JSS 32 (1990) 167-173

SYNOPSES

THE INTERMEDIARY'S DILEMMA: ASSESSING THE FINANCIAL STRENGTH OF LIFE OFFICES

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(Synopsis of a paper presented to the Society on 1 December 1987)

Under the Financial Services Act, individuals and institutions providing investment advice have to fulfil the 'best advice' requirements. Assuming that a with-profit type of contract is appropriate for a client, the intermediary will have to consider the relative merits of different life offices. The paper concentrates on financial strength and discusses a particular approach to its assessment on the basis of published information.

The intermediary's dilemma is that he has a duty to consider a life office's strength in relation to its competitors before recommending it to a client, but there is no simple and reliable means of performing this duty. There are two levels of financial strength:

—as a measure of the ability of a life company to meet its contractual liabilities, and
—as a measure of a life company's future bonus-earning potential.

The paper is concerned with the second definition of financial strength, although clearly an office able to meet the reasonable bonus expectations of its policyholders will not go into liquidation.

The intermediary's task is not simplified by the publicly-available information. The annual reports and accounts contain little that is relevant. The DTI returns are more useful and provide details of assets, liabilities and solvency margins in Forms 9 and 14 of Schedule 1. However, these published figures do not provide a satisfactory means of comparing financial strength of different companies: although assets are valued on a broadly consistent basis, the valuation of liabilities is unlikely to be consistent, both among different offices and within the same office for different years.

There is no perfect solution to the problem and no single figure which ranks life companies in order of financial strength, but a general picture of each company can be built by examining a number of measures.

The suggested approach is that of a standardized valuation for all companies, on the basis of published information. A realistic estimate is first made of free reserves, defined as the difference between the market value of the assets and the

value of guaranteed liabilities (i.e. including bonuses declared to date, but not future bonuses). This amount can be expressed as a percentage of the market value of assets.

Next, the present value of future reversionary bonuses at present rates on the in-force business is established, and the free reserves less this amount are compared with the market value of assets.

Finally, the free reserves, less the value of future reversionary bonuses on the in-force business, are compared with the support required to allow the latest year's new business to pay current rates of reversionary bonus.

Other relevant factors are discussed, including shareholders' participation (if any), new business trends, expense ratios, underwriting standards, investment strategy, financial guarantees, and transfers from investment reserves.

The methodology is based on the mutualization price techniques first developed in the late 1960's for evaluating proprietary life companies. The basis for calculations is Schedule 5 of the DTI returns, updated as necessary to take into account subsequent movements. Together with other schedules, it allows a reasonably full picture of the life company's products and portfolios to be formed. However, other sources of information are necessary as well, such as trade journals. The valuation itself is a gross premium one, with realistic mortality, interest and other assumptions. Various problems arise: timing of the DTI returns, deficiencies in the information provided, and treatment of subsidiaries.

Finally, an example is given of the results of the calculations for three life offices.

COMMERCIAL FIRE INSURANCE

BY N. R. GILLOT *et al.*

(Synopsis of a paper presented to the Society on 5 January 1988)

IN 1847 W. E. Hillman, Actuary to the Star Assurance Office, stated that "the time is approaching when . . . the present loose and almost undefined method of estimating (fire insurance) premiums for different kinds of risks will give place to one of a more scientific and definite nature". However, since that time, the actuary's role in fire insurance has been negligible and it could be argued that the setting of commercial fire insurance premiums is still not undertaken in a scientific way. The authors believe that actuarial techniques are very relevant to this problem. The paper aims to introduce the subject of fire insurance and to indicate areas in which actuaries might be usefully involved. The timing of the paper is opportune as many offices are having to produce their own premium

structures following the demise of the market tariff which had been in force for many years.

Having set out what is generally covered by a commercial fire insurance policy, the perspective of the underwriter is discussed. A typical rating structure of one office is described and areas in which other offices use different approaches are noted. The paper then indicates methods by which rating revisions can be carried out.

