fundamentally important that the member's special skills should be used in the best interests of the client, and that the client's interests should be placed ahead of the professional's interests.

The speaker listed a number of ethical issues facing actuaries, namely:

The potential for abuse by the actuary of his or her position, and the need for the primacy of the interests of the client.

The actuary's responsibility to the public, especially in view of the increasing role of actuaries in the public arena.

The development of codes of conduct.

The need for continuing education, to maintain the actuary's special knowledge and skills in current conditions.

He suggested that the testing of actuaries could be considered in three parts:

1. Knowledge of actuarial principles.
2. The ability to apply that knowledge in specific situations, such as to specific types of insurance.
3. Knowledge of specific legal and regulatory matters.

There was increasingly a need to evaluate qualifications across national boundaries.

Guidelines were required regarding the relationship between actuary and client (including business relationships). Most of the guidelines used in practice specified prohibitions, i.e. they set out what ought not to be done rather than what ought to be done, since the latter carried a much greater danger of leading to litigation.

He mentioned three key factors for a satisfactory relationship with the client: truth, confidence and consent.

The speaker then gave examples of the types of situations to be used as illustrations of potential ethical problems in the admission courses in the USA:

The danger of encouraging a client to agree to a liberal interpretation of regulations and hence lead him into an unsound course of action.

The dangers associated with inadequate data, inadequate time, or an inadequate budget.

The difficulty of dealing with an unsavoury client, who wishes to do something that would be against the public interest, or even illegal.

The difficulty of deciding when to blow the whistle — at what point does the actuary have a liability to report illegal or unprofessional activity.

The need to see that errors that have been identified are corrected — one's own, or errors on the part of another actuary.

The decision as to who is the client — e.g. the actuary's employer, or the person paying the fee, may not be the real client; for some purposes it may be considered appropriate to regard the members of a pension plan as the clients.

The speaker concluded with some comments about integrity. He remarked that the actuarial profession had acquired a reputation for integrity, despite the fact that it had not specifically set out to select its members by reference to integrity, nor had it specifically trained for it. As examples of circumstances where there might be an especial need for integrity, he referred to pressures which might be placed on the actuary to:

1. reduce perceived margins in technical reserves;
2. increase the credibility adjustment following a good claims experience; and
3. replace advance funding by pay-as-you-go.

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BROCKETT P.L. and KAHANE Y.

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HURLIMANN W.

Sur la couverture du risque financier dans l'actuariat

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Option pricing and reinsurance

Topic 2: Experience rating

BENKTANDER G.

Exposure rating in fire — A simple model based on Swiss statistics

BERNEGGER S.

Variance-loading in non-proportional reinsurance — An improved method for calculating the loading of NP-covers with the aid of personal computers

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Loi de Poisson — Inverse gaussienne et systèmes de bonus-malus

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The estimation of net premiums for cover of fire and explosion risks

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The new bonus-malus system of Switzerland

GISLER A. and REINHARD P.

Robust credibility

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Practical exponential smoothing credibility

MACK T.

A simple parametric model for rating automobile insurance or estimating IBNR claims reserves

MOREAU L.

Tarification expérimentale d'un excédent de pertes en assurance automobile

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Linear prediction and credibility in continuous time

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A stop-loss experience rating scheme for fleets of cars

Topic 3: Numerical methods

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Risque de décès et risque de ruine — Réflexions sur la mesure du risque de ruine

CENTENO L.

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Approximation of a function of two variables by a point matrix —
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Evaluating compound generalized Poisson distributions recursively
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Fourier methods for the claims amounts of largest claims reinsurance covers
- KREMER E.
An elementary upper bound for the loading of a stop-loss cover
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Speakers' Corner

- BERG M. P.
Trend detection and Bayesian prediction procedures for time nonhomogeneous claim processes
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Graduation by generalised linear modelling techniques

STEENACKERS A. and GOOVAERTS M. J.

Bounds on stop-loss premiums and ruin probabilities for given values of μ and σ^2

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