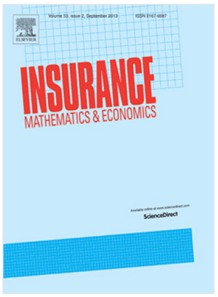
Accepted Manuscript



Non-cooperative dynamic games for general insurance markets

Tim J. Boonen, Athanasios A. Pantelous, Renchao Wu

PII: S0167-6687(17)30364-5
DOI: https://doi.org/10.1016/j.insmatheco.2017.12.001
Reference: INSUMA 2425

To appear in: *Insurance: Mathematics and Economics*

Received date : July 2017
Revised date : November 2017
Accepted date : 6 December 2017

Please cite this article as: Boonen T.J., Pantelous A.A., Wu R., Non-cooperative dynamic games for general insurance markets. *Insurance: Mathematics and Economics* (2017), https://doi.org/10.1016/j.insmatheco.2017.12.001

Non-Cooperative Dynamic Games for General Insurance Markets

Tim J. Boonen[1], Athanasios A. Pantelous[2]*, and Renchao Wu[2]

[1]Amsterdam School of Economics, University of Amsterdam, The Netherlands

[2]Department of Mathematical Sciences, University of Liverpool, United Kingdom

Abstract

In the insurance industry, the number of product-specific policies from different companies has increased significantly. The strong market competition has boosted the demand for a competitive premium. In actuarial science, scant literature still exists on how competition actually affects the calculation and the cycles of company's premiums. In this paper, we model premium dynamics via differential games, and study the insurers' equilibrium premium dynamics in a competitive market. We apply an optimal control theory methodology to determine the open-loop Nash equilibrium premium strategies. The market power of each insurance company is characterized by a price sensitive parameter, and the business volume is affected by the solvency ratio. We study two models. Considering the average market premiums, the first model studies an exponential relation between premium strategies and volume of business. The second model initially characterizes the competition between any selected pair of insurers, and then aggregates all the paired competitions in the market. Numerical examples illustrate the premium dynamics, and show that premium cycles may exist in equilibrium.

Keywords: Insurance Market Competition; Premium Cycles; Solvency Ratio; Open-loop Nash Equilibrium

*Corresponding Author: A.Pantelous@liverpool.ac.uk