

Optimal Multi-period Proportional Reinsurance Strategy

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The problem of optimal reinsurance has been an area of active research in the last few decades. There are many scholars who have studied the optimal reinsurance strategy which minimizes the insurer's ruin probability. However, in the literature, the optimal reinsurance strategy is most commonly explored in the continuous-time framework.

Our research focuses on the optimal multi-period proportional reinsurance strategy that minimizes the ruin probability of the insurer. We express the minimal ruin probability inductively, and then show that the dynamic programming approach can be used to solve this problem. Applying the dynamic programming approach, we derive several necessary conditions of the optimal multi-period proportional reinsurance strategy. Based on these results, a new concept, capital threshold of proportional reinsurance, is introduced. In the case of two periods, a lower bound of the capital threshold of proportional reinsurance is derived explicitly. We then prove that it is also a lower bound of the capital threshold of proportional reinsurance in the general case. Also the significance and properties of this new concept are discussed. Using this new concept, we obtain the optimal multi-period proportional reinsurance strategy and the according minimal ruin probability in some special cases. Finally, we offer some numerical examples to illustrate the theoretical results aforementioned.