PAPERS FROM ACTUARIAL JOURNALS WORLDWIDE

Single copies of all the papers listed here can be obtained, subject to charge and copyright regulations, from the actuarial profession's libraries. Issues may be borrowed by members.
Tel: 0131 240 1311 or 01865 268206/208; libraries@actuaries.org.uk

INSURANCE: MATHEMATICS & ECONOMICS

Volume **36** (1), 2005

CHIU, W. H. *Degree of downside risk aversion and self-protection.* 93-101. This paper shows that, identifying individuals with their utility functions, $-v'''(x)/v''(x) \leq -u'''(x)/u''(x)$ for all x implies that individual v's optimal choice of self-protection expenditure is larger than individual u's, provided that marginal increases in self-protection expenditure from u's optimal choice are mean-preserving. The result clarifies the relationship between self-protection and downside risk aversion and underscores the interpretation of $-u'''(x)/u''(x)$ as a measure of the strength of u's downside risk aversion relative to his own risk aversion because a mean-preserving increase in self-protection expenditure is shown to effect a special combination of a downside risk increase and a mean-preserving contraction.

GAJEK, L. *On the deficit distribution when ruin occurs — discrete time model.* 13-24. The paper presents an algorithm of bounding from above and from below the deficit distribution at ruin. The algorithm is based on iterating a monotone integral operator which has a fixed point at the deficit distribution at ruin. The upper and lower bounds converge monotonically with an exponential rate to the exact value of the deficit distribution. A counterpart of the famous Cramér-Lundberg inequality for the distribution of the deficit at ruin is established. A general method to improve further the algorithm is given.

HABERMAN, S. & SUNG, J.-H. *Optimal pension funding dynamics over infinite control horizon when stochastic rates of return are stationary.* 103-116. We follow up our earlier work [IME 15, 151-162], which introduced the methods of finite control optimisation to the problem of pension funding for a defined benefit pension scheme, where valuations are carried out on a short-term, winding-up valuation basis. The model involves a linear stochastic dynamic system with a quadratic optimisation criterion (i.e. an LQP problem), and the solution is based on optimal control theory. The current paper extends this work by deriving, in relation to a long-term, going-concern valuation basis, optimal funding control procedures over an infinite control horizon, making use of the monotone convergence property of the dynamic programming algorithm. The stochastic inputs modelled are the investment rates of return and benefit outgoes, both of which are assumed to be stationary. As a result, we believe that the optimal funding policy derived could provide a stationary long-term guideline for the funding of public employees' pension systems.

KORN, R. *Worse-case scenario investment for insurers.* 1-11. We consider the investment problem of an insurance company who is facing a risk process from its own business and can additionally invest money into a stock index. This index is threatened by a possible market crash but otherwise is assumed to follow a geometric Brownian motion. Building up on work by Browne, and Korn & Wilmott, or Korn & Menkens for optimal worst-case investment in a pure stock and bond market we determine equilibrium strategies for an insurer maximising exponential utility. These strategies are not constant ones — as in the crash-free setting of Browne (1995) — and are optimal in a worst-case maximising sense.

RAMSAY, COLIN M. *Pricing optional group term insurance: a new approach using reservation*

183

prices. 37-55. Consider an employer who, through an insurer, provides optional group term life insurance to a group of employees. The employees are assumed to have mortality following a mixture mortality model where they have different mortality rates belonging to a common probability distribution. To reduce the effects of possible adverse selection, the insurer sets a maximum acceptable mortality level (q^M). The insurer then uses a costly medical underwriting/exam to determine each applicant's mortality level, q. If $q > q^M$ the employee is refused insurance otherwise insurance is granted. Each employee is assumed to have a reservation price for term insurance. Economic theory is used to determine the employees' inverse aggregate demand function. This demand function is then used to determine the mortality cut-off level and premium that maximise the insurer's expected profits. First order conditions and several necessary conditions for profit maximisation are given.

SCHMIDLI, H. *On optimal investment and subexponential claims.* 25-35. We consider a classical risk model with the possibility of investment. For subexponentially distributed claim sizes we find the asymptotics of the ruin probability under the optimal investment strategy as well as the rate at which A(x) tends to infinity.

