Introduction

A Special Issue of *Journal of Risk and Decision Analysis* on Maritime Risk and Insurance Analysis

Emerging evidences indicate a global trend that SCM (supply chain management) has become more and more service based (e.g., logistics and trade services), as opposed to manufacturing based. Consequently, port-focal logistics, as opposed to typical firm-focal logistics, is playing an increasingly important role in global economy, which has generated ever-growing research interests on shipping and maritime services, from both theoretical and empirical perspectives. In light of the inevitable trend and need, we devote this special issue to the advancement of theory and methodology for *risk and insurance analysis* associated with shipping and maritime services, including:

- Marine insurance and mutual risk systems.
- Maritime law and legal services.
- Ship/shipping finance.
- Port investment and risk management.
- Logistics environment risk and protection.
- Safety and security in shipping and port logistics.
- Port-focal logistics quality and risk.

This special issue consists of four papers, outlined as following:

1. "Valuation of information-sharing in marine mutual insurance"; K. Li (lgtkxli@polyu.edu.hk), J. Liu and J. Yan. *Abstract*: With empirical evidence from marine mutual insurance (MMI), an impulse feedback model is constructed to address how information-sharing can help increase the social welfare as well as efficiency of the operation of MMI system. Focusing on information-sharing, this paper considers premium policy optimization of under a mutual insurance system with a homogeneous market of identical members. Our findings confirm that the principle of mutuality can be attained under "equal-risk pooling", but not necessarily under "unequal-risk pooling", and reveal that quantifiable difference exists in valuation of mutuality under the two schemes of risk pooling. It points out that the key to a successful MMI is the equal-risk pooling. Algorithms are developed to compute the value of mutuality by solving the HJB equations and quasi-variational inequalities. The conclusion provides a scientific basis for both managerial strategy and competition regulation. The findings are applicable to a wide range of reserve and inventory management problems.

2. "QVI characterization of contingent options in marine mutual insurance"; J. Yuan (laser.yuan@gmail.com) and J.J. Liu. *Abstract:* As compared to a commercial insurance firm, a mutual insurance organization, such as a Protection & Indemnity Club (i.e., a P&I Club) in maritime insurance, adopts a none principal-agent mechanism of incentives, which mainly comprises two contingent options (impulse control), namely, contingent calls and refunds. We develop a band-type contingent option (BTCO) model for mutual insurance, and derive QVI (quasi-variational inequality) characteristics for the optimality of a BTCO policy which was introduced for cash management by Constantinides and Richard [*Operations Research* **26**(4) (1978), 620–636]. We show that an optimal BTCO policy can be determined by solving a boundary-value problem that is constructed with the QVI-characteristics. Finally, the QVI-based solution method is tested with numerical examples of mutual insurance management.

3. "Excess-of-loss reinsurance under taxes and fixed costs"; T. Choulli and M. Taksar (taksar@math.missouri.edu). *Abstract:* We consider the problem of dividend optimization for an insurance company which can use the excess-of-loss reinsurance to control its risk. The decrease of risk results in a loss of potential profits in view of the necessity to diverge a part of the premiums to the reinsurance company. In addition to reinsurance the decision is made about the time and the amount of dividends to be paid out to shareholders. Each time when the dividends are paid a set-up cost of K is incurred independent of the amount distributed. In addition the dividends are taxed at the rate of $1 - k, 0 < k < 1$.

The resulting problem becomes a mixed regular-impulse stochastic control problem for a controlled diffusion process. We solve this problem and find the optimal policy. We give an economic interpretation to the solution obtained. The solution reveals an interesting dependence of the optimal policy on the parameters of the model. We also discuss an extension of this problem to the case when there are restrictions on the level of reinsurance available and show how one can construct the value function and the optimal policy in this case.

4. "Optimal excess-of-loss reinsurance under borrowing constraints"; S. Luo (shangzhen.luo@uni.edu) and M. Taksar. *Abstract*: Stochastic control theory has been widely applied to the literature of insurance. When control policies are restricted, the resulting HJB equations become usually more complicated to solve than the ones in the un-constrained cases. Typical constraints on controls of insurance risk and investment, such as limited levels for risk reduction, absence of shortselling, limited borrowing, expensive borrowing, etc., have been considered in many recent research works under different optimization criteria. In this paper, we focus on the effect of the borrowing constraints on the solutions of the optimal stochastic control problems with excess of loss reinsurance purchase under the criterion of ruin minimization.

The topics addressed in this special issue are only representative of some key and active research dimensions and directions in Maritime Risk and Insurance Analysis, and are far from exhaustive. We hope the special issue will stimulate further research interests and efforts to advance scientific knowledge of Maritime Risk and Insurance Analysis.

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