

Doctoral School of Information and Biomedical Technologies Polish Academy of Sciences

Subject: Modelling of imprecise rare catastrophic events in insurance system

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Scientific discipline: Technical Computer Science and Telecommunications

Recruitment form: Interview

Available positions: 1

Project description

The classical approach in insurance mathematics assumes the occurrence of many losses, which have only a small and limited influence on payments from a whole portfolio of an insurer (like, e.g., in the case of automobile crashes). Whereas, together with the progress of climate changes, the number of rare events with severe, catastrophic consequences increases (e.g., floods which affect many insureds at a flooded region at once). In the literature, simulation approaches, which enable sampling from a random distribution describing rare and catastrophic events in a numerically efficient way, are known (e.g., the splitting or the importance sampling). Unfortunately, published real data is frequently incomplete or censored. This severely hampers a process of selection and fitting of respective random distributions to values of the losses. Additionally, this data can be based on the experts' opinions or can be imprecise in other ways. The main aim of the project is to develop and apply simulation methods for rare and catastrophic events, also in the case of an imprecise approach. Based on the conducted simulations, insurer's portfolios, which are constructed using various types of financial and insurance instruments, both the classical and the more modern ones (e.g., reinsurance contracts and catastrophe bonds), will be numerically compared.

Bibliography

- [1] L'Ecuyer P., Demers V., Tuffin B. Rare Events, Splitting, and quasi-Monte Carlo, *ACM Trans. Model. Comput. Simul.*, 17(2), 2007
- [2] Rubino G., Tuffin B., *Rare Events Simulation Using Monte Carlo Methods*, John Wiley & Sons Ltd., 2009
- [3] Romaniuk M., Insurance portfolio containing a catastrophe bond and an external help with imprecise level—a numerical analysis, in: Kacprzyk J., Szmidt E., Zadrożny S., Atanassov K. T., Krawczyk M. (eds.) *Advances in Fuzzy Logic and Technology 2017: Proceedings of: EUSFLAT 2017...*, Volume 3, *Advances in Intelligent Systems and Computing*, 643, Springer International Publishing, 2018
- [4] Romaniuk M., Imprecise Approaches to Analysis of Insurance Portfolio with Catastrophe Bond, in: Lesot M-J., Vieira S., Reformat M. Z., Carvalho J. P., Wilbik A., Bouchon-Meunier B., Yager R. R. (red.) *Information Processing and Management of Uncertainty in Knowledge-Based Systems. IPMU 2020. Communications in Computer and Information Science*, 1239, Springer, Cham, 2020
- [5] Yan C., Liu Q., Dong T., Liu W., Payments Per Claim Method Based on Fuzzy Numbers, 14th International Conference on Natural Computation, Fuzzy Systems and Knowledge Discovery (ICNC-FSKD), Huangshan, China, 2018.

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