

## **A dynamic analysis of the underwriting cycle in non-life insurance**

Rocco Roberto Cerchiara<sup>1</sup>, Fabio Lamantia  
*Department of Business Science  
Faculty of Economics  
University of Calabria  
Italy*

### **Abstract**

The European Project Solvency II is devoted to the appraisal of a Solvency Capital Requirement that should capture the overall risk profile of insurance companies. In this framework there is a growing need to develop so-called internal risk models to get accurate estimates of liabilities. In the context of non-life insurance, it is crucial to correctly assess risk from different sources, such as underwriting risk with particular reference to premium, reserving and catastrophe risks. In particular the underwriting cycle is not quantified in standard formula under Quantitative Impact Study 4, but probably it could be included, as it provides additional volatility to liabilities distribution and so it could increase the capital requirement.

The aim of this paper is to correctly model the underwriting cycle for non-life insurance companies, also taking into account its effect on the solvency ratio. Starting from Collective Risk Theory, a dynamic control policy is defined to specify the relationship between solvency ratio and safety loading, to model the underwriting cycle. The corresponding dynamic equation for the solvency ratio, under some assumptions, assumes the form of a one dimensional *piecewise linear* map. In the first part of the work a deterministic version of this map is analyzed, where aggregate losses are simply regarded as a parameter. Numerical analysis and stochastic assessments of the model conclude the work.

*Key words:* non-life insurance, underwriting cycle, solvency ratio, collective risk theory, piecewise-linear dynamical systems, border collision bifurcations.

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<sup>1</sup> Corresponding author, Fax +39-0984492277, cerchiara@unical.it