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How long is the surplus below zero?

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Abstract

Assuming the classical compound Poisson continuous time surplus process, we consider the process as continuing if ruin occurs. Due to the assumptions presented, the surplus will go to infinity with probability one. If ruin occurs the process will temporarily stay below the zero level. The purpose of this paper is to find some features about how long the surplus will stay below zero. Using a martingale method we find the moment generating function of the duration of negative surplus, which can be multiple, as well as some moments. We also present the distribution of the number of negative surpluses. We further show that the distribution of duration time of a negative surplus is the same as the distribution of the time of ruin, given ruin occurs and initial surplus is zero. Finally, we present two examples, considering exponential and Gamma(2, β) individual claim amount distributions.

Keywords

- **Ruin Theory**
- **Probability and Severity of Ruin**
- **Surplus Process**
- **Martingales**
- **Compound Geometric Distribution**