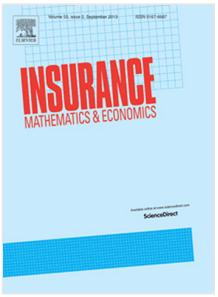
Accepted Manuscript



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PII: S0167-6687(15)30181-5
DOI: http://dx.doi.org/10.1016/j.insmatheco.2016.03.007
Reference: INSUMA 2188

To appear in: *Insurance: Mathematics and Economics*

Received date: August 2015
Revised date: February 2016
Accepted date: 10 March 2016

Please cite this article as: Tan, C.I., Varying transition rules in bonus-malus systems: From rules specification to determination of optimal relativities. *Insurance: Mathematics and Economics* (2016), http://dx.doi.org/10.1016/j.insmatheco.2016.03.007

Varying transition rules in bonus-malus systems: From rules specification to determination of optimal relativities

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Abstract

In this paper, we extend the proposed idea of level-varying transition rules in bonus-malus systems onto risk-varying rules and combine both these ideas to formulate the generalization of varying transition rules. Moreover, we generalize the analytical formulae for the determination of optimal relativities under these rules. We find that the risk-varying transition rules are the most effective among the different specifications of transition rules. Our numerical results also indicate that the resulting optimal relativities under the general-varying rules are higher than those of under the risk-varying rules partly due to the differences of the transitions imposed by the rules.

Keywords: bonus-malus system; transition rules; *a priori* claim frequency.

1. Introduction

In motor insurance ratemaking, insurers first make use of the *a priori* risk classification to segmentize a portfolio of drivers into a number of homogeneous risk classes. Since the observed variables are far from perfect in predicting the associated riskiness of driving behaviour, the residual heterogeneity is dealt with by the *a posteriori* rating scheme.

Specifically, the relevant claims experience information such as the claims frequency and the claims amount (see, e.g., Denuit et al., 2007; Frangos and Vrontos, 2001; Lemaire, 1995; Pinquet, 1997; Tzougas et al., 2014; Walhin and Paris, 1999) are utilized to determine the premium corrections. The ideal *a posteriori* correction is developed under the credibility premium (see Dionne and Vanasse, 1989) framework, whereby premiums are derived on an individual basis by incorporating both the *a priori* and *a posteriori* information. In practice, however, insurers prefer to implement another form of correction scheme called bonus-malus system (BMS) due to the complexities of introducing credibility premium for each individual.

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