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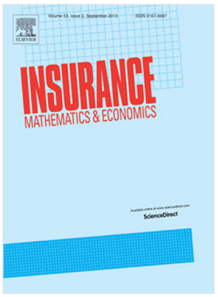

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Using Fuzzy Logic to Interpret Dependent Risks

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Abstract

One reason why an independent claim amounts assumption underlies classic risk models is because it simplifies calculations. As an alternative, this paper investigates the dependence structure via the Farlie-Gumbel-Morgenstern (FGM) Copula and its interpretation given a fuzzy logic approach for claim amounts arising from a Pareto distribution.

Keywords: Linear programming, Dependent risk, fuzzy membership function, Pareto distribution

1. Introduction

Claim amounts generally are assumed to be independent in actuarial studies [7]. However, it is also known that this assumption is inappropriate for many practical situations. For example, if family members have a policy in the same portfolio, it is clear that a dependency structure exists in terms of their mortality due to their common living habits. On the other hand, as an another example, it is clear that an insurance portfolio consists of dependent risks in catastrophic coverage such as floods, land slides, earthquakes, windstorms etc.

Let S_t be the total claim amount at time t, that is, the sum of the individual claims, which leads to the determination of the premium. This quantity, which can also be interpreted as a risk measure, is generally used to construct future strategies for the insurance company. In addition to others, [4], [17], [5] and [13] provide detailed and enlightening references with respect to total claim amounts.

As it has been indicated in [21], fuzzy logic has numerous application areas in insurance industry such as underwriting, pricing, fuzzy future and present values, premium calculation and cash flows. In this study we focused on the necessary tools for premium calculation with respect to the dependency level between risk.

The remainder of the paper is organized as follows. Section 2 introduces the tools necessary for dealing with dependency, along with their interpretation and the Farlie-Gumbel-Morgenstern (FGM) copula for dependent risks is briefly introduced in Section 3. In Section 4, the Pareto distribution is introduced. Section 5 gives some necessary fuzzy mathematical programming definitions and solutions related to the dependency parameter for the suggested copula model given in Section 2. Finally, in Section 6, a recapitulations and conclusion are provided.

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