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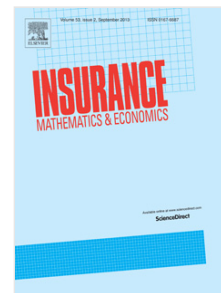Please cite this article as: Li, B., Ni, W., Constantinescu, C., Risk models with premiums adjusted to claims number. *Insurance: Mathematics and Economics* (2015), http://dx.doi.org/10.1016/j.insmatheco.2015.09.001

Risk models with premiums adjusted to claims number

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Abstract

Classical compound Poisson risk models consider the premium rate to be constant. By adjusting the premium rate to the claims history, one can emulate a Bonus-Malus system within the ruin theory context. One way to implement such adjustment is by considering the Poisson parameter to be a continuous random variable and use credibility theory arguments to adjust the premium rate a posteriori. Depending on the defectiveness of this random variable, respectively referred to as 'unforeseeable' (defective) versus 'historical' (non-defective) risks, one obtains different relations between the ruin probability with constant versus adjusted premium rate. A combination of these two kinds of risks also leads to a relation between the two ruin probabilities, when the a posteriori estimator of the number of claims is carefully chosen. Examples for specific claim sizes are presented throughout the paper.

Keywords. Ruin Probability, Mixed Poisson Process, Bonus-Malus, Bayesian Estimation, Lukacs' Theorem.

1 Introduction

One of the main assumptions of the classical collective risk models is that premiums are arriving at a constant rate c and thus the surplus of the company evolves over time as

$$U(t) = u + ct - \sum_{j=0}^{N(t)} Y_j, \quad t \geq 0, \tag{1}$$

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