



Approximate Formula for Cramér Coefficient in a Non-Linear Insurance Model Under Gamma-Distributed Claims

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Abstract

This paper provides an in-depth investigation of non-linear Cramér–Lundberg type insurance models, which occupy a critical position in risk theory and actuarial modeling, and presents Cramér-type approximate results for the ruin probability of the system. Although the Cramér coefficient (C) and the adjustment coefficient (r) used in insurance models are well known in the literature [1, 2], their existing analytical structures are not directly suitable for computation under general distributions such as the Gamma distribution due to non-linear effects, complex integral transformations, and distributional difficulties.

Within the scope of this study, the ruin probability of the non-linear model has been analyzed under the assumption that claim sizes follow a Gamma distribution, and a practical approximate formula suitable for the direct computation of the Cramér coefficient has been developed. While resolving the stochastic structure of the process, renewal theory, approximation approaches, and risk process techniques were utilized simultaneously.

In the final part of the paper, several special cases are examined, and the numerical performance of the theoretical results is demonstrated through applied examples. The proposed method is expected to provide an innovative contribution to the literature in terms of risk analysis and actuarial decision-making for insurance systems involving non-linear premium structures.

Keywords: Non-linear insurance model, Approximate formula for the Cramér coefficient, Gamma-distributed claims.

References:

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