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AUSTRALIAN ACTUARIAL JOURNAL

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CARRETT, P. & WONG, B. *Executive options: valuation and projection methodologies.* 113-176. The valuation of options awarded to senior executives of listed companies is a high profile and contentious issue. The following paper is concerned with the valuation of executive options — particularly those involving performance hurdles. Given the complexity of the underlying benefit designs, valuation of these options will frequently require simulation techniques. Accordingly the paper sets out methodologies for these techniques, within the risk-neutral framework commonly used for pricing options on shares. A methodology for estimation probabilities of achieving performance hurdles is also put forward.

LEUNG, A. P. *A formula for calculating pension assets under MD 23.* 229-237.

MARTIN, H. *Actuaries, Woozles and Heffalumps: perspectives from the Hundred Acre Wood. 2002 Presidential Address.* 1-70. The three key focuses of this Presidential Address are the importance of active participation and engagement by members in the activities and initiatives of the IAAust, and the need for the IAAust to ensure that it provides benefits and services to members that are relevant and valued; participation by the IAAust in public policy and the value that actuaries can add in a range of policy areas, by providing informed and balanced perspectives on complex issues, supported by research; and maintaining and enhancing the high global standing of the Australian actuarial qualification and education system through development and implementation of a comprehensive Australian education strategy. The continued future success of the Australian actuarial profession relies on the achievement of our vision to 'position the profession so that wherever there is uncertainty of future financial outcomes, actuaries are sought after for their valued advice and authoritative comment.' Achievement of the vision requires us to maintain the Australian actuarial education system at the leading edge, active participation on key public policy issues, but — most importantly — strong support from the profession itself and their employers.

MARTIN, H. *Options for improving the safety of superannuation. lAAust Submission.* 209-225. On 4 February 2002, the IAAust made a submission to the Superannuation Working Group of the Treasury on the Issues Paper on 'Options for Improving the Safety of Superannuation' released on 2 October 2001 by the Minister for Financial Services and Regulation.

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INSURANCE: MATHEMATICS & ECONOMICS

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CAI, J. & DICKSON, D. C. M. *On the expected discounted penalty function at ruin of a surplus process with interest.* 389-404. In this paper, we study the expected value of a discounted

penalty function at ruin of the classical surplus process modified by the inclusion of interest on the surplus. The 'penalty' is simply a function of the surplus immediately prior to ruin and the deficit at ruin. An integral equation for the expected value is derived, while the exact solution is given when the initial surplus is zero. Dickson's [IME 11 (1992) 191] formulae for the distribution of the surplus immediately prior to ruin in the classical surplus process are generalised to our modified surplus process.

CHANG, S.-C. & CHEN, C.-C. *Allocating unfunded liability in pension valuation under uncertainty.* 371-387. This paper studied the cost allocation for the unfunded liability in a defined benefit pension scheme incorporating the stochastic phenomenon of its returns. In the recent literature represented by Cairns and Parker [IME 21 (1997) 43], Haberman [IME 11 (1992) 179; IME 13 (1993) 45; IME 14 (1994) 219; IME 14(sic) (1997) 127], Owadally and Haberman [NAAJ 3 (1999) 105], the fund level is modelled based on the plan dynamics and the returns are generated through several stochastic processes to reflect the current realistic economic perspective to see how the contribution changed as the cost allocation period increased. In this study, we generalize the previous constant value assumption in cost amortization by modeling the returns and valuation rates simultaneously. Taylor series expansion is employed to approximate the unconditional and conditional moments of the plan contribution and fund level. Hence the stability of the plan contribution and the fund size under different allocation periods could be estimated, which provide valuable information adding to the previous works.

DORAY, L. G. & ARSENAULT, M. *Estimators of the regression parameters of the zeta distributions.* 439-450. The zeta distribution with regression parameters has been rarely used in statistics because of the difficulty of estimating the parameters by traditional maximum likelihood. We propose an alternative method for estimating the parameters based on an iteratively reweighted least-squares algorithm. The quadratic distance estimator (QDE) obtained is consistent, asymptotically unbiased and normally distributed; the estimate can also serve as the initial value required by an algorithm to maximize the likelihood function. We illustrate the method with a numerical example from the insurance literature; we compare the values of the estimates obtained by the quadratic distance and maximum likelihood methods and their approximate variance-covariance matrix. Finally, we calculate the bias, variance and the asymptotic efficiency of the QDE compared to the maximum likelihood estimator (MLE) for some values of the parameters.

