31 May - 03 June 2016
at
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SUBMISSION FORM

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Title of Paper / Presentation / Session to appear in program:

The application of copulas to the modelling of the marriage reverse annuity contract

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3. Agnieszka Marciniuk

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ABSTRACT

The application of copulas to the modelling of the marriage reverse annuity contract

(Joanna Dębicka, Agnieszka Marciniuk, Stanisław Heilpern)

Key words:
dependent lifetimes, reverse annuity contract, multistate model, copula, joint-life status, last surviving status.

Purpose of your paper:
The main purpose of this presentation is to model the probabilistic structure and cash flows of the marriage reverse annuity contracts. The dependent structure of the length of the spouses' lives is modelled by the copulas.

Abstract:
The aim of this presentation is to model the probabilistic structure and cash flows arising from marriage reverse annuity contracts. The multistate methodology is commonly used in calculation of actuarial values of different types of life insurances. Thus, we apply the multiple state model for marriage life insurance to model marriage reverse annuity contract. We distinguish between two survival statuses of the marriage reverse annuity contract:

- the joint-life status (JLS) - the benefit is paid only until the death of one spouses,
- the last surviving status (LSS) - the benefit is paid until the death of the other spouse.

In order to cost a contract, the probabilistic structure is necessary. In contrast to the classical approach which assumes that future lifetimes of the wife and the husband are independent, dependence of lifetimes between the spouses is assumed. The husband and wife are exposed to the same risks, which cause the dependence of their future lifetimes. We may observe the influence of the death of a spouse on the future lifetime of the second one. The "broken heart syndrome" occurs in such a situation. Moreover, a common external event called "shock", e. g. the car or airplane crash, which causes the death of both spouses, may occur. The research is planned to analyze the impact of degree of dependence between the future lifetimes of married partners on actuarial values. The structure of dependence of the length of the spouses' lives is modelled by copulas. The copula, which describes the joint distribution of the lifetime of the spouses, is determined on the basis of the real detailed data. The data comes from the Wroclaw cemeteries and Polish Central Statistical Office. The second data lets us derive the conditional joint length-life of spouses using the copulas and Markov chain.

We calculate the actuarial values of the marriage reverse annuity contract based on matrix formulas for the first moments of cash flows arising from multistate insurance contracts.

In numerical results, the Nelson-Siegel interest rate model of spot interest rate is used. The parameters of the Nelson-Siegel function are estimated by using the least-squares method on the basis of real Polish market data, related to the yield to maturity on fixed interest bonds and Treasury bills. The calculations are made by the use of own programs written in MATLAB.