Hürlimann, Werner

Bounds for actuarial present values under the fractional independence assumption. With discussion by Michel Denuit, Ole Hesselager and Alfred Müller and a reply by the author. (English) Zbl 1082.62537

N. Am. Actuar. J. 3, No. 3, 70-84 (1999).

Summary: We consider the fractional independence (FI) survival model, studied by Willmot for which the curtate future lifetime and the fractional part of it satisfy the statistical independence assumption, called the fractional independence assumption. The ordering of risks of the FI survival model is analyzed, and its consequences for the evaluation of actuarial present values in life insurance is discussed. Our main fractional reduction (FR) theorem states that two FI future lifetime random variables with identical distributed curtate future lifetime are stochastically ordered (stop-loss ordered) if, and only if, their fractional parts are stochastically ordered (stop-loss ordered). The well-known properties of these stochastic orders allow to find lower and upper bounds for different types of actuarial present values, for example when the random payoff functions of the considered continuous life insurances are convex (concave), or decreasing (increasing), or convex not decreasing (concave not increasing) in the future lifetime as argument. These bounds are obtained under the assumption that some information concerning the moments of the fractional part is given. A distinction is made according to whether the fractional remaining lifetime has a fixed mean or a fixed mean and variance. In the former case, simple unique optimal bounds are obtained in case of a convex (concave) present value function. The obtained results are illustrated at the most important life insurance quantities in a continuous random environment, which include bounds for net single premiums, net level annual premiums and prospective net reserves.

MSC:

62P05 Applications of statistics to actuarial sciences and financial mathematics
91B30 Risk theory, insurance (MSC2010)

Full Text: DOI

References:

[1] Bowers N., Actuarial Mathematics (1986) · Zbl 0634.62107
[2] Bühlmann H., ASTIN Bulletin 9 pp 75– (1977)
[3] DePril N., Transactions of the 25th International Congress of Actuaries 1 pp 129– (1995)
[4] Dhaene J., ASTIN Bulletin 20 (1) pp 81– (1990)· doi:10.2143/AST.20.1.2005484
[5] Hürlimann W., Insurance: Mathematics and Economics 9 pp 277– (1990) · Zbl 0714.62096 · doi:10.1016/0167-6687(90)90005-X
[6] Hürlimann W., ASTIN Bulletin 26 (2) pp 185– (1996)· doi:10.2143/AST.26.2.563218
[7] Hürlimann W., Journal of Computational and Applied Mathematics 82 pp 199– (1997) · Zbl 0887.65149 · doi:10.1016/S0377-0427(97)00053-8
[8] Hürlimann W., Journal of Computational and Applied Mathematics 82 pp 213– (1997) · Zbl 0887.65150 · doi:10.1016/S0377-0427(97)00055-1
[9] Hürlimann W., Application in Actuarial Science (1997)
[10] Kaas R., CAIRE Education Series 1 (1994)
[11] Kling B., Tinbergen Institute Research Series no. 60 (1993)
[12] Kling B., Insurance: Mathematics and Economics 11 pp 139– (1992) · Zbl 0785.62095 · doi:10.1016/0167-6687(92)90051-C
[13] Martin-Lóf A., Applied Stochastic Models and Data Analysis 11 pp 271– (1995) · Zbl 04530028 · doi:10.1002/asm.3150110308
[14] Shaked M., Stochastic Orders and Their Applications (1994) · Zbl 0806.62009
[15] Willmot G.E., North American Actuarial Journal 1 (1) pp 84– (1997) · Zbl 1080.62549 · doi:10.1080/10920277.1997.10595597