forfeiture) is found for a known household expense distribution. This distribution would not be known in practice and must be estimated. Using the gamma density function as an approximation the variability in this distribution (specifically, the shape parameter α) is estimated using US Consumer Expenditure Survey (CES) data. Separate estimates are provided for groupings by age and family size. It is assumed that the mean is unique to each household; thus each family in the CES represents a distinct population. A transformation to an F distribution is used to estimate the common value of α for each group. The optimal allocation is a multiple of the estimated mean: the multiplier depends on α, the probability that no expense will be incurred, the household marginal tax rate, and its risk preferences between the two losses. Values of the multiplier are provided for selected cases. It is shown that the results are relatively insensitive to moderate errors in the estimation process. *Insurance: Mathematics and Economics*, October 1992, 11(3): 223-235. (Reprinted with permission of North-Holland Publishing Company.)

PENSION FUNDING

Pension Funding with Time Delays: A Stochastic Approach, by Steven Haberman (City University, London, UK)

A model is set up which facilitates the comparison of different pension funding methods. Real rates of return on the fund are assumed to be represented by independent, identically distributed random variables. The contribution rate is fixed relative to the fund level but with a time delay. Expressions for the expectations and the variability of fund and contribution levels are obtained for finite t and in the limit as $t \rightarrow \infty$. *Insurance: Mathematics and Economics*, October 1992, 11(3): 179-189. (Reprinted with permission of North-Holland Publishing Company.)

INSURER MANAGEMENT AND REGULATION

Optimistic Reporting in the Property-Casualty Insurance Industry, by Kathy Ruby Petroni (Michigan State University)

This paper examines the response of managers of property-casualty insurers to the differential costs and benefits of understating the liability for outstanding claim losses. The primary hypothesis is that the incentive to underestimate the liability is a decreasing function of the insurer's actual financial position. Empirical tests suggest that managers of financially weak insurers bias downward their estimates of claim loss reserves relative to other insurers after controlling for exogenous economic factors. Evidence also reveals that managers of insurers "close" to receiving regulatory attention understate reserve estimates to an even larger degree. *Journal of Accounting and*

Economics, December 1992, 15(4): 485-508. (Reprinted with permission of North-Holland Publishing Company.)

Portfolio Selection by Mutual Insurance Companies and Optimal Participating Insurance Policies, by Christian Gollier (Groupe HEC, Paris, France) and Serge Wibaut (Facultés Universitaires Notre Dame de la Paix, Namur, Belgium)

The specific problem of portfolio selection by insurance companies is addressed in this paper. Assuming risk aversion on capital markets, it is optimal to transfer part of the investment risk to policyholders (participating policies), as done in life insurance. This remark leads to two results. First, it implies that underwriting profits should be countercyclic. Second, it allows for riskier investments by the insurer. Indeed, optimal risk transfer increases the risk tolerance of the pool. Regulatory constraints on investment behavior in the insurance industry may then be questioned when participating policies are provided. *Insurance: Mathematics and Economics*, October 1992, 11(3): 237-245. (Reprinted with permission of North-Holland Publishing Company.)

A Simulation Procedure for Comparing Different Claims Reserving Methods, by Teivo Pentikäinen and Jukka Rantala

The estimation of outstanding claims is one of the important aspects in the management of the insurance business. Various methods have been widely dealt with in the actuarial literature. Exploration of the inaccuracies involved is traditionally based on a *post-facto comparison* of the estimates against the actual outcomes of the settled claims. However, until recent years it has not been usual to consider the inaccuracies inherent in claims reserving in the context of more comprehensive (risk theoretical) models, the purpose of which is to analyse the insurer as a whole. Important parts of the technique which will be outlined in this paper can be incorporated into over-all risk theory models to introduce the uncertainty involved with technical reserves as one of the components in solvency and other analyses (Pentikäinen et al., 1989).

The idea in this paper is to describe a procedure by which one can explore how various reserving methods react to fictitious variations, fluctuations, trends, etc. which might influence the claims process, and, what is most important, how they reflect on the variables indicating the financial position of the insurer. For this purpose, a claims process is first postulated and claims are simulated and ordered to correspond to an actual handling of the observed claims of a fictitious insurer. Next, the simulation program will "mime" an actuary who is calculating the claims reserve on the basis of these "observed" claims data. Finally, the simulation is further continued thus generating the settlement of the reserved claims. The difference between reserved amounts and settled amounts gives the reserving (run-off) error in this particular simulated case. By repeating the simulation numerous times (Monte Carlo method) the distribution of the error can be estimated as well as its effect on the total outcome of the insurer.

By varying the assumptions which control the claims process the sensitivity of the reserving method vis-à-vis the assumed phenomena can be tested. By