SHEN, W. & XU, H. *The valuation of unit-linked policies with or without surrender options.* 79-92. This paper is concerned with the fair valuation of a kind of equity-linked policies with interest rate guarantees, and we deal with this issue in two aspects: the policies with or without surrender options before maturity date. The method we adopted in this paper is a Partial Differential Equation Approach (PDE). The PDE models for the fair valuation of the policies are derived, and their analytic solutions are obtained when surrender is not allowed. For the valuation of the policy with surrender options, the problem is reduced to a PDE model with free boundaries. The impact of the parameters appearing in the model on the surrender options is investigated by both theoretical and numerical analysis.

YANG, J., ZHOU, S. & ZHANG, Z. *The compound Poisson random variable's approximation to the individual risk model.* 57-77. In this paper we study approximating the total loss associated with the individual insurance risk model by a compound Poisson random variable. By minimising the expectation of the absolute deviation of the compound Poisson random variable from the true total loss, we investigate not only the optimal compound Poisson random variable but also the numerical calculation of the approximation error. We also discuss the influence of the Poisson parameter on the approximation error.

INSURANCE: MATHEMATICS & ECONOMICS

Volume **36** (2), 2005

CAI, J. & LI, H. *Multivariate risk model of phase type.* 137-152. This paper is concerned with several types of ruin probabilities for a multivariate compound Poisson risk model, where the claim size vector follows a multivariate phase type distribution. First, an explicit representation for the convolution of a multivariate phase type distribution is derived, and then an explicit formula for the ruin probability that the total claim surplus exceeds the total initial reserve in infinite horizon is obtained. Furthermore, the effect of the dependence among various types of claims on this type of ruin probability is considered under the convex and supermodular orders. In addition, the bounds for other types of ruin probabilities are developed by utilising the association of multivariate phase type distributions. Finally, some examples are presented to illustrate the results.

LI, S. & LU, Y. *On the expected discounted penalty functions for two classes of risk processes.* 179-193. In this paper, we consider the expected discounted penalty (Gerber–Shiu) functions for a risk model involving two independent classes of insurance risks. We assume that the two

claim number processes are independent Poisson and generalised Erlang(2) processes, respectively. Laplace transforms of two types of the Gerber–Shiu functions at ruin are derived from an integro-differential equations system. Explicit results are derived when the claims from both classes are exponentially distributed. Finally, asymptotic results are obtained when the compound Poisson process converges weakly to a Wiener process. Numerical illustrations are also given.

MIGON, H. S. & MOURA, F. A. S. *Hierarchical Bayesian collective risk model: an application to health insurance.* 119-135. This paper deals with the main statistical steps involved in building an insurance plan, with special emphasis on an application to health insurance. The pure premium is predicted based on the available past information concerning the number and the amount of losses, and also the population exposed to risk. Both the size and the number of losses are treated in a stochastic manner. The claims are assumed to follow a Poisson process and the claim sizes are independent and identically distributed non-negative random variables. The model proposed is a generalization of the collective risk model, usually applied in practice. The evolution of the population at risk is also stochastically described via a nonlinear hierarchical growth model. Furthermore, a theoretical decision framework is adopted for evaluating the premium. Model selection and premium calculation are obtained from the predictive distribution, incorporating all the uncertainties involved.

POLITIS, K. *Bounds for the probability and severity of ruin in the Sparre Andersen model.* 165-177. We propose a method for improving existing upper and lower bounds for ruin probabilities in the Sparre Andersen model. The method is based on the renewal equation for the probability of ruin in that model and may be used recursively. We discuss how the method can be used more generally for solutions of renewal equations, provided that the function in question is monotone and initial (analytic) bounds for it are available. We illustrate this by considering the severity of ruin in the Sparre Andersen model, for which we obtain initial lower and upper bounds; the application of the method is then straightforward.

YIP, K. C. H. & YAU, K. K. W. *On modeling claim frequency data in general insurance with extra zeros.* 153-163. In some occasions, claim frequency data in general insurance may not follow the traditional Poisson distribution and in particular they are zero-inflated. Extra dispersion appears as the number of observed zeros exceeding the number of expected zeros under the Poisson or even the negative binomial distribution assumptions. This paper presents several parametric zero-inflated count distributions, including the ZIP, ZINB, ZIGP and ZIDP, to accommodate the excess zeros for insurance claim count data. Different count distributions in the second component are considered to allow flexibility to control the distribution shape. The generalized Pearson χ^2 statistic, Akaike's information criteria (AIC) and Bayesian information criteria (BIC) are used as goodness-of-fit and model selection measures. With the presence of extra zeros in a data set of automobile insurance claims, our result shows that the application of zero-inflated count data models and in particular the zero-inflated double Poisson regression model, provide a good fit to the data.

