



SOCIETY OF ACTUARIES

Article from:

# The Actuary

May 1995– Volume 29, No. 5

*Intended users*

The system should contain critical information useful to both public and private sector organizations. The data could be used by actuaries to analyze the effect of economic and demographic changes on private companies or to provide accurate cost of public proposals involving federal or local governments.

*Breadth of the data*

To be universal, a model should cover the entire nation. Initially, the feasibility study would consider only the United States, with the hope of extending the model to Canada later.

To analyze the effect of various public policies, the model should contain specific data by geographical regions, industry, and plan sponsor.

*Capability of the model*

Ideally, the model would be dynamic and able to capture the interplay between government policy, the economic climate, and the private sector response. Thus, the model would provide an instrument to assess the effect of these items on one another and project that effect into the future.

*Maintenance and update*

To be effective, the database must be continually updated and the model

frequently expanded to cope with the ever-changing environment.

**Importance**

This project is probably one of the most extensive and important research projects that the actuarial profession has considered undertaking. The potential payoff is tremendous. Its success hinges on the general support received from the members of the profession. Any member with comments or any member interested in receiving a copy of the Request for Proposal may contact Judy Anderson or Tom Edwalds in the Society office.

## Research studies multiple lives dependency risk in annuities

*Jacques Carriere and Edward W. Frees*

**T**he world is becoming more competitive, and margins are shrinking. Actuaries are called upon to justify their assumptions to management and to other professional financial analysts. Explicit allowance should be made for risk, not only because of competitive market pressures but also for social equity considerations.

The Annuity Valuation with Dependent Mortality research project examines the standard industry practice of assuming independent lives for insurance products. To illustrate, when considering annuities, joint annuitants are often married couples. Social scientists generally agree that dependencies exist among the mortality of married couples. This may be due to a common living environment (is there adequate food and shelter?), shared health practices (do they belong to a health maintenance organization?), attitudes

towards risk (is skydiving a relaxing way to spend a weekend?), and so on.

Our research project investigates the use of models of dependent mortality. We consider a broad class of parametric models using a bivariate survivorship function called a copula. Using data from a large insurance company to illustrate our methods, we calculate maximum likelihood estimates to calibrate the model.

The estimation results show strong positive dependence between joint lives. This statistically significant result translates into real economic significance. When dependent mortality models are used instead of the standard models that assume independence, annuity values decrease by about 5%. We show that the results are robust in terms of the choice of parametric family of distribution functions. The dependence becomes stronger when we account for the significant adverse



selection against the company that the data reveals.

The "Annuity Valuation with Dependent Mortality" research report is available at no charge from the SOA Research Department, 708/706-3574. Jacques F. Carriere is associate professor at the University of Manitoba's Warren Centre for Actuarial Studies and Research in Winnipeg. Edward (Jed) W. Frees is professor of business and statistics at the University of Wisconsin's School of Business in Madison.