Robust LMI stability, stabilization and H_∞ control for premium pricing models in a Markovian regime switching discrete-time framework

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April 16, 2015

Abstract

The premium pricing process and the reserve stability under uncertainty are very challenging issues in the insurance industry. In the past two decades, applications of Markovian regime switching models in finance and macroeconomic have received much attention among researchers and market practitioners. However, relatively little attention has been paid to the use of regime switching models in the insurance literature. We believe that it is important to take the regime switching influence into account for long-term reserve and premium management issues.

This paper discusses the robustness and stabilization of a reserve-premium system and it considers potential effects from the abrupt structural changes in the economic fundamentals as well as the insurer's strategy over a period. A recent work which investigates the regime switching effect on the reserve process can be found in [1]. However, this work mainly concerns on ruin probability and does not consider on robustness and stability control issues.

The current work develops the model proposed by Pantelous and Papageorgiou [2] and Pantelous and Lin [3] into a Markovian regime switching framework to describe the dynamics of reserve-premium process. It aims to extend previous single regime into a hybrid multiplicate system. Here we consider a discrete-time Markovian jump linear system to formulate the reserve-premium process. Some useful techniques from control theory would be used to explore the stability, the stabilization and the robust H_∞ control for the proposed switching reserve-premium system. Linear Matrix Inequality (LMI) sufficient conditions will be derived to solve problems. Finally, a numerical example is given to show the potential usefulness of the theoretic results.

Keywords: *Premium pricing; Reserve-premium process; H_∞ control; System stability; Markovian regime switching systems*

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