BABBEL, D. F. & MERRILL, C. *Real and illusory value creation by insurance companies.* 1-21. One of the fundamental tenets of financial economics is that insurance companies, just as

other financial and non-financial firms, have a very strong incentive to maximise current shareholder value. This seemingly simple observation leads to a wide variety of managerial behavior. In this article we will review a simple decomposition of the value of an insurance company. The decomposition illuminates the motivation for a variety of strategies that can be observed in practice. These strategies run the gamut from accounting manipulation through risk transfer schemes to positive net present value (NPV) "project" selection. We will review these in some detail below. Then we will illustrate these techniques from our experience with every major U.S. life insurer insolvency since Baldwin United in 1984.

GAVER, J. J. & POTTIER, S. W. *The role of holding company financial information in the insurer-rating process: evidence from the property-liability industry.* 77-103. We examine data for the year ended December 31, 1997 for 80 publicly traded property-liability insurers that have Best financial strength ratings of their consolidated insurance-operating subsidiaries. These firms employ a holding company structure, in which a parent owns the stock of multiple insurance-operating subsidiaries. The operating subsidiaries prepare a consolidated annual report using the Statutory Accounting Principles (SAP), and an analogous set of financial statements based on the Generally Accepted Accounting Principles (GAAP) is released by the parent. We find that the financial characteristics important in determining ratings at the individual firm level — capitalisation, liquidity, profitability, and size — are also important at the group level. Further, financial ratios from holding company statements are incrementally useful in the ratings process, after group-level ratios have been taken into account. Robustness tests based on a subsample of holding companies with minimal investment outside of the property-liability industry reinforce our conclusion that parent company statements influence consolidated group ratings. However, our data do not allow us to separate the relative contribution of the GAAP model and underlying transactions to the ratings decision.

JANSSEN, M. C. W. & KARAMYCHEV, V. A. *Dynamic insurance contracts and adverse selection.* 45-59. We take a dynamic perspective on insurance markets under adverse selection and study a dynamic version of the Rothschild and Stiglitz model. We investigate the nature of dynamic insurance contracts by considering both conditional and unconditional dynamic contracts. An unconditional dynamic contract has insurance companies offering contracts where the terms of the contract depend on time, but not on the occurrence of past accidents. Conditional dynamic contracts make the actual contract also depend on individual past performance (such as in car insurances). We show that dynamic insurance contracts yield a welfare improvement only if they are conditional on past performance. With conditional contracts, the first-best can be approximated if the contract lasts long. Moreover, this is true for any fraction of low-risk agents in the population.

JENG, V. & LAI, G. C. *Ownership structure, agency costs, specialisation, and efficiency: analysis of Keiretsu and independent insurers in the Japanese nonlife insurance industry.* 105-158. This article uses the nonparametric frontier method to examine differences in efficiency for three unique organisational forms in the Japanese nonlife insurance industry — keiretsu firms, nonspecialized independent firms (NSIFs), and specialised independent firms (SIFs). It is not possible to reject the null hypothesis that efficiencies are equal, with one exception. Keiretsu firms seem to be more cost-efficient than NSIFs. The results have important implications for the stakeholders of the NSIFs. An examination of the productivity changes across the different organizational forms reveals deteriorating efficiency for all three types of firms throughout the 19851994 sample period. Finally, the evidence also suggests that the value-added approach and the financial intermediary approach provide different but complementary results.

KIM, B. J. & SCHLESINGER, H. *Adverse selection in an insurance market with government-guaranteed subsistence levels.* 61-75. We consider a competitive insurance market with adverse

selection. Unlike the standard models, we assume that individuals receive the benefit of some type of potential government assistance that guarantees them a minimum level of wealth. For example, this assistance might be some type of government-sponsored relief program, or it might simply be some type of limited liability afforded via bankruptcy laws. Government assistance is calculated ex post of any insurance benefits. This alters the individuals' demand for insurance coverage. In turn, this affects the equilibria in various insurance models of markets with adverse selection.

VISCUSI, W. K. & BORN, P. *Damages caps, insurability, and the performance of medical malpractice insurance.* 23-43. This article uses the complete property-casualty insurance files of the National Association of Insurance Commissioners from 1984 to 1991 to assess the effect of medical malpractice reforms pertaining to damages levels and the degree to which these damages are insurable. Limits on noneconomic damages were most influential in affecting insurance market outcomes. Several punitive damages variables specifically affected the medical malpractice insurance market, including limits on punitive damage levels, prohibitions of the insurability of punitive damages, and prohibition of punitive damages awards. Estimates for insurance losses, premiums, and loss ratios indicate effects of reform in the expected directions, where the greatest constraining effects were for losses. The quantile regression analysis of losses indicates that punitive damages reforms and limits were most consequential for firms at the high end of the loss spectrum. Tort reforms also enhanced insurer profitability during this time period.