A section giving the actuarial perspective shows that underwriters and actuaries view the same problem in different ways. The interdependency between rating factors and the extent to which each factor contributes to the true differentiation between risk is often not well understood. Use of experience rating within commercial fire insurance is another area where it might be thought the actuary could usefully contribute. Other issues such as rating excesses, credibility theory and the impact of investment income are also discussed. The paper argues for a joint approach between underwriters and actuaries to the statistical problems of fire insurance.

The use of computerized fire underwriting systems for the setting of rates is briefly described. Experimentation with the use of expert systems for the same purpose is also discussed.

The last three sections of the paper leave the subject of premium rating to concentrate on reinsurance, claims and statistics. Reinsurance is a complex issue for fire insurance; the different aspects of the subject covered are the type of reinsurance used, the level of retentions, catastrophe protection, security and coinsurance. There is a brief consideration of the settlement, reserving and distribution by size of claims, before the final section of the paper which considers statistics. Perhaps the first thing that any actuary will have to do before becoming usefully involved in the subject of fire insurance is to collect some appropriate statistics in an area where good statistics are often not easily available. The availability, collection and analysis of statistics is a prerequisite to applying some of the techniques described earlier in the paper.

DETERMINATION OF THE CONTRIBUTION RATE TO MONEY PURCHASE ARRANGEMENTS

BY DAVID CARR with help from GARY SIMMONS

(Synopsis of a paper presented to the Society on 15 March 1988)

THE paper explored money purchase scheme design, in particular the effect on design of money purchase contracting out.

Simple scheme designs were explored and were found to result in some very

peculiar distributions of benefits. More complex scheme designs could overcome this feature, but the complexity itself became a serious drawback.

The main conclusions reached in the paper were:

(i) Offering merely to pay a uniform contribution rate to a Contracted Out Money Purchase plan might be perceived as grossly unfair. Older employees, particularly late entrants, can do very badly from such arrangements. Younger employees can do very well. Women tend to fare worse than men.

(ii) Trying to even out the incidence of benefits from a money purchase arrangement could result in a complex and/or costly scheme. Also, attempts to target benefits through a money purchase route might well fail: targets could be missed in practice.

(iii) Aiming for the same target benefits in a money purchase arrangement as in a conventional final salary scheme may cost considerably more in the money purchase case. This is because a true money purchase arrangement gives better benefits to early leavers than the typical final salary scheme.

(iv) In the new legislative environment, the best money purchase scheme for employees will offer a choice between contracting out or not. Young employees should contract out. Employees closer to retirement should not.

Similarly, the best pensions strategy for individuals providing for themselves through personal pensions would be to contract out while young and to contract back in closer to state pension age.

(v) There are considerable dangers to the employee and the tax-payer in the new pensions arrangements.

(vi) To the individual, the danger is that inappropriate scheme design or the wrong decision on contracting out can lead to a costly pension scheme producing only very poor benefits in particular cases.

(vii) To the tax-payer, the danger is that employers and employees are being encouraged to select against the state.

This selection against the state works against two of the aims of the government:

To reduce to cost of providing State Pensions.

To reduce the extent to which people rely on State Pensions.

The costs of providing SERPS benefits is increased if an over-generous rebate is claimed by young employees, who then contract back in when the cost of providing their SERPS pension rises above the rebate in later years.

Reliance on SERPS pensions will not be removed either, because of the contracting-back-in phenomenon. It is even conceivable that the proportion of employees contracted out may fall because of the new legislation. Firms that previously contracted out all their employees may now prefer instead to contract out only their young employees.

GENERALIZED LINEAR MODELS IN ACTUARIAL WORK

BY S. HABERMAN AND A. E. RENSHAW

(A synopsis of a paper presented to the Society on 2 February 1988)

THE use of classical linear models in actuarial work is not new. Such models have become an established part of the description of claim frequency rates and average claim costs in motor insurance—as evidenced by a number of papers, including Johnson and Hey[1], Grimes[2], Bennett[3], Baxter *et al.*[4] and Coutts[5].