JONES, B. L. & MEREU, J. A. *A critique of fractional age assumptions.* 363-370. Published mortality tables are usually calibrated to show the survival function of the age at death distribution at exact integer ages. Actuaries make fractional age assumptions when valuing payments that are not restricted to integer ages. A fractional age assumption is essentially an interpolation between integer age values which are accepted as given.

   Three fractional age assumptions have been widely used by actuaries. These are the uniform distribution of death (UDD) assumption, the constant force assumption and the hyperbolic or Balducci assumption. Under all three assumptions, the interpolated values of the survival function between two consecutive ages depend only on the survival function at those ages. While this has the advantage of simplicity, all three assumptions result in force of mortality and probability density functions with implausible discontinuities at integer ages.

   In this paper, we examine some families of fractional age assumptions that can be used to correct this problem. To help in choosing specific fractional age assumptions and in comparing different sets of assumptions, we present an optimality criterion based on the length of the probability density function over the range of the mortality table.

JURI, A. & WÜTHRICH, M. V. *Copula convergence theorems for tail events.* 405-420. Tail dependence is studied from a distributional point of view by means of appropriate copulae. We derive similar results to the famous Pickands-Balkemade Haan Theorem of Extreme Value

Theory. Under regularity conditions, it is shown that the Clayton copula plays among the family of archimedean copulae the role of the generalized Pareto distribution. The practical usefulness of the results is illustrated in the analysis of stock market data.

LANDSMAN, Z. M. *Credibility theory: a new view from the theory of second order optimal statistics.* 351-362. Second order (s.o.) Bayes estimators, being the main tool in the s.o. optimal statistical theory, provides a natural basis for a new approach to credibility evaluation. For the cases, where the classical credibility formula fails in the sense that it does no longer represent the predicted mean, this approach suggests an s.o. modified credibility formula, which approximately (in some sense) equals the predicted mean even for small size samples. The results are applied to the important class of location dispersion distributions and are illustrated by a number of numerical experiments.

SUNDT, B. *Recursive evaluation of aggregate claims distributions.* 297-322. In this paper, we give a survey of recursive methods presented in the actuarial literature for exact and approximate evaluation of univariate and multivariate aggregate claims distributions. For the approximations, we present error bounds.

TAYLOR, G. C. *Stochastic control of funding systems.* 323-350. This paper is concerned with funding systems, i.e. systems which accumulate funds for the future payment of financial obligations. Commonly, such funding requires a balance between (1) the desire to minimise the contributions that need to be diverted from other use to the support of the Fund, and (2) the need to maintain reasonable solvency in the Fund. Such funding is discussed here in a general framework. Applications are numerous. The specific applications mentioned in the paper are: defined benefit retirement funding; maintenance of a prudential margin by a non-life insurer; dividend payment strategy. The paper applies stochastic optimal control theory to determine how rates of contribution to the Fund and allocation of its assets by asset sector should respond to changing solvency. These results are obtainable from a particular differential equation, which may be solved numerically. Detailed numerical examples are provided.

WEI, L. & WU, R. *The joint distributions of several important actuarial diagnostics in the classical risk model.* 451-462. In this paper we examine the joint distributions of several actuarial diagnostics which are important to insurers' running in the classical risk model. They include the time of the surplus process leaving zero ultimately (simply, the ultimately leaving-time), the number of zero, the surplus immediately prior to ruin, the deficit at ruin, the supreme and minimum profits before ruin, the supreme profits and deficit until it leaves zero ultimately and so on. We obtain explicit expressions for their joint distributions mainly by strong Markov property of the surplus process — a technique used by Wu et al. (2002) [J. Appl. Math., in press], which is completely different from former contributions on this topic. Further, we give the exact calculating results for them when the individual claim amounts are exponentially distributed.

WILLMOT, G. E. *Compound geometric residual lifetime distributions and the deficit at ruin.* 421-438. Some reliability based properties of compound geometric distributions are derived using an approach motivated by the analysis of the deficit at ruin in a renewal risk theoretic setting. Implications for generalizing the result of Cai and Kalashnikov [J. Appl. Prob. 37 (2000) 283-289] are discussed. Subsequently, analysis of the distribution of the deficit itself in the renewal risk setting is considered. The regenerative nature of the ruin problem in the renewal risk model is exploited to study exact and approximate properties of the deficit at ruin (given that ruin occurs). Central to the discussion are the compound geometric components of the maximal aggregate loss. The proper distribution of the deficit, given that ruin occurs, is a mixture of residual ladder height distributions, from which various exact relationships and

bounds follow. The asymptotic (in the initial surplus) distribution of the deficit is also considered. Stronger results are obtained with additional assumptions about the interclaim time or claim size distribution.

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