NORTH AMERICAN ACTUARIAL JOURNAL

Volume **8** (4), 2004

BOLNICK, H. J. *A framework for long-term actuarial projections of health care costs: The importance of population aging and other factors.* 1-29. Ever-expanding life expectancy is increasing the size of elderly populations with profound social and economic consequences for developed nations, including future cost of their health care systems. Most existing long-term health care cost projections are driven mainly by changing demographics (aging populations). This simplified approach fails to recognise the many variables, and complicated interactions among them, affecting the future of health, health care, and health care costs. This study presents a framework incorporating key health care cost drivers. Using the framework, the study then introduces three plausible futures for health care along with broad, nonmodeled estimates of their costs that point to a very wide range of potential future costs. By taking the next step and building actuarial models based on the framework presented in this study, actuaries and health economists can create a powerful tool for health policymakers and health officials to better understand the long-term consequences of decisions taken during their stewardship of health care systems.

BROWN, R. L. & PRUS, S. G. *Social transfers and income inequality in old age: a multinational perspective.* 30-36. This paper examines variation in old-age income inequality between industrialised nations with modern welfare systems. The analysis of income inequality across countries with different retirement income systems provides a perspective on public pension policy choices and designs and their distributional implications. Because of the progressive nature of public pension programs, we hypothesise that there is an inverse relationship between the quality of public pension benefits and old-age income inequality — that is, countries with comprehensive, universal, and generous public pension systems will exhibit

more equal distributions of income in old age. Luxembourg Income Study data indeed show that cross-national variation in old-age income inequality is partly explained by differences in the percentage of seniors' total income derived from public pension transfers. Sweden, for example, has the highest level of government transfers and the lowest level of old-age income inequality, while Israel and the United States have the lowest levels of dependency on government transfers and the highest levels of income inequality. A notable exception is Canada, where public transfers represent only a moderate portion of elderly income, yet old-age income inequality is relatively low. These findings suggest that quality of public pension benefits does indeed play a role in explaining differences in old-age income inequality between industrialised nations, yet these variations are also likely influenced by other factors.

CHAN, W.-S., WONG, A. C. S. & TONG, H. *Some nonlinear threshold autoregressive time series models for actuarial use.* 37-61. This paper introduces nonlinear threshold time series modeling techniques that actuaries can use in pricing insurance products, analyzing the results of experience studies, and forecasting actuarial assumptions. Basic "self-exciting" threshold autoregressive (SETAR) models, as well as heteroscedastic and multivariate SETAR processes, are discussed. Modeling techniques for each class of models are illustrated through actuarial examples. The methods that are described in this paper have the advantage of being direct and transparent. The sequential and iterative steps of tentative specification, estimation, and diagnostic checking parallel those of the orthodox Box-Jenkins approach for univariate time series analysis.

HARDY, M. R. & WIRCH, J. L. *The iterated CTE: A dynamic risk measure.* 62-75. In this paper we present a method for defining a dynamic risk measure from a static risk measure, by backwards iteration. We apply the method to the conditional tail expectation (CTE) risk measure to construct a new, dynamic risk measure, the iterated CTE (ICTE). We show that the ICTE is coherent, consistent, and relevant according to the definitions of Riedel (2003), and we derive formulae for the ICTE for the case where the loss process is lognormal. Finally, we demonstrate the practical implementation of the ICTE to an equity-linked insurance contract with maturity and death benefit guarantees.

KOLKIEWICZ, A. W. & TAN, K. S. *Volatility risk for regime-switching models.* 127-145. Regime-switching models have proven to be well-suited for capturing the time series behavior of many financial variables. In particular, they have become a popular framework for pricing equity linked insurance products. The success of these models demonstrates that realistic modeling of financial time series must allow for random changes in volatility. In the context of valuation of contingent claims, however, random volatility poses additional challenges when compared with the standard Black-Scholes framework. The main reason is the incompleteness of such models, which implies that contingent claims cannot be hedged perfectly and that a unique identification of the correct risk-neutral measure is not possible.