However, the use of generalized linear models in actuarial work is relatively new. Thus, McCullagh and Nelder[6] give a number of examples of the fitting of generalized linear models to different types of data. One of these relates to data from Baxter *et al.*[4] on the average claim costs in a motor insurance portfolio (originally modelled by Baxter *et al.* using a weighted least-squares approach). We made a small step in the direction of using generalized linear models in life insurance when we modelled the variation of lapse rates with age at entry, duration of policy, type of policy and insurance company[7]. Some of these models are described further in this paper.

The purpose of the paper is to show that generalized linear models have a wide area of application in actuarial work and are not confined merely to models for motor insurance premiums. This purpose is fulfilled by demonstrating three separate practical applications in actuarial work:

(i) fitting of loss distributions in non-life insurance (Section 3);
(ii) representing the variation in force of mortality in life insurance underwriting (Section 4); and
(iii) representing the variation in lapse rates with policy characteristics in life insurance (Section 5).

Each of these applications involves different types of data and a different type of model.

Section 3 is concerned with the fitting of skewed loss distributions. It shows how to adapt the GLIM package to fit certain types of distribution which are not immediately available within the package. Three examples are the Pareto, Burr and Weibull distributions. It is a trivial matter to fit other loss distributions such as the log normal, gamma and log gamma to uncomplicated data.

The applications discussed in Section 4 are particularly novel. The GLIM-based approach outlined here could pave the way for a completely new, scientifically sound approach to life insurance underwriting. It offers a more dynamic means of model building than has hitherto been attempted in this field. The models allow the effects of individual factors and their interactions on excess mortality may be assessed. We would highlight the meager assumptions on which the models are based, the comparative ease with which they can be fitted and compared using GLIM and the appealing connection which these models have with the traditional actuarial approach using standard mortality ratios.

Section 5 indicates how Generalized Linear Models may be applied to a wide range of problems where an actuarial rate or probability, or a one-year risk premium can be represented as a function of a set of significant rating factors. Section 5 deals specifically with lapse rates but earlier authors have also examined the components of motor insurance risk premiums (i.e. claim frequency and average claim cost). There is considerable scope for extending these ideas into other areas (e.g. group life risk premiums or marine insurance risk premiums).

Both Sections 4 and 5 deal with generalized linear models of large complex data sets. Modelling such large complex data sets may be viewed as a balancing act between model complexity and the need to encapsulate the salient underlying features present in the data. The simpler the model, the simpler the interpretation of the underlying data generating mechanism. Modelling does not necessarily have a unique solution, but a model may be deemed adequate only if it achieves this goal.

One way of assessing the adequacy is through a thorough graphical analysis of model residuals which, ideally, should be 'pattern free'. Additionally, what might be termed 'fine tuning' may then be attempted, and its effects formally assessed.

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SUMMARIES OF RESEARCH DISCUSSION PAPERS

(Copies of these papers may be borrowed from the Institute Library)

AN ACTUARIAL MODEL FOR AIDS

BY A. D. WILKIE

(Paper No. 40 deposited in the Library in August 1988)

THIS paper describes fully the actuarial model used by the Institute of Actuaries AIDS Working Party for the calculations presented in AIDS Bulletins Nos 1, 2, and 3. The model is described in terms of states: Clear, At Risk, Positive, Immune (not in fact used by the Working Party), Sick and Dead. Conditional on a given starting position, the proportions in each state at future times are governed by a series of differential equations, which are mostly of the usual actuarial type. However, the representation of infection follows a more complex epidemiological model.

The various transition intensities (forces of mortality, infection, etc.) used in the different set of projections are described, and the reasons for the choice of values are explained. There is some discussion of alternative formulae for the distribution of the 'incubation period'.

The initial conditions used for population projections are described. Finally, there is brief comment about the way of allowing for insurance selection, discussed rather more fully in AIDS Bulletin No. 2.