The objective of this paper is to provide tools for managing the volatility risk. First we present a formula for the expected value of a shortfall caused by misspecification of the realised cumulative variance. This, in particular, leads to a closed-form expression for the expected shortfall for any strategy a hedger may use to deal with the stochastic volatility. Next we identify a method of selection of the initial volatility that minimises the expected shortfall. This strategy is the same as delta hedging based on the cumulative volatility that matches the Black-Scholes model with the stochastic volatility model. We also discuss methods of managing the volatility risk under model uncertainty. In these cases, super-hedging is a possible strategy but it is expensive. The results presented enable a more accurate analysis of the trade-off between the initial cost and the risk of a shortfall.

MORALES, M. *On a surplus process under a periodic environment: A simulation approach.* 76-89. The problem of modeling claims occurring in periodic random environments is discussed in

this paper. In the classical approach of risk theory, the occurrence of claims is modeled by counting processes that do not account for claims following a periodic pattern. The author discusses how the use of the classical approach to model a periodic portfolio might lead to the miscalculation of important risk indices, namely the associated ruin probability.

He presents a periodic model, in terms of nonhomogeneous Poisson processes, that has potential practical applications. The discussion is based on some properties of the modeled periodic intensities. Existing simulation techniques are adapted to this periodic model, which provides a practical way to evaluate ruin probabilities.

PANJER, H. H. *Continuing the tradition: Editorial.* iii.

YAO, Y. *Efficient factor models for yield curve dynamics.* 90-105. This paper derives a class of efficient factor models that bridge a gap between factor models and Heath-Jarrow-Morton models. These efficient factor models provide arbitrage-free dynamics for the yield curve, can be readily extended to fit the current yield curve, and have closed-form formulas for pricing default-free zero-coupon bonds. The short rate is a state variable in these efficient factor models. There are no restrictions imposed on the functional form of the volatility of the short rate except for certain technical conditions to ensure the solvability of the associated stochastic differential equations. The stochastic volatility of the short rate can be one of the state variables. The paper also presents a closed-form solution for default-free discount bond prices in the Malkiel model and provides a new method to derive the Ritchken-Sankarasubramanian model.

YOUNG, V. R. *Optimal investment strategy to minimise the probability of lifetime ruin.* 106-126. I study the problem of how individuals should invest their wealth in a risky financial market to minimise the probability that they outlive their wealth, also known as the probability of lifetime ruin. Specifically, I determine the optimal investment strategy of an individual who targets a given rate of consumption and seeks to minimise the probability of lifetime ruin. Two forms of the consumption function are considered: (1) The individual consumes at a constant (real) dollar rate, and (2) the individual consumes a constant proportion of his or her wealth. The first is arguably more realistic, but the second has a close connection with optimal consumption in Merton's model of optimal consumption and investment under power utility.

For constant force of mortality, I determine (a) the probability that individuals outlive their wealth if they follow the optimal investment strategy; (b) the corresponding optimal investment rule that tells individuals how much money to invest in the risky asset for a given wealth level; (c) comparative statics for the functions in (a) and (b); (d) the distribution of the time of lifetime ruin, given that ruin occurs; and (e) the distribution of bequest, given that ruin does not occur. I also include numerical examples to illustrate how the formulas developed in this paper might be applied.

Reproduced with the permission of the Society of Actuaries.
Subscription details available from: Society of Actuaries, 475 N. Martingale Road, Schaumburg, ILL 60173 U.S.A., www.soa.org

SCANDINAVIAN ACTUARIAL JOURNAL

2004

DAHAN, M., FROSTIG, E. & LANGBERG, N. A. *Insurance contracts portfolios with heterogenous parametric life distributions.* 431-447. In this paper we consider two portfolios: one of *m* endowment insurance contracts and one of *m* whole life insurance contracts. We introduce the majorisation order, Schur functions, and parametric families of distribution functions. We assume that the owners of the portfolios are exposed to different members of a known

parametric family of distributions and study the effect of this stochastic heterogeneity on the premiums and death benefits of the insurance contracts. We show that the premiums paid in both contracts are Schur concave and that the death benefit awarded in the whole life contract is Schur convex. We provide upper and lower bounds for the premiums and for the death benefit, and compute the bounds for four parametric families of distribution functions used frequently in the Actuarial Sciences.

IGNATOV, Z. G., KAISHEV, V. K. & KRACHUNOV, R. S. *Optimal retention levels, given the joint survival of cedent and reinsurer.* 401-430. A certain volume of risks is insured and there is a reinsurance contract, according to which claims and total premium income are shared between a direct insurer and a reinsurer in such a way, that the finite horizon probability of their joint survival is maximised. An explicit expression for the latter probability, under an excess of loss (XL) treaty is derived, using the improved version of the Ignatov & Kaishev's ruin probability formula and assuming, Poisson claim arrivals, any discrete joint distribution of the claims, and any increasing real premium income function. An explicit expression for the probability of survival of the cedent only, under an XL contract is also derived and used to determine the probability of survival of the reinsurer, given survival of the cedent. The absolute value of the difference between the probability of survival of the cedent and the probability of survival of the reinsurer, given survival of the cedent is used for the choice of optimal retention level. We derive formulae for the expected profit of the cedent and of the reinsurer, given their joint survival up to the finite time horizon. We illustrate how optimal retention levels can be set, using an optimality criterion based on the expected profit formulae. The quota share contract is also considered under the same model. It is shown that the probability of joint survival of the cedent and the reinsurer coincides with the probability of survival of solely the insurer. Extensive, numerical comparisons, illustrating the performance of the proposed reinsurance optimality criteria are presented.

LINDER, U. & RONKAINEN, V. *Solvency II — towards a new insurance supervisory system in the EU.* 462-474. This article describes the current state of affairs in the EU Solvency II project. The background and international context of the project is discussed, as well as the general outline of a future EU solvency system. In particular, several areas where further technical work is needed are outlined. These topics could provide interesting objects of study for professionals of actuarial sciences as well as to those of other related sciences.

LUO, Y., YOUNG, V. R. & FREES, E. W. *Credibility ratemaking using collateral information.* 448-461. Credibility ratemaking is a technique used in pricing health care, property and casualty, workers' compensation, and group life coverages. It has been a part of actuarial practice since the time of Mowbray's (1914) contribution. In earlier work, we showed how many types of credibility models could be expressed as special cases of mixed linear models. This article extends this approach to credibility by formally introducing collateral information through the use of Bayesian methods.

Specifically, we derive credibility estimators and mean square errors for normal hierarchical linear models. We provide intuition for the credibility estimators by establishing the link between these estimators and homogeneous and inhomogeneous estimators that appear in non-Bayesian credibility theory.

SCANDINAVIAN ACTUARIAL JOURNAL

2005

HOEDEMAKERS, T., BEIRLANT, J., GOOVAERTS, M. J. & DHAENE, J. *On the distribution of discounted loss reserves using generalised linear models.* 25-45. Renshaw and Verrall [11] specified the generalised linear model (GLM) underlying the chain-ladder technique and

suggested some other GLMs which might be useful in claims reserving. The purpose of this paper is to construct bounds for the discounted loss reserve within the framework of GLMs. Exact calculation of the distribution of the total reserve is not feasible, and hence the determination of lower and upper bounds with a simpler structure is a possible way out. The paper ends with numerical examples illustrating the usefulness of the presented approximations.

KOIVU, M., PENNANEN, T. & RANNE, A. *Modeling assets and liabilities of a Finnish pension insurance company: a VEqC approach.* 46-76. This paper develops a stochastic model for assets and liabilities of a Finnish pension insurance company. The assets and liabilities are expressed in terms of seven economic factors from Finland and the EU-area. The development of these factors is modeled with a Vector Equilibrium Correction model, that incorporates statistical information with expert views in the form of user specified growth rates and long term equilibria. The forecast performance of the resulting model is tested and the model is used in long-term solvency and asset liability simulations.

TANG, Q. *Asymptotic ruin probabilities of the renewal model with constant interest force and regular variation.* 1-5. Klüppelberg and Stadtmüller (1998, SAJ, 49-58) obtained a simple asymptotic formula for the ruin probability of the classical model with constant interest force and regularly varying tailed claims. This short note extends their result to the renewal model. The proof is based on a result of Resnick & Willekens (1991, Comm. Statist. Stochastic Models 7, 511-525).

WILLMOT, G. E., DREKIC, S. & CAI, J. *Equilibrium compound distributions and stop-loss moments.* 6-24. A convolution representation is derived for the equilibrium or integrated tail distribution associated with a compound distribution. This result allows for the derivation of reliability properties of compound distributions, as well as an explicit analytic representation for the stop-loss premium, of interest in connection with insurance claims modelling. This result is extended to higher order equilibrium distributions, or equivalently to higher stop-loss moments. Special cases where the counting distribution is mixed Poisson or discrete phase-type are considered in some detail. An approach to handle more general counting distributions is also outlined.

Reproduced with the permission of Taylor & Francis, www.tandf.no/saj